City of Eugene

River Road-Santa Clara

Volume VIII of VIII

September 2012

August 2002

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

CITY OF EUGENE STORMWATER MANAGEMENT PROGRAM

Local Stormwater Planning Can Make a World of Difference

ADMINISTRATIVE ORDER NO. 58-12-14
of the
Executive Director of the Public Works Department

APPROVING THE RIVER ROAD-SANTA CLARA STORMWATER BASIN MASTER PLAN.

The Executive Director of the Public Works Department finds that:

A. Under the provisions of Chapter IV, Section 16 of the Eugene Charter of 2002, the City Manager is designated as the administrative head of the City, and is specifically authorized to appoint and remove all employees (except as otherwise provided in the Charter), and to enforce all ordinances of the City.

B. Pursuant to that authority, I have been designated as Executive Director of the City's Public Works Department. My appointment has most recently been affirmed by the City Manager's Administrative Order No. 21-12-10. In such capacity, I have the responsibility for supervision of the Public Works Department and its employees.

C. The River Road-Santa Clara Stormwater Basin Master Plan (Basin Plan) has been developed to replace the 1990 Otak Areawide Drainage Master Plan for River Road–Santa Clara. The new Basin Plan will be included in the 2002 Stormwater Basin Master Plan as Volume VIII. The Basin Plan documents the comprehensive basin planning process and results, and provides guidance for the management of stormwater throughout the study area. This plan describes a "multiple-objective" approach (i.e., incorporating water quality, stormwater-related natural resources and flood control) to stormwater management, and is to be used by City staff for background/contextual information, for development of the City's biennial CIP, for contextual support for stormwater development standards, and for evaluating technical information about the stormwater system. However, the Basin Plan will not be used in a manner that regulates conduct or activities of the public.

D. The new Basin Plan:

(1) Identifies the major drainage basins and major sub-basin delineations in River Road-Santa Clara;

(2) Describes the study area characteristics (existing/build-out land use, impervious surface cover, slopes, topography, soil types, drainage features, etc.);

(3) Describes the flood control, water quality and stormwater-related natural resource problems and opportunities in each major basin of River Road-Santa Clara;

(4) Describes the long-term (35 year) multiple objective capital improvement program for River Road-Santa Clara (including water quality, flood control and stormwater-related natural resources projects as well as stream corridor acquisitions) and stormwater development standards that would, together and along with the other multitude of activities in the stormwater program, address the identified problems and opportunities; and

(5) Compliments the adopted 2002 Stormwater Basin Master Plans which describe the City's drainage criteria for design of stormwater system improvements.

E. The drainage criteria for design of stormwater system improvements contained in the Basin Plan, and other specific information about design storm events and analysis and design methods serve as guidance to the City and the public and are neither requirements nor prohibited conduct.

Now, therefore, based on the above findings, which are hereby adopted:

IT IS HEREBY ORDERED THAT:

1. The River Road-Santa Clara Stormwater Basin Master Plan (Basin Plan) attached to this Order is hereby approved, and shall be utilized by staff on the Public Works Department in lieu of the 1990 Otak Areawide Drainage Master Plan for River Road–Santa Clara in evaluating development proposals. The Basin Plan shall not be used as approval criteria.

2. Copies of this Order shall be forwarded to all Public Works Department Division Managers.

Dated this 2nd **day of** November**, 2012.**

Jw MR

Kurt Corey, Executive Director
Public Works Department

BEFORE THE BOARD OF COUNTY COMMISSIONERS OF LANE COUNTY, OREGON

ORDER NO. **12-10-24-12**	IN THE MATTER OF APPROVING THE RIVER ROAD-SANTA CLARA STORMWATER BASIN MASTER PLAN

WHEREAS, per Board Order No. 03-3-12-4, the Board of County Commissioners authorized an Intergovernmental Agreement with City of Eugene to satisfy requirements of the County's NPDES Phase II MS4 Stormwater Permit, and

WHEREAS, through this Intergovernmental Agreement, Lane County agreed to partner with the City of Eugene for consultant work to develop a Comprehensive Basin Plan for the North Eugene/Santa Clara area and that Lane County would provide staff support in completing the Comprehensive Basin Plan, and

WHEREAS, the Comprehensive Basin Plan, titled "The River Road – Santa Clara Stormwater Basin Master Plan" has been completed by City and County staff,

NOW THEREFORE, BE IT HEREBY ORDERED, that the Lane County Board of Commissioners approves and accepts The River Road – Santa Clara Stormwater Basin Master Plan as presented to the Board on October 24, 2012.

Adopted this **24th** day of **October**, 2012.

APPROVED AS TO FORM
Date 10/17/12 Lane County
OFFICE OF LEGAL COUNSEL

Chair, Lane County Board of Commissioner

Stormwater Basin Master Plan

Volume VIII of VIII

River Road – Santa Clara

September 2012

Prepared by:

City of Eugene
URS Corporation
Brown and Caldwell
Lane Council of Governments

ACKNOWLEDGEMENTS

The River Road – Santa Clara 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 County, URS Corporation, Brown & Caldwell Consultants, and Lane Council of Governments (LCOG).

The project team would like to gratefully acknowledge the efforts of the many city, county and consultant staff that provided input for and review of this document.

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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.

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The Context

The River Road – Santa Clara stormwater basin, located in the northwest corner of the Eugene-Springfield metropolitan area, is generally bounded by the Willamette River on the east, the Bethel-Danebo drainage basin on the south and the Metro Plan boundary on the west and north. The basin is the second largest of Eugene's stormwater basins at 10,458 acres in size, with about 58 percent (6,071 acres) of its area within the Eugene urban growth boundary (UGB) and the remaining 42% located outside of the urban growth boundary. The basin includes five major drainage systems: the A1 Channel, Highway 99, Flat Creek, Spring Creek, and the Willamette Overflow (also referred to as the East Santa Clara Waterway). These waterways flow in a north-northwesterly direction and drain to the Willamette River either directly (Flat Creek, Spring Creek, East Santa Clara Waterway) or indirectly via Amazon Creek and the Long Tom River (A1 Channel, Highway 99).

Inside the UGB, the predominant land uses in the basin are low and medium-density residential (2,558 acres) and industrial/commercial (747 acres). Outside of the UGB, the predominant land uses are government, including the Eugene airport (960 acres) and agriculture (2,433 acres).

The River Road – Santa Clara basin is unique in many ways, including it's patchwork of City/County jurisdictional areas: 1,802 acres located inside Eugene city limits; 4,270 acres outside city limits and inside the UGB; and 4,387 acres outside of the UGB. It is also one of the most complex basins in terms of stormwater management. Results of the stormwater assessment for this basin revealed:

- A discontinuous stormwater system comprised of pipes, drywells, ditches and waterways
- Historic use of drywells for managing stormwater drainage
- Very flat topography
- Shallow groundwater levels
- Rapidly draining soils in some areas
- Rural "country" feel in some areas, with large residential lots and curbless streets

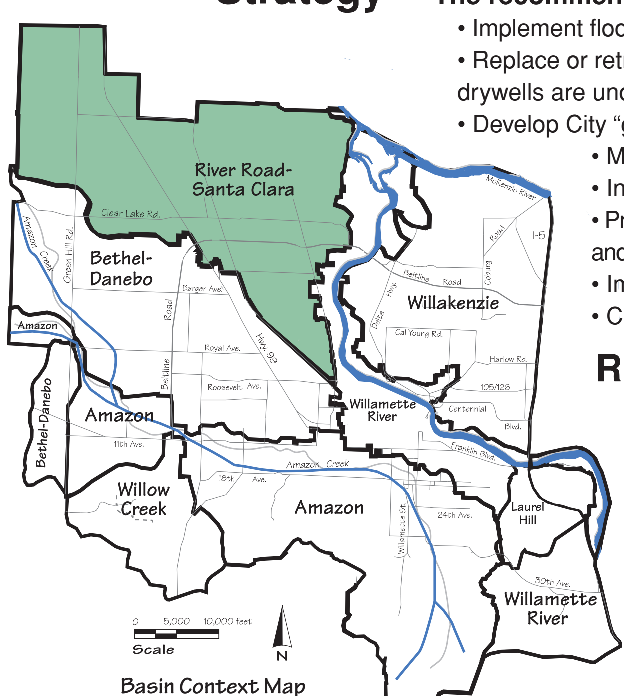
City and County Jurisdictions

Given the mixed jurisdictional nature of the River Road-Santa Clara basin, the City and County will ultimately view and implement strategies and opportunities differently. Through a "basin partnership," the jurisdictions will work together for the best benefit of all. This executive summary attempts to outline some of these opportunities.

Strategy

The recommended strategy for this basin is:

- Implement flood control capital projects to address predicted flooding problems in specific areas.
- Replace or retrofit existing public drywells to meet Safe Drinking Water Act requirements (private drywells are under the authority of DEQ).
- Develop City "green street" concepts for local street improvements.
  - Minimize future pollutants through City's on-site stormwater development standards.
  - Increase City's implementation of low impact development practices.
  - Protect water quality by relying on Goal 5 natural resource protections for certain waterways and by filling the gaps in protection on specific waterway segments not protected by Goal 5.
  - Implement City's *Stream Corridor Acquisition Plan*.
  - Continue to provide flood protection services basin wide.



Basin Context Map

River Road–Santa Clara Basin Facts:

- Almost all of the basin (99%) has slopes of 5% or less.
- Ranks 1st among the City's major basins in total length of open waterways (48 miles within the basin boundary) and 2nd in extent of open drainage system per square mile of basin area (3.0 miles/square mile), relative to other basins.
- Impervious surface area inside the UGB is projected to increase from 37.5% to 50.1% at buildout.
- The Willamette River, to which runoff from River Road – Santa Clara drains directly or indirectly, is listed by the Oregon DEQ as water quality limited for temperature, bacteria and mercury.
- Approximately 25% of the basin drains to drywells (19% public, 81% private).

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 stormwater program. In addition to protecting the community from flooding problems, CSWMP expanded the program to include protection of stormwater water 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 and county 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
- Stormwater system maintenance
- 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 are designed to address the incremental effects of new development.
- Low impact development practices are effective at reducing runoff volumes and minimizing problems associated with increased flows from new development.
- Flows from decommissioning of public drywells (see Water Quality below) will be accomodated through decommissioning capital projects to match current drywell functions.

Water Quality

- *Pollution associated with new development:* Development standards are effective for addressing pollutants at their source. Implementing low impact development practices further enhances effectiveness.
- *Pollution associated with existing development:* Capital projects to retrofit the stormwater system in high pollutant source areas are effective in improving the current water quality condition.
- *Problems associated with public drywells*: Capital projects to replace or retrofit public drywells are the most effective solutions for meeting federal water quality regulations. Both the City and County registered their drywells with DEQ and have applied for a permit to manage the drywells until they can be authorized or decommissioned.
- *Gaps in water quality protections for certain waterways*: Water quality waterway protections to address gaps will result in a *system* of protected waterways.

Stormwater-Related Natural Resources

- Capital projects are the most viable method for addressing negative effects of high runoff volumes associated with existing developed areas.
- Relying on Goal 5 natural resource protections is an effective way to protect certain waterways for multiple benefits including natural resources and water quality benefits.
- Stream corridor acquisition can be used to protect a limited number of high-priority waterways.

More Information

Visit the City's website at **www.eugene-or.gov/pw** (follow the links to stormwater).
Contact Therese Walch, Water Resources Manager, at (541) 682-5549.

The Management Strategy

Flood Control

Issue:
Some areas do not meet existing drainage system conveyance standards.

Desired Outcome:
Flood protection needs are met basin-wide.

Actions: **Capital Projects – see map (red dots)**

- System improvements to enhance capacity: A1 tributary south of Irving Rd; Willamette Overflow upstream of Division Ave.
- Culvert replacements to improve capacity: various locations.
- Public drywell decommissioning projects (see Water Quality) will be designed to convey the 5-year storm to match existing drywell functions.

Stormwater Related Natural Resources

Issue:
Natural resources functions and values of streams, ponds, wetlands and waterways are important to the overall health of a watershed and would be at risk without adequate protection.

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

Actions: **Capital Projects**

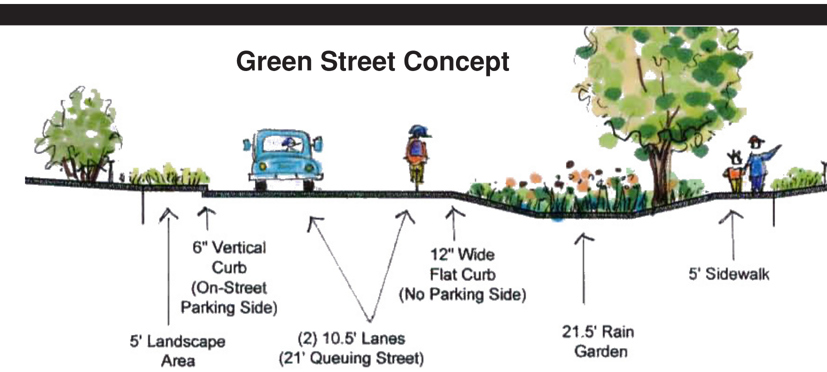
- Yearly City budget category – Streambank stabilization and outfall stabilization projects.

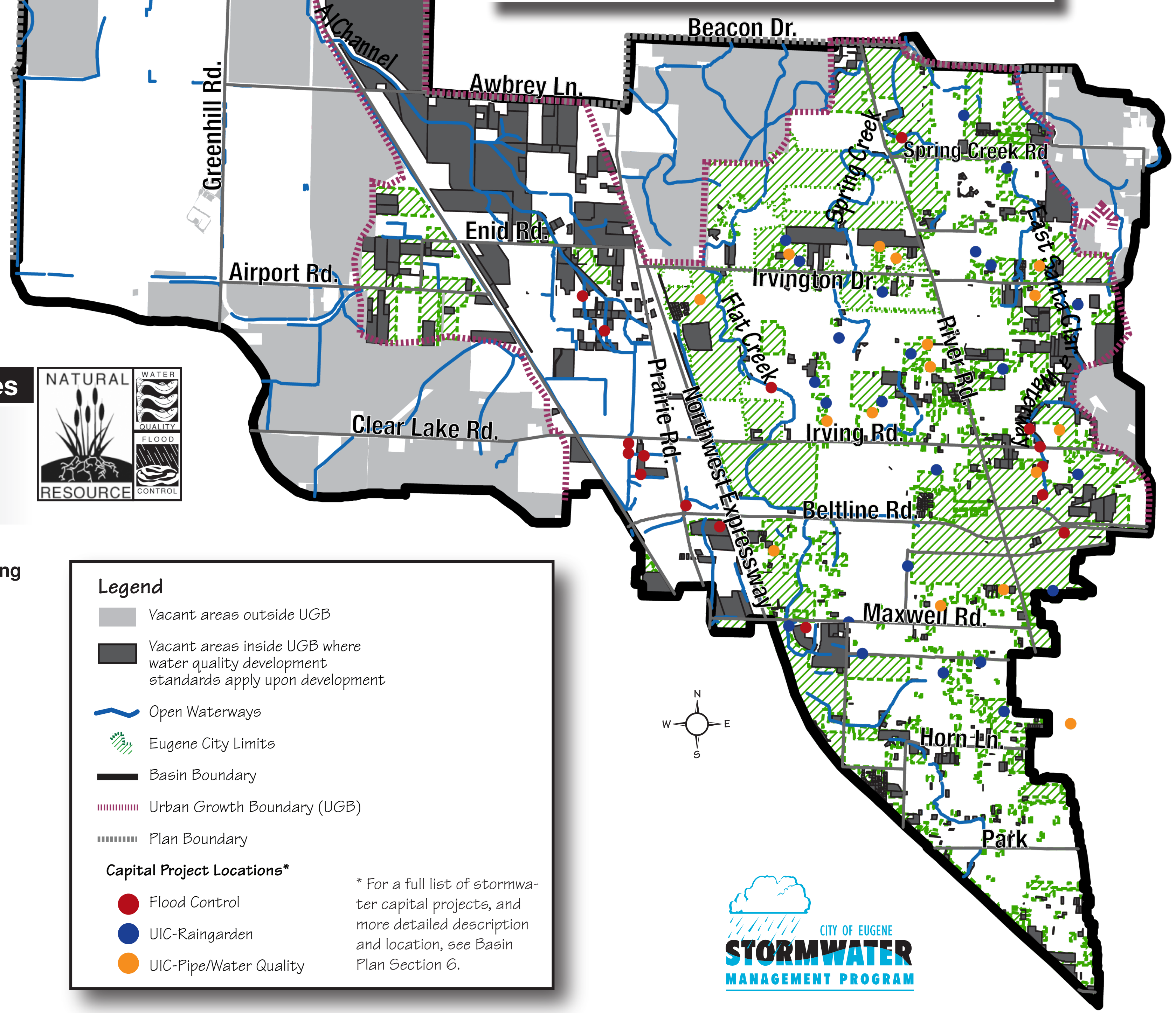
Development Standards:

- Support implementation of Goal 5 natural resource protections.

Acquisition:

- Acquire stream corridors according to the City's *Stream Corridor Acquisition Study.*





Water Quality

Issue:
Runoff from existing development is a significant source of pollutants; Runoff from future development will increase pollutant discharges.

Desired Outcome:
Reduce stormwater pollution from existing land uses and from new development.

Actions: **Capital Projects**

- Yearly City budget category – Water quality facilities in high source areas.
- Yearly City budget category – Retrofit tip-ups.
- Yearly City budget categories – Outfall stabilization/stream bank stabilization.

Development Standards:

- New and significant development projects in Eugene are required to treat all runoff from City's water quality design storm.
- Increase City's implementation of low impact development practices through administrative adjustments, integration of LID practices with other initiatives, land use code amendments, and other program enhancements.

Green Street Concepts

- Develop green street alternatives, for use in local street improvements or for new City local streets that utilize rain gardens to manage stormwater runoff from rights-of-way.

Issue: **Some existing public drywells have inadequate separation to seasonal high groundwater.**

Desired Outcomes: **Replace or retrofit existing public drywells consistent with Safe Drinking Water Act requirements.**

Actions: **Capital Projects–see map (blue & gold dots)**

- Decommission/Retrofit Public Drywells (33 "UIC Cluster" projects, to be implemented in partnership with Lane County) utilizing rain gardens or piped systems with pre-treatment facilities.
- DEQ has authority for private drywell systems.

Issue: **Gaps in protections exist for waterways that are tributary to those listed by the Oregon DEQ as "water quality impaired."**

Desired Outcomes: **Water quality functions on specific waterways of interest to water quality are protected by preventing piping/filling and further encroachment.**

Actions: **Development Standards**

- Fill the gaps in waterway protections on specific waterway segments currently not protected by Goal 5 natural resource protections.

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, the Safe Drinking Water Act and State Underground Injection Control Rules – for these broader topics and other issues, please refer to Volume I).
- Complement other existing stormwater best management practices (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.

This report represents the final River Road Santa Clara Basin Plan, Volume VIII of an eight-volume set. The Initial Study Towards the Development of an Integrated Stormwater Management Strategy for the River Road Santa Clara Basin (Initial Study) was developed in 2002, and held in draft form pending resolution of inter-jurisdictional issues as well as additional information gathering and analysis. In 2004, subsequent to entering into an Intergovernmental Agreement (IGA), the City of Eugene and Lane County commenced with a joint effort to finalize the Initial Study. Outreach to the River Road and Santa Clara Community Organizations was conducted periodically throughout the process. This report incorporates feedback received from these initial public outreach efforts.

The City completed the other seven volumes of the Stormwater Basin Master Plan that summarize and document integrated strategies for each of the other basins in Eugene. 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 basin-specific volumes. Each of the six companion volumes covers a specific drainage basin as follows: *Volume II - Amazon Creek, Volume III - Bethel-Danebo, Volume IV – Laurel Hill, Volume V - Willakenzie, Volume VI - Willamette River, Volume VII - Willow Creek.* This document is *Volume VIII – River Road Santa Clara.*

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 overall process conducted to develop integrated strategies for each of the City's stormwater basins included in the Stormwater Basin Master Plans consisted of the following thirteen steps. The details regarding each of these steps are provided in Volume I of the City's Stormwater Basin Master Plans.

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 described above for developing integrated strategies for each of the stormwater basins, including River Road Santa Clara, is outlined in Figure 1-1.

Information updates related to this plan are provided at the end of this section. The integrated basin strategy specific to the River Road-Santa Clara basin is described in the following sections. In order to complete the Initial Study for River Road Santa Clara, some additional analysis was necessary to address the unique challenges represented by the mix of City and County jurisdictional areas, the large number of sub-dividable lots and unimproved streets, and federal Safe Drinking Water Act regulations related to underground injection controls which are predominant in the basin. Thus, additional steps were needed and are outlined in Figure 1-2.

Section 2.0 of this report provides a summary of the specific characteristics in the River Road Santa Clara basin (from Step 1). Sections 3.0, 4.0, and 5.0 provide summaries of the flood control, water quality and natural resources evaluations, respectively (from Steps 2 and 3). These evaluations provide a list of identified problems, and potential solutions in the form of capital projects and development standards. Section 6.0 describes implementation of the integrated stormwater management strategy for the River Road Santa Clara basin.

Information Updates (June 2012)

Eugene's Stormwater Basin Plans are used for background/contextual information, development of capital improvement programming, contextual support for proposed development standards, and for evaluating technical information about the stormwater system. Since the drafting of the Stormwater Basin Master Plan for River Road-Santa Clara, several other efforts have been initiated or are planned to begin within the next year or so that have a relationship to stormwater management and in some cases further the goals of the Stormwater Basin Master Plans including for River Road – Santa Clara. This section describes these other efforts and their status.

Envision Eugene, Followed by Area Plan for River Road/Santa Clara

Envision Eugene is our community's process for determining the best way to accommodate growth projected over the next 20 years. The Envision Eugene process began with a broad spectrum of community input in 2010, followed by a draft proposal and technical analysis in 2011 and draft recommendations published in March 2012. The Envision Eugene process established seven "pillars" which reflect the values of the community and serve as the foundation from which the draft recommendation emerged. Recommendations include a proposed urban growth boundary and strategies for accommodating growth. Under the pillar: "Protect, Repair and Enhance Neighborhood Livability," Strategy 4 is to: "Create neighborhood plans to address unique situations and impacts in different neighborhoods." Strategy 4b in particular is most relevant to River Road/Santa Clara:

> Complete area planning for the River Road and Santa Clara neighborhoods to address impacts of increasing urbanization. Base future planning efforts on previous work done under the River Road/Santa Clara Transition Project and Final Report, June 2006, and the Santa Clara-River Road Outreach and Learning (SCRROL) project, 2012. Begin this planning process immediately following local adoption of Envision Eugene.

On June 13, 2012, the Eugene City Council passed the following motion which reflects the current status of the Envision Eugene process:

> *"Move to direct the City Manager to prepare, for a formal adoption process, planning documents to establish a new Urban Growth Boundary based on recommendations in the Technical Components Document (Attachment A), as revised,* ***and that carry forward the pillars and strategies [emphasis added]*** *described in the Envision Eugene Draft Proposal, March 14, 2012."*

In effect, this means that the community visioning and strategy refinement phases are complete, and the formal adoption process and implementation work is underway. The adoption process will include decision-making by the Eugene City Council and the Lane County Board of Commissioners. Implementation of the area planning strategy for the River Road and Santa Clara neighborhoods, to address impacts of increasing urbanization, will begin following adoption of Envision Eugene. For additional information about Envision Eugene, including the seven pillars and related strategies, how to get involved, and up-to-date status of the process, see City's web page at www.envisioneugene.org.

Eugene's Municipal Stormwater Permit

Stormwater discharges from municipal stormwater systems are regulated under the federal Clean Water Act via a permit program which, in Oregon, is administered by the Oregon Department of Environmental Quality (DEQ). Eugene's National Pollution Discharge Elimination System Municipal Separate Storm Sewer Permit (or "MS4 permit") was first issued in 1994, which prompted the City to adopt the comprehensive stormwater policy, CSWMP, described previously in Section 1. Eugene's permit was issued under Phase I of the program, and is therefore called a MS4 Phase I permit. The City's MS4 permit was re-issued in 2004, and again most recently in December 2010. The goal of the MS4 permit program is to reduce stormwater pollution and help improve the condition of the nation's water bodies. Eugene's permit is designed to reduce pollution from Eugene's municipal stormwater system and protect and improve the water quality of our local waterways, including Amazon Creek and the Willamette River. Adaptive management to continually improve the effectiveness of the City's stormwater program and further reduce stormwater pollution is a regulatory expectation and is an on-going part of the City's stormwater program. Adaptive management coupled with the Issuance of the 2010 MS4 permit will result in additional refinements to the City's stormwater program, including in the following areas:

- Stormwater Development Standards - As described in Action 4.3.2. of this plan, development standards for water quality were adopted City-wide in June 2006. Stormwater Development Standards apply to all new development and re-development that adds or replaces 1,000 square feet or more of impervious surface area. Acceptable stormwater management facility types along with siting and design criteria are included in the City's Stormwater Management Manual (SWMM). The current SWMM leaves the choice of facility type up to the applicant, as long as siting and design criteria are met. In response to the 2010 MS4 permit, Eugene's Stormwater Development Standards will need to be modified to prioritize low impact development techniques and green infrastructure facilities (for example: vegetated stormwater planters, rain gardens and swales) over mechanical treatment approaches (for example: prefabricated underground water quality treatment manholes) for managing stormwater. Making these changes will involve revising Eugene City Code and the SWMM. Draft revisions are under development for public review beginning in fall 2012, and adoption by the City Council in fall 2013. More information about the proposed Stormwater Development Standards changes will be posted on the City's web page by fall 2012.
- Retrofit Strategy – Under the 2010 MS4 permit, the City is required to develop a strategy to retrofit its municipal stormwater system to further reduce pollution in runoff from existing developed areas. Over the past 20 years, Eugene has implemented many environmental restoration and stormwater system retrofit projects, developed concepts for additional retrofit projects (including via the Stormwater Basin Plans), and in a limited capacity worked with property owners to encourage retrofitting stormwater systems on private property. The City's retrofit strategy will be reviewed and refined as necessary to meet the 2010 permit conditions. Public input will be solicited on the City's retrofit strategy in approximately spring 2013. For more information and an up-to-date status on development of the City's retrofit strategy, see City's web site: http://www.eugene-or.gov. Go to Services > Stormwater > Stormwater Planning, Permits and Regulations > NPDES.

Lane County's Municipal Stormwater Permit

Lane County received its first MS4 permit in 2007. Lane County's permit was issued under Phase II of the program, and is therefore called a MS4 Phase II permit. The permit required Lane County to establish a stormwater program for the regulated area corresponding to the area between the city limits of Eugene and Springfield and the cities' Urban Growth Boundaries (UGB). Lane County was required to establish a stormwater program for the regulated area to address the following minimum control measures:

NPDES Six Minimum Control Measures:

- Public Education & Outreach
- Public Involvement & Participation
- Illicit Discharge & Elimination
- Construction Site Stormwater Control
- Post-Construction Stormwater Management
- Pollution Prevention in Municipal Operations

Lane County provides stormwater services in accordance with its Stormwater Management Plan (SWMP). Many of the services in the River Road-Santa Clara area are provided by the City of Eugene on behalf of Lane County through Inter-governmental Agreements (IGAs). Lane County's SWMP was updated in July of 2011 and a new Stormwater IGA with the City of Eugene was approved in December 2011. Lane County's current NPDES was to expire on December 31, 2011 but has been administratively extended by the DEQ until a new permit is negotiated and issued.

Drywell Elimination Program

The regulatory drivers for eliminating most or all public drywells are described in this Basin Plan in Section 4.1.2. Approximately half of the City of Eugene's publicly owned and managed drywells, and most of Lane County's owned and managed drywells, are in the River Road-Santa Clara area. At the time of this information update, the Oregon DEQ has not yet issued any WPCF permits in Oregon, with the exception of City of Portland's permit. While permit conditions are not finalized, based upon the latest draft WPCF permit template, the City of Eugene is proceeding with its strategy, described in Section 4.3 of this Plan, to eliminate public drywells. Once a permit is issued, the City will re-evaluate and refine its strategy if necessary. The County is currently prioritizing risk levels for its drywells and is reevaluating its drywell management/decommissioning strategy with regard to changes in the latest draft WPCF permit template. Where the City and County have drywells in the same area, the agencies will continue to seek ways to partner on projects for the sake of efficiency and cost-effectiveness.

Capital project concepts identified in the document to address UIC decommissioning are simply starting points for the project design and implementation. Final designs are likely to differ from conceptual design concepts based on changing circumstances and additional information gathered during the design process. The South of Horn Lane UIC cluster, for example, identified on-street raingardens as the conceptual decommissioning strategy. However at this time, large-scale street improvements are not likely in the near future for this area, and other options such as individual rain gardens will need to be considered. As another example, one of the City's first UIC capital projects to be constructed (A1-8-UIC, Escalante, further described in the following paragraph) was conceptually identified as a piped decommissioning project. However, through the dynamic design process a more advantageous solution was developed resulting in a neighborhood vegetated swale as the final design.

Capital projects A1-3-UIC, A1-4-UIC (Shirley 1&2), and A1-8-UIC (Escalante) were selected for implementation by the City of Eugene first because they include drywells with the least vertical separation to seasonal high groundwater and thus pose the highest relative risk to groundwater quality. As with all capital projects when they are selected for implementation, the planning-level concepts were viewed from a more detailed perspective taking into account neighborhood input, stormwater characteristics (e.g. soil types, slopes, catchment area), system design opportunities and constraints, and cost effectiveness. Final design for both projects includes constructing a piped conveyance system which will collect the stormwater runoff from these two areas and, in each case, direct it to a neighborhood vegetated infiltration facility. In the case of the Shirley project, the infiltration facility will be located in Ferndale Park and has been designed to meet multiple objectives including consistency with park planning objectives. Designs for these two initial projects have been finalized and construction is scheduled for summer/fall 2012. For more information about the City's drywell elimination program, see City's web site: http://www.eugene-or.gov. Go to Departments > Public Works > Public Works Projects > Drywell Decommissioning.

Street Design Standards

Low impact development ("green streets"), the Pedestrian & Bicycle Master Plan "tool box" the update of the Transportation System Plan and the Envision Eugene strategies are driving the need to review and update the City's street standards. The green street concepts developed as part of the River Road – Santa Clara Basin Plan (Figures 4-5 through 4-10) will be utilized inasmuch as they illustrate potential configurations for incorporating vegetated stormwater facilities that infiltrate runoff from the adjacent right of way. The Basin Plan concepts are simply meant to help inform the street design standards update, and do not, in and of themselves, translate directly to new standards. Updating the street design standards is included in the Engineering Division's FY13 work plan.

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

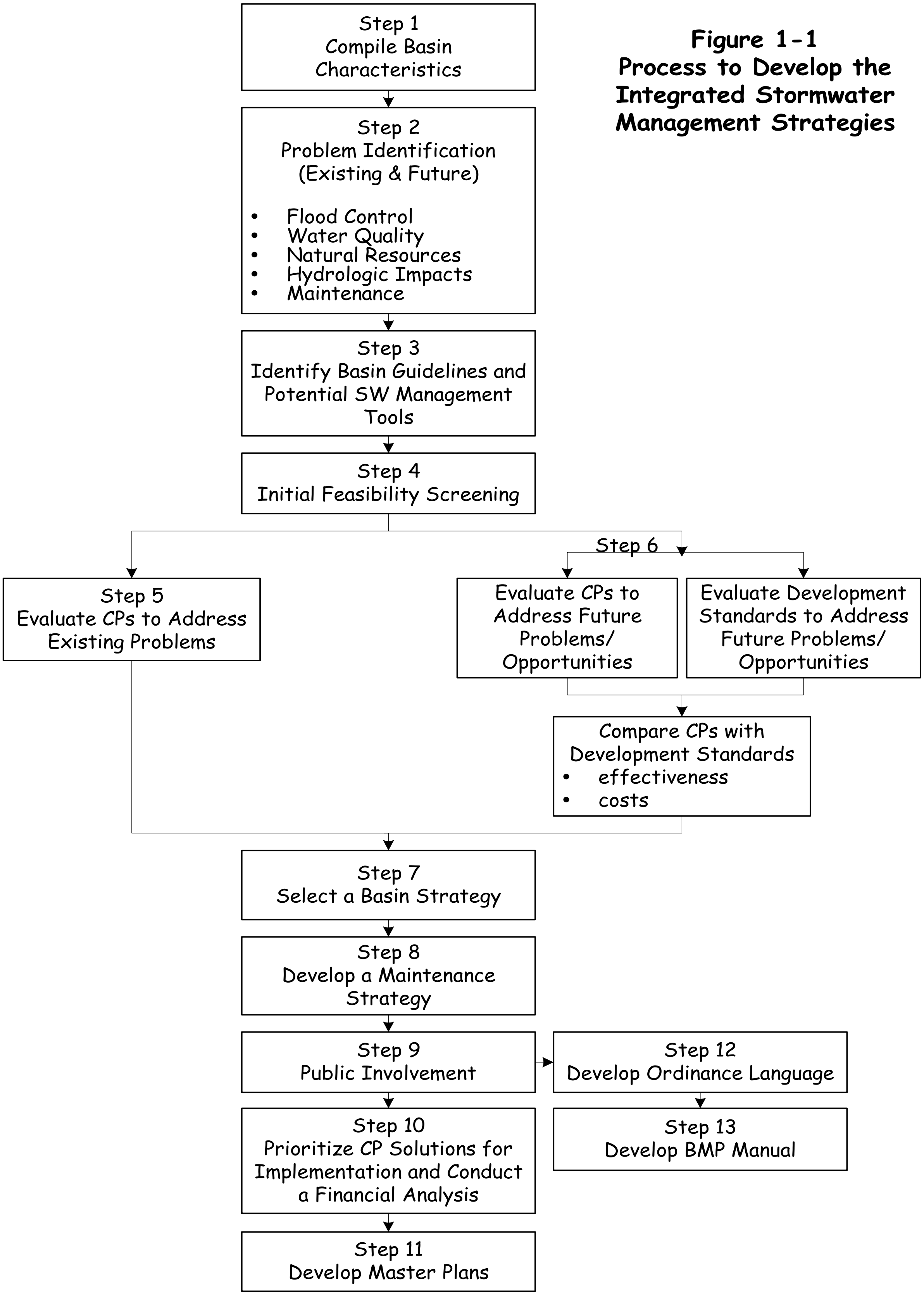
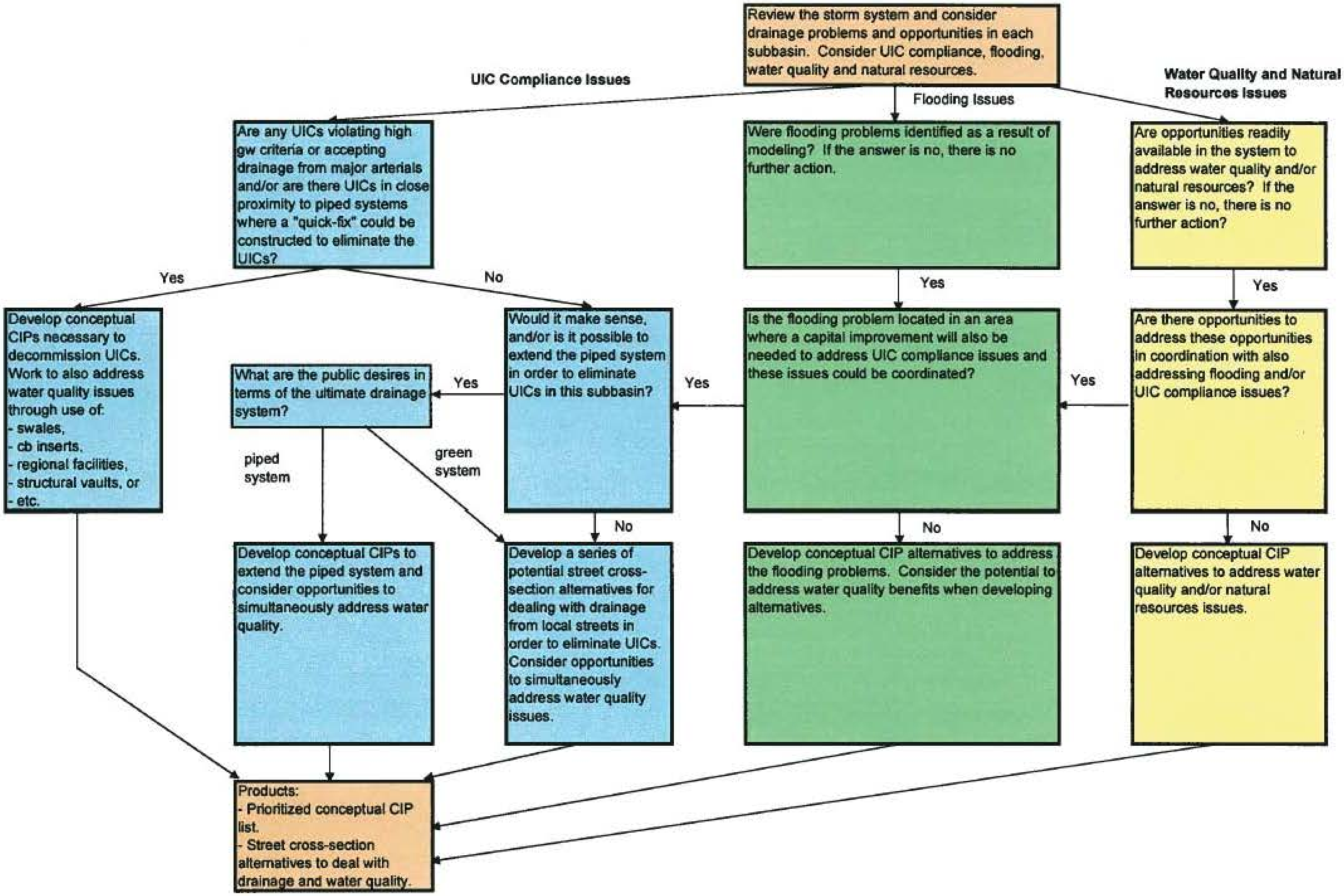


Figure 1-2
CIP/Master Planning Phase



This section provides background information regarding the existing physical characteristics of the River Road Santa Clara basin. This information was used to assess opportunities and constraints for meeting the multiple-objective goals of this study. Specifically this section includes the following information for the River Road Santa Clara 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

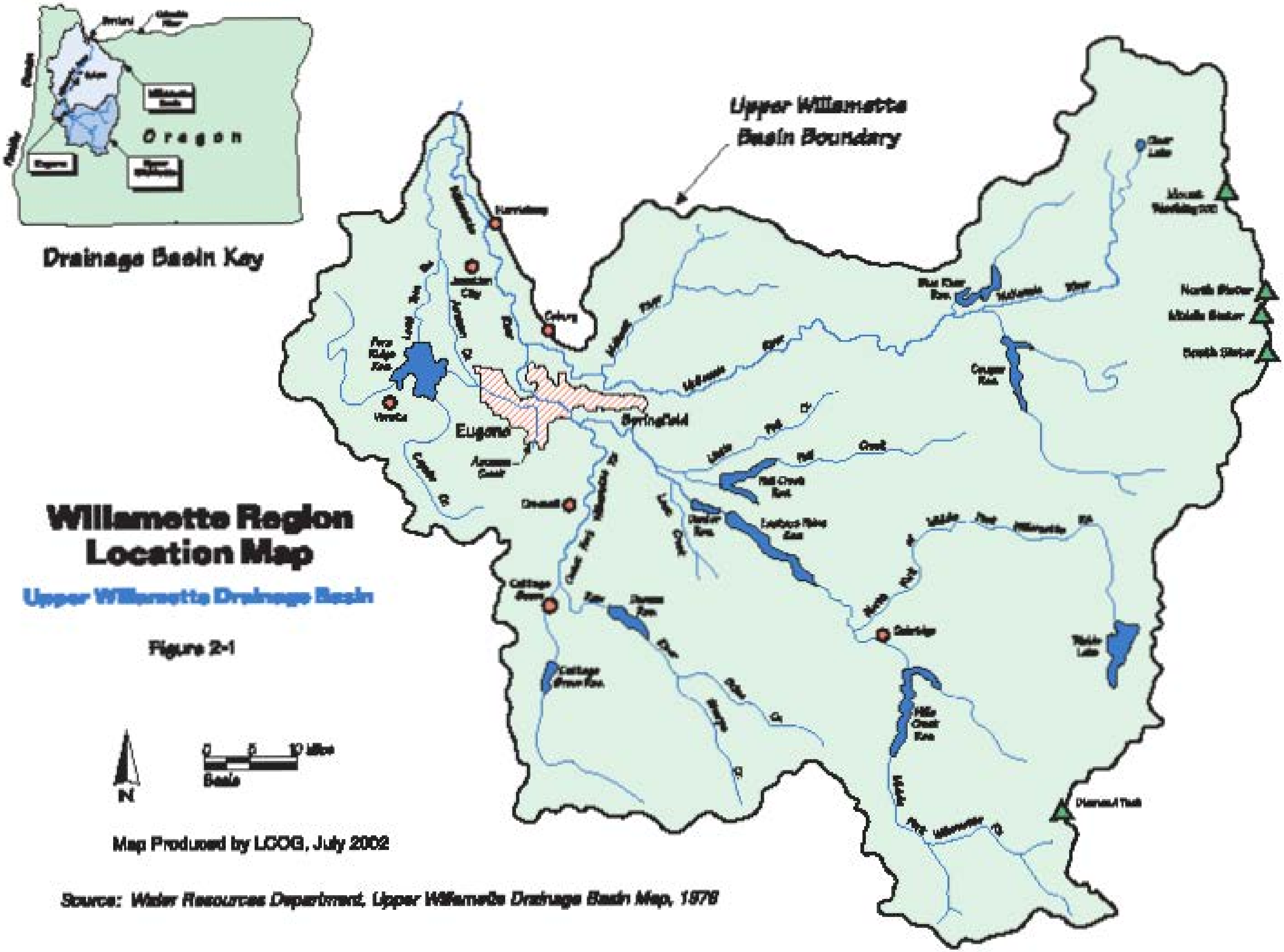
2.1.1 Regional Drainage Context

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's 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 basin plan study includes both the current city limits and the Lane County 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.



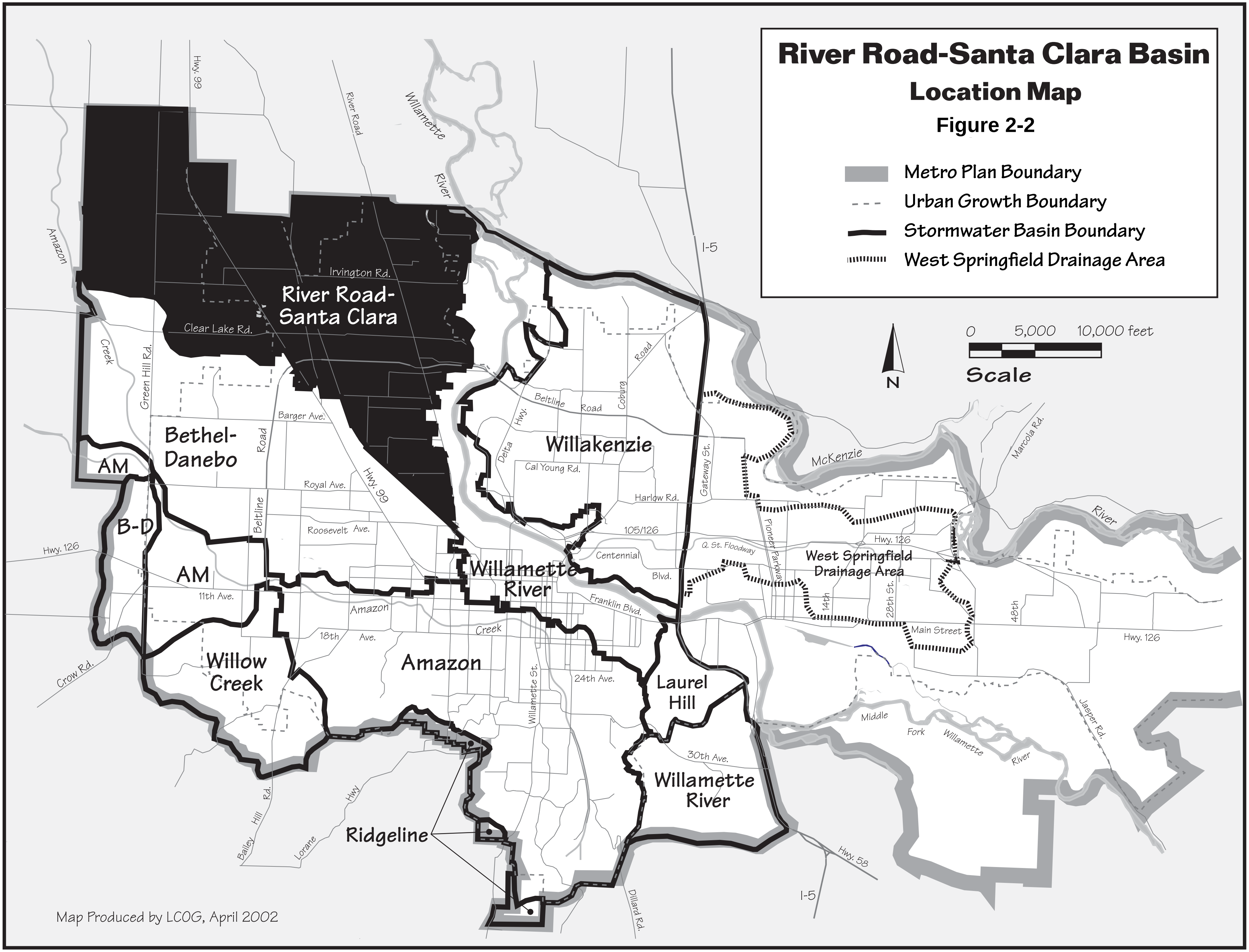
Willamette Region Location Map

Upper Willamette Drainage Basin

Figure 2-1

Map Produced by LCOG, July 2002

Source: Water Resources Department, Upper Willamette Drainage Basin Map, 1976



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

2.1.3 River Road Santa Clara Basin

As shown on Figure 2-2, the River Road Santa Clara basin forms the northwest corner of the Eugene-Springfield metropolitan area, and is generally bounded by the Willamette River on the east, the Bethel-Danebo drainage basin on the south and the *Metro Plan* boundary on the west and north. The basin is 10,458 acres in size with about 58 percent (6,071 acres) located within the Eugene urban growth boundary (UGB).

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 1949-1997.

Figure 2-3
Average Monthly Rainfall

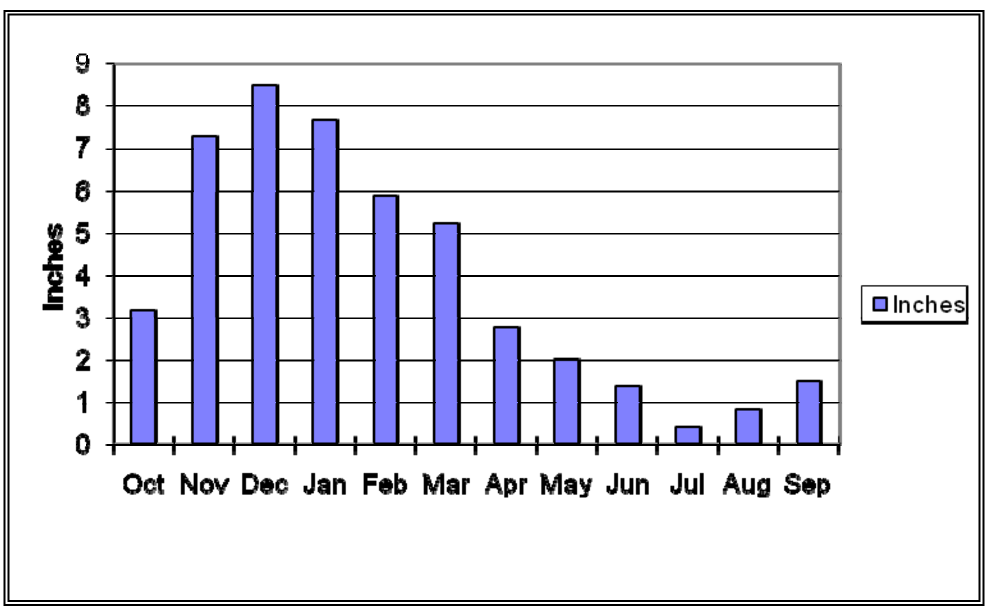


Table 2-1 characterizes a typical storm event for the Eugene area based on the historic 48-year precipitation record measured at the Eugene Airport:

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 Section 3.1.2 and 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 roadways 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 based upon the current use of the property as depicted on the Land Use Parcel Data GIS layer as of January 2007. Buildout data presented in Map 2 are based on *Metro Plan* designations. It was assumed that 15% of the area designated as "vacant" on the 2007 Land Use Parcel Data GIS layer would be for the creation of new streets. 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: agriculture (2,949 acres); low-medium density residential (2,658 acres); industrial/airport (1,447 acres); other undeveloped land (1,326 acres); street rights-of-way (1,197 acres); commercial (350 acres); and schools/churches/cemeteries (187 acres).

Table 2-2
Existing Land Use – River Road Santa Clara Basin

Land Use Categories	Acres	Percent Of Area
Inside UGB		
Agriculture	516	4.9%
Commercial	297	2.8%
Communication, Utilities	47	0.5%
Golf Courses	17	0.2%
Government	20	0.2%
Industrial	450	4.3%
Low-Med. Density Residential	2,558	24.5%
Med-High Density Residential	68	0.6%
Other Undeveloped Land	702	6.7%
Parks, Open Space, & Recreation	65	0.6%
Railroad	40	0.4%
Streets (R.O.W.)	1,106	10.6%
Schools, Churches, & Cemetaries	187	1.8%
Subtotal	**6,071**	**58.1%**
Outside UGB		
Agriculture	2,433	23.3%
Commercial	53	0.5%
Communication, Utilities	6	0.1%
Golf Courses	35	0.3%
Government	960	9.2%
Industrial	75	0.7%
Low-Med. Density Residential	99	0.9%
Med-High Density Residential	1	0.0%
Other Undeveloped Land	608	5.8%
Parks, Open Space, & Recreation	12	0.1%
Railroad	10	0.1%
Streets (R.O.W.)	91	0.9%
Timber	3	0.0%
Subtotal	**4,387**	**41.9%**
Grand Total	**10,458**	**100.0%**

Source: LCOG 2007 Parcel File

2.3.2 Buildout Land Use

The primary land use policies pertaining to the River Road Santa Clara basin are contained in the following locally adopted policy documents:

- *Eugene-Springfield Metro Area General Plan (1987)*
- *River Road Santa Clara Urban Facilities Plan (1988)*
- *Annexation and Urban Services Policy Agreement, City of Eugene and the Industrial Corridor Community Organization [ICCO], (April 1991)*

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 River Road Santa Clara basin.

2.3.2.1 Buildout Land Use Within the UGB

This area includes both the current city limits and the unincorporated UGB, totaling 6,071 acres (58% of basin). 1,217 acres are vacant and considered available for development. For the purposes of this report, the term "vacant acres" refers to lands within the UGB that are expected to develop to urban uses. As shown in Table 2-3, land use categories with significant remaining vacant acres include: industrial and commercial-industrial mixed (641 acres), low-density residential (326 acres), medium-density residential (32 acres), and commercial and residential-commercial mixed (20 acres).

2.3.2.2 Projected Land Use Outside the UGB

Forty-two percent of the River Road Santa Clara basin (4,387 acres) is located outside the UGB. All of the area outside the UGB in this basin will remain rural and land uses will be restricted to the Metro Plan designations as shown in Table 2-3. 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 General

General Plan Designation	Designated Acres	
	Total	Vacant* (2006) for Future Urban Development
Inside UGB		
Low-Density Residential	2,855	326
Medium-Density Residential	168	34
Commercial and Residential-Commercial Mixed Use	135	20
Industrial and Commercial-Industrial Mixed	1,459	641
Parks and Open Space	37	9
Government, Education, and Research	127	4
Agriculture and Agriculture/Airport Reserve	2	0.4
Streets (R.O.W.)**	1,288	183
Subtotal	6,071	1,217
Outside UGB		
Rural Residential	101	0
Low-Density Residential	0.2	0
Industrial and Commercial-Industrial Mixed	23	0
Government, Education, and Research	2,034	0
Parks and Open Space	7	0
Agriculture and Agriculture/Airport Reserve	2,114	0
Outside Metro Plan Boundary	16	0
Streets (R.O.W.)**	91	0
Subtotal	4,386	0
Grand Total	10,458	

Source: LCOG and City of Eugene Geographic Information System, 2006
*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 groundwater. 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. The infiltration capacity of undisturbed areas may be reduced during conversion to urban lawns and agricultural crops. Stormwater quality may also be impacted by lawn care and agricultural practices. Pervious surfaces in developed areas provide stormwater benefits, although to a lesser degree than undisturbed natural areas.

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 existing surface cover conditions with data current to 2007, and as they are projected to exist at buildout of the River Road Santa Clara 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 River Road Santa Clara basin is estimated to be 2,277 acres or 37.5 percent of the basin's UGB area. [Note:

calculations for this data are available from the City of Eugene.] The majority of this impervious surface area is concentrated between Highway 99 (west) and the east boundary of the basin. 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 management 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 3,044 acres, or 50 percent of the basin's UGB area at buildout. [Note: calculations for this data are available from the City of Eugene.]

2.3.3.2 Pervious Surfaces

Except for the impervious surface areas noted above, the rest of the basin remains in a pervious condition, consisting mostly in the form of prairie wetlands, forest, agriculture and lawns.

Overall, pervious area cover is expected to decrease from the current 62.5 percent of the UGB portion of the basin (3,794 acres) to 50 percent (3027 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:

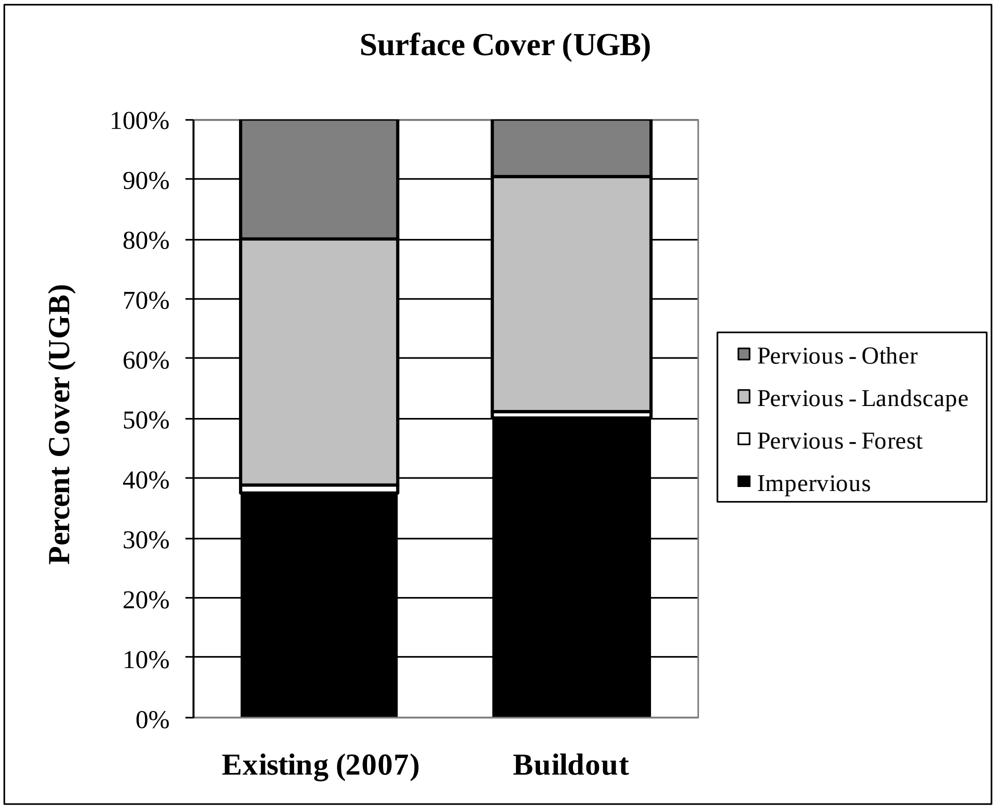
- Forest Cover is highly effective in reducing runoff volumes, and in preventing erosion (e.g., reduces soil impact by slowing down the velocity of precipitation and by intercepting up to 35 percent of it before hitting the ground) and stabilizing steep slopes (established root zones). Areas were included in this category if the forested area exceeded one acre in size. One percent of the River Road Santa Clara basin is currently in forest cover and at UGB buildout, forest cover would decrease to 0 percent.

- 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 decrease from the existing 41 percent to 39 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 20 percent of the UGB to 9.7 percent at UGB buildout.

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

Figure 2-4
Surface Cover in the River Road Santa Clara Basin UGB



2.4 Landform, Topography, Slopes

Ninety-nine percent of the basin has slope in the 0%-5% category. The following table is keyed to Map 4, Slope and Topography, and indicates the amount of acres affected by varying categories of slope steepness.

Table 2-4
River Road Santa Clara Basin Slope Distribution

Location	Slope Distribution (percent)					
	Slopes 0-5%	Slopes 6-10%	Slopes 11-15%	Slopes 16-25%	Slopes >25%	Total
Within UGB	99%	1%	0%	0%	0%	100%
Outside UGB	99%	1%	0%	0%	0%	100%
Total Basin	99%	1%	0%	0%	0%	100%

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 over banking conditions has been accomplished for most small storm events.

Five major drainage systems exist in this basin including: the A-1 Channel, Flat Creek, Spring Creek, Highway 99 and the Willamette Overflow (also referred to as the East Santa Clara Waterway). Generally, these open waterways run in a northerly or northwesterly direction. Historically, most of these features meandered along the valley floor before reaching the Willamette River or Long Tom River. Some of these have been altered into narrow, deep and well defined channels designed to collect and convey runoff while others remain relatively undisturbed.

2.5.1.1 A-1 Channel

The A-1 Channel originates at the junction of Beltline Highway and the Northwest Expressway. It is the largest waterway in this basin flowing northwesterly about three miles through the Highway 99 Industrial Corridor. The channel is surrounded by residential use in the Santa Clara neighborhood changing to adjacent agricultural use as it leaves the UGB. The channel drains into Amazon Creek outside of the *Metro Plan* boundary. This channel was constructed by the Soil Conservation Service as part of the Lower Amazon and Flat Creek Watershed Improvement Projects primarily for flood control purposes. Vegetation lacks diversity along the channel contributing to poor wildlife habitat. The channel has high enhancement potential however, due to its connectivity with other waterways. The A-1 Channel is listed as a riparian resource site (refer to E60: A-1 Channel) in the adopted 2007 Goal 5 Water Resources Conservation Plan, a refinement plan to the Eugene-Springfield Metro Plan. Protections for two of three identified segments of Site E60 in the form of the Water Resources Conservation Overlay Zone (Eugene Code 9.4910) were adopted by the City of Eugene in November 2005 (effective January 1, 2006) and Lane County in December 2006 (effective January 12, 2007), including setbacks of 20 feet from top of high bank.

2.5.1.2 Flat Creek

The southern portion of Flat Creek begins near the Northwest Expressway and Park Avenue and flows north towards Beltline Road. With development of Beltline Road and the Northwest Expressway, the natural Flat Creek drainage area south of Beltline Road was diverted into the A-1 Channel, and is no longer hydrologically linked to the northern portion of Flat Creek. The southern portion of Flat Creek includes riparian resource sites E61 (Middle Flat Creek) and E69

(South Flat Creek). Eight of the ten identified segments of Sites E61 and E69 are protected in the form of the Water Resources Conservation Overlay Zone adopted by the City of Eugene and Lane County, including setbacks ranging from 0 to 40 feet from top of high bank. Although not hydrologically linked with the southern portion, the northern portion of Flat Creek extends from Beltline Road and continues north where it exits the *Metro Plan* boundary near Beacon Drive. Eventually the creek joins the Willamette River by way of Ingram Slough near the community of Monroe. Unlike the A1 Channel, Flat Creek is a natural drainage feature and is identified for possible protection in the 1987 River Road Santa Clara Urban Facilities Plan (Environmental Design Element), a refinement plan to the Eugene-Springfield Metro Plan. More recently, Flat Creek is listed as a riparian resource site (refer to E59: Flat Creek) in the adopted 2007 Goal 5 Water Resources Conservation Plan, also a refinement plan to the Metro Plan. Six of seven identified segments of Site E59 are protected in the form of the Water Resources Conservation Overlay Zone adopted by the City of Eugene and Lane County, including setbacks ranging from 0 to 20 feet from top of high bank. The condition and function of Flat Creek within the UGB varies significantly with some segments relatively undisturbed and others significantly altered due to urban development property owner impacts.

2.5.1.3 Spring Creek

Spring Creek is about two miles long (within the UGB) and flows south-to-north beginning just north of Greenfield Avenue. It crosses River Road near Spring Creek Drive and continues north where it eventually joins the Willamette River nearly 3 miles north of the UGB. The creek flows through Awbrey Park and is adjacent to Spring Creek Elementary School serving both a stormwater and open space function. The creek is bordered by riparian vegetation, predominately Oregon ash and Bigleaf maple. Spring Creek is identified for possible protection in the 1987 River Road Santa Clara Urban Facilities Plan (Environmental Design Element), a refinement plan to the Eugene-Springfield Metro Plan. More recently, Spring Creek is listed as a riparian resource site (refer to E58: Spring Creek) in the adopted 2007 Goal 5 Water Resources Conservation Plan, also a refinement plan to the Metro Plan. Five of six identified segments of Site E58 are protected in the form of the Water Resources Conservation Overlay Zone adopted by the City of Eugene and Lane County, including setbacks ranging from 0 to 40 feet from top of high bank.

2.5.1.4 Willamette Overflow

The Willamette Overflow, also referred to as the “East Santa Clara Waterway” is a two mile long waterway located in the northeast portion of the basin and straddles the UGB. It has a relatively high wildlife value and is one of a few vegetated sloughs identified for potential protection in the River Road Santa Clara Urban Facilities Plan (Environmental Design Element), a refinement plan to the Eugene-Springfield Metro Plan. More recently, it is listed as a riparian resource site (refer to E57: East Santa Clara Waterway) in the adopted 2007 Goal 5 Water Resources Conservation Plan, also a refinement plan to the Metro Plan. Two of four identified segments of Site E57 are protected in the form of the Water Resources Conservation Overlay Zone adopted by the City of Eugene and Lane County, including setbacks ranging from 20 to 40 feet from top of high bank.

2.5.1.5 Highway 99

This drainage system mainly consists of a long roadside ditch along Highway 99. This ditch drains in a northwesterly direction and into the A-1 channel. The ditch is owned and maintained by the Oregon Department of Transportation.

2.5.2 Wetlands

Most wetland features within the basin are associated with riparian areas adjacent to creeks and open waterways. There are also a few wetland sites located primarily near the relatively undeveloped northern and western portions of the basin outside the UGB. About 281 acres of wetlands are identified in the basin in the National Wetland Inventory (NWI) which provides basic data about the general characteristics and extent of wetlands in the nation. The NWI identifies the general boundaries of wetlands; however, in many instances actual wetland boundaries are more extensive than what is identified. About 54 percent of the NWI wetlands in the basin are located outside the UGB, and the area outside the UGB represents about 42 percent of the total basin area.

A Local Wetland Inventory (LWI) was conducted in 2005, and the wetland sites evaluated for potential protection as part of the City and County's Goal 5 efforts. Several wetland sites in the River Road Santa Clara basin are identified in the adopted 2007 Goal 5 Water Resources Conservation Plan in the River Road Santa Clara basin and are protected in the form of the Water Resources Conservation Overlay Zone adopted by the City of Eugene and Lane, including setbacks ranging from 25 to 50 feet from the jurisdictional wetland boundary.

The River Road Santa Clara basin also includes several open water ponds; all located in the general vicinity of the Northwest Expressway and/or Highway 99 North. These ponds are identified in the adopted 2007 Goal 5 Water Resources Conservation Plan as Site E62: Northwest Expressway Ponds. The Northwest Expressway ponds are located just south of Maxwell Road and on both the east and west sides of the Northwest Expressway. The eastern pond (Dianna’s Pond) is within the River Road Santa Clara basin and is hydrologically connected with Upper (or South) Flat Creek. The pond is a former borrow pit that currently supports willow, black cottonwood, reed canary grass, rush and sedge as the predominant plant species. The southern and eastern arms of the pond have healthy riparian strips, while much of the rest of the banks are bare and eroding.

2.5.3 Public Piped Drainage System

Most of the existing development in this basin occurred prior to the City of Eugene having jurisdiction over urban land use requirements and, as a consequence, this basin lacks a stormwater pipe system found in the other basins. Only 94.5 miles of stormwater pipes exist in this basin and 43 of these miles are located outside the UGB, mostly serving Mahlon Sweet Airport. The piped system located within the UGB was constructed to serve more recent development that was required to annex and develop to City of Eugene standards. See Map 5.

2.5.4 Drywell Drainage System

Drywells are underground structures that collect stormwater runoff which is then discharged into the ground where it mixes with the groundwater. The River Road Santa Clara stormwater basin is unique compared to other Eugene-area basins in its frequent use of drywells for managing stormwater. Approximately 22% of the River Road Santa Clara stormwater basin currently drains to drywells. This area has historically utilized drywells because it lacks a continuous stormwater system and because the flatness of the topography and the relatively high permeability of the soils are conducive to stormwater management through this method. There are 785 known drywells in the River Road Santa Clara basin. Of those drywells, 634 (81%) are privately owned, 79 (10%) are owned by Lane County, and 72 (9%) are owned by the City of Eugene. Drywells come in numerous configurations which are collectively termed "Underground Injection Controls" or "UICs."

2.5.5 Maintaining the Drainage System

The Lane County Public Works Department, the Junction City Water Control District, and the City of Eugene share limited maintenance responsibilities in this basin. Lane County Public Works Department is responsible for stormwater facility maintenance in the unincorporated portions of this basin. This maintenance activity is limited to drainage problems that directly affect County right-of-way, such as roadside ditches, culverts, and bridge crossings. The Junction City Water Control District is responsible for maintenance of irrigation ditches, channels and waterways within the District's boundaries, which lie in the unincorporated areas north of Eugene in the Flat Creek, A, A-1 and A-2 Channel watershed boundaries. The City is responsible for maintaining areas that have been annexed to the City. The City and County share maintenance responsibilities in this basin which results in greater efficiencies for both jurisdictions.

2.5.6 Floodplain

A flood insurance study for the Federal Emergency Management Agency (FEMA) has been conducted within the River Road Santa Clara basin. As part of this study, areas subject to the 100-year flood event have been identified. One thousand two hundred seventy acres of floodplain have been mapped within the basin. There are approximately equal acres of floodplain within and outside the UGB. Most of the broad floodplain area is associated with the Willamette River in the northeast portion of the basin just outside the UGB. Ribbons of floodplain are also located adjacent to the five primary waterways that flow through the basin. (See Map 5) More detailed floodplain studies necessary to map floodway boundaries have not been conducted for this basin.

2.6 Water Quality

This section provides a description of water quality conditions in the River Road Santa Clara basin. Water quality conditions can vary dramatically 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.

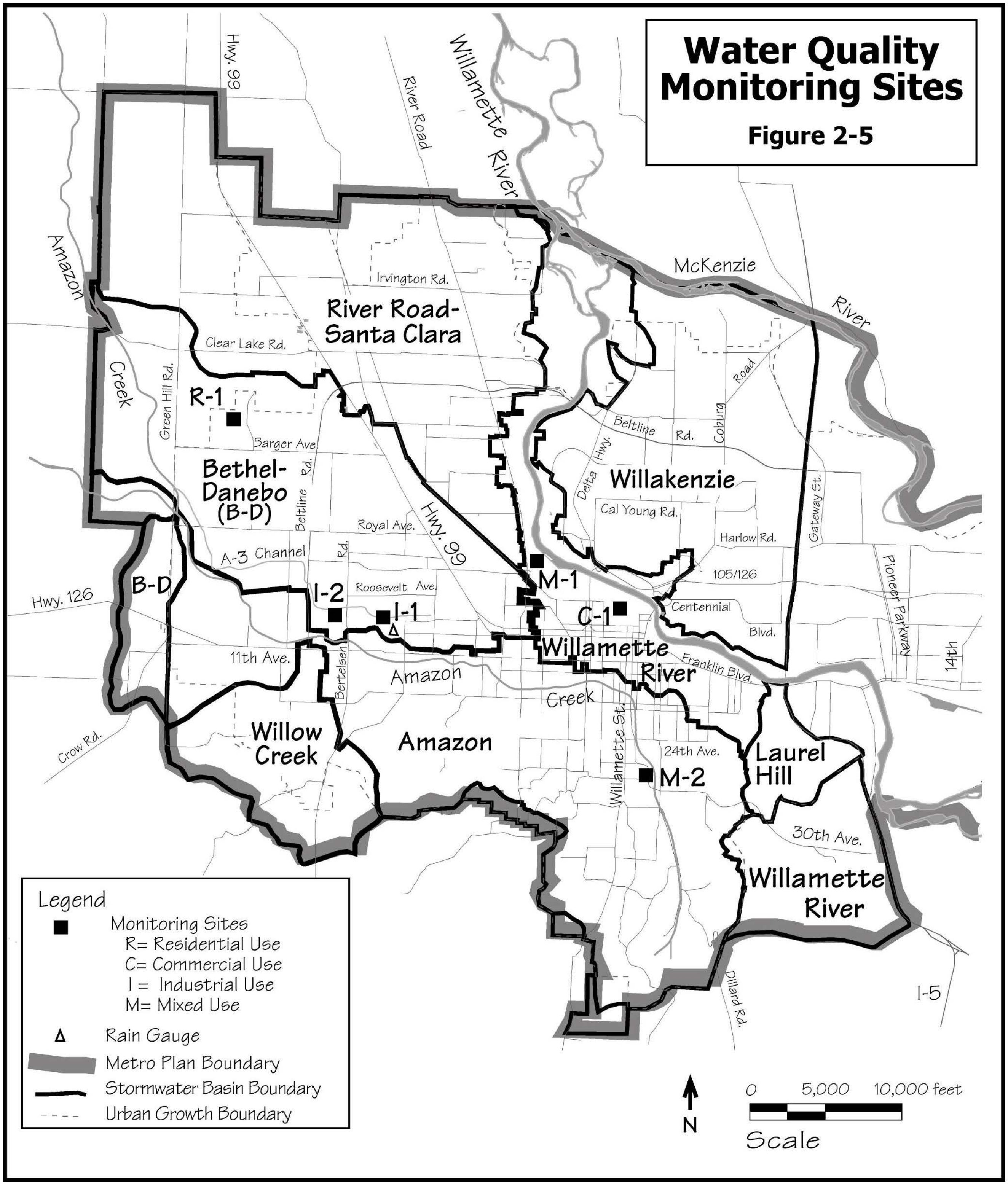
2.6.1 Documented Water Quality Problems

The following subsections describe the water quality problems that have been documented for the River Road Santa Clara 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 none of these data were collected from within the River Road Santa Clara basin, they provide general information regarding stormwater quality in Eugene and were used in this initial study towards the development of a stormwater basin master plan.



Water Quality Monitoring Sites
Figure 2-5
River Road-Santa Clara
Bethel-Danebo (B-D)
B-D
Willakenzie
Willow Creek
Amazon
Laurel Hill
Willamette River
R-1
I-2
I-1
M-1
C-1
M-2
Hwy. 99
River Road
Willamette River
McKenzie River
Amazon Creek
Irvington Rd.
Clear Lake Rd.
Green Hill Rd.
Barger Ave.
Beltline Rd.
Royal Ave.
A-3 Channel
Roosevelt Ave.
Hwy. 126
11th Ave.
Bertelsen
Crow Rd.
Delta Hwy.
Cal Young Rd.
Coburg Road
Harlow Rd.
Gateway St.
105/126
Centennial Blvd.
Pioneer Parkway
Franklin Blvd.
14th
24th Ave.
Willamette St.
30th Ave.
Dillard Rd.
I-5
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

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 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 River Road Santa Clara basin, the commercial and industrial areas are in the following locations:

- Along Highway 99.
- Along the Northwest Expressway.
- Along Prairie Rd.
- In the vicinity of the Beltline, River Road intersection.

2.6.1.2 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:

- *Excessive Sediment:* Elevated levels of sediment have been observed in Spring Creek, potentially due to poor erosion control practices at construction sites.

- *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 in this basin and maintenance access is often limited for removing debris.

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.

No water bodies in the River Road Santa Clara basin appear on the 303(d) list. However, two subbasins drain to the Amazon Creek and all subbasins in River Road Santa Clara eventually drain to the Upper Willamette River. Amazon Creek appears on the 303(d) list for bacteria, arsenic and lead. The Willamette River appears on the 303(d) list for bacteria, temperature and mercury. A TMDL was issued for the Willamette River basin in September 2006 for bacteria, mercury, and temperature. Lane County and the City of Eugene have each developed TMDL implementation plans outlining specific actions and programs to address water quality problems in the Willamette Basin. Lane County's plan was approved by the DEQ on June 17, 2008. The City of Eugene's plan was approved on December 23, 2008.

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 is 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 River Road Santa Clara Basin (UGB)

Miles per Square Mile of Open Drainage System in the River Road Santa Clara Basin	River Road Santa Clara Basin Relative to the Range in Other Eugene Basins (miles/sq mile)
3.0	

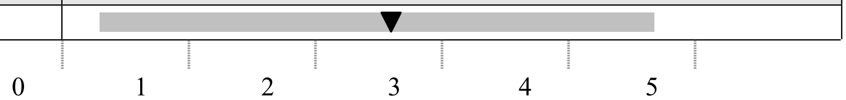
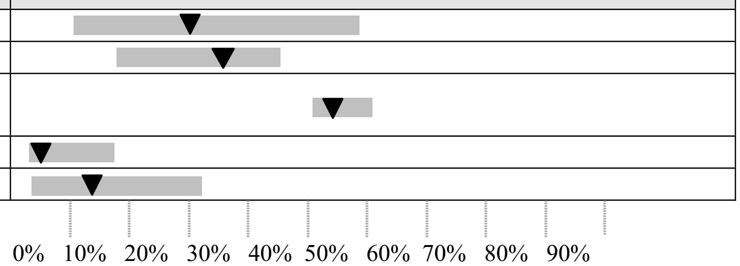


Figure 2-7
Extent of Area as a Percentage of the River Road Santa Clara Basin (UGB)

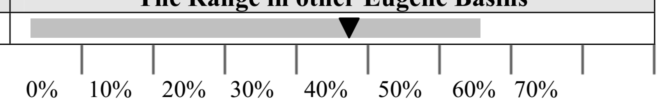
Factors	Percent in River Road Santa Clara Basin	River Road Santa Clara Basin Relative to The Range in other Eugene Basins
Remaining Vacant Lands*	**29%**	
Existing Impervious Surface Area	**34%**	
Projected Impervious Surface Area	**51%**	
Wetlands	**3%**	
100-Year Floodplain	**12%**	



* *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 River Road Santa Clara Basin

Percent of 100-Yr. Floodway Fringe Vacant* in the River Road Santa Clara Basin	River Road Santa Clara Basin Relative to The Range in other Eugene Basins
44%	



* *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 River Road Santa Clara basin as follows:

- 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.

- The extent of the open drainage system in the basin on a miles per square mile basis is in the mid-range when compared with other Eugene drainage basins.
- At 34 percent, the basin currently has levels of imperviousness that are expected to degrade water quality. Projections at UGB buildout indicate that the impervious surface area will increase to 51 percent, which is the highest for all of the basins.

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 chapter is to describe the known rare species and communities located in the River Road Santa Clara basin so that the details of these resources can be consulted prior to any final decisions. Review of the Oregon Natural Heritage Program database reveals no records of rare plant, animal, or community observations.

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 completed a review of its own processes, procedures, and development standards and identified those that may not be compatible with the 4(d) rules for potential adjustment. Lane County has established a Routine Road Maintenance Manual outlining procedures and standards for road maintenance activities designed to be compatible with the 4(d) rules.

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 River Road Santa Clara basin. All soils data were obtained from the *USDA Soil Survey of Lane County*. Refer to Tables 2-6 to 2-8 and Maps 6 to 10 for a description of the soil mapping units and relevant stormwater related data found in River Road Santa Clara 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.

Compared with other Eugene basins, soil permeability in the River Road Santa Clara basin within the UGB is relatively high with 81% being moderately slow and 17% being moderate to very rapid. The following table displays the distribution of soil permeability for the basin.

Table 2-6
Soil Permeability in the River Road Santa Clara Basin

Location	Permeability (percent)							
	Very Rapid	Moderately Rapid	Moderate	Moderately Slow	Slow	Very Slow	No Data*	Total
Within UGB	4%	3%	10%	81%	0%	1%	1%	100%
Outside UGB	8%	2%	3%	74%	3%	8%	2%	100%
Total Basin	7%	3%	7%	78%	1%	3%	1%	100%

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

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 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 with a high runoff potential are more likely to have low infiltration rates. 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, the River Road Santa Clara basin within the UGB contains soil groups with runoff ratings ranging from moderately low (16%), moderately high (71%) to "high" (11%). The following table displays the distribution of potential runoff qualities of the basin:

Table 2-7
Runoff Potential in the River Road Santa Clara Basin

Location	Medium	Low	Negligible	No Data*	Total
Within UGB	80.7%	17.3%	0.5%	1.4%	100%
Outside UGB	75.9%	22.5%	0.3%	1.3%	100%
Total Basin	78.7%	19.5%	0.4%	1.4%	100%

**Includes borrow pits and water features such as ponds*
Source:NRCS Soil Data, December 2006.

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.

The *Soil Survey of Lane County* indicates soils in this basin are generally not susceptible to high levels of erosion (See Map 8).

2.8.4 Unstable Slopes

Soils that are subject to slumping can present structural problems especially where extensive grading is made for roads and building pads.

The *Soil Survey of Lane County* indicates there are no soils in this basin 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.

The following table displays the percentage of hydric soils found in the basin. Hydric soils areas are located almost entirely west of the Northwest Expressway corresponding to historic low lying drainage areas (See Map 9).

Table 2-8
Hydric Soils in River Road Santa Clara Basin

Location	Hydric Soils (percent)
Within UGB	11%
Outside UGB	37%
Total Basin	22%

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.

The second issue relates to depth to the water table. Map 11 shows the depth to high water table during the wet season. This information is linked to soil type and comes from the *USDA Soil Survey of Lane County*. During the course of the year, these elevations respond to rainfall amounts and, therefore, vary accordingly. As with hydric soil location, the Northwest Expressway is a definitive boundary where deeper water table elevations are found to the east and shallower depths to the west. As part of this study a more detailed analysis of high groundwater was conducted by reviewing well logs from the Oregon Water Resources department. The results of the evaluation showed that seasonal high groundwater levels are approximately 8 feet deep on average in this basin. A copy of study results is provided in Appendix E.

With regard to the issues of aquifer protection and depth to the water table, the numerous drywells used for stormwater management in this basin present a unique environmental problem because drywells have the potential to discharge surface water pollutants directly to groundwater without sufficient treatment.

Congress enacted groundwater protection rules in 1974 under the federal Safe Drinking Water Act (SDWA). The U.S. Environmental Protection Agency (EPA) administers these rules under Title 40 of the Code of Federal Regulations (CFR) Parts 144 -148. In Oregon, the EPA has delegated the regulation of groundwater protection rules to the Department of Environmental Quality (DEQ). The DEQ regulates this program for the EPA under the Oregon Administrative Rules (OAR) Chapter 340, Division 44.

As part of these groundwater protection rules, DEQ specifies a minimum of 10 feet of separation between the bottom of a drywell and the seasonal high groundwater. Due to high groundwater in a large portion of the River Road Santa Clara basin, most of the UICs in this area do not meet the necessary separation criteria and cannot, therefore, be Authorized by Rule by the DEQ. Both the City of Eugene and Lane County have registered their known UICs with the DEQ and have applied for a Water Pollution Control Facility (WPCF) permit to manage the UICs until they can be authorized or decommissioned. More detail regarding these regulations and strategies for compliance are provided in Section 4.0 of this document.

2.10 Existing and Planned Educational Facilities

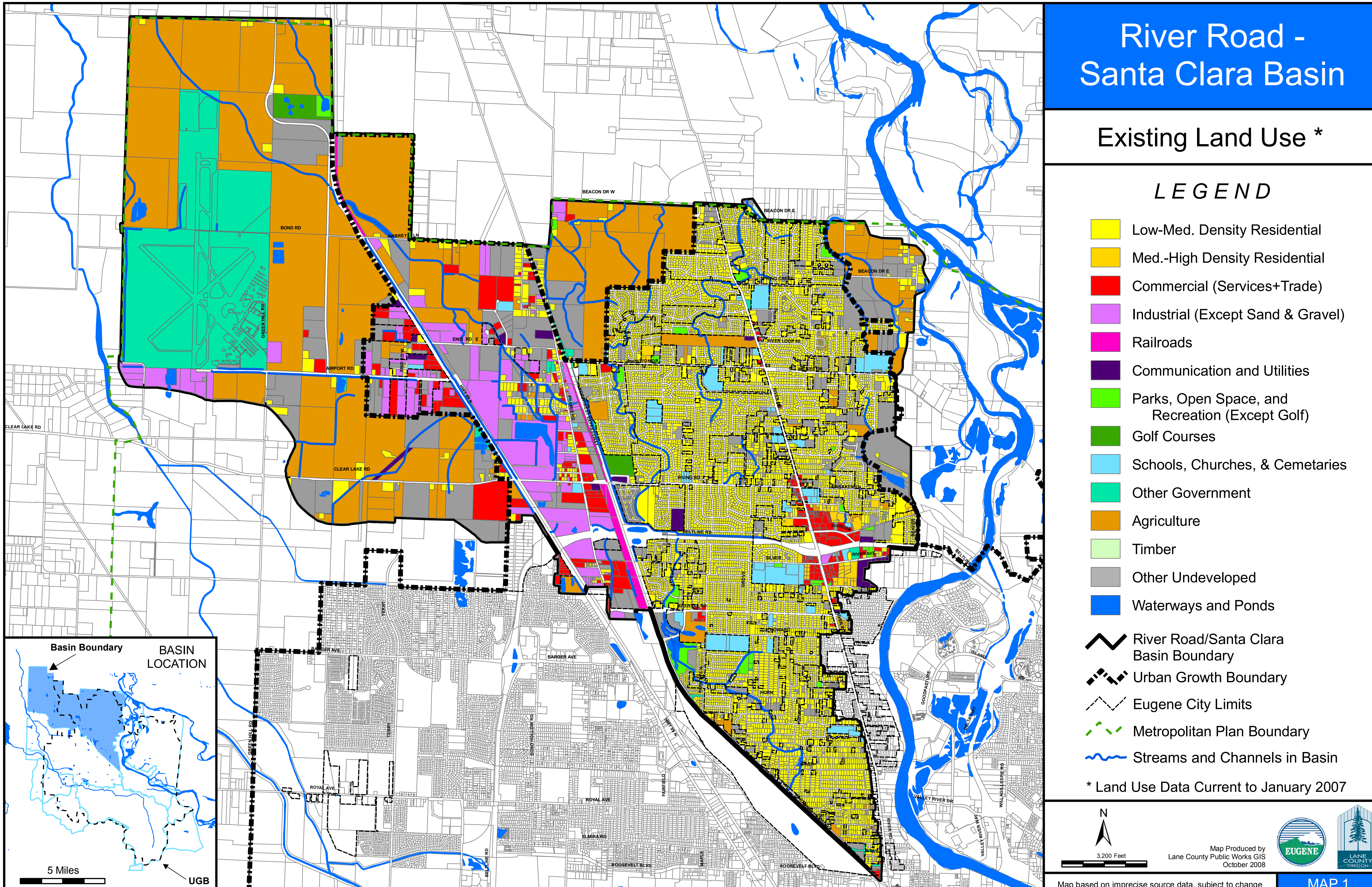
The River Road Santa Clara basin currently has nine public schools (including two middle schools and one high school) and one private school. No additional schools are currently planned in the basin.

2.11 Existing and Planned Park and Recreational Facilities

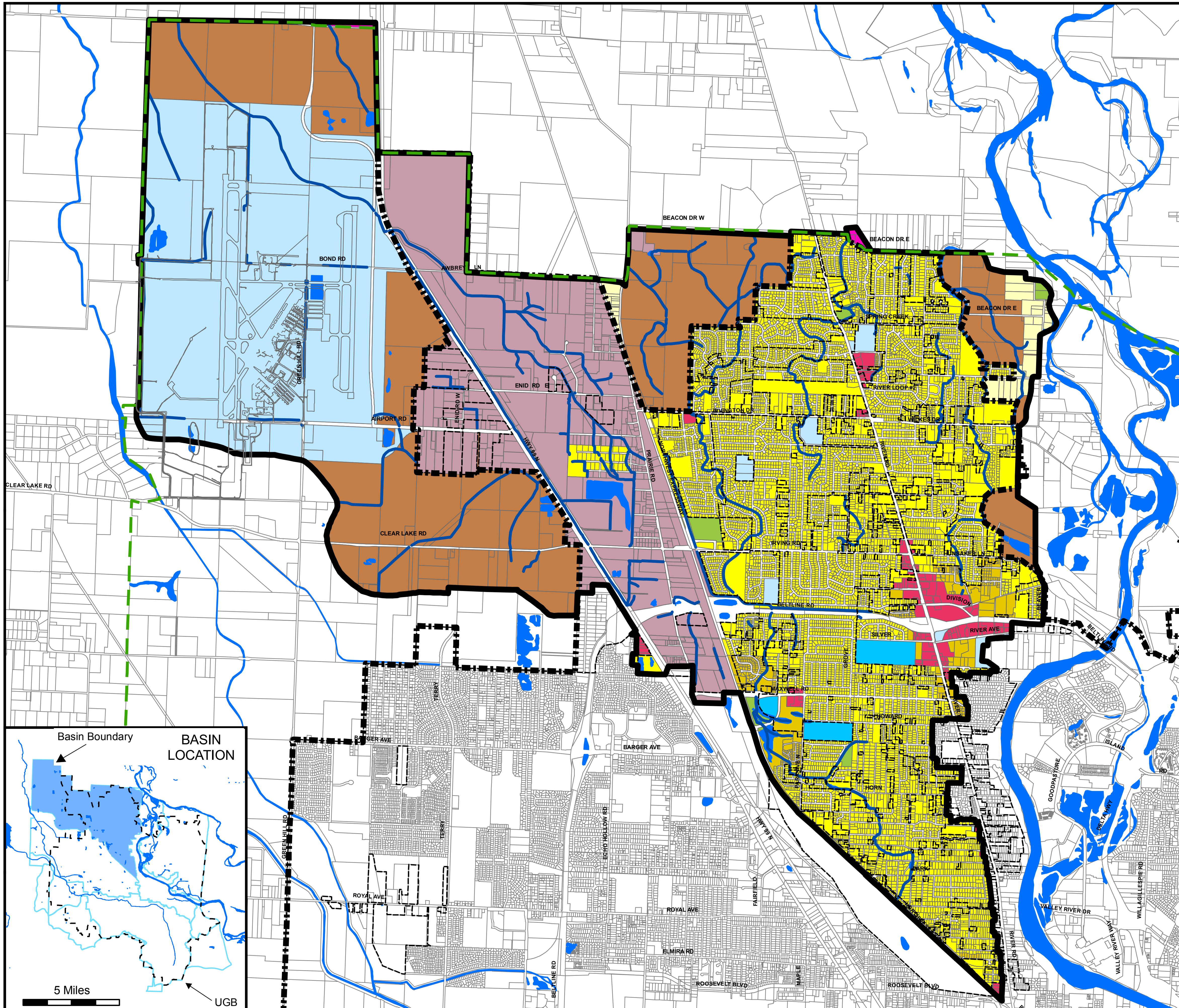
The River Road Santa Clara basin contains 69 acres of public park land spread over 13 separate park parcels (see Map 12). The two largest parks are Emerald Park (9.78 acres) and Walnut Grove (19.75).

Because of its environmental, historic and social significance, Walnut Grove Park is one of the few neighborhood parks in Eugene to be maintained as a natural environment. The plan for the park, which was developed in collaboration with area neighbors, emphasizes native plant and wildlife preservation and enhancement, passive recreation, and educational opportunities.

River Road Santa Clara basin is currently served with limited on-street bicycle lanes.



River Road - Santa Clara Basin
Existing Land Use *
LEGEND
Low-Med. Density Residential
Med.-High Density Residential
Commercial (Services+Trade)
Industrial (Except Sand & Gravel)
Railroads
Communication and Utilities
Parks, Open Space, and Recreation (Except Golf)
Golf Courses
Schools, Churches, & Cemeteries
Other Government
Agriculture
Timber
Other Undeveloped
Waterways and Ponds
River Road/Santa Clara Basin Boundary
Urban Growth Boundary
Eugene City Limits
Metropolitan Plan Boundary
Streams and Channels in Basin
* Land Use Data Current to January 2007
N
3,200 Feet
Map Produced by
Lane County Public Works GIS
October 2008
EUGENE
LANE COUNTY OREGON
Map based on imprecise source data, subject to change
MAP 1
Basin Boundary
BASIN LOCATION
5 Miles
UGB
BEACON DR W
BEACON DR E
BOND RD
AIRPORT RD
CLEAR LAKE RD
BELTLINE RD
BARGER AVE
ROYAL AVE
ROOSEVELT BLVD



River Road - Santa Clara Basin

Projected Land Use *

LEGEND

- Rural Residential
- Low Density Residential
- Medium Density Residential and and MDR 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
- Agricultural and Ag/Airport Reserve
- Waterways and Ponds
- River Road-Santa Clara 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 approved on April 8, 2004. Also reflects ammendments approved by individual jurisdictions.

N

3,200 Feet

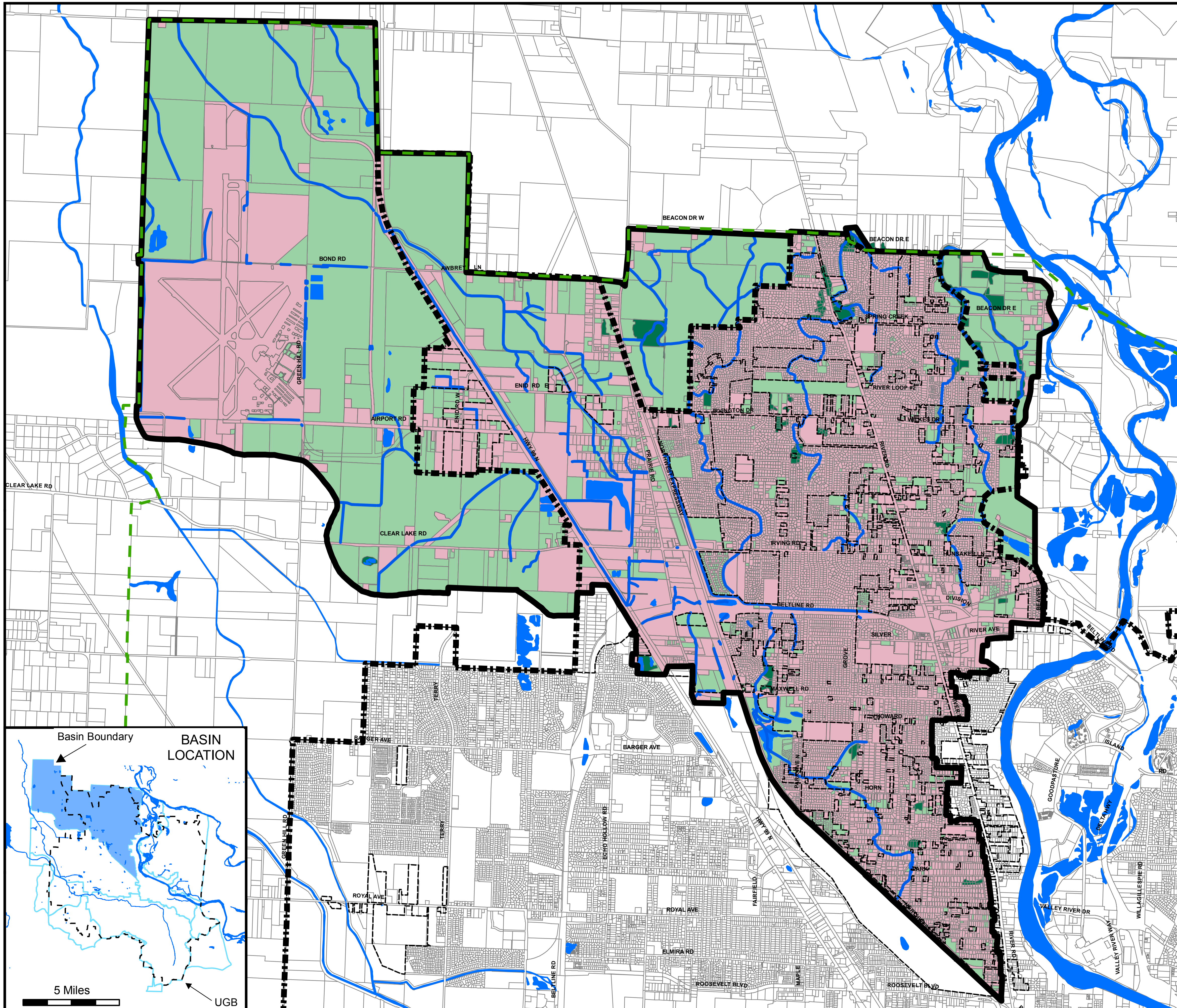
Map Produced by
Lane County Public Works GIS
December 2008

Map based on imprecise source data, subject to change

MAP 2

River Road - Santa Clara Basin

Surface Cover*



LEGEND

- Pervious - Other Vegetated Areas
- Pervious - Generalized Forest Cover
- Impervious Surface Areas - includes percentage of pervious landscaped areas
- Waterways and Ponds
- River Road - Santa Clara Basin Boundary
- Urban Growth Boundary
- Eugene City Limits
- Waterways and Ponds
- Metropolitan Plan Boundary

* The Impervious Surface Areas category is derived from the 2007 Land Use 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 2004 color aerial photographs, and includes all forest patches over one acre in size.

N

3,200 Feet

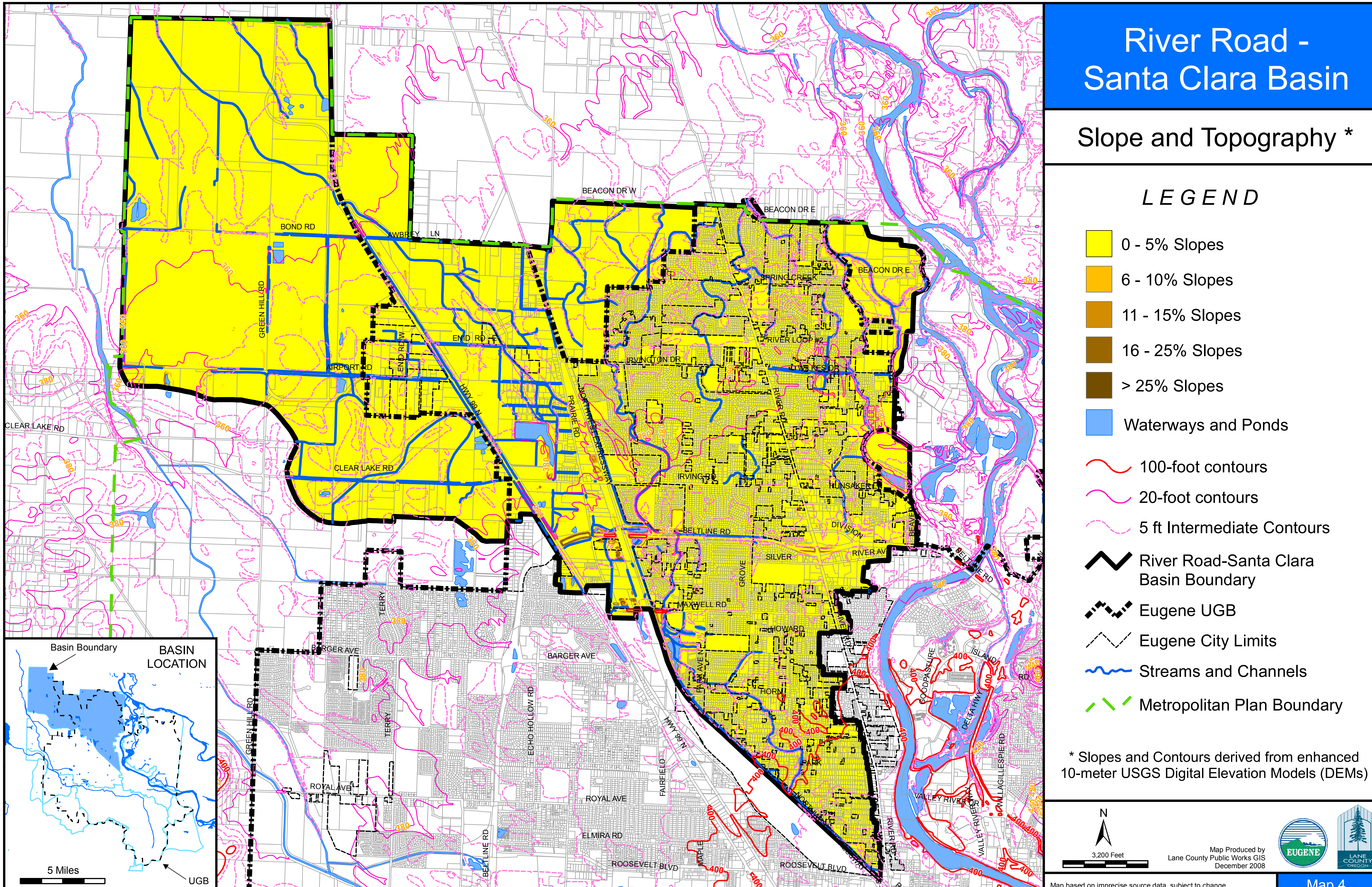
Map Produced by
Lane County Public Works GIS
December 2008

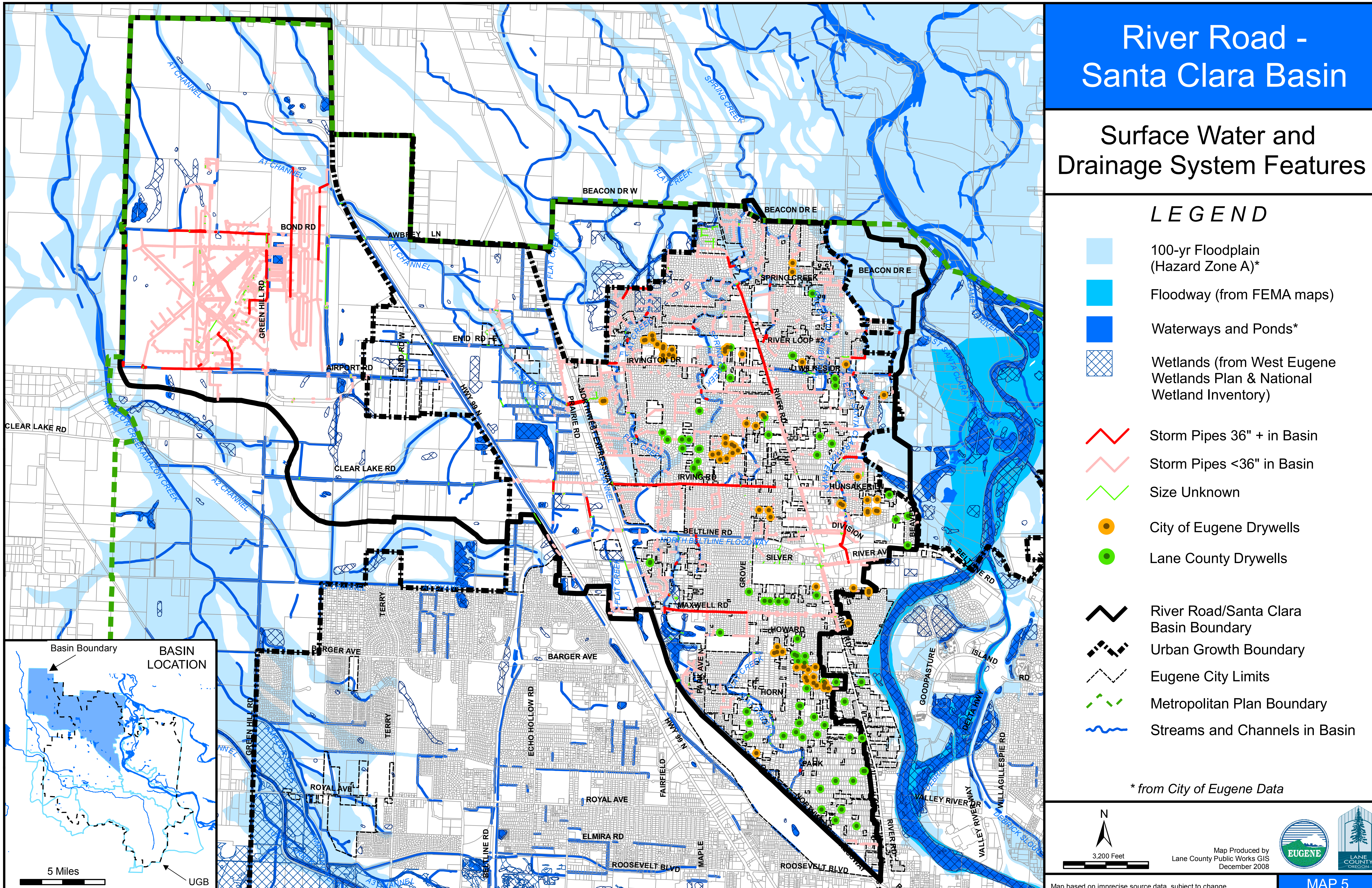
EUGENE

LANE COUNTY OREGON

Map based on imprecise source data, subject to change

MAP 3

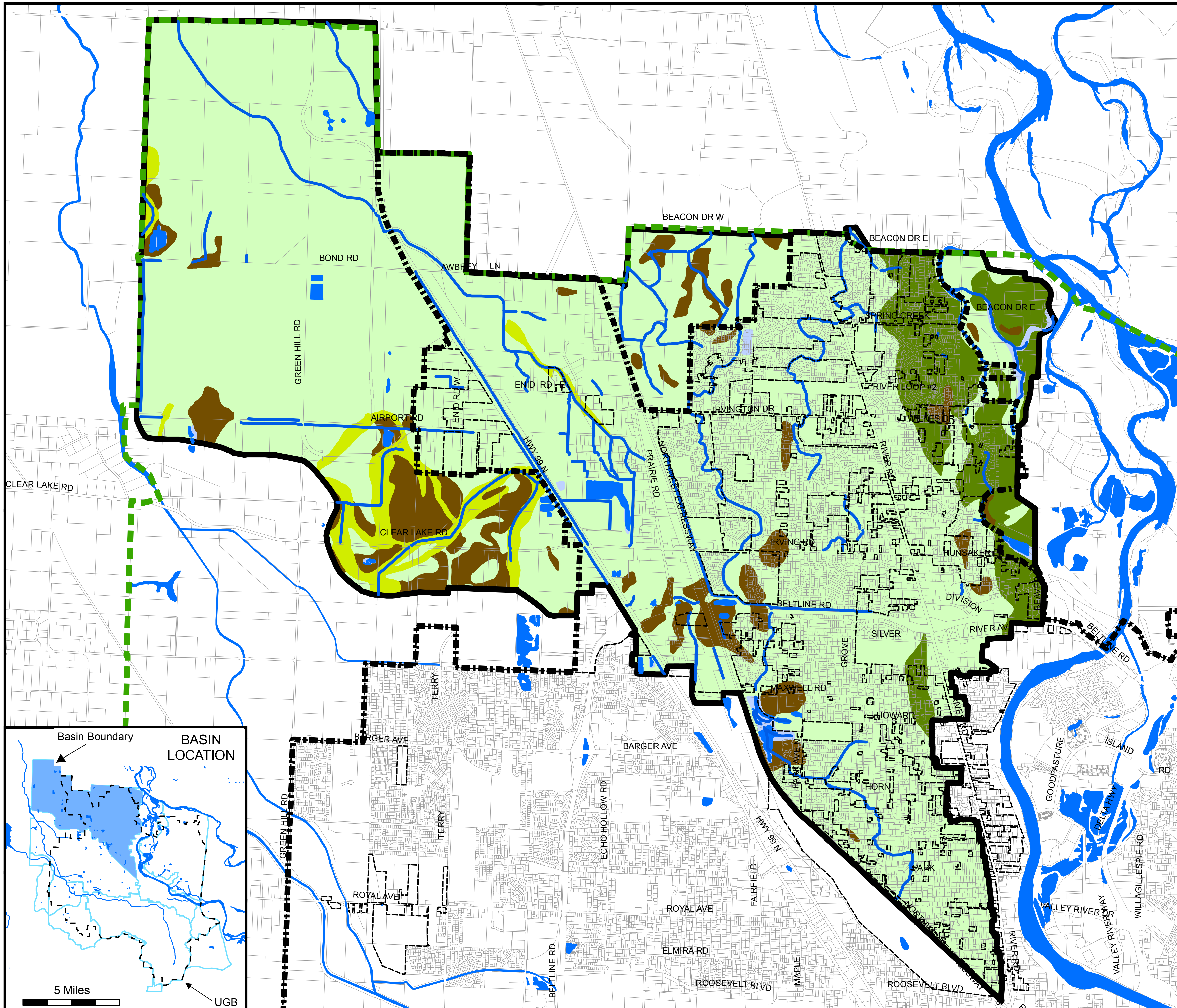

River Road - Santa Clara Basin
Slope and Topography *
LEGEND
0 - 5% Slopes
6 - 10% Slopes
11 - 15% Slopes
16 - 25% Slopes
> 25% Slopes
Waterways and Ponds
100-foot contours
20-foot contours
5 ft Intermediate Contours
River Road-Santa Clara Basin Boundary
Eugene UGB
Eugene City Limits
Streams and Channels
Metropolitan Plan Boundary
* Slopes and Contours derived from enhanced 10-meter USGS Digital Elevation Models (DEMs)
N
3,200 Feet
Map Produced by Lane County Public Works GIS December 2008
EUGENE
LANE COUNTY OREGON
Map based on imprecise source data, subject to change
Map 4
Basin Boundary
BASIN LOCATION
5 Miles
UGB
BEACON DR W
BEACON DR E
BOND RD
AWBREY LN
GREEN HILL RD
CLEAR LAKE RD
AIRPORT RD
ENID RD
HWY 99 N
PRAIRIE RD
IRVINGTON DR
SPRING CREEK
RIVER LOOP #2
WILKES DR
IRVING RD
HUNSAKER
DIVISION
BELTLINE RD
SILVER
RIVER AV
GROVE
MAXWELL RD
HOWARD
HORN
PARK
BARGER AVE
TERRY
ECHO HOLLOW RD
FAIRFIELD
ROYAL AVE
ELMIRA RD
ROOSEVELT BLVD
BELTLINE RD
MAPLE
GOODPASTURE
ISLAND
DELTA HWY
VALLEY RIVER DR
GILLESPIE RD



River Road - Santa Clara Basin
Surface Water and Drainage System Features
LEGEND
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
Size Unknown
City of Eugene Drywells
Lane County Drywells
River Road/Santa Clara Basin Boundary
Urban Growth Boundary
Eugene City Limits
Metropolitan Plan Boundary
Streams and Channels in Basin
* from City of Eugene Data
N
3,200 Feet
Map Produced by Lane County Public Works GIS December 2008
EUGENE
LANE COUNTY OREGON
Map based on imprecise source data, subject to change
MAP 5
Basin Boundary
BASIN LOCATION
5 Miles
UGB
BEACON DR W
BEACON DR E
BOND RD
AWBREY LN
A1 CHANNEL
SPRING CREEK
FLAT CREEK
SPRING CREEK
RIVER LOOP #2
IRVINGTON DR
WILKES DR
GREEN HILL RD
END RD
AIRPORT RD
HWY 99 N
PRAIRIE RD
NORTHWEST EXPRESSWAY
CLEAR LAKE RD
AMAZON CREEK
A2 CHANNEL
IRVING RD
HUNSAKER LN
DIVISION
BELTLINE RD
NORTH BELTLINE FLOODWAY
SILVER
RIVER AV
GROVE
MAXWELL RD
HOWARD
TERRY
BARGER AVE
ECHO HOLLOW RD
HORN
PARK
ROYAL AVE
FAIRFIELD
ELMIRA RD
BELTLINE RD
MAPLE
ROOSEVELT BLVD
RIVER RD
GOODPASTURE ISLAND RD
DELTA HWY
VALLEY RIVER DR
VALLEY RIVER WAY
WILLAGILLESPIE RD
DEBRICK SLOUGH
WILLAMETTE RIVER
A3 CHANNEL

River Road - Santa Clara Basin

Saturated Hydraulic Conductivity (Permeability)*



LEGEND

Saturated Hydraulic Conductivity (Ksat), Standard Classes

- Very Low
- Low
- Moderately Low
- Moderately High
- High
- Very High
- Pits & Water Bodies from Soil Layer (no data)
- Waterways and Ponds
- River Road-Santa Clara Basin Boundary
- Eugene UGB
- Eugene City Limits
- Streams and Channels
- Metropolitan Plan Boundary

* This Information was produced using the NRCS Soil Data Viewer Extension. NRCS defines Ksat as:

"Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture."

N

3,200 Feet

Map Produced by Lane County Public Works GIS January 2009

EUGENE

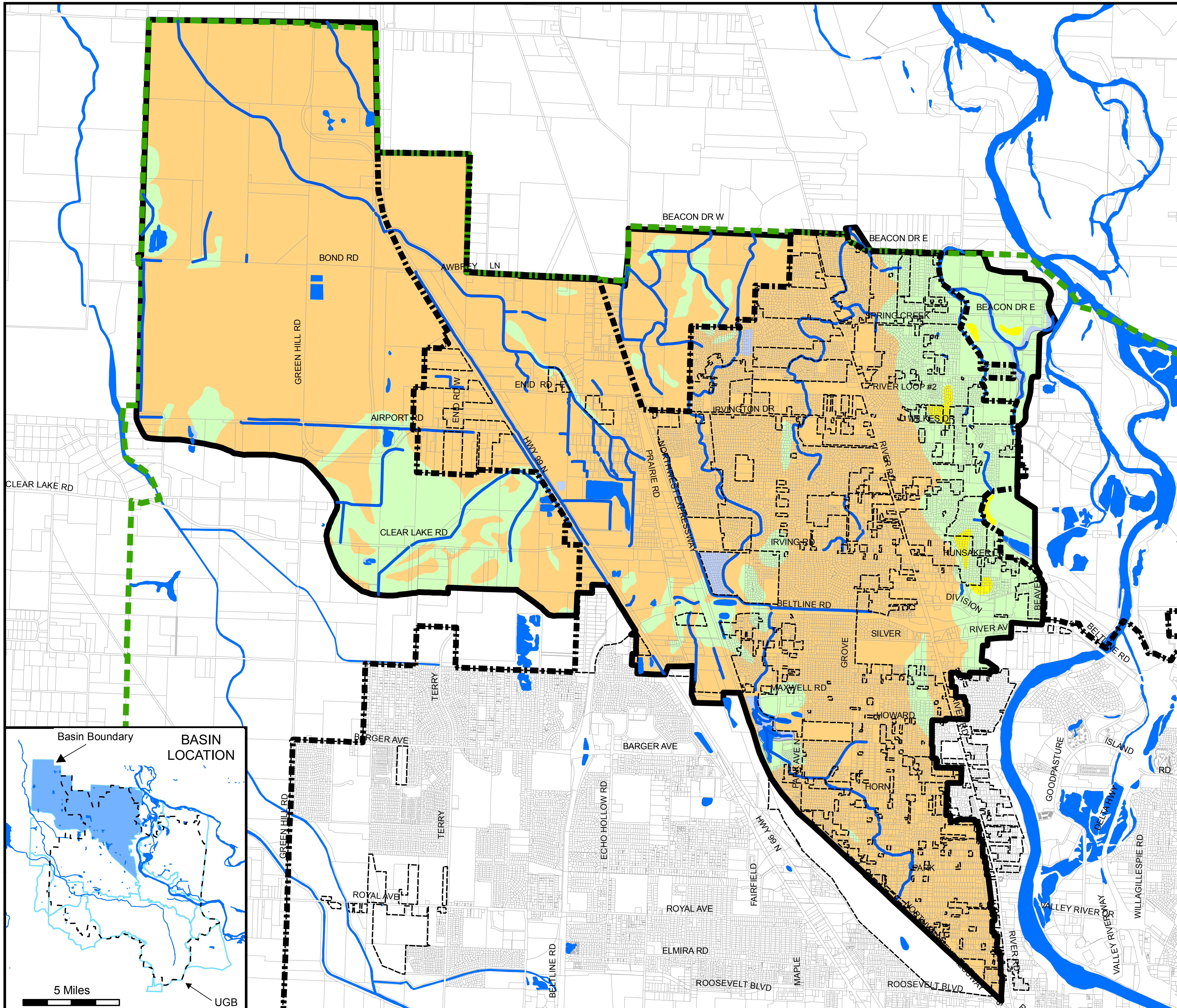
LANE COUNTY OREGON

Map based on imprecise source data, subject to change

Map 6

River Road - Santa Clara Basin

Soil Runoff Potential *



LEGEND

- Negligible
- Low
- Medium
- Pits & Water Bodies from Soil Layer (no data)
- Waterways and Ponds
- River Road-Santa Clara Basin Boundary
- Eugene UGB
- Eugene City Limits
- Streams and Channels
- Metropolitan Plan Boundary

*Runoff categories furnished by NRCS. The runoff class is determined from the hydrologic group assigned to the soil map units in a field, and the average slope gradient. Hydrologic groups are groups of soils having similar runoff potential under similar storm and cover conditions. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonally high water table, intake rate and permeability after prolonged wetting, and depth to a very slowly permeable layer.

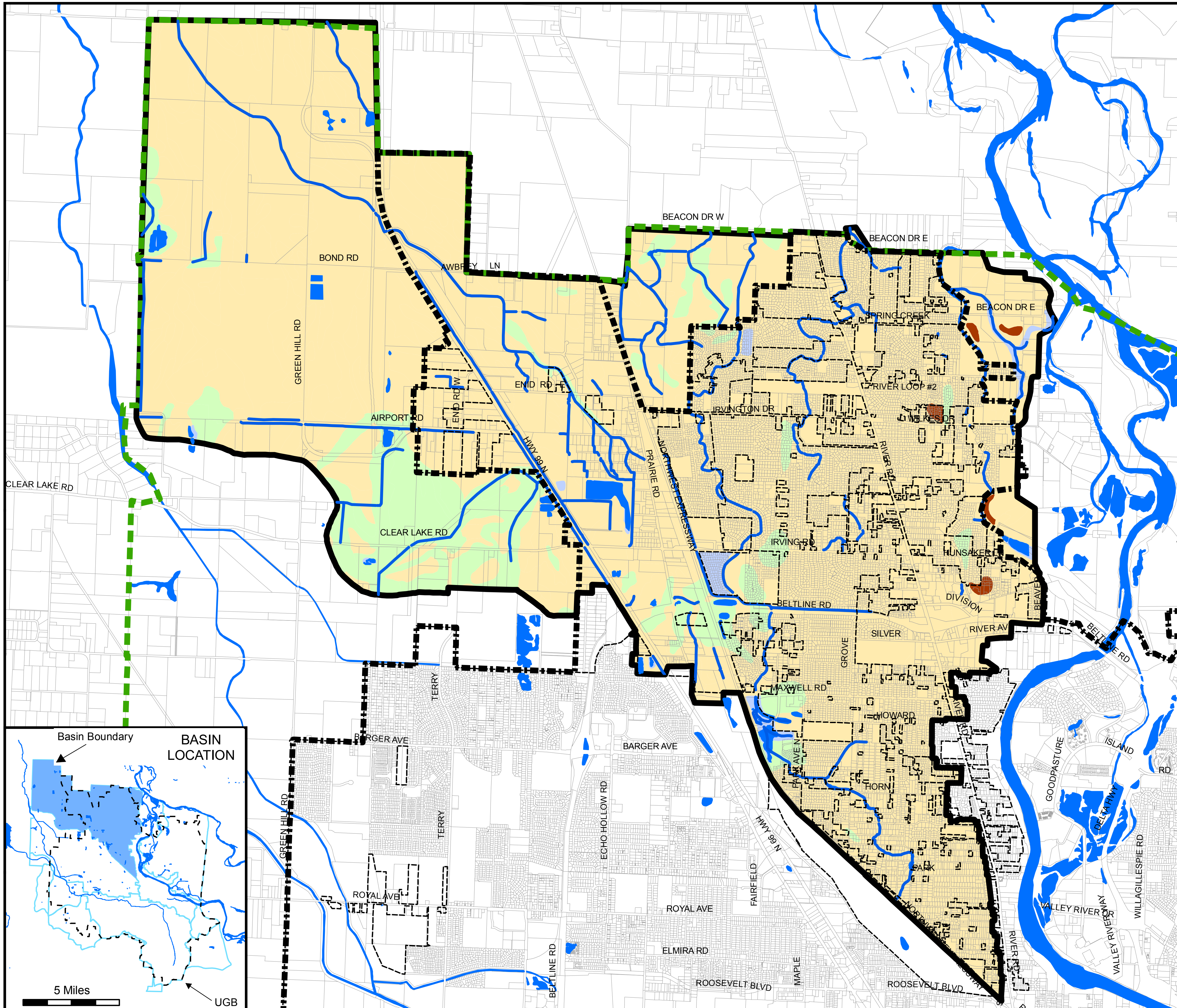
N

3,200 Feet

Map Produced by
Lane County Public Works GIS
January 2009

Map based on imprecise source data, subject to change

Map 7



River Road - Santa Clara Basin

Erodible Soils *

LEGEND

Soil loss in tons per acre per year

- Low - .02 to .10
- Moderately Low - .15 to .24
- Moderately High - .28 to .43
- High - .49 to .64
- Pits & Water Bodies from Soil Layer (no data)
- Waterways and Ponds
- River Road-Santa Clara Basin Boundary
- Eugene UGB
- Eugene City Limits
- Streams and Channels
- Metropolitan Plan Boundary

* This information was produced using the NRCS Soil Data Viewer Extension. NRCS defines whole soil erosion factors as:

"The average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity (Ksat). Values of K range from 0.02 to 0.69."

N

3,200 Feet

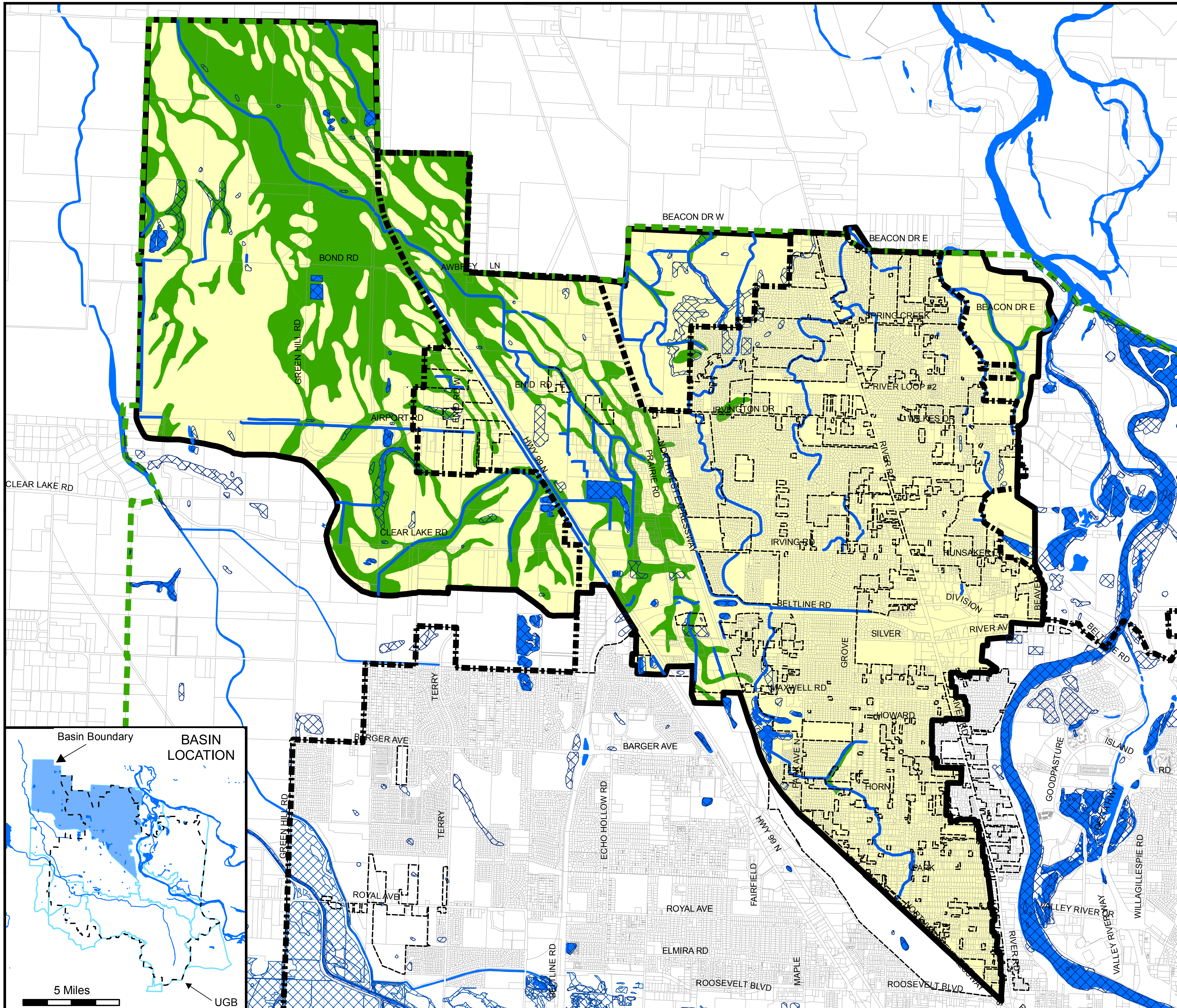
Map Produced by Lane County Public Works GIS January 2009

Map based on imprecise source data, subject to change

Map 8

River Road - Santa Clara Basin

Hydric Soils *



L E G E N D

- Hydric Soils
- All Other Soils
- Wetlands (from West Eugene Wetlands Plan & National Wetland Inventory)
- Waterways and Ponds
- River Road-Santa Clara Basin Boundary
- Eugene UGB
- Eugene City Limits
- Streams and Channels
- Metropolitan Plan Boundary

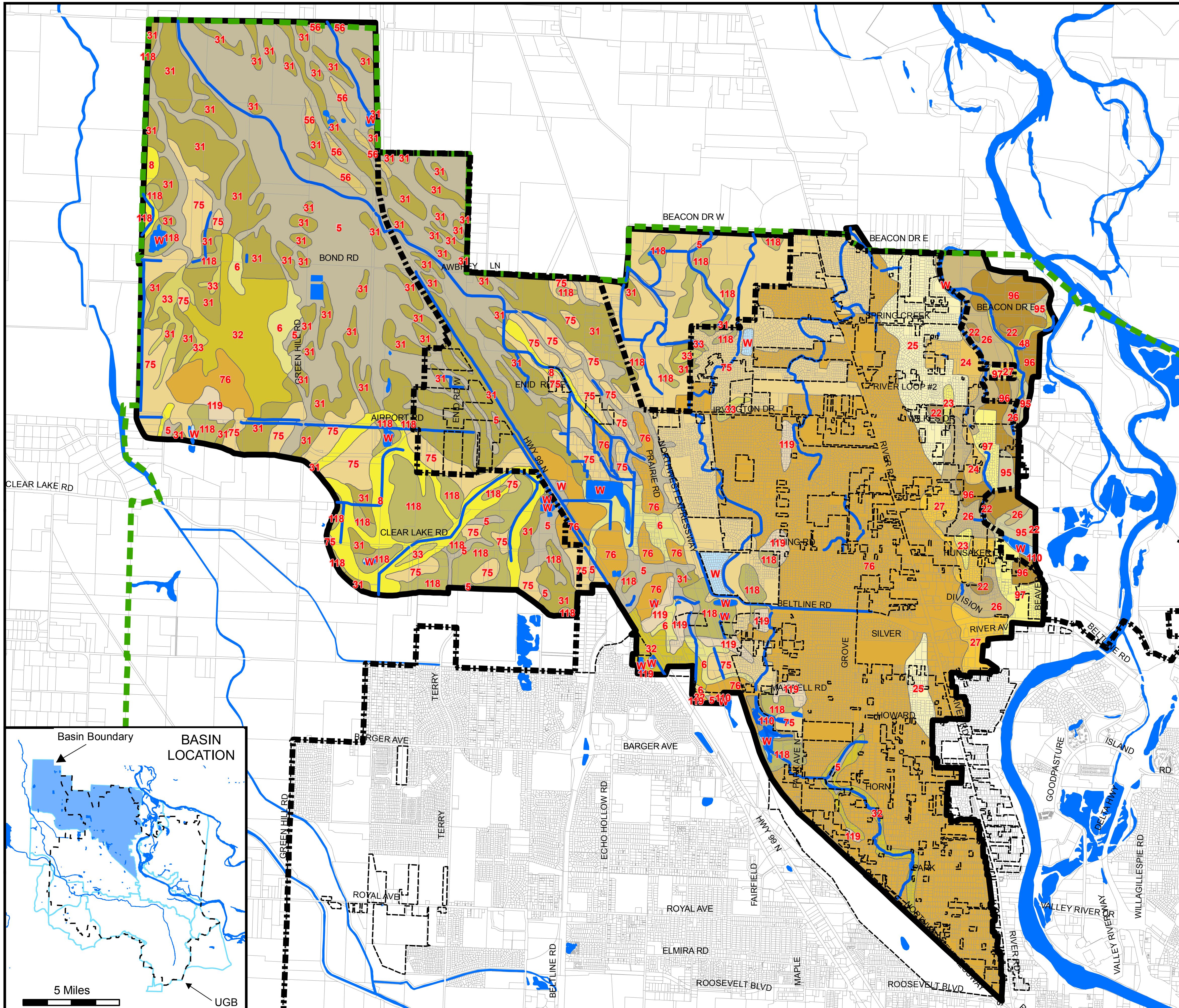
* This information was produced using the NRCS Soil Data Viewer Extension. NRCS defines Hydric Soils as:

"Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994). Under natural conditions, these soils are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation."

N

3,200 Feet

Map Produced by
Lane County Public Works GIS
January 2009



River Road - Santa Clara Basin

Soil Types *

LEGEND

- W, Water
- 5, Awbrig silty clay loam
- 6, Awbrig-Urban land complex
- 8, Bashaw clay
- 22, Camas gravelly sandy loam, occasionally flooded
- 23, Camas-Urban land complex
- 24, Chapman loam
- 25, Chapman-Urban land complex
- 26, Chehalis silty clay loam, occasionally flooded
- 27, Chehalis-Urban land complex
- 31, Coburg silty clay loam
- 32, Coburg-Urban land complex
- 33, Conser silty clay loam
- 48, Fluvents, nearly level
- 56, Holcomb silty clay loam
- 75, Malabon silty clay loam
- 76, Malabon-Urban land complex
- 95, Newberg fine sandy loam
- 96, Newberg loam
- 97, Newberg-Urban land complex
- 110, Pits
- 118, Salem gravelly silt loam
- 119, Salem-Urban land complex
- Soils subject to slumping (none indicated in this basin)

- Waterways and Ponds
- River Road-Santa Clara Basin Boundary
- Eugene UGB
- Eugene City Limits
- Streams and Channels
- Metropolitan Plan Boundary

* From USDA NRCS data

N

3,200 Feet

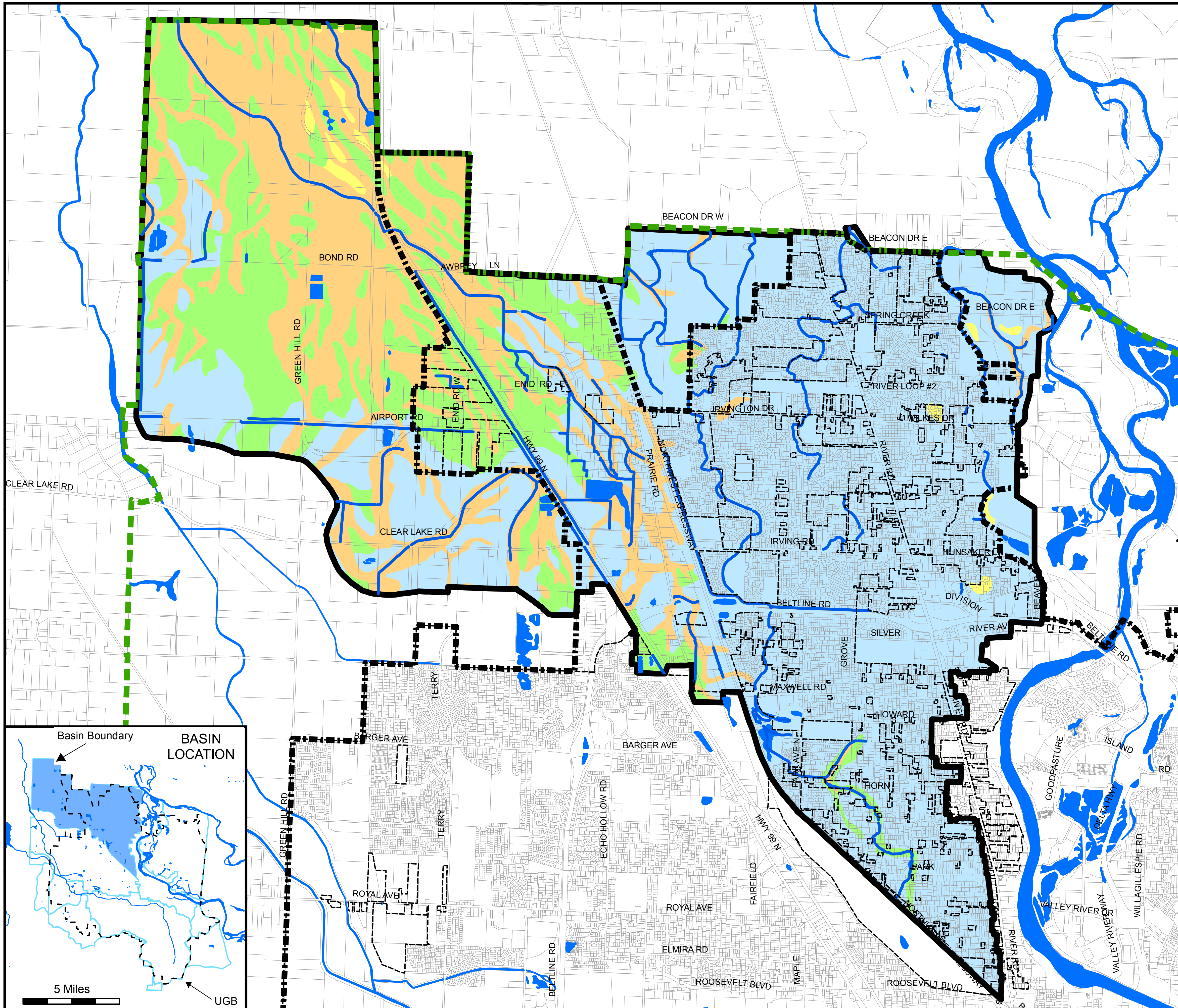
Map Produced by
Lane County Public Works GIS
January 2009

EUGENE

LANE COUNTY OREGON

Map based on imprecise source data, subject to change

Map 10



River Road - Santa Clara Basin

High Water Table *

LEGEND

- Shallow Water Table .82 ft (25 cm) or less
- Moderately shallow Water Table .82 to 1.64 ft (25 - 50 cm)
- Moderately Deep Water Table 1.64 to 6.56 ft (50 - 200 cm)
- Deep Water Table 6.56 ft (200 cm) or greater
- Waterways and Ponds
- River Road-Santa Clara Basin Boundary
- Eugene UGB
- Eugene City Limits
- Streams and Channels
- Metropolitan Plan Boundary

* This information was produced using the NRCS Soil Data Viewer Extension. NRCS defines "Depth to Water Table" as:

"Water table" refers to a saturated zone in the soil. It occurs during specified months. Estimates of the upper limit are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

N

3,200 Feet

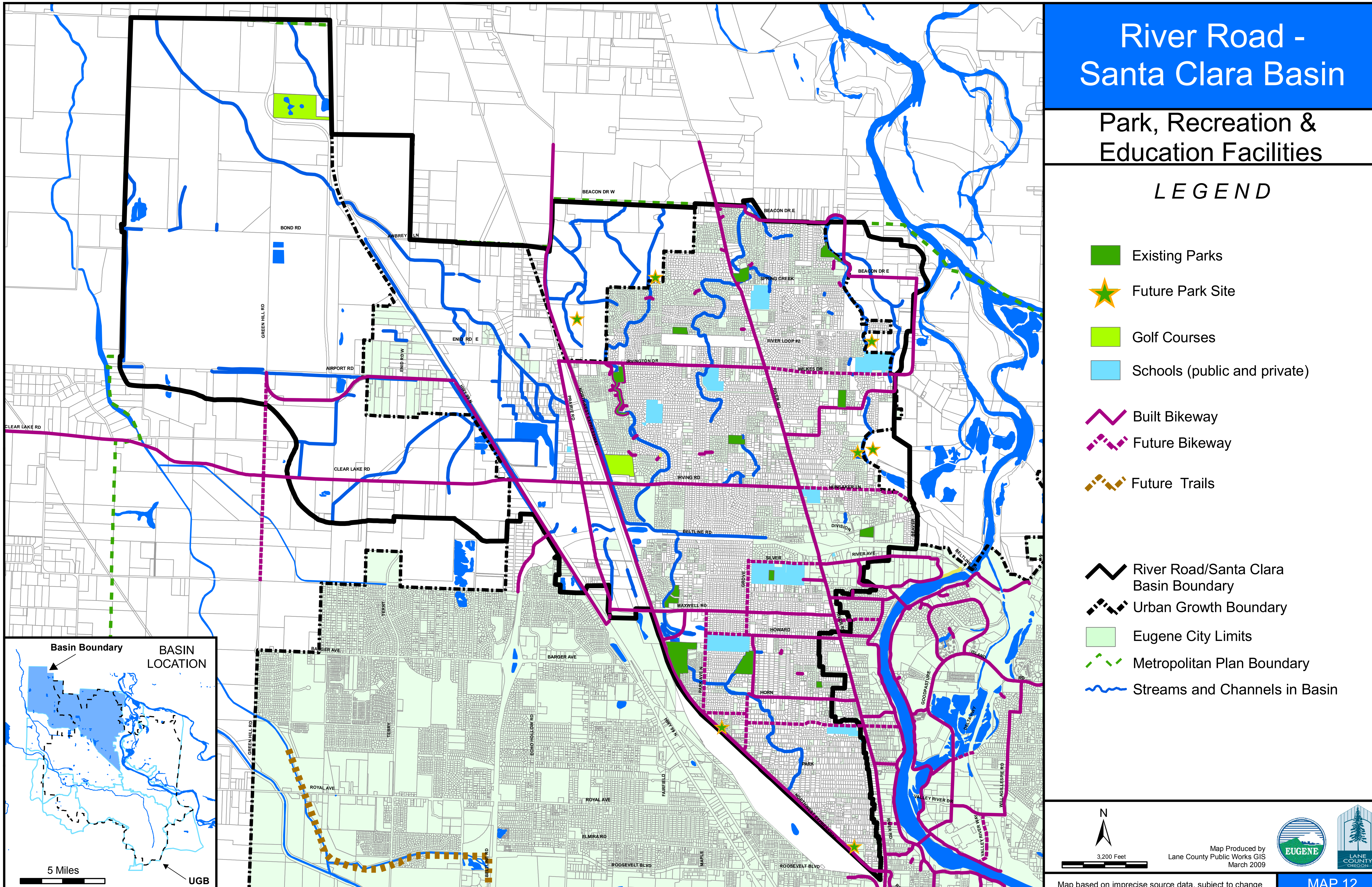
Map Produced by
Lane County Public Works GIS
March 2009

EUGENE

LANE COUNTY OREGON

Map based on imprecise source data, subject to change

Map 11



River Road - Santa Clara Basin
Park, Recreation & Education Facilities
LEGEND
Existing Parks
Future Park Site
Golf Courses
Schools (public and private)
Built Bikeway
Future Bikeway
Future Trails
River Road/Santa Clara Basin Boundary
Urban Growth Boundary
Eugene City Limits
Metropolitan Plan Boundary
Streams and Channels in Basin
Basin Boundary
BASIN LOCATION
5 Miles
UGB
N
3,200 Feet
Map Produced by
Lane County Public Works GIS
March 2009
EUGENE
LANE COUNTY OREGON
Map based on imprecise source data, subject to change
MAP 12
BEACON DR W
BEACON DR E
BOND RD
AWBREY LN
GREEN HILL RD
AIRPORT RD
CLEAR LAKE RD
SPRING CREEK
RIVER LOOP #2
WILKES DR
IRVING RD
BELTLINE RD
DIVISION
RIVER AVE
SILVER
MAXWELL RD
HOWARD
HORN
BARGER AVE
ROYAL AVE
ELMIRA RD
ROOSEVELT BLVD
PARK
GOODPASTURE
VALLEY RIVER DR

In order to identify flood related problems and opportunities, a flood control evaluation was completed for the drainage system in the River Road Santa Clara basin that is described in Section 2.5 and illustrated on Map 5. A computer model was used to predict capacity deficiencies in the existing storm drainage system. Section 3.1 provides a brief description of the computer model and a summary of the hydrologic and hydraulic model input data. Section 3.2 describes the model validation process, and Section 3.3 provides a description of model results. Section 3.4 provides a general description of the identified flood-related problems. Section 3.5 describes the project alternatives and development standard alternatives that were selected to address the identified flooding problems.

3.1 Hydrologic/Hydraulic Model Development

To develop a flood control strategy for the River Road Santa Clara 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. The City of Eugene selected the XP-SWMM model software to conduct these analyses. In general, the evaluation concentrated on the conveyance capacity of the significant components of the public drainage system; typically, all storm sewer pipes with a diameter equal to or greater than 36" and the associated open waterways on the Willamette Overflow (also referred to as the East Santa Clara Waterway), Spring Creek, Flat Creek, and the A-1 Channel.

The River Road Santa Clara basin drainage system, including pipes, open channels and drywells, is shown on Figures 3-2 through 3-8. Figure 3-1 provides an index map that illustrates the relative locations of Figures 3-2 through 3-8 in the basin. Modeled drainage segments and locations of the proposed capital projects are also illustrated on Figures 3-2 through 3-8.

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

- Model selection process.
- Sources of model input data.
- Design storm selection process.
- Model calibration (note: while Volume I contains calibration information that was applied City-wide during the development of the 2002 basin plans, a separate model validation was conducted that is specific to the River Road Santa Clara basin and is described in Section 3.2 of this plan).

This section of the River Road Santa Clara report provides a summary of the basin specific hydrologic and hydraulic data used in the models.

3.1.1 River Road Santa Clara Basin Hydrologic Data

The original River Road Santa Clara Study was an initial study towards development of a stormwater basin master plan and was created in 2002. The Study identified a number of hydrologic data gaps, specifically related to the subbasin delineations and locations of runoff nodes in the model (a runoff node is a point where runoff from a subbasin area enters the modeled system). Since the original Study was prepared, data gaps have been addressed by the City of Eugene and Lane County. Specifically, survey data collected by Lane County between October and December 2005 allowed for refinement of the original subbasin delineations and node locations in the model (described in more detail in Subsection 3.1.2 and in Appendix G). These refinements have been applied to the original model, and the following discussion summarizes the overall hydrologic input data in the refined model.

Hydrologic Data Based on the Piped and Surface Water Drainage System

The River Road Santa Clara basin was subdivided into five major subbasins. The major subbasin boundaries are presented in Figure 3-1. The five major subbasins were further divided into 75 subbasins for modeling purposes. The subbasin boundaries presented on Figures 3-2 through 3-8 were delineated based on both topography and the piped and open channel drainage system layout. The subbasin boundaries were digitized into the City's/County's GIS so that hydrologic data could be compiled 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 RS for River Road Santa Clara. The second two characters represent a two-letter abbreviation for the major subbasin. The 5 major subbasins in the River Road Santa Clara basin are as follows:

A1 = A-1 Channel Drainage System
FC = Flat Creek Drainage System
SC = Spring Creek Drainage System
WO = Willamette Overflow Drainage System (also referred to as the East Santa Clara Waterway)
99 = Highway 99

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 Willamette Overflow major subbasin of the River Road Santa Clara basin are RSWO010 and RSWO020. 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 3-1 (provided at the back of this section) includes the major hydrologic information for each of the River Road Santa Clara subbasins. Specifically, the tables provide the information for parameters 1 - 5 listed above and 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 B.

The following subbasins were not included in the model for the reasons noted:

- The A-1 Channel subbasins A1-000 and A1-005 were excluded from the model since they are located outside the City limits and the Urban Growth Boundary.
- The Highway 99 major subbasin (including subbasins 99-010 and 99-020) were excluded since they drain to a roadside ditch along Highway 99N that is owned and maintained by the Oregon Department of Transportation.
- Flat Creek subbasin FC-000 was excluded from the model since it is located outside the City limits and the Urban Growth Boundary.
- Willamette Overflow subbasin WO-000 was excluded from the model since it is located outside the City limits and the Urban Growth Boundary.

Hydrologic Data Associated with Drywell Drainage Areas

After completing the subbasin delineations described above, a second step was conducted to delineate the portion of each subbasin where runoff is draining to drywells as opposed to the piped or surface conveyance system. Section 2.5.4 provides a description of the drywells in the River Road Santa Clara basin including 79 County wells, 72 City wells, and approximately 634 private drywells. At the time that this exercise was conducted, the GIS system for drywells was still under development and somewhat incomplete. Therefore, the delineation of drywell drainage areas included a subset (or approximately 759) of the total 785 drywells. For each subbasin that included some portion of area draining to drywells, the subbasin was subdivided into these two areas, and the hydrologic information described above (e.g., inlet node number, subbasin area, impervious percentage, etc.) was generated for both the subset of the subbasin draining to the drywells and the subset of the subbasin draining to the piped or surface conveyance system. The purpose of delineating these drywell areas individually was to simulate the effect of drywells in the hydrology portion of the XP-SWMM model and on the runoff calculations.

In order to develop a model that would simulate the infiltration characteristics associated with drywells, the drywells were modeled as storage nodes that would store runoff generated up to the 5-year, 25-hour (3.6 inches) storm event. This was based upon the City's design criteria for public drywells which includes that they serve an area no greater than 40 acres and infiltrate all of the runoff up to a 5-year, 24-hour event. In the model, when the capacity of the storage node was reached, the areas draining to drywells would begin to contribute additional runoff to the piped and surface water drainage system. The drywell storage nodes were sized using an iterative trial and error process until the 5-year, 24-hour event filled the storage volume but did not contribute runoff flows to the piped and surface stormwater drainage system.

As a result, two hydrologic modeling scenarios were developed for the River Road Santa Clara Basin:

1) One model scenario was developed that did not account for the infiltration associated with existing drywells.

2) The second model scenario was developed to account for the infiltration associated with existing drywells.

The purpose of developing both model scenarios was to evaluate the impacts that the drywells were having on the capacity of the piped and surface drainage system during the various design events. Decommissioning of the public drywells in this basin is ultimately required (see Section 4.0 for a summary of relevant requirements). Therefore, comparing the results from the two model scenarios provided useful information in order to better understand how decommissioning will impact the system and planned capital projects in terms of capacity and sizing.

3.1.2 River Road Santa Clara Basin Hydraulic Data

The primary purpose of the modeling was to evaluate the capacity of the existing storm drainage system. The evaluation of the storm drainage system included a hydraulic analysis of the major storm pipes, culverts, and open channels, which convey stormwater discharges. The original River Road Santa Clara Basin Plan, created in 2002, identified a number of hydraulic data gaps due to the multi-jurisdictional ownership of the drainage system and the lack of a comprehensive data set for the overall drainage system, a result of the multi-jurisdictional ownership. Data gaps have since been addressed by the City of Eugene and Lane County. Specifically, survey data collected by Lane County between October and December 2005 allowed for refinement of the piped and open channel segments of the drainage system (described further in this section and in Appendix G). These refinements have been applied to the original model, and the following parameters (i.e., model input data) were compiled for each pipe, culvert or open channel section:

1. Conduit name.
2. Upstream node number.
3. Downstream node number.
4. Conduit size (diameter for pipes and culverts; cross-section dimensions for open channels).
5. Conduit length.
6. Conduit material for pipes and culverts.
7. Upstream and downstream invert elevations.
8. Upstream and downstream ground surface elevations.

9. Channel roughness coefficients (for open channels).

For the River Road Santa Clara basin, the model was used to evaluate the capacity of approximately 160 open waterway and pipe segments under existing and future land use conditions. Table 3-2 (provided at the back of this section) provides the major hydraulic information for each of the modeled conduits in the 4 major subbasins evaluated within the River Road Santa Clara basin. Specifically, the table provides the information for parameters 1 – 6 listed above, in addition to the drainage area for each conduit, the relevant design storm, and the model results for the relevant design storm. Model results are presented in terms of peak flows and maximum water surface elevations. The results for all storm events that were run through the models (i.e., 10-year, 25-year, 50-year, and 100-year storms) can be found in Appendix B.

As discussed previously, due to the multi-jurisdictional ownership of the drainage system, the City did not have a comprehensive data set on the drainage system in this basin at the time the original River Road Santa Clara Basin Plan was completed. Since the original Plan was completed in 2002, the City and County partnered to develop this revised Plan, and the following areas were surveyed and updated in the original model, resulting in a more refined hydrologic and hydraulic data set and a more refined modeled system. A more detailed summary of major changes made to the model is provided in Appendix G. The refined model results were used for design of the capital projects described in Section 3.5.

- Willamette Overflow major subbasin:
  - A large elevation difference was noted between the inlet and outlet pipes to the manhole at node 58287, located east of River Road and north of Division on Figure 3-7. Hydraulic conditions at this location were field verified and surveyed.
  - The pipe system that conveys stormwater from Beltline Road to the Willamette Overflow drainage system, as shown on Figure 3-7, appeared to include pipes with a diameter equal to or greater than 36 inches, which would ordinarily be included in the model, but insufficient data were initially available for these pipes. Hydraulic conditions at this location were field verified and surveyed.
  - Field crews noted that fill had been placed in the open waterway between Division and Hunsaker, which blocks the waterway except under high flow conditions. This fill was not reflected in the original survey data so a revised survey of this open channel segment was conducted.

- Flat Creek major subbasin:
  - The hydrologic connection of subbasin FC-070 and Flat Creek was field verified.

- A-1 Channel major subbasin:
  - Hydraulic conditions in the pipe system along Irving Road that conveys stormwater to the A-1 Channel, shown on Figure 3-7, were unclear, and therefore the system was field verified and surveyed.
  - Drainage patterns in the A-1 Channel major subbasin, south of Beltline Road on Figures 3-7 and 3-8 were unclear. A number of drywells may result in less area that is directly connected with the A-1 channel. Hydrologic conditions at this location were field verified.

- The open waterway profile of the A-1 Channel between Bushnell Lane East and Irving Road (node 72730 to node 72797) on Figure 3-7 was unknown, and therefore the system was field verified and surveyed.
- Conditions of the western tributary of the A-1 Channel from node 72102 to 71215, shown on Figure 3-5, were unclear, and therefore the system was field verified and surveyed.

3.2 Model Validation Process

As described previously, an initial model calibration was applied City-wide during the development of the 2002 basin plans. However, a separate model validation was conducted specific to the River Road Santa Clara basin because of the unique conditions of the basin associated with fairly high permeability soils and the use of drywells to handle some of the drainage. In addition, photos from a large storm event were available from within the basin for use in validating the model.

Flow monitoring data were not available for a calibration process; therefore, a model validation process was conducted based on photos and observed freeboard elevations provided by the City. The information was provided from the Willamette Overflow subbasin in the Willamette Overflow Waterway at Lone Oak Way (node 74406) for three days of rainfall in 2005: December 28th, 30th, and 31st. Validation of the model was based on comparisons between model-simulated water surface elevations at node 74406 (converted to freeboard elevations) and the freeboard observed during the rainfall event(s), as provided below.

To start, the base hydrologic/hydraulic model that was used for the model validation process assumed that the drywells in the Willamette Overflow Basin were functioning as they were designed to infiltrate all of the runoff from the 5-year, 24 hour design storm (model scenario 2 from subsection 3.1.1). Another assumption in the base model was that the impervious percentages were equal to the mapped impervious percentages areas as opposed to using effective impervious percentage areas. The comparison between simulated and observed freeboard elevations revealed that the model-simulated freeboard was less than the observed freeboard (i.e. the model was conservative as it was simulating higher water surface elevations and hence, lower freeboards). Model parameters were adjusted in an attempt to reduce the differences between model-simulated and observed freeboard. These adjustments to the model input parameters were applied to the entire Willamette Overflow subbasin model, and the model was run for the period from December 27, 2005 to January 3, 2006 using real rainfall data. A summary of the daily rainfall depths that were used in the model validation is provided in Table 3-3 below. Several additional model runs were conducted to evaluate the model's sensitivity to changes in input parameters. The results of these sensitivity analyses indicated that the impervious percentage area was the most sensitive model input parameter.

Table 3-3
Rainfall Data Used for the Model Validation

Date	Daily Rainfall Total (inches)	Validation Conducted for Day? (Y/N)
December 27, 2005	1.25	N
December 28, 2005	0.88	Y
December 29, 2005	0.17	N
December 30, 2005	2.56	Y
December 31, 2005	0.94	Y
January 1, 2006	0.16	N
January 2, 2006	0.37	N
January 3, 2006	0.12	N
Total:	**6.45**	

Several combinations of model adjustments were evaluated to obtain the best match to observed conditions (i.e., to reduce differences between simulated and observed freeboard). The model adjustments that were evaluated during the model validation process are shown in Table 3-4. The best results (i.e., closest to observed data) were obtained when the model input parameters were adjusted to reflect the use of effective impervious percentage areas instead of mapped impervious percentage areas (i.e., lowering the impervious percentages). Effective impervious percentage areas were estimated based on Roger Sutherland's paper (provided as Appendix C) titled *Methodology for Estimating the Effective Impervious Area of Urban Watersheds* (1995). His method includes five different equations for estimating the effective impervious area from mapped impervious area. The five equations are based on how directly connected the mapped impervious areas are to the piped storm drainage system. Equation #1 (below) was used to calculate effective impervious area for the purpose of conducting this model validation.

- *Average subbasins which are predominately sewered with curbs and gutters, have no infiltration facilities, and the residential rooftops are not directly connected to the drainage system:*

$$\text{Effective Imp.\%} = 0.1 * (\text{Mapped Imp.\%})^{1.5}$$

Although the use of equation #1 (for average connected basins) and associated revised impervious surface estimates resulted in somewhat better model results (i.e., closest to observed data), the drainage area upstream of the calibration site was determined to be all curb and gutter, and the impervious area was estimated to be mostly connected. As the calibration data came from only one point in the basin, and as it was observed as opposed to measured, it was decided that it would be better to use the more realistic input parameters and err on the conservative side (i.e., model-simulated flows higher than observed flows). The entire River Road Santa Clara basin varies with respect to whether streets have curb and gutter, but without better calibration data the variations were not taken into account with the equation used to calculate effective impervious surface and thus accounted for in the model. In other words, one consistent equation was used to convert mapped impervious areas to effective impervious areas for the entire basin.

Therefore, the following model adjustments were recommended that are shown as shaded in Table 3-4.

Table 3-4
Model Adjustments and Associated Model Results for Node 74406

	Alternative Model Adjustments	Storm Event Date	Observed Freeboard (ft)	Simulated Freeboard (ft)	Difference (ft)
1	No initial Changes	12/28/2005	5.00	3.20	1.80
	No initial Changes	12/30/2005	9.00	4.47	4.53
	No initial Changes	12/31/2005	6.00	3.03	2.97
2	Imp. % Reduced using Average Formula*	12/28/2005	5.00	3.57	1.43
	Imp. % Reduced using Average Formula*	12/30/2005	9.00	5.75	3.25
	Imp. % Reduced using Average Formula*	12/31/2005	6.00	3.11	2.89
3	Imp. % Reduced using Low Formula**	12/28/2005	5.00	4.20	0.80
	Imp. % Reduced using Low Formula**	12/30/2005	9.00	6.17	2.83
	Imp. % Reduced using Low Formula**	12/31/2005	6.00	3.17	2.83
4	Saturated Hydraulic Conductivity Increase by 20%	12/28/2005	5.00	3.20	1.80
	Saturated Hydraulic Conductivity Increase by 20%	12/30/2005	9.00	4.47	4.53
	Saturated Hydraulic Conductivity Increase by 20%	12/31/2005	6.00	3.03	2.97
5	Basin width decrease by 50%	12/28/2005	5.00	3.20	1.80
	Basin width decrease by 50%	12/30/2005	9.00	4.47	4.53
	Basin width decrease by 50%	12/31/2005	6.00	3.03	2.97
6	Model includes only non Drywell areas	12/28/2005	5.00	3.20	1.80
	Model includes only non Drywell areas	12/30/2005	9.00	4.47	4.53
	Model includes only non Drywell areas	12/31/2005	6.00	3.06	2.94
7	Model includes only non Drywell areas with Imp. Reduced by Average Formula*	12/28/2005	5.00	3.57	1.43
	Model includes only non Drywell areas with Imp. Reduced by Average Formula*	12/30/2005	9.00	5.75	3.25
	Model includes only non Drywell areas with Imp. Reduced by Average Formula*	12/31/2005	6.00	3.14	2.86
8	Model includes only non-Drywell areas with Imp. Reduced by Low Formula**	12/28/2005	5.00	4.20	0.80
	Model includes only non-Drywell areas with Imp. Reduced by Low Formula**	12/30/2005	9.00	6.17	2.83
	Model includes only non-Drywell areas with Imp. Reduced by Low Formula**	12/31/2005	6.00	3.17	2.83

* For Average Connected Impervious Areas: Effective imp.% = 0.1 * (Mapped Imp.%)$^{1.5}$ (equation # 1 – Appendix C)

** For Low Connected Impervious Areas: Effective imp.% = 0.04 * (Mapped Imp.%)$^{1.7}$ (equation # 4 – Appendix C)

Based on the above information, the City and County agreed to move ahead with the #2 model adjustments from Table 3-4, which included reducing mapped impervious percentage areas using Equation #1. These model adjustments were applied basin-wide to the A-1 Channel, Spring Creek, Flat Creek, and the Willamette Overflow major subbasins.

3.3 Model Results

As described in Section 3.1 of Volume I (City-wide Study Methodology and Summary), models were run for the selected design storms, and model output was produced for peak flows and water surface elevations for both existing and future conditions. These results were used to identify capacity deficiencies in the system. Surcharging was considered to be acceptable and problems were only identified if the models indicated that water was exiting the system and onto the streets. For this basin, model results were produced for existing and future conditions for two scenarios as described in subsection 3.1.1: 1) the model scenario did not account for infiltration from the existing drywells in the model simulation; and 2) the model scenario did account for existing drywells in the model simulation.

Given new rules related to stormwater discharges to drywells (under the Safe Drinking Water Act), decommissioning of the public drywells in this basin will ultimately be required (with the possibility of some exceptions depending on confirmed groundwater levels). Therefore, the model scenario without the incorporation of drywells was used to evaluate the capacity of the drainage system when public drywells are ultimately decommissioned. It should be noted that private drywells are under the authority of the Oregon Department of Environmental Quality (ODEQ) and any decommissioning associated with private drywells (if required) would be directed by ODEQ. Of the 785 drywells in the basin, 634 (81 %) are privately owned, 79 (10%) are owned by Lane County, and 72 (9%) are owned by the City of Eugene. Section 4.0 of this plan provides more detail regarding the Safe Drinking Water Act and associated DEQ requirements for stormwater discharges to drywells.

As mentioned in Section 3.1, the model simulation that accounted for drywells was based on an incomplete dataset at the time and included a portion (approximately 759) of the total 785 drywells. It was anticipated that the modeling results would show that the existing drywells are providing some relief with respect to capacity deficiencies. However, the comparison of model results between both scenarios (with and without drywells) for the 10-year and 25-year design events did not show significant differences with respect to identified flooding problems. Based on a more detailed review of the results, it was assumed that this occurred for the following two reasons:

1. The drywells were only designed to infiltrate runoff from up to the 5-year storm event and the design events modeled to identify flooding issues were the 10-year and 25-year events. The accommodation of the flows from the 5-year storm had minimal impacts with respect to flows from the larger storms when comparing the two model scenarios.
2. Only 22% of the total modeled drainage area was estimated to be draining to drywells (following this analysis, the number was updated to 25%). Therefore, the majority of the drainage area was already accommodated via the pipe and surface storm drainage system and not highly impacted by infiltration associated with drywells for the larger storms.

Because the drywells were not shown to provide significant benefits with respect to resolving capacity deficiencies for the larger storms; and given that the public drywells will eventually need to be decommissioned; and given that the City and County do not have authority over the private drywells, a decision was made to continue with the flood control evaluation and the identification of capital projects using the model that did not include the infiltration of runoff associated with existing drywells. The hydraulic model results are summarized by conduit in Table 3-2 for the system design storm, and full model results are provided in Appendix B.

3.4 Flooding Problems Identified by the Model

This section provides a general description of model-identified flooding problems. The model results are summarized in Table 3-2 and include both peak flows and water surface elevations for the relevant design storm under both existing and buildout conditions. The last columns in the table indicate the design event and land use condition when certain conduits are expected to be deficient and the associated capital project that addresses the deficiency (discussed in more detail in Section 3.5). For pipe segments and roadway crossings, surcharging was considered to be acceptable, and flooding problems were only identified if the models predicted water getting out of the system and into the streets. For open waterways, deficiencies were identified when the depth of the design flow was predicted to exceed the tops of the channel banks.

In general, very few flooding problems were identified in the River Road Santa Clara basin. Specifically, one flooding problem is expected to occur in the Flat Creek drainage system during existing land use conditions. Nineteen open channel and 17 pipe segments were identified as deficient for their respective design storms in the remaining three drainage systems (i.e., A-1 Channel, Spring Creek, and Willamette Overflow). Eighteen of the 19 open channel segments and eleven of the 17 pipe segments are expected to be deficient under existing land use conditions. Additionally, one open channel and six pipe segments are expected to be deficient under buildout conditions. Each of these problems is listed in Section 3.5 in association with the proposed capital project to address the problem.

In addition to flooding problems associated with predicted capacity deficiencies, decommissioning of drywells would result in the need for an alternative drainage system to handle or convey the 5- year flows that are currently discharging to drywells. Management strategies to address this issue are described in Section 3.5 and 3.6 as well.

3.5 Development of the Flood Management 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 includes problem identification under both existing and future land use conditions, focusing on the major components of the public drainage system. These results are provided in Section 3.4 above. The next step includes the development of potential stormwater management tools (i.e., capital projects or development standards) to address the identified problems. This section describes the capital project and development standard alternatives that were considered to address the identified flooding problems.

3.5.1 Capital Projects to Address Capacity Deficiencies

All flooding problems (i.e., capacity deficiencies) identified through modeling and proposed capital projects (CPs) to address these problems are referenced in Table 3-2 and presented in Table 3-5. Prior to this study, design standards for flood protection levels in Eugene were based on the previous storm drainage master plan (OTAK 1990). The 1990 plan includes varying degrees of protection depending on the size of the drainage area, type of system (open channel or pipe), and type of roadway (local collector vs. major arterial). Depending upon these factors, the standards for designing CIPs ranged from the 5-year to the 50-year recurrence interval storm. For this plan, the City elected to retain the flood protection levels listed in the 1990 plan with the exception that the minimum level of protection would be the 10-year as opposed to the 5-year storm (see Section 3.1.4, Table 3-1 of Volume 1 for exceptions). Flooding problems were identified for the open waterways and the pipe system and CIPs were developed based on the relevant design storm as listed in Table 3-2. A flooding problem was identified for an open waterway if the water depth exceeded the top of bank elevation. For the pipe system, surcharging was allowed, however, if the water entered the street a flooding problem was identified. In all, 10 flood control CPs focused on existing culvert replacement and upsizing of the culverts are proposed. Two CPs are proposed that include regrading of the existing channel to improve conveyance capacity. Three CPs are associated with providing storage to relieve predicted capacity issues and one CP is associated with additional survey efforts.

Table 3-5
Capacity Deficiencies Identified Through Modeling and Proposed Capital Projects to Address Them

Selected Flood Control Capital Project Name	Selected Flood Control Capital Project Description	Conduits Addressed with Capital Project
A1 Channel		
A1-1	Regrade the existing open channel segment (RSA1090B) from node 72789 to 78790 (18’).	RSA1090B, RSA1090C1 and C2, and RSA1090D
A1-2	Upsize and replace the existing 36” CMP culvert (RSA1090A) with a 48” CMP culvert.	RSA1090A, RSA1090B, RSA1090C1 and C2, and RSA1090D
A1-3	Construct storage facilities at nodes 72782 and 72102 to provide a total of 85 acre-ft of storage.	RSA1090A, RSA1090B, RSA1090C1 and C2, RSA1090D, RSA1090E1, E2, and E3, RSA1090F, RSA1080B, RSA1060H, RSA1060M, RSA1060O, RSA1060Q, RSA1060U, RSA1100B.1, RSA1100C, RSA1100D.1, RSA1100E, RSA1100F.1, RSA1100G, RSA1100H, and RSA1100K
A1-4	Upsize and replace the existing 24” CMP culvert (RSA1100I) with a 36” CMP culvert.	RSA1100I.1, RSA1100J, RSA1110A1 and A2

Selected Flood Control Capital Project Name	Selected Flood Control Capital Project Description	Conduits Addressed with Capital Project
A1-5	Upsize and replace the existing 3-24" CMP culverts (RSA1090E) with a 2' x 8' box culvert.	RSA1090E1, E2, and E3, RSA1090F, RSA1100B.1, RSA1100C, RSA1100D.1, RSA1100E, RSA1100F.1, RSA1100G, and RSA1100K
A1-6	Upsize and replace the existing 24" CMP culvert (RSA1060L) with a 2' x 4' box culvert.	RSA1060U, RSA1080B, RSA1090A.1, RSA1060M, RSA1060Q and RSA1060U
A1-7	Upsize and replace the existing 18" and 24" CSP culverts (RSA1060G) with a 2' x 4.5' box culvert.	RSA1060H, RSA1060U, RSA1080B, RSA1090A.1
A1-8	Install a storage CP at nodes 72725 and 59020 to provide approximately 135 acre-ft of storage.	RSA1160B, RSA1160D, RSA1160F, RSA1160H
A1-9	Conduct survey of open channel segments	RSA1160D, RSA1160H, RSA1080B
Flat Creek		
FC-1	Upsize and replace the existing 3-12" CSP culverts (RSFC050D) with a 1.5' x 5.0' box culvert.	RSFC050E
Spring Creek		
SC-1	Upsize and replace the existing 2-30" CSP culverts (RSSC050B) with a 12' long pedestrian bridge.	RSSC040B
Willamette Overflow		
WO-1	Upsize and replace the existing 18" CMP culvert (RSWO070D) with a 66" CSP culvert.	RSWO070D.1, RSWO070E
WO-2	Upsize and replace the existing 36" CSP culvert (RSWO110A) with a 60" CSP culvert.	RSWO110B.1, RSWO110C.1
WO-3	Upsize and replace the existing 48" CSP culvert (RSWO080A) with a 66" CSP culvert.	RSWO090A, RSWO090Aa, RSWO090B, RSWO090C, RSWO090F, RSWO090H
WO-4	Regrade the existing open channel segments (RSWO090Aa, RSWO090B, RSWO090C, and RSWO090D) from node 74405 to 78833 (724').	RSWO090A, RSWO090Aa, RSWO090B, RSWO090C, RSWO090F, RSWO090H
WO-5	Install a storage CP at node 77703 to provide approximately 124 acre-ft of storage.	RSWO070D.1, RSWO070E, RSWO090A, RSWO090Aa, RSWO090B, RSWO090C, RSWO090F, RSWO090H, RSWO110B.1, RSWO110C.1

For more detail regarding each of these projects, capital project fact sheets are provided in Appendix A.

3.5.2 Selected Projects to Address Flows Associated With Drywell Decommissioning

As stated previously, DEQ is expected to require decommissioning of all the public drywells in the basin (more detail is provided in Section 4.0). As a result, alternative systems will be necessary to handle the flows (up to the 5-year, 24 hour design event) that were previously handled through drywells. The drywell drainage areas were reviewed, and three project options were developed to handle the flows from these areas as follows:

1) Piped Option – If the drywell is located in close proximity to an existing storm drainage pipe and the pipe has the capacity to handle the flow, a new piped system would be constructed as necessary to route the drywell flows to the existing piped system.

2) Surface Infiltration/Rain Garden Option – If the drywell is located in an area where flow is not able to be routed to an existing piped system, flows would be routed to an area where a vegetated infiltration/rain garden type facility would be constructed to handle flows. Infiltration of municipal stormwater runoff that occurs through the ground surface as opposed to the subsurface is not regulated under the Safe Drinking Water Act.

3) On-Street Rain Garden Option – In areas where street improvements are planned, right-of-way plans/cross-sections that include street side rain gardens for the storage and infiltration of runoff could be used to handle flows from the right-of-way (ROW). For this option, properties adjacent to the R.O.W. would be required to deal with their individual drainage on-site in accordance with requirements for stormwater in the City of Eugene Code (Chapter 9, Section 9.6791(3)).

Many of the drywells are concentrated in various portions of the basin. Therefore, prior to selecting an option for the individual drywells, drywells located in close proximity to each other where flows were proposed to be managed in accordance with the same option as defined above, were grouped into drywell “clusters”. This grouping of drywells was conducted because some of the management options could be applied and constructed in a manner to address a “cluster” of drywells. A total of 39 drywell clusters were delineated, as illustrated on the Stormwater Management Strategy Development map in Appendix H and listed in Table 3-6 below. Table 3-6 also lists the CPs associated with each drywell cluster to address decommissioning of the drywells. A capital project fact sheet including a map, estimated costs, and conceptual design assumptions is provided for each of these projects in Appendix A, and the location of each of these projects is also shown in Figures 3-2 through 3-8. The project options were selected for each cluster to maximize water quality benefits while addressing the flows associated with decommissioning. See Section 4.0 – Water Quality Evaluation for more detail regarding the development of each of these projects.

Table 3-6
Capital Project Options Selected to Address Decommissioning of Drywells (UICs)*

CP/ Cluster Number	# of County Drywells Addressed by the CP	# of City Drywells Addressed by the CP	CP Project Option Selected	CP/ Cluster Name
Willamette Overflow Major Subbasin				
WO-1-UIC		2	Piped	Green UIC Cluster
WO-2-UIC		4	Rain Garden/Infiltration Facility	Corliss/ Carolyn/ Onyx UIC Cluster
WO-3-UIC	4	6	Rain Garden/Infiltration Facility	Autumn, Ross, Moore/Oak UIC Cluster
WO-4-UIC		1	Piped	Taz UIC
WO-5-UIC	3		Rain Garden/Infiltration Facility	Silver Meadows UIC Cluster
WO-6-UIC	3		Piped	Poplar UIC Cluster
WO-7-UIC		1	Piped	Kendra UIC
WO-8-UIC	1	1	Piped	Kent UIC Cluster
WO-9-UIC		1	Rain Garden/Infiltration Facility	Baywood UIC
WO-10-UIC		1	Rain Garden/Infiltration Facility	Greenwood UIC
WO-11-UIC	1		Rain Garden/Infiltration Facility	Warrington UIC
A-1 Channel Major Subbasin				
A1-1-UIC A1-2-UIC	7		Piped	Crocker 1 and 2 UIC Cluster
A1-3-UIC A1-4-UIC		10	Piped	Shirley 1 and 2 UIC Cluster
A1-5-UIC	4		Piped	Hamilton UIC Cluster
A1-6-UIC	2		Piped	Bushnell UIC Cluster
A1-7-UIC	8	14	Rain Garden/Infiltration Facility	Anderson UIC Cluster
A1-8-UIC		4	Rain Garden/Infiltration Facility	Escalante UIC Cluster
A1-9-UIC	1		Piped	Greenleaf UIC Cluster
A1-10-UIC	4		Rain Garden/Infiltration Facility	Grove UIC Cluster
A1-11-UIC		3	Rain Garden/Infiltration Facility	Exeter UIC Cluster
A1-12-UIC	1		Rain Garden/Infiltration Facility	Brentwood UIC Cluster
A1-13-UIC		2	Piped	Korbel UIC Cluster
A1-14-UIC	1		Rain Garden/Infiltration Facility	Howard UIC
A1-15-UIC	26	1	On-Street Rain Gardens	South of Horn Lane UIC Cluster
Spring Creek Major Subbasin				
SC-1-UIC SC-2-UIC SC-3-UIC	2	3	Piped	Zinnia 1, 2, and 3 UIC Cluster
SC-4-UIC		1	Piped	Countryside Cluster
SC-5-UIC	1	3	Piped	Lodenquai UIC Cluster
SC-6-UIC	2		Rain Garden/Infiltration Facility	Byron UIC Cluster
SC-7-UIC	1		Rain Garden/Infiltration Facility	Stark UIC Cluster
SC-8-UIC	2		Rain Garden/Infiltration Facility	Castrey UIC Cluster
SC-9-UIC		2	Rain Garden/Infiltration Facility	Calumet UIC Cluster

CP/ Cluster Number	# of County Drywells Addressed by the CP	# of City Drywells Addressed by the CP	CP Project Option Selected	CP/ Cluster Name
Flat Creek Major Subbasin				
FC-1-UIC FC-2-UIC FC-3-UIC		12	Rain Garden/Infiltration Facility	Willowbrook 1, 2, and 3 UIC Cluster
FC-4-UIC	5		Rain Garden/Infiltration Facility	Maesner UIC Cluster
Total Drywells:	**79**	**72**		

* In the regulatory context, drywells are referred to as Underground Injection Controls (UICs). The terms drywell and UIC are used interchangeably in this document.

3.5.3 Selected Development Standard Alternatives

As part of the Storm Drainage Master Plans that were completed in 2002, detailed analyses were conducted with regards to the potential implementation of development standards to address identified flooding issues (i.e., capacity deficiencies). For each of the basins, the estimated costs to address flooding problems through public capital projects was compared with the estimated costs to address flooding problems through a combination of both capital projects and the implementation of on-site controls required for private development.

As a result of these analyses, development standards to address capacity deficiencies (through on-site controls for private development) were not selected for implementation (see Section 3.3 of the Eugene Stormwater Basin Master Plan, Volumes II-VII for more information). The reason for this decision was that most of the identified flooding problems were anticipated to occur as a result of existing developed conditions. While future development would exacerbate some of the problems, a capital project would already be required to address existing condition flooding, and increasing the size of the capital project to address flows from future development was more cost effective than requiring developers to address the issue through on-site storage requirements. For this basin, the conclusions from this previous analysis were assumed to apply.

Note: It should be noted that in the City and County, stormwater system improvements are currently designed to meet conveyance design criteria based upon the size of the drainage area and the type of system (closed or open) being improved. Conveyance design criteria will still apply to new development and re-development, to provide the appropriate level of protection from the risk of flooding and a consistent level of service city-wide. See Eugene Stormwater Basin Master Plan, Volume I Sections 3.1.4 and 4.3.2 for more information.

TABLE 3-1
MAJOR HYDROLOGIC INPUT/OUTPUT DATA FOR THE RIVER ROAD SANTA CLARA STORM DRAINAGE SYSTEM

Subbasin Name	Inlet Node	Subbasin Area (acres)	Impervious Area (%)					Average Subbasin Slope (ft/ft)	Subbasin Width (ft)	Subbasin Peak Flow (cfs) Existing Land Use Conditions					Subbasin Peak Flow (cfs) Future Land Use Conditions				
			Existing Land Use		Future Land Use		Increase in the Impervious Area Percentage [1]			10-Year	25-Year-W[2]	25-Year-S[3]	50-Year	100-Year	10-Year	25-Year-W[2]	25-Year-S[3]	50-Year	100-Year
			Mapped	Effective	Mapped	Effective													
River Road-Santa Clara - A1-Channel																			
RSA1-010	72757	34.6	3.7	0.7	35.4	21.1	20.4	0.025	2540	11	4	8	13	19	15	12	12	25	33
RSA1-020	72757	87.3	13.0	4.7	14.8	5.7	1.0	0.014	1446	12	7	10	16	22	12	8	11	18	24
RSA1-030	72744	239.8	24.3	12	37.1	22.6	10.6	0.016	11160	73	44	61	103	139	87	70	76	149	191
RSA1-050	72746	65.4	15.5	6.1	56.3	42.2	36.1	0.007	1543	8	5	7	11	15	24	31	22	47	56
RSA1-060	72740	152.8	36.8	22.3	49.4	34.7	12.4	0.016	20023	76	57	63	140	180	82	77	70	171	212
RSA1-070	72742	63.6	29.3	15.9	51.0	36.4	20.5	0.015	2570	18	13	15	28	37	26	27	23	51	63
RSA1-080	72748	73.1	50.4	35.8	54.0	39.7	3.9	0.021	2693	30	31	26	58	71	32	34	28	63	77
RSA1-090	72788	50.0	37.9	23.3	54.4	40.1	16.8	0.024	3434	17	13	11	29	37	21	22	16	44	54
RSA1-100	72784	82.1	49.1	34.4	51.5	37	2.6	0.043	3276	19	31	20	52	61	20	34	21	56	66
RSA1-110	72103	57.8	54.3	40	55.2	41	1.0	0.043	2500	16	26	16	44	52	16	26	17	45	53
RSA1-120	72102	91.4	32.8	18.8	54.1	39.8	21.0	0.050	4154	12	19	12	34	42	25	40	26	70	82
RSA1-130	72737	107.1	36.0	21.6	45.3	30.5	8.9	0.023	7687	41	29	33	67	88	46	39	38	84	107
RSA1-140	69264	54.3	38.1	23.5	39.3	24.6	1.1	0.017	3325	21	16	17	35	45	21	16	17	36	46
RSA1-150	72797	73.5	43.9	29.1	49.4	34.7	5.6	0.043	2701	14	24	15	41	48	17	28	18	49	57
RSA1-160	72733	106.5	40.1	25.4	43.1	28.3	2.9	0.022	6146	23	30	19	53	64	25	34	21	59	71
RSA1-170	72736	98.9	45.5	30.7	47.7	32.9	2.2	0.017	5947	33	35	28	66	79	34	37	30	69	84
RSA1-180	72101	78.8	42.7	27.9	43.5	28.7	0.8	0.014	2650	20	25	18	43	51	20	25	18	44	52
RSA1-190	72100	59.6	43.6	28.8	43.6	28.8	0.0	0.011	1623	15	19	13	32	38	15	19	13	32	38
RSA1-200	72725	42.2	40.2	25.5	50.1	35.5	10.0	0.042	1297	8	12	8	21	26	11	17	11	29	34
RSA1-210	59021	99.0	45.6	30.8	46.0	31.2	0.4	0.006	4869	27	34	24	58	69	27	35	24	59	69
RSA1-220	85032	53.8	45.9	31.1	46.8	32	0.9	0.005	1315	13	19	12	28	33	13	19	12	29	34
RSA1-230	72723	86.7	34.3	20.1	38.8	24.2	4.1	0.030	4686	13	19	12	35	43	15	23	15	42	50
RSA1-240	72719	169.1	38.4	23.8	42.2	27.4	3.6	0.015	4837	126	49	40	86	104	45	55	44	96	115
RSA1-245	72719	566.3	40.1	25.4	42.5	27.7	2.3	0.014	9500	41	168	127	274	326	135	182	136	298	348
RSA1-270	74040	28.3	46.8	32	47.1	32.3	0.3	0.008	4532	6	10	6	17	20	6	10	6	17	20
RSA1-280	74030	39.2	45.2	30.4	45.3	30.5	0.1	0.004	3610	12	14	11	25	30	12	14	11	25	30
RSA1-290	74020	48.4	43.3	28.5	44.3	29.5	1.0	0.013	2809	15	16	13	29	35	15	16	13	30	36
River Road-Santa Clara - Flat Creek																			
RSFC-010	70197	51.3	44.0	29.2	44.1	29.3	0.1	0.024	2500	16	17	13	32	38	16	17	13	32	38
RSFC-020	72767	84.7	42.8	28	46.8	32	4.0	0.015	3743	25	27	22	50	60	27	31	24	56	67
RSFC-030	72761	104.2	41.9	27.1	45.1	30.3	3.2	0.016	5722	36	33	30	65	81	38	37	32	71	88
RSFC-040	75659	35.9	42.1	27.3	43.7	28.9	1.6	0.013	1700	10	11	9	20	25	10	12	9	21	26
RSFC-050	72799	42.8	36.9	22.4	42.9	28.1	5.7	0.013	1680	10	11	9	20	24	12	14	10	24	29
RSFC-060	72800	46.2	44.8	30	44.8	30	0.0	0.010	2412	11	15	10	26	30	11	15	10	26	30
RSFC-070	72794	30.2	35.7	21.3	38.2	23.6	2.3	0.016	2903	8	7	6	15	18	9	8	6	16	20
River Road-Santa Clara - Spring Creek																			
RSSC-010	72013	50.5	38.2	23.6	43.1	28.3	4.7	0.024	2938	16	14	14	29	36	18	17	15	33	41
RSSC-035	76560	51.9	44.8	30	45.8	31	1.0	0.009	1200	14	18	12	29	34	14	18	13	29	35
RSSC-040	72008	42.8	38.1	23.5	40.1	25.4	1.9	0.027	1869	10	11	8	21	25	10	12	8	22	26
RSSC-050	72030	54.4	43.3	28.5	44.9	30.1	1.6	0.013	2656	12	17	11	30	35	13	18	12	32	37
RSSC-060	79470	114.1	41.4	26.6	47.9	33.1	6.5	0.013	4948	26	34	22	60	70	31	42	27	73	84
RSSC-070	76587	40.4	47.2	32.4	47.5	32.7	0.3	0.009	1941	12	15	10	25	30	12	15	10	26	30
RSSC-080	76564	100.3	41.2	26.4	45.9	31.1	4.7	0.008	1424	20	29	19	44	51	24	35	22	50	58

TABLE 3-1
MAJOR HYDROLOGIC INPUT/OUTPUT DATA FOR THE RIVER ROAD SANTA CLARA STORM DRAINAGE SYSTEM

Subbasin Name	Inlet Node	Subbasin Area (acres)	Impervious Area (%)					Average Subbasin Slope (ft/ft)	Subbasin Width (ft)
			Existing Land Use		Future Land Use		Increase in the Impervious Area Percentage [1]		
			Mapped	Effective	Mapped	Effective			
RSSC-090	72004	82.8	43.3	28.5	43.6	28.8	0.3	0.020	3761
RSSC-100	72002	66.4	40.6	25.9	43.0	28.2	2.3	0.013	2722
RSSC-110	72770	95.9	27.3	14.3	42.5	27.7	13.4	0.010	2777
RSSC-120	72000	323.9	40.8	26.1	43.4	28.6	2.5	0.014	4475
River Road-Santa Clara - Willamette Overflow									
RSWO-010	99820	54.8	11.3	3.8	27.5	14.4	10.6	0.034	4578
RSWO-020	99827	27.5	39.7	25	45.4	30.6	5.6	0.015	2261
RSWO-030	99827	47.8	36.3	21.9	42.8	28	6.1	0.018	2282
RSWO-035	99827	110.8	39.9	25.2	44.5	29.7	4.5	0.014	4687
RSWO-040	73907	25.4	37.1	22.6	38.0	23.4	0.8	0.024	5712
RSWO-045	73910	44.7	36.0	21.6	43.7	28.9	7.3	0.027	3000
RSWO-050	72081	80.0	25.3	12.7	39.0	24.4	11.7	0.019	3396
RSWO-060	72080	37.9	4.0	0.8	12.5	4.4	3.6	0.025	1817
RSWO-070	74013	66.1	31.4	17.6	41.4	26.6	9.0	0.022	5273
RSWO-080	74004	55.4	51.8	37.3	54.6	40.3	3.0	0.008	3737
RSWO-090	74405	34.2	44.9	30.1	45.8	31	0.9	0.022	3460
RSWO-100	58315	15.2	40.3	25.6	40.4	25.7	0.1	0.009	3030
RSWO-110	58311	49.4	57.7	43.8	64.7	52	8.2	0.012	2980
RSWO-120	77703	30.9	56.5	42.5	57.3	43.4	0.9	0.044	2010
RSWO-130	77703	136.9	50.6	36	52.2	37.7	1.7	0.010	4533
RSWO-140	77703	30.6	59.4	45.8	62.2	49.1	3.3	0.033	1773

Subbasin Name	Subbasin Peak Flow (cfs) Existing Land Use Conditions					Subbasin Peak Flow (cfs) Future Land Use Conditions				
	10-Year	25-Year-W[2]	25-Year-S[3]	50-Year	100-Year	10-Year	25-Year-W[2]	25-Year-S[3]	50-Year	100-Year
RSSC-090	28	27	24	53	65	28	28	24	53	66
RSSC-100	19	20	17	37	45	20	22	18	40	48
RSSC-110	17	16	14	30	38	26	30	23	52	62
RSSC-120	65	94	60	145	169	71	103	66	157	182
River Road-Santa Clara - Willamette Overflow										
RSWO-010	1	2	1	5	10	5	9	6	16	22
RSWO-020	5	8	5	13	16	6	9	6	16	19
RSWO-030	7	12	7	20	24	9	15	9	25	30
RSWO-035	19	31	20	51	59	22	37	23	60	69
RSWO-040	4	6	4	13	17	4	7	4	13	18
RSWO-045	7	11	7	18	20	9	14	9	24	27
RSWO-050	7	11	7	19	21	13	22	14	36	41
RSWO-060	0	0	0	1	1	1	2	1	3	4
RSWO-070	8	13	8	22	26	12	20	12	33	38
RSWO-080	20	23	17	42	50	21	25	18	45	53
RSWO-090	7	11	7	20	24	7	12	7	21	24
RSWO-100	6	5	5	11	14	6	5	5	11	14
RSWO-110	19	24	17	43	50	22	29	20	49	58
RSWO-120	14	17	13	31	37	14	17	13	31	37
RSWO-130	38	55	37	91	107	40	58	39	95	111
RSWO-140	12	16	10	29	34	13	17	11	31	36

Note.
1. Increase in effective impervious percentage from existing land use conditions to future land use conditions.
2. W = Winter
3. S = Summer

TABLE 3-2
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA 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	CIP # to Address Problems
								Existing Land Use		Future Land Use			
	US	DS				Existing	Future	US	DS	US	DS		
A-1 Channel													
RSA1010A	72757	72745	Bridge	42	25	419	465	356.5	355.6	356.6	355.7		
RSA1010B	72744	72757	Natural	2400	25	405	449	359.9	356.5	360.1	356.6		
RSA1030A	72743	72744	Natural	4200	25	358	386	367.6	359.9	367.8	360.1		
RSA1030B.1	72742	72743	Bridge	32	25	356	385	367.8	367.6	367.9	367.8		
RSA1030BRD	72742	72743	Roadway	32		0	0	367.6	367.6	367.8	367.8		
RSA1030C	73394	72744	Natural	1633	10	6	14	362.7	359.8	362.8	359.9		
RSA1030D	75021	73394	Natural	1016	10	7	14	366.6	362.7	366.7	362.8		
RSA1030Da.	75020	75021	24" x 141" CMP Culvert	96	10	7	14	367.3	366.6	367.7	366.7		
RSA1030DaR	75020	75021	Roadway	96		0	0	366.6	366.6	366.7	366.7		
RSA1030Db	73395	75020	Natural	522	10	7	15	367.3	367.3	367.7	367.7		
RSA1030E	72747	73395	Natural	1633	10	8	24	368.8	367.3	369.0	367.7		
RSA1030F1	72746	72747	14" CSP Culvert	55	10	4	7	369.9	368.8	371.2	369.0		
RSA1030F2	72746	72747	24" CSP Culvert	55	10	4	16	369.9	369.5	371.2	370.3		
RSA1030FRD	72746	72747	Roadway	55		0	0	368.8	368.8	369.0	369.0		
RSA1060A	71215	72742	Natural	1140	25	343	368	369.0	367.8	369.2	367.9		
RSA1060B	72741	71215	Natural	560	25	321	346	370.1	369.0	370.2	369.2		
RSA1060C	72740	72741	Bridge	39	25	321	346	370.3	370.1	370.5	370.2		
RSA1060D	72739	72740	Natural	1000	25	280	297	372.0	370.3	372.1	370.5		
RSA1060E	72738	72739	Natural	500	25	260	275	372.4	372.0	372.5	372.1		
RSA1130A1	72737	72738	72" CSP Culvert	600	25	86	91	373.1	372.4	373.2	372.5		
RSA1130A2	72737	72738	72" CSP Culvert	600	25	88	93	373.1	372.4	373.2	372.5		
RSA1130A3	72737	72738	72" CSP Culvert	600	25	86	91	373.1	372.4	373.2	372.5		
RSA1130ARD	72737	72738	Roadway	600		0	0	372.4	372.4	372.5	372.5		
RSA1130B	70756	72737	Natural	2145	25	239	252	377.6	373.1	377.7	373.2		
RSA1140A	72796	70756	Natural	1155	25	228	241	378.4	377.6	378.5	377.7		
RSA1140B.1	69264	70756	36" CSP Culvert	839	10	21	21	379.8	377.4	380.0	377.5		
RSA1140BRD	69264	70756	Roadway	839		0	0	377.4	377.4	377.5	377.5		

TABLE 3-2
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA 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	CIP # to Address Problems
								Existing Land Use		Future Land Use			
	US	DS				Existing	Future	US	DS	US	DS		
RSA1270A.1	74046	72796	60" CSP Culvert	160	10	25	25	378.2	378.2	378.3	378.3		
RSA1270ARD	74046	72796	Roadway	160		0	0	378.2	378.2	378.3	378.3		
RSA1270B.1	74044	74046	60" CSP Culvert	463	10	25	25	378.2	378.2	378.3	378.3		
RSA1270BRD	74044	74046	Roadway	463		0	0	378.2	378.2	378.3	378.3		
RSA1270C.1	74042	74044	60" CSP Culvert	412	10	25	26	378.2	378.2	378.3	378.3		
RSA1270CRD	74042	74044	Roadway	412		0	0	378.2	378.2	378.3	378.3		
RSA1270D.1	74040	74042	60" CSP Culvert	409	10	26	26	378.2	378.2	378.4	378.3		
RSA1270DRD	74040	74042	Roadway	409		0	0	378.2	378.2	378.3	378.3		
RSA1280A.1	74034	74040	60" CSP Culvert	216	10	21	22	378.3	378.2	378.4	378.4		
RSA1280ARD	74034	74040	Roadway	216		0	0	378.3	378.3	378.4	378.4		
RSA1280B.1	74032	74034	60" CSP Culvert	269	10	21	22	378.3	378.3	378.4	378.4		
RSA1280BRD	74032	74034	Roadway	269		0	0	378.3	378.3	378.4	378.4		
RSA1280C.1	74031	74032	60" CSP Culvert	1331	10	22	22	378.3	378.3	378.4	378.4		
RSA1280CRD	74031	74032	Roadway	1331		0	0	378.3	378.3	378.4	378.4		
RSA1280D.1	74030	74031	60" CSP Culvert	1012	10	24	24	378.4	378.3	378.5	378.4		
RSA1280DRD	74030	74031	Roadway	1022		0	0	378.3	378.3	378.4	378.4		
RSA1290A.1	74026	74030	54" CSP Culvert	496	10	13	14	378.4	378.4	378.5	378.5		
RSA1290ARD	74026	74030	Roadway	496		0	0	378.4	378.4	378.5	378.5		
RSA1290B.1	74024	74026	48" CSP Culvert	182	10	14	14	378.5	378.4	378.6	378.5		
RSA1290BRD	74024	74026	Roadway	182		0	0	378.4	378.4	378.5	378.5		
RSA1290C.1	74022	74024	48" CSP Culvert	410	10	14	14	378.5	378.5	378.6	378.6		
RSA1290CRD	74022	74024	Roadway	410		0	0	378.5	378.5	378.6	378.6		
RSA1290D.1	74020	74022	42" CSP Culvert	880	10	14	15	379.2	378.5	379.3	378.6		

TABLE 3-2
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA 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	CIP # to Address Problems
								Existing Land Use		Future Land Use			
	US	DS				Existing	Future	US	DS	US	DS		
RSA1290DRD	74020	74022	Roadway	880		0	0	378.5	378.5	378.6	378.6		
RSA1150A1	72797	72796	72" CSP Culvert	167	25	103	109	379.0	378.4	379.2	378.5		
RSA1150A2	72797	72796	72" CSP Culvert	155	25	104	111	379.0	378.4	379.2	378.5		
RSA1150ARD	72797	72796	Roadway	160		0	0	379.0	379.0	379.2	379.2		
RSA1150B	72734	72797	Natural	3273	25	199	210	382.8	379.0	382.9	379.2		
RSA1160A.1	72733	72734	Bridge	92	25	156	167	382.9	382.8	383.0	382.9		
RSA1160ARD	72733	72734	Roadway	92		0	0	382.8	382.8	382.9	382.9		
RSA1160B	72732	72733	Natural	165	25	152	161	382.8	382.7	382.9	382.8	10-yr Existing	A1-8
RSA1160C1	72731	72732	60" CSP Culvert	61	25	76	81	383.0	382.8	383.1	382.9		
RSA1160C2	72731	72732	60" CSP Culvert	61	25	76	81	383.0	382.8	383.1	382.9		
RSA1160CRD	72731	72732	Roadway	61		0	0	382.8	382.8	382.9	382.9		
RSA1160D	72730	72731	Natural	769	25	150	160	383.3	383.0	383.5	383.1	10-yr Existing	A1-8 and A1-9
RSA1160E1	72729	72730	72" CMP Culvert	89	25	74	79	383.5	383.3	383.8	383.5		
RSA1160E2	72729	72730	72" CMP Culvert	89	25	75	80	383.5	383.3	383.8	383.5		
RSA1160ERD	72729	72730	Roadway	89		0	0	383.3	383.3	383.5	383.5		
RSA1160F	71940	72729	Natural	1207	25	149	159	383.6	383.5	383.8	383.8	10-yr Existing	A1-8
RSA1160G.1	71941	71940	60" x 144" CMP Culvert	61	25	155	165	384.0	383.6	384.2	383.8		
RSA1160GRD	71941	71940	Roadway	61		0	0	383.6	383.6	383.8	383.8		
RSA1160H	72726	71941	Natural	650	25	159	170	384.1	384.0	384.4	384.2	10-yr Existing	A1-8 and A1-9
RSA1170A	72736	72734	Natural	610	10	76	79	382.7	382.6	382.8	382.8		
RSA1170B.1	72101	72736	60" CSP Culvert	140	25	25	25	382.7	382.7	382.8	382.8		
RSA1170BRD	72101	72736	Roadway	140		0	0	382.7	382.7	382.8	382.8		
RSA1170C	72735	72736	Natural	2200	10	18	18	384.0	382.7	384.0	382.8		
RSA1170D.1	72100	72735	36" CSP Culvert	150	25	19	19	385.1	384.0	385.1	384.0		
RSA1170DRD	72100	72735	Roadway	150		0	0	384.0	384.0	384.0	384.0		

TABLE 3-2
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA 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	CIP # to Address Problems
								Existing Land Use		Future Land Use			
	US	DS				Existing	Future	US	DS	US	DS		
RSA1200A1	72725	72726	60" CMP Culvert	200	25	69	74	384.7	384.1	385.1	384.4		
RSA1200A2	72725	72726	60" CMP Culvert	200	25	68	73	384.7	384.1	385.1	384.4		
RSA1200ARD	72725	72726	Roadway	200		0	0	384.1	384.1	384.4	384.4		
RSA1200B	72724	72725	Natural	950	25	142	151	384.8	384.7	385.1	385.1		
RSA1230A.1	72723	72724	60" CMP Culvert	136	25	158	168	387.6	384.8	388.1	385.1		
RSA1230ARD	72723	72724	Roadway	136		0	0	384.8	384.8	385.1	385.1		
RSA1230B	72722	72723	Natural	900	25	149	159	387.7	387.6	388.1	388.1		
RSA1230C	72721	72722	Natural	1400	25	172	185	387.8	387.7	388.2	388.1		
RSA1230D1	72720	72721	36" CSP Culvert	68	25	62	68	389.3	387.8	390.0	388.2		
RSA1230D2	72720	72721	36" CSP Culvert	68	25	62	68	389.3	387.8	390.0	388.2		
RSA1230D3	72720	72721	36" CSP Culvert	68	25	62	68	389.3	387.8	390.0	388.2		
RSA1230DRD	72720	72721	Roadway	68		0	0	387.8	387.8	388.2	388.2		
RSA1230E	72719	72720	Natural	900	25	198	217	389.4	389.3	390.1	390.0		
RSA1060F.1	85030	71215	48" CMP Culvert	30	10	23	27	368.8	368.8	369.0	368.9		
RSA1060FRD	85030	71215	Roadway	30		0	0	368.8	368.8	368.9	368.9		
RSA1060Fa	71214	85030	Natural	415	10	23	26	369.7	368.8	369.7	369.0		
RSA1060G1	71213	71214	18" CMP Culvert	31	10	12	13	371.6	369.7	371.8	369.7		
RSA1060G2	71213	71214	24" CMP Culvert	28	10	11	13	371.6	370.1	371.8	370.2		
RSA1060GRD	71213	71214	Roadway	31		0	0	369.7	369.7	369.7	369.7		
RSA1060H	71212	71213	Natural	1034	10	23	27	371.8	371.6	372.0	371.8	25-yr Winter Future	A1-7 & A1-3
RSA1060I1	71211	71212	18" CMP Culvert	42	10	11	13	372.4	371.8	372.7	372.0		
RSA1060I2	71211	71212	18" CMP Culvert	42	10	12	15	372.4	371.8	372.7	372.0		
RSA1060IRD	71211	71212	Roadway	42		0	0	371.8	371.8	372.0	372.0		

TABLE 3-2
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA 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	CIP # to Address Problems
								Existing Land Use		Future Land Use			
	US	DS				Existing	Future	US	DS	US	DS		
RSA1060J	71210	71211	Natural	712	10	24	28	373.5	372.4	373.6	372.7		
RSA1060S.1	85031	71210	36" x 72" CMP Culvert	18	10	32	33	373.8	373.5	373.9	373.6		
RSA1060Sa	71209	85031	Natural	586	10	32	33	374.0	373.8	374.0	373.9		
RSA1060SRD	85031	71210	Roadway	18		0	0	373.5	373.5	373.6	373.6		
RSA1060U	72749	71209	Natural	308	10	55	57	374.2	374.0	374.3	374.0	10-yr Existing	A1-6, A1-7 & A1-3
RSA1080A.1	72748	72749	48" CMP Culvert	40	10	55	57	374.9	374.2	375.0	374.3		
RSA1080ARD	72748	72749	Roadway	40		0	0	374.2	374.2	374.3	374.3		
RSA1080B	72791	72748	Natural	1857	10	29	32	375.7	374.9	375.9	375.0	10-yr Existing	A1-6, A1-7, A1-9 & A1-3
RSA1090A.1	72790	72791	36" CMP Culvert	438	10	29	31	378.7	375.7	379.3	375.9	25-yr Winter Future	A1-6, A1-7, A1-2 & A1-3
RSA1090ARD	72790	72791	Roadway	438		0	0	375.7	375.7	375.9	375.9		
RSA1090B	72789	72790	Natural	18	10	29	31	378.7	378.7	379.3	379.3	10-yr Existing	A1-1, A1-2 & A1-3
RSA1090C1	72788	72789	27" x 40" CMP Culvert	30	10	14	14	378.7	378.7	379.3	379.3	10-yr Existing	A1-1, A1-2 & A1-3
RSA1090C2	72788	72789	27" x 40" CMP Culvert	30	10	14	14	378.7	378.7	379.3	379.3	10-yr Existing	A1-1, A1-2 & A1-3
RSA1090CRD	72788	72789	Roadway	30		24	30	378.7	378.7	379.3	379.3		
RSA1090D	72787	72788	Natural	386	10	23	25	378.7	378.7	379.3	379.3	10-yr Existing	A1-1, A1-2 & A1-3
RSA1090E1	72786	72787	24" CMP Culvert	40	10	7	7	378.7	378.7	379.3	379.3	10-yr Existing	A1-5 & A1-3
RSA1090E2	72786	72787	24" CMP Culvert	40	10	7	7	378.7	378.7	379.3	379.3	10-yr Existing	A1-5 & A1-3
RSA1090E3	72786	72787	24" CMP Culvert	40	10	7	7	378.7	378.7	379.3	379.3	10-yr Existing	A1-5 & A1-3
RSA1090ERD	72786	72787	Roadway	40		19	23	378.7	378.7	379.3	379.3		
RSA1090F	72785	72786	Natural	772	10	26	28	378.7	378.7	379.3	379.3	10-yr Existing	A1-5 & A1-3
RSA1090G1	72784	72785	36" CMP Culvert	91	10	14	15	378.8	378.7	379.4	379.3		

TABLE 3-2
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA 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	CIP # to Address Problems
								Existing Land Use		Future Land Use			
	US	DS				Existing	Future	US	DS	US	DS		
RSA1090G2	72784	72785	36" CMP Culvert	91	10	14	15	378.8	378.7	379.4	379.3		
RSA1090GRD	72784	72785	Roadway	91		0	0	378.7	378.7	379.3	379.3		
RSA1100A	72783	72784	Natural	19	10	14	17	378.8	378.8	379.4	379.4		
RSA1100B.1	72782	72783	24" x 42" CMP Culvert	858	10	13	17	379.0	378.8	379.6	379.4	25-yr Winter Future	A1-5 & A1-3
RSA1100BRD	72782	72783	Roadway	800		0	0	378.8	378.8	379.4	379.4		
RSA1100C	72781	72782	Natural	9	10	13	16	379.1	379.0	379.6	379.6	10-yr Existing	A1-5 & A1-3
RSA1100D.1	72780	72781	30" CSP Culvert	24	10	13	16	379.1	379.1	379.7	379.6	25-yr Winter Future	A1-5 & A1-3
RSA1100DRD	72780	72781	Roadway	24		0	0	379.1	379.1	379.6	379.6		
RSA1100E	72793	72780	Natural	133	10	12	15	379.1	379.1	379.7	379.7	10-yr Existing	A1-5 & A1-3
RSA1100F.1	72792	72793	30" CSP Culvert	30	10	13	17	379.2	379.1	379.9	379.7	25-yr Summer Future	A1-5 & A1-3
RSA1100FRD	72792	72793	Roadway	30		0	0	379.1	379.1	379.7	379.7		
RSA1100G	72779	72792	Natural	135	10	13	17	379.2	379.2	379.9	379.9	10-yr Existing	A1-5 & A1-3
RSA1100K	72798	72779	Natural	740	10	6	16	379.2	379.2	379.9	379.9	10-yr Existing	A1-5 & A1-3
RSA1100L.1	72102	72798	36" CMP Culvert	292	10	12	25	379.8	379.2	381.0	379.9		
RSA1100LRD	72102	72798	Roadway	292		0	0	379.2	379.2	379.9	379.9		
RSA1100H	72778	72779	Natural	50	10	13	13	379.2	379.2	379.9	379.9	10-yr Existing	A1-3
RSA1100I.1	72777	72778	24" CMP Culvert	70	25	21	20	381.8	379.6	382.0	380.2	50 ex	A1-4
RSA1100IRD	72777	72778	Roadway	70		0	0	379.6	379.6	380.2	380.2		
RSA1100J	72776	72777	Natural	180	10	15	15	380.3	380.3	380.8	380.8	10-yr Existing	A1-4
RSA1110A1	72103	72776	30" CSP Culvert	280	25	13	13	382.1	381.8	382.2	382.0	25-yr Summer Existing	A1-4
RSA1110A2	72103	72776	30" CSP Culvert	280	25	13	13	382.1	381.8	382.2	382.0	25-yr Summer Existing	A1-4
RSA1110ARD	72103	72776	Roadway	280		0	4	382.1	382.0	382.2	382.0		
RSA1060K	71208	72740	Natural	800	10	25	26	372.3	370.2	372.3	370.3		
RSA1060L	71207	71208	24" CMP Culvert	40	10	8	8	373.5	372.3	373.6	372.3		
RSA1060M	71210	71207	Natural	550	10	10	10	373.5	373.5	373.6	373.6	10-yr Existing	A1-6 & A1-3

TABLE 3-2
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA 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	CIP # to Address Problems
								Existing Land Use		Future Land Use			
	US	DS				Existing	Future	US	DS	US	DS		
RSA1060N.1	72754	72739	36" CMP Culvert	25	10	20	22	372.0	371.8	372.2	371.9		
RSA1060NRD	72754	72739	Roadway	25		0	0	371.8	371.8	371.9	371.9		
RSA1060O	72753	72754	Natural	320	10	21	22	372.7	372.0	372.7	372.2	100 EX	A1-6 & A1-3
RSA1060P.1	72752	72753	26" x 42" CMP Culvert	40	10	21	22	373.4	372.7	373.4	372.7		
RSA1060PRD	72752	72753	Roadway	40		0	0	372.7	372.7	372.7	372.7		
RSA1060Q	72751	72752	Natural	330	10	21	23	373.5	373.4	373.5	373.4	10-yr Existing	A1-6 & A1-3
RSA1060R.1	72750	72751	36" CMP Culvert	40	10	22	23	373.9	373.5	374.0	373.5		
RSA1060RRD	72750	72751	Roadway	40		0	0	373.5	373.5	373.5	373.5		
RSA1060T	71209	72750	Natural	270	10	22	23	374.0	373.9	374.0	374.0		
RSA1160I.1	59020	72726	60" CMP Culvert	1081	10	37	37	384.3	383.9	384.4	384.1		
RSA1160IRD	59020	72726	Roadway	1081		0	0	384.3	384.3	384.4	384.4		
RSA1210A.1	59021	59020	54" CSP Culvert	560	10	38	38	384.6	384.3	384.7	384.4		
RSA1210ARD	59021	59020	Roadway	560		0	0	384.3	384.3	384.4	384.4		
RSA1210B.1	59112	59021	48" CSP Culvert	1506	10	12	12	384.7	384.6	384.8	384.7		
RSA1210BRD	59112	59021	Roadway	1506		0	0	384.7	384.7	384.8	384.8		
RSA1210C.1	85032	59112	36" CSP Culvert	33	10	13	13	384.8	384.7	384.8	384.8		
RSA1210CRD	85032	59112	Roadway	33		0	0	384.7	384.7	384.8	384.8		
Flat Creek													
RSFC010A	99329	70197	Natural	850	10	57	60	368.0	367.8	368.0	367.8		
RSFC010B1	99330	99329	41' x 60" CMP Culvert	92	10	28	29	368.2	368.0	368.3	368.0		
RSFC010B2	99330	99329	41' x 60" CMP Culvert	92	10	29	31	368.2	368.0	368.3	368.0		
RSFC010BRD	99330	99329	Roadway	92		0	0	368.0	368.0	368.0	368.0		
RSFC020A	72768	99330	Natural	750	10	57	60	368.4	368.2	368.4	368.3		
RSFC020B1	72767	72768	36" CSP Culvert	72	10	28	30	368.7	368.4	368.8	368.4		

TABLE 3-2
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA 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	CIP # to Address Problems
								Existing Land Use		Future Land Use			
	US	DS				Existing	Future	US	DS	US	DS		
RSFC020B2	72767	72768	36" CSP Culvert	72	10	29	30	368.7	368.4	368.8	368.4		
RSFC020BRD	72767	72768	Roadway	72		0	0	368.4	368.4	368.4	368.4		
RSFC020C	72766	72767	Natural	200	10	41	43	369.0	368.7	369.0	368.8		
RSFC020D1	72765	72766	36" CSP Culvert	68	10	18	19	369.2	369.0	369.3	369.0		
RSFC020D2	72765	72766	36" CSP Culvert	68	10	23	24	369.2	369.0	369.3	369.0		
RSFC020DRD	72765	72766	Roadway	68		0	0	369.0	369.0	369.0	369.0		
RSFC020Da	76952	72765	Natural	233	10	41	43	369.3	369.2	369.4	369.3		
RSFC020Db.	76953	76952	50" x 76" CMP Culvert	63	10	41	43	369.5	369.3	369.6	369.4		
RSFC020DbR	76953	76952	Roadway	63		0	0	369.5	369.5	369.6	369.6		
RSFC020E	72764	76953	Natural	809	10	41	42	369.7	369.5	369.8	369.6		
RSFC020F1	72763	72764	36" x 48" CMP Culvert	65	10	14	15	369.9	369.7	370.0	369.8		
RSFC020F2	72763	72764	36" x 48" CMP Culvert	65	10	12	13	369.9	369.7	370.0	369.8		
RSFC020F3	72763	72764	36" x 48" CMP Culvert	65	10	14	14	369.9	369.7	370.0	369.8		
RSFC020FRD	72763	72764	Roadway	65		0	0	369.7	369.7	369.8	369.8		
RSFC020G	72762	72763	Natural	800	10	42	44	370.1	369.9	370.2	370.0		
RSFC030A1	72761	72762	82" x 84" CSP Culvert	55	10	22	23	370.2	370.1	370.2	370.2		
RSFC030A2	72761	72762	82" x 84" CSP Culvert	55	10	22	23	370.2	370.1	370.2	370.2		
RSFC030ARD	72761	72762	Roadway	55		0	0	370.1	370.1	370.2	370.2		
RSFC030B	72244	72761	Natural	1456	10	18	19	371.0	370.2	371.0	370.2		
RSFC050A	75660	72244	Natural	1294	10	19	20	373.3	371.0	373.3	371.0		
RSFC050B1	75659	75660	24" CSP Culvert	61	10	6	7	373.6	373.3	373.7	373.3		
RSFC050B2	75659	75660	24" CSP Culvert	61	10	7	7	373.6	373.3	373.7	373.3		
RSFC050B3	75659	75660	24" CSP Culvert	61	10	6	6	373.6	373.3	373.7	373.3		

TABLE 3-2
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA 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	CIP # to Address Problems
								Existing Land Use		Future Land Use			
	US	DS				Existing	Future	US	DS	US	DS		
RSFC050BRD	75659	75660	Roadway	61		0	0	373.6	373.6	373.7	373.7		
RSFC050C	78673	75659	Natural	1056	10	13	13	376.6	373.6	376.7	373.7		
RSFC050D1	75654	78673	12" CSP Culvert	25	10	6	6	378.4	376.6	378.5	376.7		
RSFC050D2	75654	78673	12" CSP Culvert	25	10	3	4	378.4	377.8	378.5	377.8		
RSFC050D3	75654	78673	12" CSP Culvert	25	10	3	4	378.4	377.8	378.5	377.8		
RSFC050DRD	75654	78673	Roadway	25		0	0	376.6	376.6	376.7	376.7		
RSFC050E	72799	75654	Natural	1016	10	15	16	378.4	378.4	378.5	378.5	10-yr Existing	FC-1
RSFC060A.1	72800	72799	30" CSP Culvert	56	10	12	11	378.5	378.4	378.5	378.5		
RSFC060ARD	72800	72799	Roadway	56		0	0	378.4	378.4	378.5	378.5		
RSFC060B	72795	72800	Natural	850	10	6	6	378.5	378.5	378.5	378.5		
RSFC070A.1	72794	72795	30" CSP Culvert	45	5	8	9	378.5	378.5	378.5	378.5		
RSFC070ARD	72794	72795	Roadway	45		0	0	378.5	378.5	378.5	378.5		
Spring Creek													
OFALL#1	72014	76427	Natural	200	25	158	178	362.8	362.8	362.8	362.8		
RSSC010A1	72013	72014	48" x 72" CMP Culvert	51	25	79	89	363.5	362.8	363.7	362.8		
RSSC010A2	72013	72014	48" x 72" CMP Culvert	51	25	79	89	363.5	362.8	363.7	362.8		
RSSC010ARD	72013	72014	Roadway	51		0	0	362.8	362.8	362.8	362.8		
RSSC010B	85033	72013	Natural	150	25	148	167	363.6	363.5	363.8	363.7		
RSSC010D	79483	85033	Natural	392	25	148	167	363.7	363.7	363.9	363.9		
RSSC010Da1	79482	79483	68" x 144" Box Culvert	38	25	74	83	363.7	363.7	364.0	363.9		
RSSC010Da2	79482	79483	68" x 144" Box Culvert	38	25	75	84	363.7	363.7	364.0	363.9		
RSSC010DaR	79482	79483	Roadway	38		0	0	363.7	363.7	363.9	363.9		
RSSC010Db	72012	79482	Natural	1620	25	150	171	364.2	363.7	364.4	364.0		
RSSC010E.1	72011	72012	Natural	13	25	153	174	364.2	364.2	364.5	364.4		
RSSC010ERD	72011	72012	Roadway	13		0	0	364.2	364.2	364.4	364.4		

TABLE 3-2
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA 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	CIP # to Address Problems
								Existing Land Use		Future Land Use			
	US	DS				Existing	Future	US	DS	US	DS		
RSSC035A	76560	72011	42" CSP Culvert	127	10	14	14	364.2	364.1	364.4	364.3		
RSSC035ARD	76560	72011	Roadway	127		0	0	364.1	364.1	364.3	364.3		
RSSC010F	72010	72011	Natural	100	25	144	164	364.2	364.2	364.5	364.5		
RSSC010G.1	72009	72010	Natural	12	25	144	164	364.4	364.2	364.7	364.5		
RSSC010GRD	72009	72010	Roadway	12		0	0						
RSSC010H	72008	72009	Natural	300	25	144	165	364.7	364.4	365.0	364.7		
RSSC040D	72033	72008	Natural	800	10	12	12	365.1	364.6	365.2	364.8		
RSSC040E.1	72032	72033	40" x 54" CMP Culvert	90	10	12	13	366.3	365.1	366.4	365.2		
RSSC040ERD	72032	72033	Roadway	33		0	0	365.1	365.1	365.2	365.2		
RSSC040F	72031	72032	Natural	530	10	12	13	367.1	366.3	367.1	366.4		
RSSC050A1	72030	72031	48" CMP Culvert	50	10	6	7	367.1	367.1	367.1	367.1		
RSSC050A2	72030	72031	48" CMP Culvert	50	10	6	6	367.1	367.1	367.1	367.1		
RSSC050ARD	72030	72031	Roadway	33		0	0	367.1	367.1	367.1	367.1		
RSSC040A	72007	72008	Natural	120	25	130	149	365.1	364.7	365.3	365.0		
RSSC040B1	72006	72007	30" CSP Culvert	12	25	55	55	367.0	365.1	367.2	365.3	10-yr Existing	SC-1
RSSC040B2	72006	72007	30" CSP Culvert	12	25	55	56	367.0	365.1	367.2	365.3	10-yr Existing	SC-1
RSSC040BRD	72006	72007	Roadway	12		20	40	367.0	367.0	367.2	367.1		
RSSC040C	72005	72006	Natural	800	25	130	149	367.4	367.0	367.6	367.2		
RSSC060A.1	79470	72005	42" CSP Culvert	383	10	53	61	368.6	367.3	369.2	367.5		
RSSC060ARD	79470	72005	Roadway	383		0	0	367.3	367.3	367.5	367.5		
RSSC060B.1	76587	79470	54" CSP Culvert	2906	10	31	33	370.5	368.6	370.7	369.2		
RSSC060BRD	76587	79470	Roadway	2906		0	0	368.6	368.6	369.2	369.2		
RSSC070A.1	76569	76587	48" CMP Culvert	919	10	20	23	371.3	370.5	371.5	370.7		
RSSC070ARD	76569	76587	Roadway	919		0	0	370.5	370.5	370.7	370.7		
RSSC080A.1	76564	76569	36" CSP Culvert	69	10	20	24	371.6	371.3	371.8	371.5		

TABLE 3-2
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA 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	CIP # to Address Problems
								Existing Land Use		Future Land Use			
	US	DS				Existing	Future	US	DS	US	DS		
RSSC080ARD	76564	76569	Roadway	69		0	0	371.3	371.3	371.5	371.5		
RSSC090A1	72004	72005	48" x 84" Box Culvert	92	10	40	45	367.4	367.3	367.5	367.5		
RSSC090A2	72004	72005	48" x 84" Box Culvert	92	10	40	45	367.4	367.3	367.5	367.5		
RSSC090ARD	72004	72005	Roadway	92		0	0	367.3	367.3	367.5	367.5		
RSSC090B	72003	72004	Natural	2880	10	61	69	370.2	367.4	370.5	367.5		
RSSC100A1	72002	72003	48" CMP Culvert	85	10	32	37	370.5	370.2	370.9	370.5		
RSSC100A2	72002	72003	48" CMP Culvert	85	10	32	37	370.5	370.2	370.9	370.5		
RSSC100ARD	72002	72003	Roadway	85		0	0	370.2	370.2	370.5	370.5		
RSSC100B	75387	72002	Natural	1238	10	54	63	370.6	370.5	370.9	370.9		
RSSC100C.1	75386	75387	48" x 96" Box Culvert	92	10	59	70	370.6	370.6	370.9	370.9		
RSSC100CRD	75386	75387	Roadway	92		0	0	370.6	370.6	370.9	370.9		
RSSC100D	72770	75386	Natural	371	10	61	72	370.6	370.6	371.0	370.9		
RSSC110A	72001	72770	Natural	1700	10	56	60	370.7	370.6	371.0	371.0		
RSSC110B.1	72000	72001	72" CMP Culvert	61	10	65	71	371.3	370.7	371.5	371.0		
RSSC110BRD	72000	72001	Roadway	61		0	0	370.7	370.7	371.0	371.0		
Willamette Overflow													
RSWO010A	99820	72088	Natural	1050	25	109	129	370.7	370.7	370.7	370.7		
RSWO020A.1	99827	99820	36" CSP Culvert	675	5	31	37	372.7	370.7	373.5	370.7	25-yr Summer Existing	OK design=5-yr
RSWO020ARD	99827	99820	Roadway	675		0	0	372.7	372.7	373.5	373.5		
RSWO010B	72086	99820	Natural	1950	10	85	91	370.8	370.7	370.8	370.7		
RSWO040A1	72085	72086	72" CMP Culvert	61	10	7	8	371.1	370.8	371.2	370.8		
RSWO040A2	72085	72086	72" CMP Culvert	61	10	5	7	371.1	370.8	371.2	370.8		
RSWO040A3	72085	72086	60" CMP Culvert	61	10	73	76	371.1	370.8	371.2	370.8		
RSWO040ARD	72085	72086	Roadway	61		0	0	370.8	370.8	370.8	370.8		
RSWO040B	73907	72085	Natural	570	10	85	91	371.2	371.1	371.3	371.2		

TABLE 3-2
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA 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	CIP # to Address Problems
								Existing Land Use		Future Land Use			
	US	DS				Existing	Future	US	DS	US	DS		
RSWO040C.1	73910	73907	60" CMP Culvert	760	10	83	89	375.1	371.2	375.7	371.3		
RSWO040CRD	73910	73907	Roadway	760		0	0	371.2	371.2	371.3	371.3		
RSWO045A	72084	73910	Natural	570	10	81	87	375.2	375.1	375.7	375.7		
RSWO045B1	72083	72084	72" CMP Culvert	68	10	42	45	375.3	375.2	375.8	375.7		
RSWO045B2	72083	72084	72" CMP Culvert	68	10	40	43	375.3	375.2	375.8	375.7		
RSWO045BRD	72083	72084	Roadway	68		0	0	375.2	375.2	375.7	375.7		
RSWO045C	72082	72083	Natural	850	10	83	90	375.7	375.3	376.1	375.8		
RSWO050A1	72081	72082	72" CSP Culvert	46	10	41	45	375.8	375.7	376.1	376.1		
RSWO050A2	72081	72082	72" CSP Culvert	46	10	43	47	375.8	375.7	376.1	376.1		
RSWO050ARD	72081	72082	Roadway	46		0	0	375.7	375.7	376.1	376.1		
RSWO050B	70615	72081	Natural	1353	10	83	88	377.4	375.8	377.5	376.1		
RSWO050C	72080	70615	Natural	141	10	83	88	378.2	377.4	378.3	377.5		
RSWO060A	74014	72080	Natural	693	10	83	88	378.2	378.2	378.3	378.3		
RSWO060B	74013	74014	Natural	420	10	85	89	378.2	378.2	378.3	378.3		
RSWO070A	74009	74013	Natural	288	10	83	84	378.5	378.2	378.6	378.3		
RSWO070B1	74008	74009	48" CSP Culvert	501	10	29	29	380.2	378.5	380.2	378.6		
RSWO070B2	74008	74009	48" CSP Culvert	501	10	27	27	380.2	378.5	380.2	378.6		
RSWO070B3	74008	74009	48" CSP Culvert	501	10	28	28	380.2	378.6	380.2	378.6		
RSWO070BRD	74008	74009	Roadway	501		0	0	378.5	378.5	378.6	378.6		
RSWO070C	74007	74008	Natural	826	10	83	85	381.1	380.2	381.2	380.2		
RSWO070D.1	74006	74007	18" CMP Culvert	253	10	9	9	386.7	381.1	386.7	381.2	10-yr Existing	WO-1 & WO-5
RSWO070DRD	74006	74007	Roadway	250		75	77	386.7	386.4	386.7	386.4		
RSWO070E	74005	74006	Natural	296	10	83	85	386.7	386.7	386.7	386.7	10-yr Existing	WO-1 & WO-5
RSWO080A.1	74004	74005	48" CSP Culvert	43	10	83	85	387.5	386.7	387.5	386.7		
RSWO080ARD	74004	74005	Roadway	43		0	0	386.7	386.7	386.7	386.7		

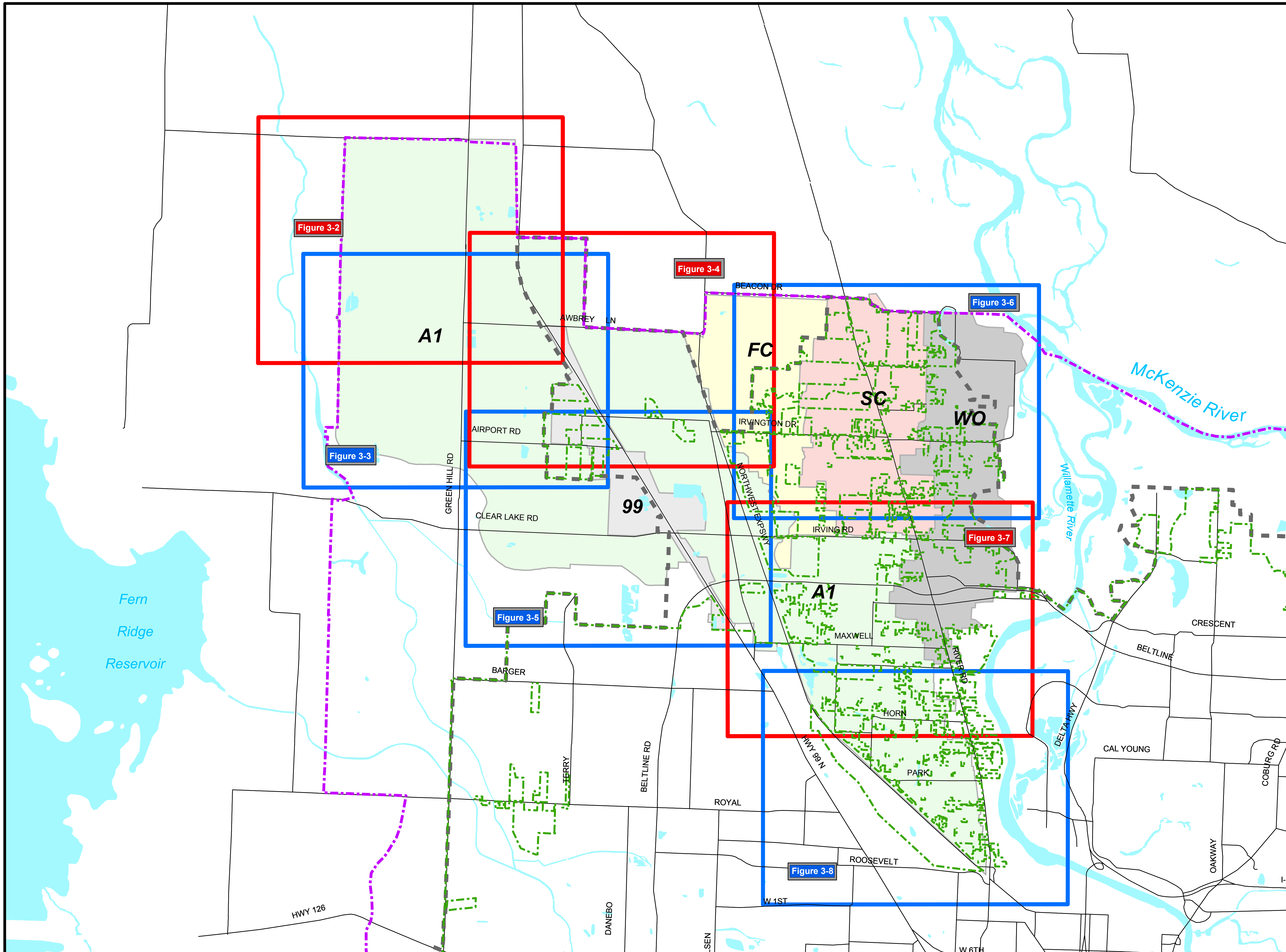
TABLE 3-2
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA STORM DRAINAGE SYSTEM

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	CIP # to Address Problems
								Existing Land Use		Future Land Use			
	US	DS				Existing	Future	US	DS	US	DS		
RSWO090A	78833	74004	Natural	197	10	69	70	387.5	387.5	387.5	387.5	10-yr Existing	WO-3, WO-4, & WO-5
RSWO090Aa	74003	78833	Natural	208	10	68	70	387.5	387.5	387.6	387.5	10-yr Existing	WO-3, WO-4, & WO-5
RSWO090B	75433	74003	Natural	153	10	68	69	387.6	387.5	387.6	387.6	10-yr Existing	WO-3, WO-4, & WO-5
RSWO090C	74001	75433	Natural	112	10	68	69	387.6	387.6	387.6	387.6	10-yr Existing	WO-3, WO-4, & WO-5
RSWO090D	74405	74001	Natural	251	10	67	68	387.6	387.6	387.6	387.6		
RSWO090E.1	74406	74405	84" x 120" CMP Culvert	71	10	63	64	387.6	387.6	387.7	387.6		
RSWO090ERD	74406	74405	Roadway	71		0	0	387.6	387.6	387.7	387.7		
RSWO090F	76415	74406	Natural	146	10	63	64	387.6	387.6	387.7	387.7	10-yr Existing	WO-3 & WO-5
RSWO090G.1	76414	76415	84" x 120" CMP Culvert	57	10	63	64	387.6	387.6	387.7	387.7		
RSWO090GRD	76414	76415	Roadway	57		0	0	387.6	387.6	387.7	387.7		
RSWO090H	58287	76414	Natural	116	10	62	64	387.6	387.6	387.7	387.7	10-yr Existing	WO-3 & WO-5
RSWO110A.1	58310	58287	36" CSP Culvert	47	10	62	64	389.2	387.6	389.3	387.7		
RSWO110ARD	58310	58287	Roadway	26		0	0	387.6	387.6	387.7	387.7		
RSWO110B.1	58311	58310	54" CSP Culvert	387	10	62	64	389.7	389.2	389.9	389.3	10-yr Future	WO-2 & WO-5
RSWO110BRD	58311	58310	Roadway	388		0	1	389.2	389.2	389.9	389.8		
RSWO110C.1	58315	58311	27" CSP Culvert	1155	10	5	7	389.6	389.7	389.9	389.9	10-yr Future	WO-2 & WO-5
RSWO110CRD	58315	58311	Roadway	1154		0	4	389.6	389.7	389.9	389.9		
RSWO140	77703	58311	54" CSP Culvert	544	10	64	66	390.3	389.7	390.5	389.9		

River Road/ Santa Clara Basin Drainage System

INDEX MAP

This index map shows the layout of the River Road/Santa Clara basin for the seven geographic areas depicted on Figures 3-2 through 3-8. These figures contain detailed drainage system information for areas within the city limits and urban growth boundary (UGB).



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.)

River Road/Santa Clara Basin Major RR-SC Subbasins

- 99 = Highway
- A1 = A1 Channel
- FC = Flat Creek
- SC = Spring Creek
- WO = Willamette Overflow

N W E S

1 inch = 0.8 mile
0.4 0 0.4 0.8 Miles

Produced by Lane County Public Works GIS - March 2009
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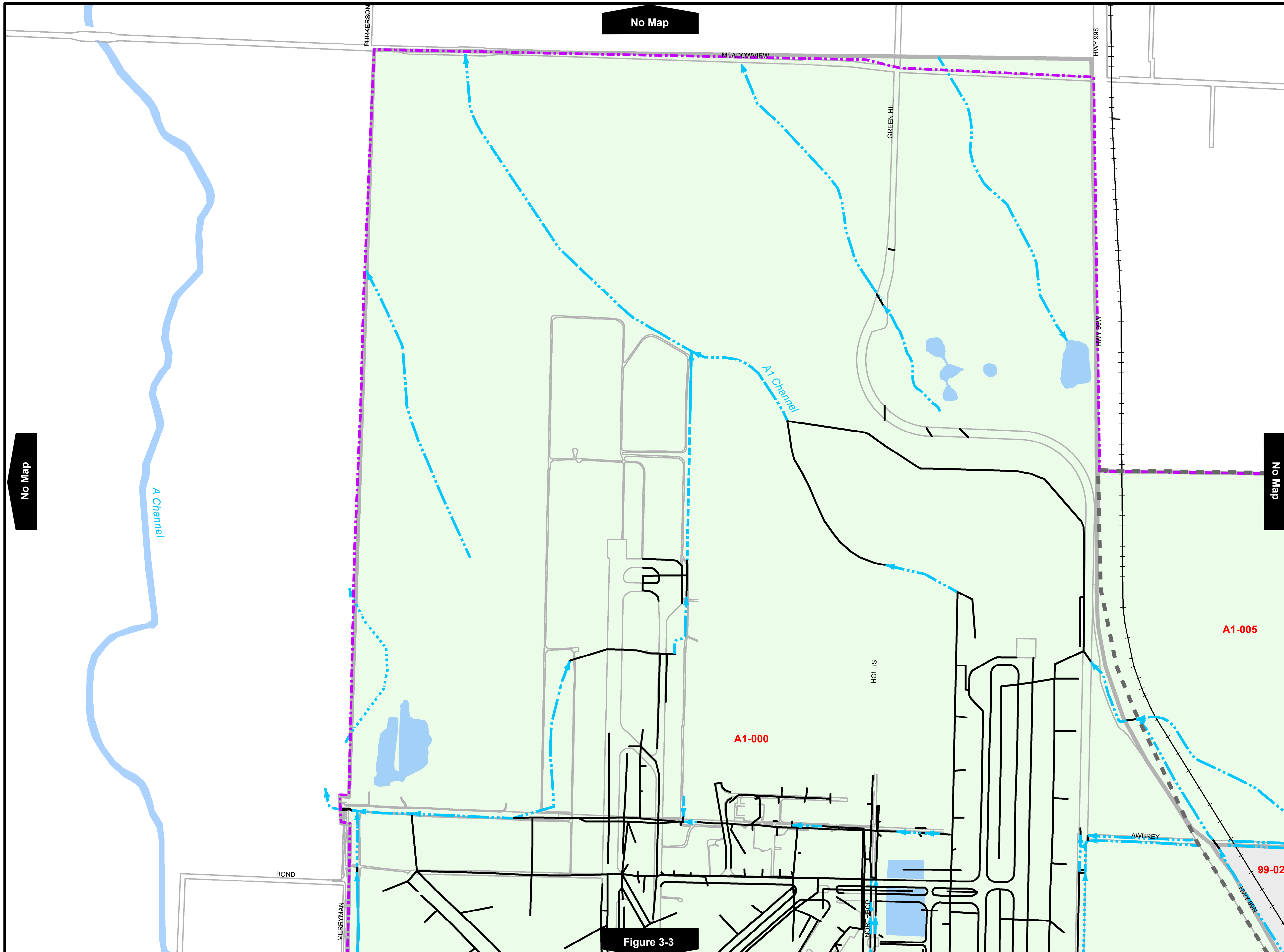
Figure 3-1

River Road - Santa Clara Basin Drainage System



Legend

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

Major RR-SC Subbasins

- A1 = A1 Channel
- 99 = Highway 99
- FC = Flat Creek
- SC = Spring Creek
- WO = Willamette Overflow
- AB-123 Subbasin ID's within Major RR-SC Subbasins

- Modeled Point
- *12345* Modeled Reference Numbers
- City of Eugene Drywell
- Lane County Drywell

Capital Projects

- Rain Garden CP to decommission UIC's
- Rain Garden CP to decommission UIC's South of Horn Lane
- Pre-treat and Pipe CP to decommission UIC's
- RSxx Flood Control Capital Project
- Other Water Features
- Urban Growth Boundary
- Metropolitan Plan 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 3-2.

N W E S

EUGENE

LANE COUNTY OREGON

1 inch = 1,000 feet

500 0 500 1,000 Feet

Produced by Lane County Public Works GIS - July 2009
g:\stormwater\System_Maps\Fig3Maps\RRSC_Fig32.mxd

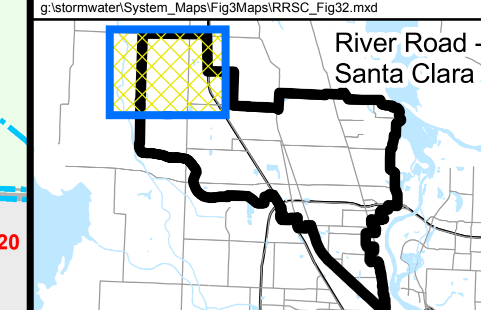
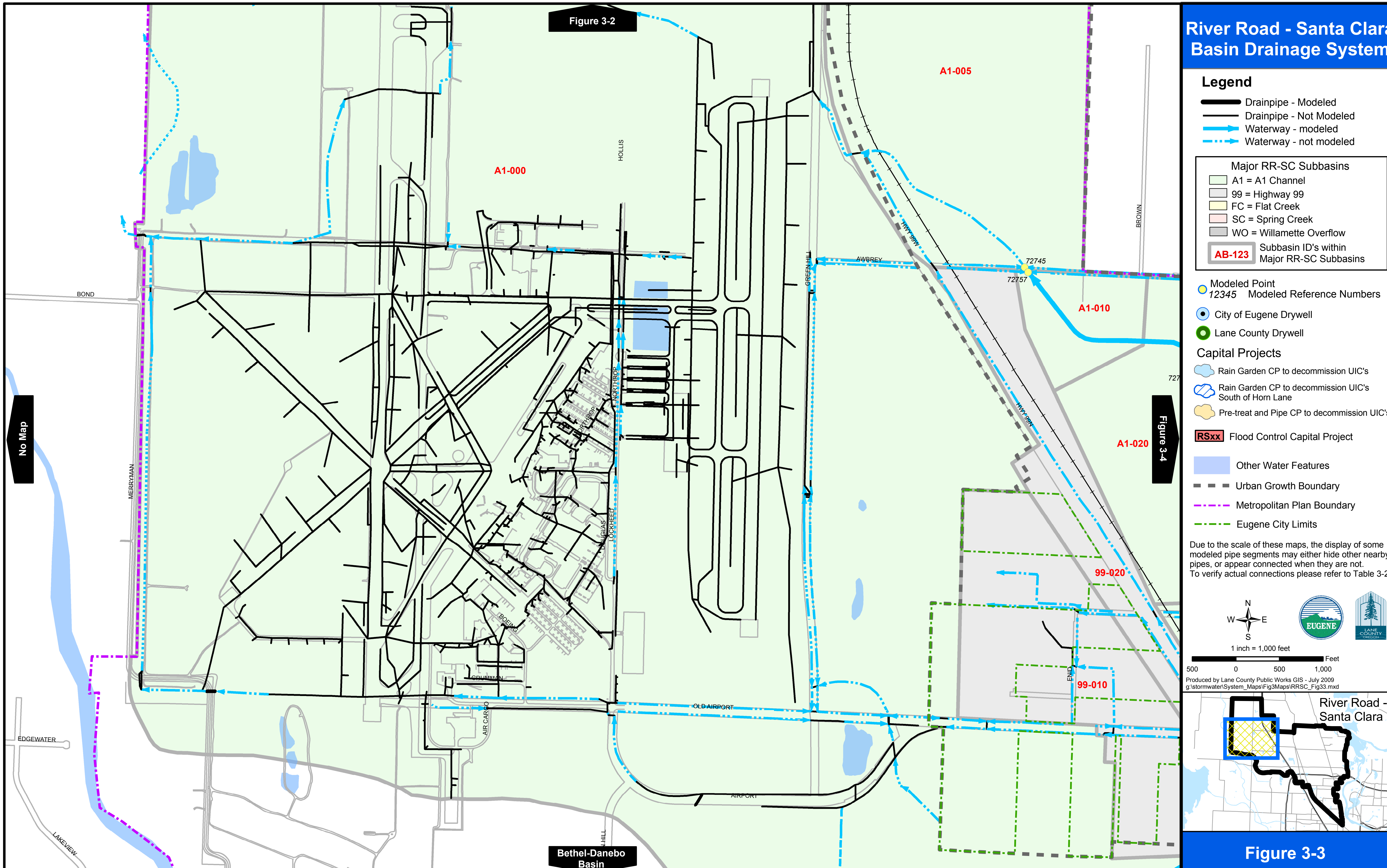
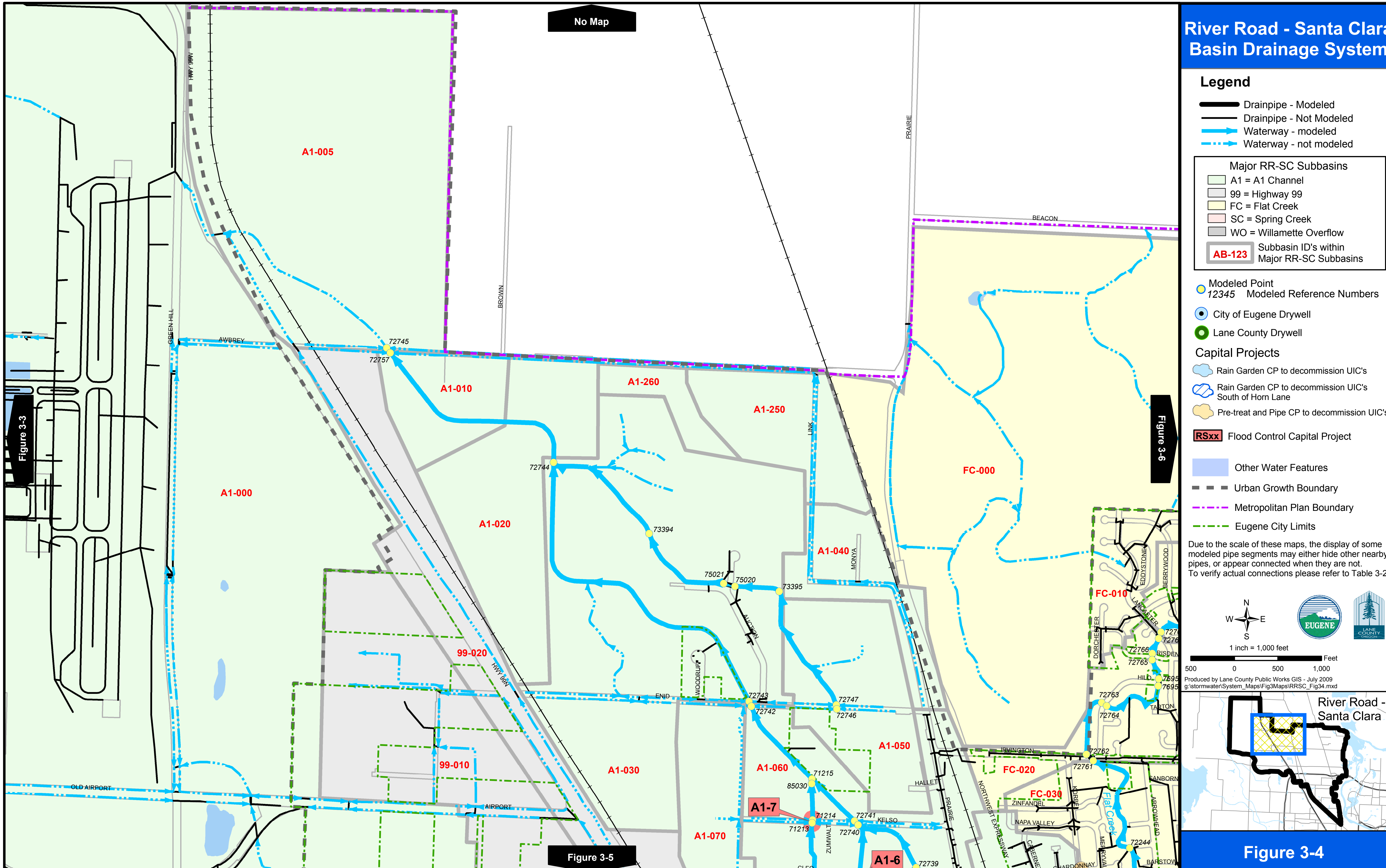


Figure 3-2



River Road - Santa Clara Basin Drainage System
Legend
Drainpipe - Modeled
Drainpipe - Not Modeled
Waterway - modeled
Waterway - not modeled
Major RR-SC Subbasins
A1 = A1 Channel
99 = Highway 99
FC = Flat Creek
SC = Spring Creek
WO = Willamette Overflow
AB-123
Subbasin ID's within Major RR-SC Subbasins
Modeled Point
12345 Modeled Reference Numbers
City of Eugene Drywell
Lane County Drywell
Capital Projects
Rain Garden CP to decommission UIC's
Rain Garden CP to decommission UIC's South of Horn Lane
Pre-treat and Pipe CP to decommission UIC's
RSxx
Flood Control Capital Project
Other Water Features
Urban Growth Boundary
Metropolitan Plan 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 3-2.
N
W
E
S
1 inch = 1,000 feet
500
0
500
1,000
Feet
Produced by Lane County Public Works GIS - July 2009
g:\stormwater\System_Maps\Fig3Maps\RRSC_Fig33.mxd
EUGENE
LANE COUNTY OREGON
River Road - Santa Clara
Figure 3-2
Bethel-Danebo Basin
No Map
Figure 3-4
A1-000
A1-005
A1-010
A1-020
99-010
99-020
72745
72757
HOLLIS
BROWN
AWBREY
GREEN HILL
HWY 99W
BOND
MERRYMAN
EDGEWATER
LAKEVIEW
NORTHROP
DOUGLAS
LOCKHEED
BOEING
GRUMMAN
AIR CARGO
OLD AIRPORT
AIRPORT
ENID

Figure 3-3



River Road - Santa Clara Basin Drainage System
Legend
Drainpipe - Modeled
Drainpipe - Not Modeled
Waterway - modeled
Waterway - not modeled
Major RR-SC Subbasins
A1 = A1 Channel
99 = Highway 99
FC = Flat Creek
SC = Spring Creek
WO = Willamette Overflow
AB-123 Subbasin ID's within Major RR-SC Subbasins
Modeled Point
12345 Modeled Reference Numbers
City of Eugene Drywell
Lane County Drywell
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Rain Garden CP to decommission UIC's
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Urban Growth Boundary
Metropolitan Plan Boundary
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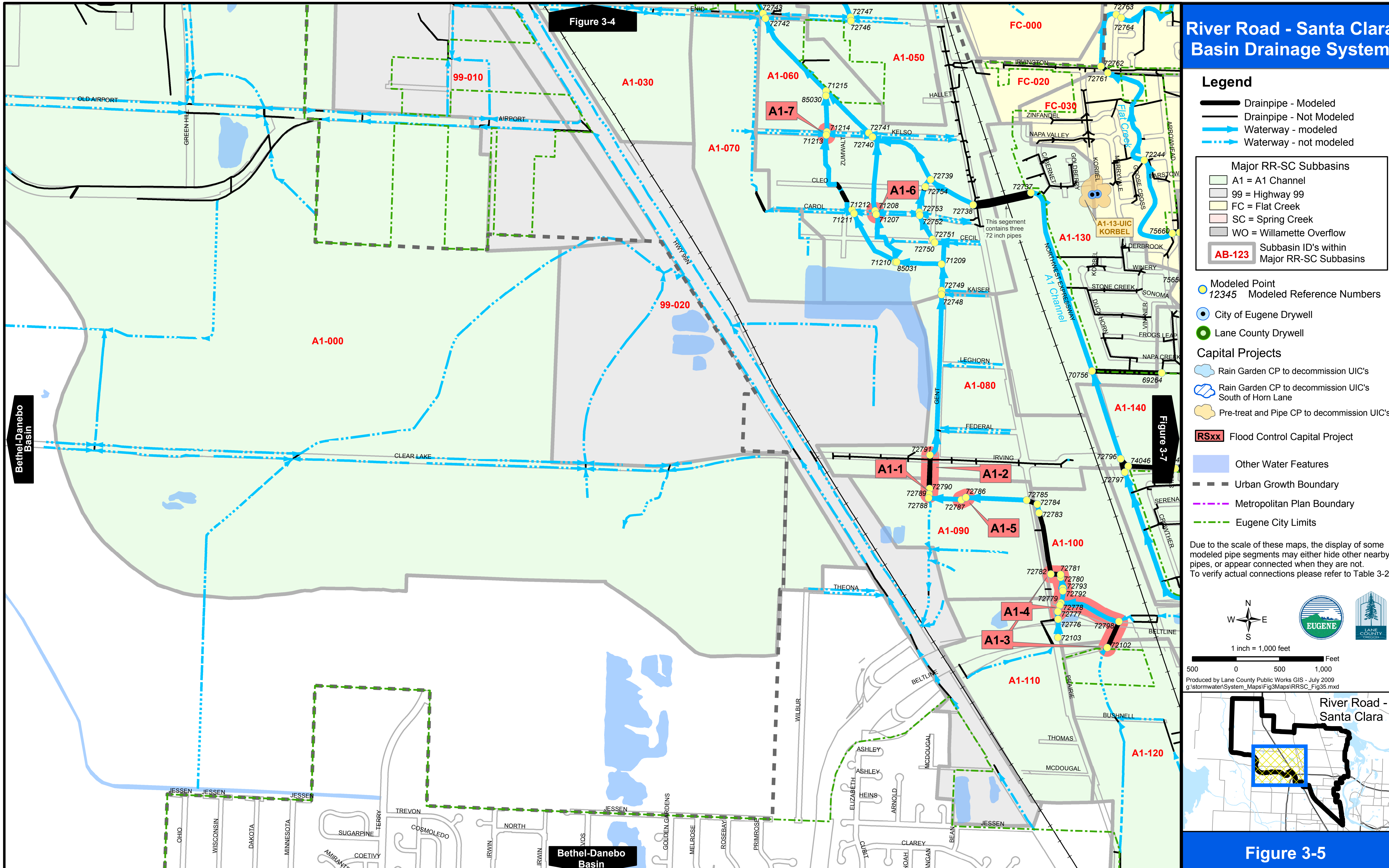
Due to the scale of these maps, the display of some modeled pipe segments may either hide other nearby pipes, or appear connected when they are not. To verify actual connections please refer to Table 3-2.
N
W
E
S
1 inch = 1,000 feet
500
0
500
1,000
Feet
EUGENE
LANE COUNTY OREGON
Produced by Lane County Public Works GIS - July 2009
g:\stormwater\System_Maps\Fig3Maps\RRSC_Fig34.mxd
River Road - Santa Clara
Figure 3-4
No Map
Figure 3-3
Figure 3-5
Figure 3-6
A1-005
A1-010
A1-260
A1-250
A1-000
A1-020
A1-040
FC-000
FC-010
99-020
99-010
A1-030
A1-060
A1-050
A1-070
FC-020
FC-030
A1-7
A1-6
72745
72757
72744
73394
75021
75020
73395
72743
72742
72747
72746
71215
85030
71214
71213
72741
72740
72739
72763
72764
72762
72761
72766
72765
72244
HWY 99W
HWY 99N
GREEN HILL
AWBREY
BROWN
PRAIRIE
BEACON
LINK
MONYA
ENID
WOODRUFF
OLD AIRPORT
AIRPORT
HALLET
KELSO
CLEO
ZUMWALT
NORTHWEST EXPRESSWAY
IRVINGTON
ZINFANDEL
NAPA VALLEY
CABERNET
CHARDONNAY
MERRYVALE
KORBE
ARROWHEAD
SANBORN
BARSTOW
TARTON
HILO
RISDEN
EDDYSTONE
BERRYWOOD
DORCHESTER
LANCASTER
Flat Creek



River Road - Santa Clara Basin Drainage System
Legend
Drainpipe - Modeled
Drainpipe - Not Modeled
Waterway - modeled
Waterway - not modeled
Major RR-SC Subbasins
A1 = A1 Channel
99 = Highway 99
FC = Flat Creek
SC = Spring Creek
WO = Willamette Overflow
AB-123 Subbasin ID's within Major RR-SC Subbasins
Modeled Point
12345 Modeled Reference Numbers
City of Eugene Drywell
Lane County Drywell
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Rain Garden CP to decommission UIC's
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Other Water Features
Urban Growth Boundary
Metropolitan Plan 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 3-2.
1 inch = 1,000 feet
500 0 500 1,000 Feet
Produced by Lane County Public Works GIS - July 2009
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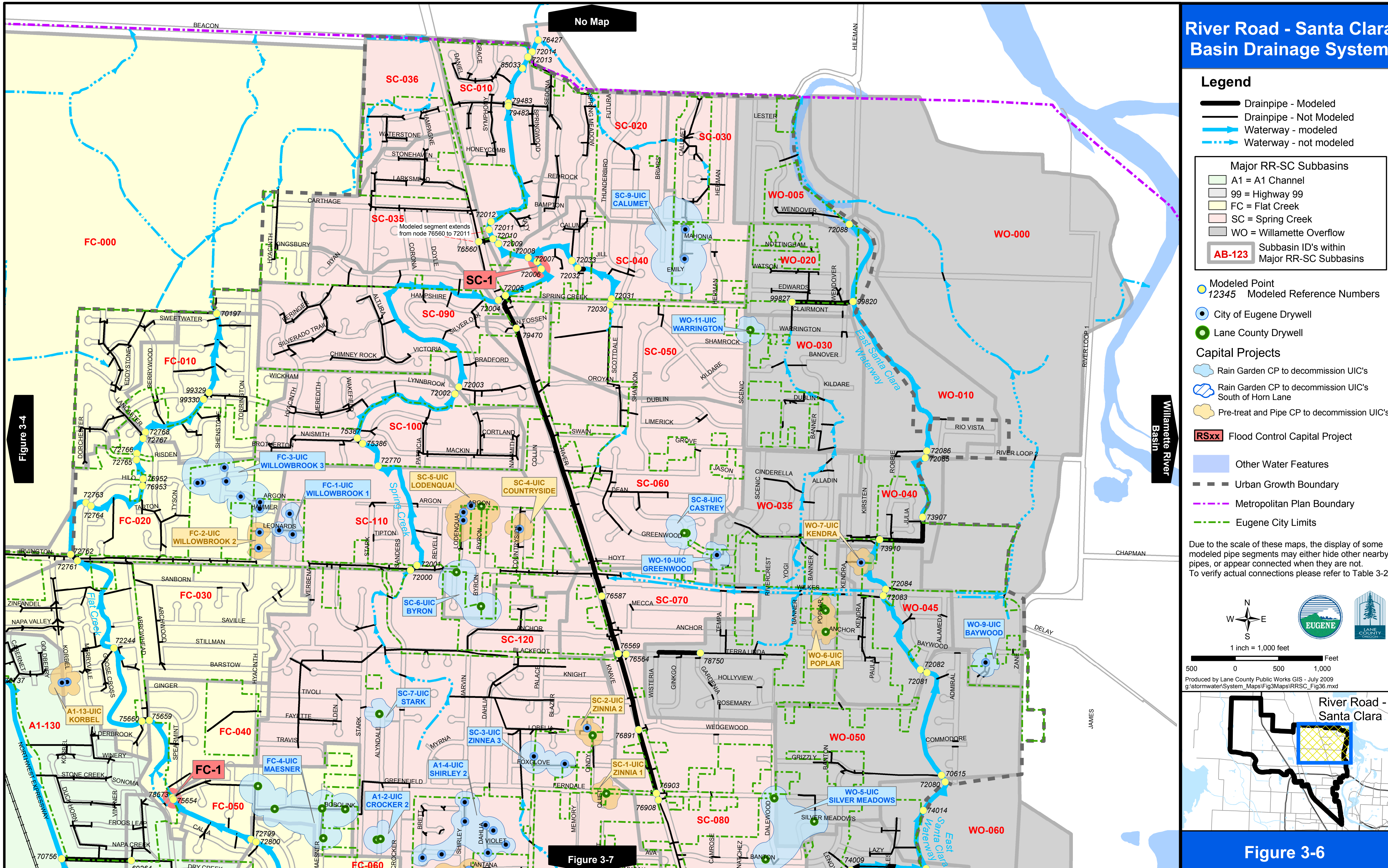
River Road - Santa Clara
Figure 3-4
Figure 3-7
Bethel-Danebo Basin
This segement contains three 72 inch pipes
A1 Channel
Flat Creek
A1-000
A1-030
A1-050
A1-060
A1-070
A1-080
A1-090
A1-100
A1-110
A1-120
A1-130
A1-140
99-010
99-020
FC-000
FC-020
FC-030
A1-1
A1-2
A1-3
A1-4
A1-5
A1-6
A1-7
A1-13-UIC KORBEL

Figure 3-5


River Road - Santa Clara Basin Drainage System
Legend
Drainpipe - Modeled
Drainpipe - Not Modeled
Waterway - modeled
Waterway - not modeled
Major RR-SC Subbasins
A1 = A1 Channel
99 = Highway 99
FC = Flat Creek
SC = Spring Creek
WO = Willamette Overflow
AB-123 Subbasin ID's within Major RR-SC Subbasins
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Lane County Drywell
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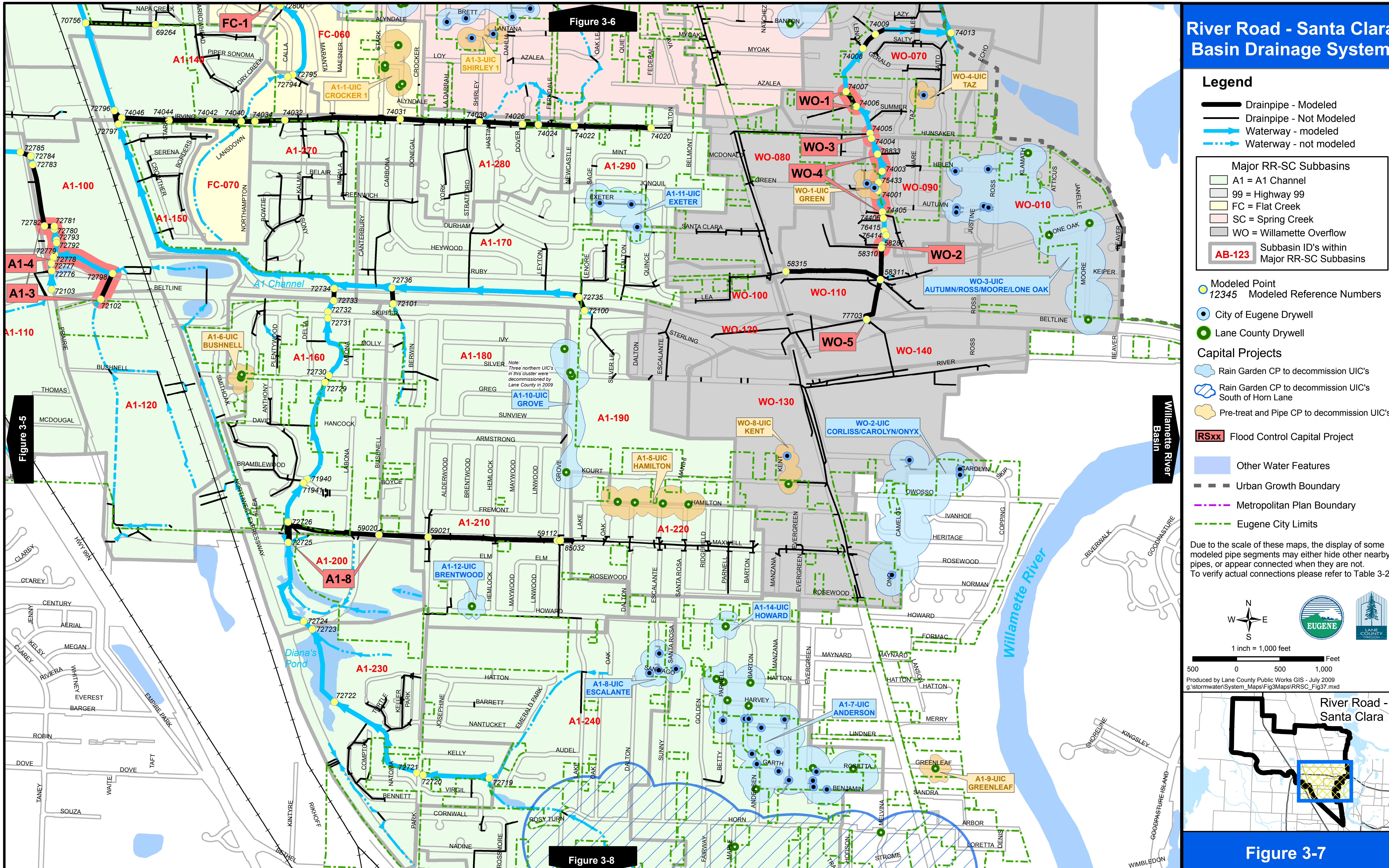
Metropolitan Plan Boundary
Eugene City Limits
Due to the scale of these maps, the display of some modeled pipe segments may either hide other nearby pipes, or appear connected when they are not.
To verify actual connections please refer to Table 3-2.
1 inch = 1,000 feet
500 0 500 1,000 Feet
Produced by Lane County Public Works GIS - July 2009
g:\stormwater\System_Maps\Fig3Maps\RRSC_Fig36.mxd
River Road - Santa Clara
No Map
Figure 3-4
Figure 3-7
Willamette River Basin
East Santa Clara Waterway
Spring Creek
Flat Creek
SC-1
FC-1
Modeled segment extends from node 76560 to 72011
Figure 3-6



River Road - Santa Clara Basin Drainage System
Legend
Drainpipe - Modeled
Drainpipe - Not Modeled
Waterway - modeled
Waterway - not modeled
Major RR-SC Subbasins
A1 = A1 Channel
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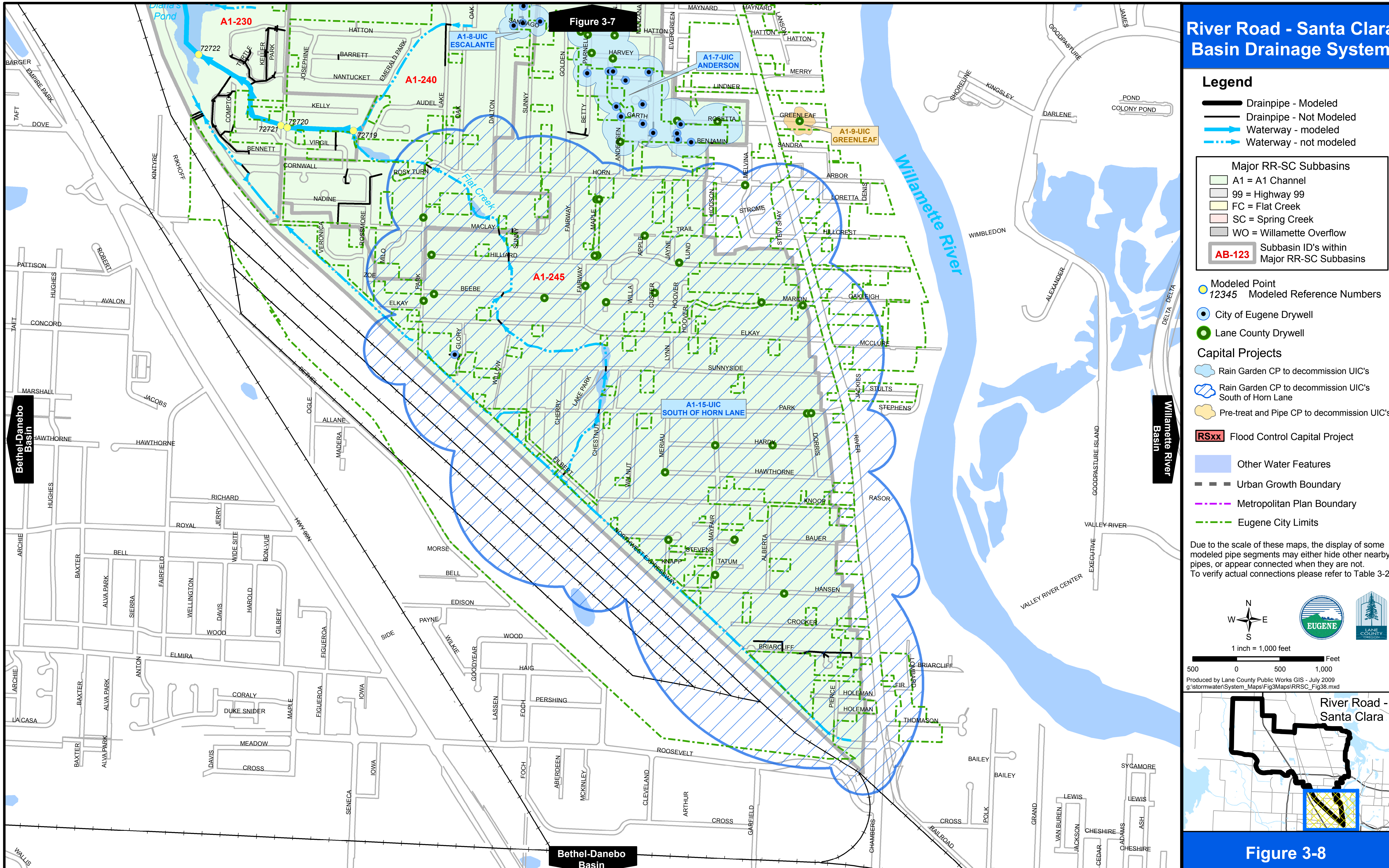
Due to the scale of these maps, the display of some modeled pipe segments may either hide other nearby pipes, or appear connected when they are not. To verify actual connections please refer to Table 3-2.
1 inch = 1,000 feet
500 0 500 1,000 Feet
Produced by Lane County Public Works GIS - July 2009
g:\stormwater\System_Maps\Fig3Maps\RRSC_Fig37.mxd
EUGENE
LANE COUNTY OREGON
River Road - Santa Clara
Figure 3-7
Figure 3-6
Figure 3-5
Figure 3-8
Willamette River Basin
Willamette River
A1 Channel
Diana's Pond
Note: Three northern UIC's in this cluster were decommissioned by Lane County in 2009
FC-1
A1-4
A1-3
A1-8
WO-1
WO-2
WO-3
WO-4
WO-5
A1-1-UIC CROCKER 1
A1-3-UIC SHIRLEY 1
A1-5-UIC HAMILTON
A1-6-UIC BUSHNELL
A1-7-UIC ANDERSON
A1-8-UIC ESCALANTE
A1-9-UIC GREENLEAF
A1-10-UIC GROVE
A1-11-UIC EXETER
A1-12-UIC BRENTWOOD
A1-14-UIC HOWARD
WO-1-UIC GREEN
WO-2-UIC CORLISS/CAROLYN/ONYX
WO-3-UIC AUTUMN/ROSS/MOORE/LONE OAK
WO-4-UIC TAZ
WO-8-UIC KENT


River Road - Santa Clara Basin Drainage System
Legend
Drainpipe - Modeled
Drainpipe - Not Modeled
Waterway - modeled
Waterway - not modeled
Major RR-SC Subbasins
A1 = A1 Channel
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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 3-2.
1 inch = 1,000 feet
500 0 500 1,000 Feet
Produced by Lane County Public Works GIS - July 2009
g:\stormwater\System_Maps\Fig3Maps\RRSC_Fig38.mxd
River Road - Santa Clara
Figure 3-8
Figure 3-7
Bethel-Danebo Basin
Willamette River Basin
Willamette River
Flat Creek
A1-230
A1-240
A1-245
A1-8-UIC ESCALANTE
A1-7-UIC ANDERSON
A1-9-UIC GREENLEAF
A1-15-UIC SOUTH OF HORN LANE
72722
72721
72720
72719
Diana's Pond

While a very general characterization of water quality in this basin is described in Section 2.6, this section includes discussion of water quality in more detail. Section 4.1 starts off by providing detailed information related to regulatory drivers associated with water quality in the basin. Section 4.2 provides a description and results of the processes that were used to evaluate water quality with respect to both surface and groundwater discharges. And, finally, Section 4.3 describes the capital project alternatives and development standards that were considered and selected to address the identified water quality issues.

4.1 Regulatory Drivers Related to Water Quality

Two federal acts, the Clean Water Act (CWA) and the Safe Drinking Water Act (SDWA), regulate the discharge of urban stormwater runoff. The CWA regulates discharges of urban stormwater to surface waters, and the SDWA regulates the discharges of urban stormwater to the subsurface or groundwaters. This section describes each of these regulatory drivers with respect to stormwater management in the River Road Santa Clara basin.

4.1.1 Stormwater Discharges to Surface Waters

In the early 1990s, the Federal Clean Water Act required municipalities with populations greater than 100,000 to apply for and obtain a National Pollutant Discharge Elimination System (NPDES) permit for their stormwater discharges. In Oregon, this program was delegated to the Oregon Department of Environmental Quality (DEQ). As a result, DEQ directed jurisdictions in six Oregon urban areas to apply for and obtain a Phase I municipal NPDES stormwater permit. The City of Eugene was one of the jurisdictions required to obtain a Phase I permit. In December 1999, EPA adopted rules to implement “Phase II” of the stormwater program. Phase II expanded the stormwater permitting program to include smaller communities located in U.S. census-defined urban areas. Lane County was included as one of the smaller jurisdictions required to obtain a Phase II MS4 NPDES permit. The City of Eugene obtained its first Phase I permit in November, 1994; and Lane County received its Phase II permit in January, 2007. In the River Road Santa Clara Stormwater Basin, Lane County’s Phase II MS4 NPDES permit covers the areas inside the UGB not covered by the City of Eugene’s Phase I NPDES permit.

The municipal NPDES stormwater permits initially required municipalities to perform a review of their stormwater systems including mapping, outfall inventories, and for the Phase I communities, monitoring of stormwater quality. Based on the results of this review, jurisdictions were then required to develop a Stormwater Management Plan (SWMP). The SWMPs were required to include specific categories of Best Management Practices (BMPs) that should be implemented to reduce the discharge of pollutants to the “maximum extent practicable”. Categories of BMPs included those that addressed public education, public involvement, elimination of illicit discharges, construction site erosion controls, post-construction development standards, and operations and maintenance practices. In addition, the Phase I permits require municipalities to look for opportunities to retrofit their existing systems to address water quality. The development of this basin plan represents one of the City’s BMPs that is identified and listed in their required SWMP. The basin plan also represents a BMP in Lane County’s SWMP.

The other Clean Water Act program related to urban stormwater discharges is the total maximum daily load (TMDL) program. The Oregon Department of Environmental Quality (DEQ) has the responsibility for developing water quality standards that protect beneficial uses of rivers, streams, lakes, and estuaries. Once standards are established, the state monitors water quality and reviews available data and information to determine if these standards are being met and water is protected. Section 303(d) of the Federal Clean Water Act requires each state to develop a list of water bodies that do not meet the standards. The list serves as a guide for developing and implementing watershed pollution reduction plans to achieve water quality standards and protect beneficial uses. These watershed pollution reduction plans are referred to as TMDLs. With respect to the River Road Santa Clara basin, the tributaries in the basin eventually drain to the Willamette River, and the Willamette River has an established TMDL for bacteria, mercury, and temperature. The City and the County have both submitted and obtained DEQ approval on their TMDL implementation plans (see Section 2.6.2). This basin plan and the water quality management measures proposed in Section 4.3 were developed with these regulatory drivers in mind and will help the City and County move in the direction of reducing pollutant loads, improving water quality, and supporting compliance with these regulations.

4.1.2 Stormwater Discharges to the Subsurface (i.e., through drywells)

As described in Section 2.5.4, a portion of stormwater runoff in the basin discharges to the subsurface through the use of drywells. Over the years, drywells have been a management strategy of choice for dealing with drainage in the River Road Santa Clara basin largely due to the flat topography, highly permeable soil conditions, and lack of a continuous storm drainage system. In the regulatory context, these drywells are referred to as Underground Injection Controls (UICs). Injection of water below ground, particularly to underground sources of drinking water, is strictly regulated under the Safe Drinking Water Act (SDWA). Injection systems fall into five classes (Class I-V). Class V is reserved for small injection systems, including stormwater disposal systems such as drywells. As with the CWA, implementation of the SDWA has been delegated to the Oregon Department of Environmental Quality (DEQ).

Infiltration has become increasingly more attractive as a management practice for addressing surface water quality concerns. Therefore, DEQ is concerned that stormwater disposal in underground systems will become more highly utilized. DEQ promulgated new state rules in 2001 to implement the SDWA. One of DEQ's intents in promulgating the new rules was to see that all stormwater management entities exercise the same care with respect to stormwater discharged to the ground that they do with stormwater discharged to surface waters under the NPDES permitting program. The 2001 rules require stormwater management entities to evaluate the quality of water disposed of in all facilities that have a "subsurface fluid distribution system", including dry wells/sumps and infiltration trenches. The program also requires comprehensive stormwater management plans that address: 1) the need for and effectiveness of pre-treatment before injection; 2) spill prevention and control measures designed to minimize immediate harm to underlying aquifers; 3) systematic monitoring and record keeping; and, 4) system performance evaluation. DEQ representatives noted that there are long-standing regulations against groundwater contamination, and that the 2001 UIC program rules were designed to assist stormwater managers in complying with these regulations.

As part of the process to implement the new rules, DEQ required UIC systems (i.e., drywells) to be registered with DEQ by December 31, 1999 (with amnesty for public systems until December 31, 2000). Stormwater UICs are prohibited unless they can be shown to meet criteria for being regarded as "exempt", "authorized by rule", or "authorized by a permit". These three categories of allowable stormwater UICs are described in more detail as follows:

Exempt – Stormwater UICs that are exempt include single residential roof drains and footing drains receiving only rainwater.

Authorized by Rule – Municipalities may apply to have stormwater UICs "rule authorized" if the following criteria are met:

a) No other waste is mixed with the stormwater.
b) Stormwater runoff is minimized.
c) No other disposal option is appropriate. An appropriate method shall protect groundwater quality and may consider management of surface water quality and watershed health issues.
d) No domestic drinking water supply wells are present within 500 feet.
e) No public drinking water supply wells are present within 500 feet or the 2 year time-of-travel whichever is more protective.
f) No soil or groundwater contamination is present.
g) The wells are not deeper than 100 feet and they do not discharge into groundwater or below the highest seasonal groundwater level.
h) A confinement barrier or a natural or engineered filtration medium is present between the base of the injection system and the highest seasonal groundwater level and prevents contaminants from reaching groundwater, or the owner or operator implements best management practices that prevent drainage into the injection system in the event of an accidental spill. (DEQ has suggested that they would like to see 10 feet of separation between the bottom of the drywell and the high groundwater).
i) Design and operation prevents accidental or illicit disposal and temporary blocking is available.

Authorized by Permit - Municipalities may apply to have their stormwater UICs covered by a water pollution control facilities (WPCF) permit. If UICs are not exempt or can not be rule authorized, the permit would provide a mechanism for the municipality to work with DEQ to develop a plan for these UICs, which could include retrofitting the UICs so that they meet "rule authorization" criteria or developing a plan for decommissioning UICs that can not be rule authorized. A WPCF permit would likely include significant requirements for monitoring.

The County evaluated their public drywells and had them registered with DEQ by December, 2001. The City evaluated their public drywells and had them registered with DEQ by November 2001. None of the City or County public drywells met the criteria for being exempt. An initial study conducted by the City as part of the UIC registration process also showed that only 16 (of 78) wells were not likely to be rule authorizable. However, based on more recent DEQ clarification/interpretation of rules with respect to criteria for separation distance to groundwater, it is unlikely that any of the drywells in the basin will meet criteria for rule authorization based on criteria g) and h) from above. An evaluation of the City and County drywells with respect to high groundwater and the presence of a filtration medium between the drywell bottom and the high groundwater was conducted for this basin plan and is provided in Appendix E. Seasonal high groundwater levels were found to be close to the surface in this basin (i.e., approximately 8 feet deep on average). Based on this evaluation, there are several drywells that are expected to be discharging directly to high groundwater, and there were not any drywells where a distance of 10 feet was expected between the bottom of the drywell and the high groundwater level. Therefore, it is likely that most or all of the County and City drywells will eventually require decommissioning. Both the County and City have applied for a WPCF permit with DEQ. A plan to decommission the drywells will be a part of the permit. The decommissioning plan will be based on the management alternatives evaluated and selected as part of this storm drainage master plan and as provided in Section 4.3. As decommissioning projects are being implemented, if further groundwater investigations reveal opportunities to rule authorize drywells, retaining and/or retrofitting selected drywells may be considered. As mentioned previously in Section 3, private drywells are under the authority of DEQ and any decommissioning associated with private drywells (if required) would be directed by DEQ.

4.2 Evaluation of Existing and Expected Future Water Quality Conditions

This section describes water quality conditions in the basin in terms of both pollutant loads and stream stability issues.

Pollutant Loads

To supplement the general water quality information provided in Section 2.6, pollutant loads for total suspended solids (TSS) were calculated for this basin. Although TSS has not been shown to directly relate to all other pollutants, it was used as a general indicator of other pollutants for the purposes of making relative comparisons. The relative values of the TSS load were used to evaluate the impact of drywells on water quality, as drywells infiltrate runoff resulting in a net pollutant load reduction, and to highlight those land uses and drainage areas that appear to contribute the largest pollutant load to receiving waters. The values were also used to evaluate the relative contribution and increase in pollutant loads expected from future development. The methods used to estimate pollutant loads are described in Volume I, Section 3.2.

The pollutant load estimates for the River Road Santa Clara basin are summarized 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 none of these data were collected from within the River Road Santa Clara Basin, they provide general information regarding stormwater quality in Eugene and were used in identifying a stormwater management strategy for this basin. The pollutant load estimates are based on the following assumptions: 1) new development would occur without the inclusion of water quality best management practices (consistent assumption used for the other basins, enabling comparison of pollutant estimates between basins): 2) during an average year, all flows from drywells (and, hence pollutant loads) would be infiltrated and would not discharge to surface waters; 3) all drywells were assumed to be located in residential areas; and 4) decommissioning of all drywells would result in those discharges being transferred, untreated, to surface waters. In general, pollutant loads in the River Road Santa Clara basin (based on 2007 land use data) could potentially increase by up to 85% as a result of future development and drywell decommissioning, if treatment and/or other forms of infiltration are not provided for flows associated with drywell decommissioning.

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

Estimated TSS Pounds Per Year in the River Road Santa Clara Basin	1,000 Pounds	River Road Santa Clara Basin Relative to the Range of TSS Pounds Per Year in Other Eugene Basins
From Existing Development (assuming drywells in place and functioning)	1,403	
Potential Increase from Development of Vacant Land	740	
Potential Increase from Drywell Decommissioning	434	
Total Buildout	2,597	

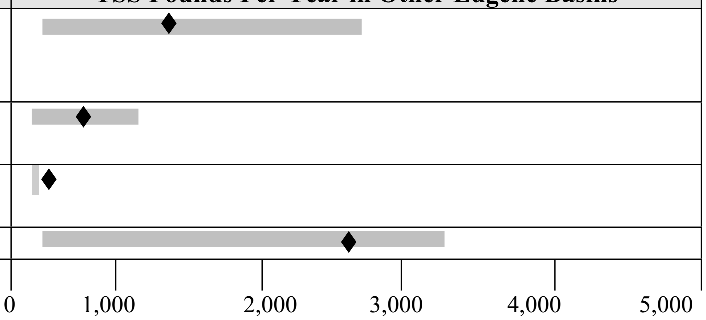


Figure 4-2
Estimated Increases in Total Suspended Solids Loads Associated with Future Buildout in the River Road Santa Clara Basin (within the UGB)

Estimated Increase in TSS Loads	Percent	River Road Santa Clara Basin Relative to the Range of Increase in TSS Loading in Other Eugene Basins
Potential Increase from Future Development	54	
Potential Increase from Drywell Decommissioning	20	
Total Potential Increase	85	

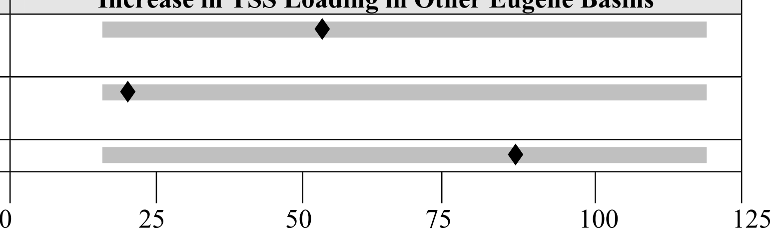
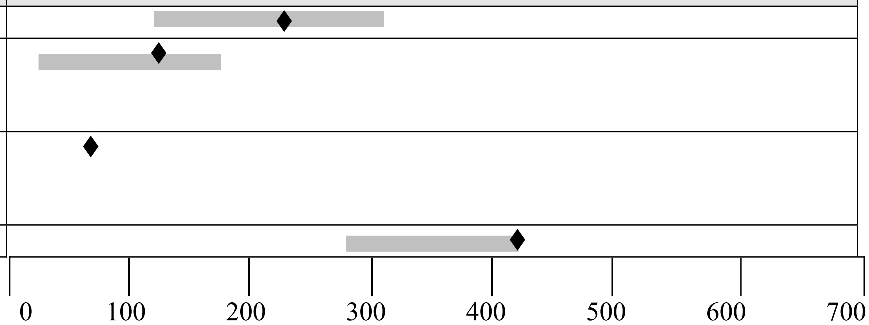


Figure 4-3
Estimated Total Suspended Solids Loads Per Acre - Per Year
in the River Road Santa Clara Basin (within the UGB)

Estimated TSS Pounds Per Acre Per Year in the River Road Santa Clara Basin	Pounds per Acre per Year	River Road Santa Clara Basin Relative to the Range of TSS Pounds Per Acre Per Year in Other Eugene Basins
Existing Development	231	
Potential Increase from Development of Vacant Land	126	
Potential Increse from Drywell Decommissioning	71	
Total Buildout	428	



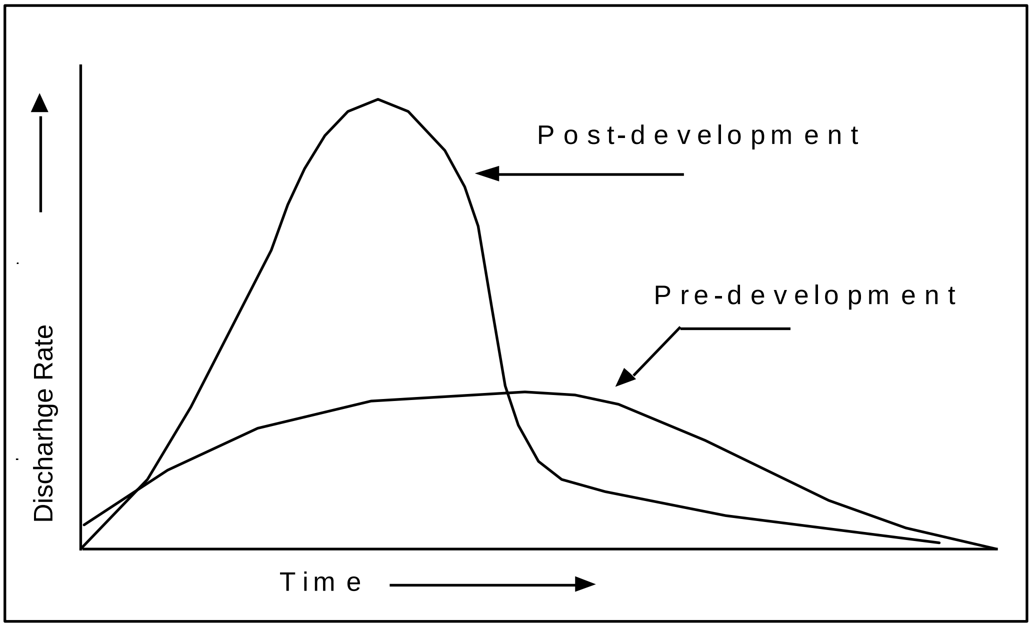
Note: The pollutant load estimates are based on the following assumptions: 1) new development would occur without the inclusion of water quality best management practices: 2) during an average year, all flows from drywells (and, hence pollutant loads) would be infiltrated and would not discharge to surface waters; 3) all drywells were assumed to be located in residential areas; and 4) decommissioning of drywells would result in those discharges being transferred, untreated, to surface waters.

Stream Stability

In addition to pollutant loads discharged to surface waters, an additional water quality issue is streambank erosion. As urbanization occurs, changes to the natural hydrology of an area are inevitable. Hydrologic changes associated with development include both an increase in the volume of runoff and an increase in the peak rate of runoff, as illustrated by the storm hydrograph comparison shown in Figure 4-4. These changes occur in response to site clearing, grading, and the addition of impervious surfaces and maintained landscapes. In addition to hydrologic changes associated with urbanization, activities within and adjacent to waterways such as vegetation removal, construction of retaining walls, weirs, fences, bridges and other features, can affect stream stability and, ultimately, water quality. Collectively, these activities can produce the following impacts to stream corridors:

- An increase in streambank and streambed erosion;
- Increased deposition of newly eroded debris and sediment, which reduces flood conveyance capacity;
- Damage to riparian habitat;
- Reduced streamflows during the dry season as a result of reduced infiltration and hence groundwater recharge;
- Increased water temperatures in the summer due to reduced and hence more shallow streamflows; and
- Increased maintenance needs and liabilities.

Figure 4-4
Comparison of Pre and Post-Development Hydrographs



While some of the waterways in River Road Santa Clara remain relatively undisturbed, many of these conditions have been observed in the basin. Many of the open channel systems in this basin are also lacking vegetated buffers, which is likely impacting stream temperatures. Section 4.3 provides a description of the water quality strategy developed to address both the potential increases in pollutant loads and stream stability issues.

4.3 Development of the Water Quality Strategy

As shown in the stormwater basin master planning process flow chart (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 Sections 4.1 and 4.2 above. The next steps included the development of potential stormwater management tools (i.e., capital projects or development standards) to address the identified problems. This section describes the capital projects (CPs) and development standards that were considered to address the identified water quality problems.

4.3.1 Capital Project Alternatives

Identifying potential CPs to address water quality concerns is very different from identifying CPs to address flooding issues. With respect to flooding, specific capacity deficiencies are identified through modeling and CPs are proposed to address those deficiencies. With respect to water quality, pollutant discharges associated with urban runoff are ubiquitous. When the city-wide basin planning project was initiated, the focus of developing CP alternatives for water quality was on identifying the best opportunity areas for the siting of water quality CPs in developed areas that would not be affected by stormwater development standards except over the very long term through re-development, and developed areas with high pollutant source land uses such as commercial and industrial uses. This effort included identifying areas with the following characteristics: 1) largely developed areas with little remaining vacant land; 2) densely developed high pollutant source areas; 3) sufficient space available for a surface water quality facility; 4) the space that was available is publicly owned or vacant and potentially available for purchase; and 5) the location could potentially be used to construct a CP that addresses objectives in addition to water quality control (i.e., flood control, natural resources enhancement, recreation, education).

Given the differences in the River Road Santa Clara basin when compared to the other basins (i.e., the mix of County/City jurisdiction and the significant presence of drywells), the identification of water quality CPs was conducted somewhat differently from the previous basins. The development of water quality CPs was predominantly focused on water quality projects that could be implemented to deal with increases in runoff and pollutant loads associated with the decommissioning of public drywells. Approximately 151 public drywells (79 County and 72 City) will need to be decommissioned to comply with DEQ's UIC rules. Decommissioning of the drywells is expected to be a significant undertaking. Therefore CPs were developed to address the water quality objectives in parallel with the decommissioning effort, especially since the potential decommissioning of public drywells could result in a significant increase in pollutant loads to the surface water system (see Figure 4-2). These proposed CPs are described below under "Water Quality CPs Associated with UIC Decommissioning."
Additional water quality CPs were also developed to specifically target high pollutant source areas and stream stability problems that were described in Subsection 4.2 above. These proposed CPs are described below under "Other Water Quality CPs."

<u>Water Quality CPs Associated with UIC Decommissioning</u>
As described in Section 3.0, drywells located in close proximity to each other were grouped into drywell "clusters". This grouping of drywells was conducted because some of the decommissioning options could be applied and constructed in a manner to address a "cluster", as opposed to individual drywells. A total of 39 drywell clusters were identified. The drywell clusters are illustrated on the Stormwater Management Strategy Development map in Appendix H, and listed in Table 3-6, and the location of each of these clusters is also shown in Figures 3-2 through 3-8. As a result of the decommissioning of drywells, alternative systems will be necessary to handle the flows (up to the 5-year, 24 hour design event) that are currently being handled through drywells. CP options were selected for each drywell cluster with the intent of maximizing water quality benefits while addressing increases in flows from a flood control and conveyance standpoint. As described in Section 3.0, three project options were developed to handle the flows from these drywell drainage areas:

1) construct pipes to handle flows and route them to the nearest storm piped system – provide structural pre-treatment as part of the pipe retrofit (Pipe and Pre-treat Option);
2) direct drainage to a neighborhood-scale surface infiltration/rain garden facility for storage and infiltration (Surface Infiltration/Rain Garden Option); or
3) construct on-street rain gardens to handle right-of-way drainage as local street improvements are made (On-Street Rain Garden Option for Local Streets).

More detail regarding each of these three options and the methods that were used for developing the CP conceptual designs and costs is provided as follows:

1) Pipe and Pre-treat Option – All of the drywell clusters were reviewed in terms of selecting the best option for dealing with drainage resulting from decommissioning. Some of the drywells were located in very close proximity to an existing storm drainage pipe and directing the drainage to that pipe appeared to be the most cost-effective option. This option was selected for the following 16 drywell clusters (the list includes the CP IDs that were assigned). It should be noted that this is a planning level analysis and while preliminary invert elevations were confirmed, the project level engineering analysis and design will need to confirm the viability of piped options for decommissioning.

<u>Willamette Overflow Subbasin</u>
WO-1-UIC: Green UIC Cluster
WO-4-UIC: Taz UIC Cluster
WO-6-UIC: Poplar UIC Cluster
WO-7-UIC: Kendra UIC Cluster
WO-8-UIC: Kent UIC Cluster

<u>A1-Channel Subbasin</u>
A1-1-UIC: Crocker 1 UIC Cluster
A1-3-UIC: Shirley 1 UIC Cluster
A1-5-UIC: Hamilton UIC Cluster
A1-6-UIC: Bushnell UIC Cluster
A1-9-UIC: Greenleaf UIC Cluster
A1-13-UIC: Korbel UIC Cluster

<u>Spring Creek Subbasin</u>
SC-1-UIC: Zinnia 1UIC Cluster
SC-2-UIC: Zinnia 2 UIC Cluster
SC-4-UIC: Countryside UIC
SC-5-UIC: Lodenquai UIC Cluster

<u>Flat Creek Subbasin</u>
FC-2-UIC: Willowbrook 2 UIC Cluster

There were two methods used for developing conceptual pretreatment and pipe designs for this category of CPs. The first, and more simple method was used if the drywell or drywells were located in close proximity to an existing pipe system and within the delineated drainage subbasin for that piped system. Given that the XP-SWMM hydrologic model to estimate future flows was already run assuming no drywells (see Section 3.0), the hydrologic results from the model already included flows from the area that would be associated with drywell decommissioning. Therefore, the calculations that were performed to size the pretreatment and pipe system included 1) delineation of the sub-drainage area associated with the drywell; 2) estimation of flow from the sub-drainage area using the Rational Method; and 3) estimation of a pretreatment system size and pipe size (using Manning's equation) based on the calculated flow rate. In some cases, more detailed information was desired regarding the proposed pipe size and length. In these cases, a new pipe was actually included in the XP-SWMM model and iterative model runs were conducted to size the pipe as opposed to using the Rationale Method and Manning's equation. See the design assumptions section of each CP fact sheet in Appendix A for specific sizing methods for each individual CP.

The second method was used if routing of the drywell drainage area to the closest piped system would require a re-delineation of the existing subbasin boundaries. In other words, including a new pipe in the system would result in redirecting some flows into a different subbasin. In these cases, the drywell drainage area was delineated and subtracted from the existing subbasin and moved to the new subbasin that would incorporate the drainage. The model was then run to ensure that capacity would be available to handle the new drainage. Then, either the Rational Method/Manning's Equation, or if more detail was desired, an XP-SWMM model simulation was conducted to size the pretreatment system and pipe.

The CP fact sheets for each of these projects are provided in Appendix A. Construction and retrofit of the piped system provides an opportunity to provide for water quality treatment. Costs of the proposed pretreatment systems (i.e., underground structural devices to provide water quality treatment) are also included along with costs of the proposed pipe systems.

2) Surface Infiltration/Rain Garden Option – Given the flat topography and long distance to the closest piped system for some of the drywell clusters, alternative options were needed to address the decommissioning of drywell clusters in areas north of Horn Lane, where street improvements were not likely to occur in the near future. For these drywell clusters, the proposed option was to route the flows to an area where a neighborhood-scale vegetated infiltration/rain garden type facility could be constructed to handle flows. It should be noted that infiltration of municipal stormwater runoff that occurs through the surface of the ground as opposed to the subsurface is not considered to be a UIC and is therefore not regulated under the Safe Drinking Water Act.

For the modeling conducted and described in Section 3.0, drainage areas were initially delineated for the drywells that were included in the system at the time. The system included the 79 County wells, 46 of the 72 City wells, and 634 private wells. The system (drywell database) was under development and thus 26 of the existing City drywells were not included in this drywell drainage area delineation. These drywell drainage areas that were delineated represented areas draining to multiple drywells (i.e., clusters). Individual drywell drainage areas were not delineated. Based on this information, an average drainage area per drywell was estimated to be 2.70 acres. As drainage areas were only calculated for some of the drywell clusters, use of the average drainage area per drywell allowed for conceptual sizing, design and cost estimating for neighborhood-scale infiltration/rain garden facilities or CPs for all clusters on a normalized basis. Detail regarding the steps conducted to size the rain garden facilities for each cluster is provided as follows:

Step 1) Determine the number of drywells in the cluster.

Example: Number of Drywells in Cluster: 10

Step 2) A drainage area for each drywell cluster needing a surface infiltration/ rain garden CP was estimated based on the number of drywells in the cluster and assuming a 2.70 acre drainage area per drywell.

Example: Drainage Area Per Drywell: 2.7 acres
Total Drainage Area for Example Drywell Cluster: 10 x 2.7 = 27 acres

Step 3) Given the number of drywell clusters and the level of uncertainty associated with the defined drainage areas for each drywell cluster, site-specific rain garden designs (as described above for the on-street, rain garden option) were not developed. Instead, using one of the ROW rain garden configurations (from one of the initial on-street rain garden options), the total drainage area associated with one "rain garden unit" was determined to be 1.12 acres.

Step 4) Given the total drainage area for the drywell cluster, and the drainage area accommodated by one rain garden unit, the number of rain garden units required for treatment of the drywell cluster was estimated.

Example: # of Rain Garden Units Req'd: 27 acres ÷ 1.12 acres = 24 Rain Garden Units

Step 5) The on-street rain gardens were sized to treat only the ROW area within the drainage area. This represented approximately 19% of the entire unit drainage area or 0.21 acres of the 1.12 acres. It was assumed that drainage from the remaining portion of the drainage area would be treated on-site. The rain gardens within one "rain garden unit" were designed to be 12" deep with 3:1 horizontal to vertical side slopes. The 5-year, 24 hour design storm runoff volume from the ROW that would have to be managed by a rain garden was calculated to be approximately 2,120 cubic feet. Assuming a single, rectangular rain garden, the required surface area to manage the required volume of runoff from the 0.21 acres of ROW per rain garden unit is approximately 2,854 square feet. As a result, the rain garden total surface area required to treat runoff from the drywell cluster was estimated.

Example: Rain Garden Surface Area Per Rain Garden Unit: 2,854 ft2
Total Surface Area Req'd: 24 Rain Garden Units x 2,854 ft2 = 68,496ft2 (or 1.6 acres)

Step 6) Finally, assuming each rain garden unit has 2,854 square feet of rain garden, and that construction of one square foot of rain garden (with native soils) is approximately $8.00 (for non-engineered soils), the average cost of rain garden construction per drywell cluster was estimated. It should be noted that the installation of these neighborhood-scale rain gardens could also require land acquisition. The CP cost estimates for neighborhood-scale rain gardens do not include the piping that could potentially be necessary (in addition to the street gutter system) to route flows to the rain garden.

Example: *68,496ft2 x $8/ft2 = $547,968*

Note: If the actual ROW in the drainage area represents a higher or lower percentage of the drainage basin, the rain garden sizes would be somewhat higher or lower. In addition, if engineered soils are used, a cost estimate of $29/square foot should be used (see Appendix D for unit cost tables). These methods for sizing rain gardens that are described above are rough estimates made for conceptual planning purposes.

This neighborhood scale surface infiltration facility/rain garden option was selected for the following 22 drywell clusters (the list includes the CP IDs that were assigned):

Willamette Overflow Subbasin	
WO-2-UIC	Corliss/ Carolyn/ Onyx UIC Cluster
WO-3-UIC	Autumn, Ross, Moore/Oak UIC Cluster
WO-5-UIC	Silver Meadows UIC Cluster
WO-9-UIC	Baywood UIC Cluster
WO-10-UIC	Greenwood UIC Cluster
WO-11-UIC	Warrington UIC Cluster
A1- Channel Subbasin	
A1-2-UIC	Crocker 2 UIC Cluster
A1-4-UIC	Shirley 2 UIC Cluster
A1-7-UIC	Anderson UIC Cluster
A1-8-UIC	Escalante UIC Cluster
A1-10-UIC	Grove UIC Cluster
A1-11-UIC	Exeter UIC Cluster
A1-12-UIC	Brentwood UIC Cluster
A1-14-UIC	Howard UIC Cluster
Spring Creek Major Subbasin	
SC-3-UIC	Zinnia 3 UIC Cluster
SC-6-UIC	Byron UIC Cluster
SC-7-UIC	Stark UIC Cluster
SC-8-UIC	Castrey UIC Cluster
SC-9-UIC	Calumet UIC Cluster
Flat Creek Major Subbasin	
FC-1-UIC	Willowbrook 1 UIC Cluster
FC-3-UIC	Willowbrook 3 UIC Cluster
FC-4-UIC	Maesner UIC Cluster

A CP fact sheet for each of these projects is included in Appendix A. It should be noted that at the time of writing of this report, Lane county funding for CPs has not been identified.

3) On-Street Rain Garden Option for Local Streets – The South of Horn Lane drywell cluster includes a relatively large area with many drywells (26 County wells and 1 City well). Almost the entire area within the River Road Santa Clara basin and south of Horn Lane is drained through the use of drywells and informal surface infiltration, except for the area adjacent to and including River Road which is drained through a piped system. In addition, this area reflects a mix of County and City jurisdiction (sometimes on a lot-to-lot basis). As redevelopment and street improvements occur in this area, it is likely that City annexations will also occur. For this area, constructing pretreatment systems and pipes to discharge to the nearest surface drainage was considered to be infeasible due to the flat topography and lack of available capacity in the downstream system. The decommissioning option that was selected for this drywell cluster was to construct street side rain gardens for the storage and infiltration of runoff as local street improvements occur. For this option, individual properties adjacent to the right of way (ROW) would be required to manage their drainage on-site, in accordance with requirements for stormwater in the City of Eugene Code (Chapter 9, Section 9.6791(3)), and the street side rain gardens would be constructed to handle all runoff from the ROW (for a five-year design storm).

Six different concept options were evaluated in terms of providing street side rain gardens for handling drainage from local streets. Each option assumes a base 45-foot ROW width and various initial raingarden configurations. The six initial options were evaluated to determine the amount of additional ROW that would be required to accommodate runoff from the ROW during the 5-year design storm. The six initial options are described according to the following:

1. Shed Cross-Section, Reduced Parking Bays One Side, Sidewalk Opposite Side
2. Shed Cross-Section, Parking Bays One Side, Sidewalk Opposite Side
3. Crown Cross-Section, Reduced Parking Bays One Side, Sidewalk Opposite Side
4. Shed Cross-Section, On-Street Parking, Sidewalk One Side
5. Crown Cross-Section, On-Street Parking, Sidewalk Both Sides
6. Crown Cross-Section, On-Street Parking, Sidewalk One Side

Figures illustrating these six initial options are provided in Appendix F.

Each option was evaluated as one ROW unit, which includes four 50-foot wide residential lots on each side of the street and a base ROW width of 45 feet. For each option, the pervious and impervious areas associated with the ROW were computed, and the Santa Barbara Urban Hydrograph method was used to estimate the volume of runoff that would need to be accommodated by the rain gardens for a 5-year, 24-hour design storm of 3.6” using an SCS Type IA rainfall distribution. Rain garden sizing was based on guidance from Eugene’s manual (Eugene’s Stormwater Management Manual, 2006) for a rain garden facility. The rain gardens were assumed to be 12” deep with a 3:1 horizontal to vertical sideslope. By comparing the volume of runoff generated during the 5-year design storm with the volume of storage associated with the initial rain garden configurations, the initial rain garden configuration did not accommodate all of the volume of runoff as necessary. Therefore, the additional ROW width that would allow for expansion of the initial rain gardens to accommodate the total volume of runoff was determined. As the addition of ROW would also result in the addition of contributing area and runoff to the rain gardens, an iterative sizing process was conducted until the size of the rain gardens would also handle the increases in runoff associated with the expanding ROW. The results of this process and the associated increases in ROW width are summarized in Table 4-1 below for each of the six options.

As a result of this evaluation process and attempts to minimize the required ROW width, Concepts #2, #4, and #6 were selected for potential future implementation. Concepts #1, #3, and #5 were eliminated from further consideration for the following reasons:

Concept #1 – This ROW option was eliminated, as providing sidewalk directly adjacent to the street is not optimal from a safety standpoint.

Concept #3 – This ROW option was eliminated due to the significant amount of additional ROW width that would be required to accommodate a rain garden that would be large enough to manage the runoff from the ROW during the 5-year event.

Concept #5 – This ROW option was also eliminated due to the significant amount of additional ROW that would be required.

Final renderings of the three selected local street concepts (both plan views and cross-section views) including the required ROW widths are provided in Figures 4-5 through 4-10.
CP A1-15-UIC includes the development of street-side rain gardens, and it was selected to address drywell decommissioning for the drywell cluster south of Horn Lane. This project will provide water quality benefits in terms of preventing a significant increase in pollutant loads and hydrologic impacts that would be associated with decommissioning of drywells and routing discharges to surface waters. It should be noted that, while these street-side rain garden concept options for local street improvements were developed to address UIC decommissioning needs, these options are envisioned to be employed for various circumstances beyond UIC-related projects. Implementing the street-side rain garden concepts will require first making some changes to the City's Local Street Plan under a separate process subsequent to completion of the River Road Santa Clara Basin Plan. A decision flowchart was developed as part of this basin planning process, to illustrate the approach to managing stormwater runoff from sites, and where the street-side rain garden approach could be employed. In the broad sense, the approach to managing stormwater runoff from a site, and the potential application of the street-side rain garden concept options, will depend on whether a project is public or private, whether it is for an arterial or collector street, and whether it is for infill or new development. A decision flow chart for the project planning phase, to show where the new local street concepts could be employed, is provided in Figure 4-11.

During the conceptual development of CP A1-15-UIC, for decommissioning drywells south of Horn Lane, a timeline mandate for decommissioning was not known. It was assumed that UIC decommissioning could occur over a decades-long timeframe that could allow for decommissioning to occur in association with street improvements in annexed areas. The Department of Environmental Quality (DEQ) has more recently indicated that decommissioning of all non-compliant UICs will be required in a shorter timeframe – one that will likely require UICs in this area to be decommissioned using individual or clustered Surface Infiltration / Rain-Gardens (Option #2). Due to budget and time concerns for completing this document, The City of Eugene and Lane County have elected not redo the analysis on this UIC cluster at this time.

Table 4-1
Summary of Increased ROW Required for Six Different On-Street Rain Garden Options for Local Streets

				North-Side						South-Side							
ROW Options	Crown	Shed	Number of parking bays per unit	Sidewalk	Landscape	Rain garden	Curb	Parking Bays Included?	Travel Lanes	Parking Spaces Included	Curb	Landscape	Rain garden	Sidewalk	Base ROW Width	Additional ROW Required for Rain Gardens	Total ROW Required
1 - Shed with parking bays on south and sidewalk on north		X	2	5.0 feet	N/A	N/A	0.5 foot	No	20.0 feet	Yes (1)	0.5 foot	Intermittent	19.0 feet	N/A	45.0 feet	5.0 feet on south	50.0 feet
2 - Shed with parking bays on north and sidewalk on south		X	4	N/A	Intermittent	N/A	0.5 foot	Yes - 7.0 feet	20.0 feet	No	1.0 foot	Intermittent	11.5 feet	5.0 feet	45.0 feet	12.0 feet on south	57.0 feet
3- Crown with parking bays on north and sidewalk on south	X		2	N/A	Intermittent (2)	12.0 feet	0.5 foot	Yes (2)	20.0 feet	No	0.5 foot	Intermittent	7.0 feet	5.0 feet	45.0 feet	14.0 feet on north 6.5 feet on south	65.5 feet
4- Shed with on street parking on north and sidewalk on south		X	N/A	N/A	5.0 feet	N/A	0.5 foot	Not Bays - On-street only.	21.0 feet (3)	No	1.0 foot	Intermittent	12.5 feet	5.0 feet	45.0 feet	9.0 feet on south	54.0 feet
5 - Crown with parking bays and sidewalk on both sides of the street	X		4	5.0 feet	Intermittent	7.0 feet	0.5 foot	Yes (4)	20.0 feet	Yes (3)	0.5 foot	Intermittent	7.0 feet	5.0 feet	45.0 feet	20.0+ feet on north 20.0+ feet on south	85.0+ feet (5)
6 - Crown with on street parking on north and sidewalk on north	X		N/A	5.0 feet	Intermittent	8.75 feet	0.5 foot	Not Bays - On-street only.	21.0 feet (3)	No	1.0 foot	Intermittent	8.75 feet	N/A	45.0 feet	4.5 feet on north 2.0 feet on south	51.5 feet

1. For option #1, the parking spaces are staggered with rain gardens; therefore in areas where there is parking, the rain garden area would be 12' instead of 19' wide.
2. For option #3, the parking spaces are staggered with the landscaping; therefore, in the areas where there is no parking, the rain gardens would be 12.0 feet wide and in areas where there is parking, the parking is 7.0 feet wide and the landscaping is 5.0 feet wide.
3. A total travel lane width of 21.0 feet is anticipated to accommodate on-street parking on the north side of the street.
4. For option #5, the parking spaces are staggered with the rain gardens and therefore, the dimension has already been accounted for under the rain garden column.
5. For options #5, multiple iterations were conducted to determine the actual necessary ROW width. With an additional 40 feet of ROW (total), the volume requirements are still not met with the rain garden configuration, but it seems unlikely that additional ROW exceeding 40' would result in a feasible option.

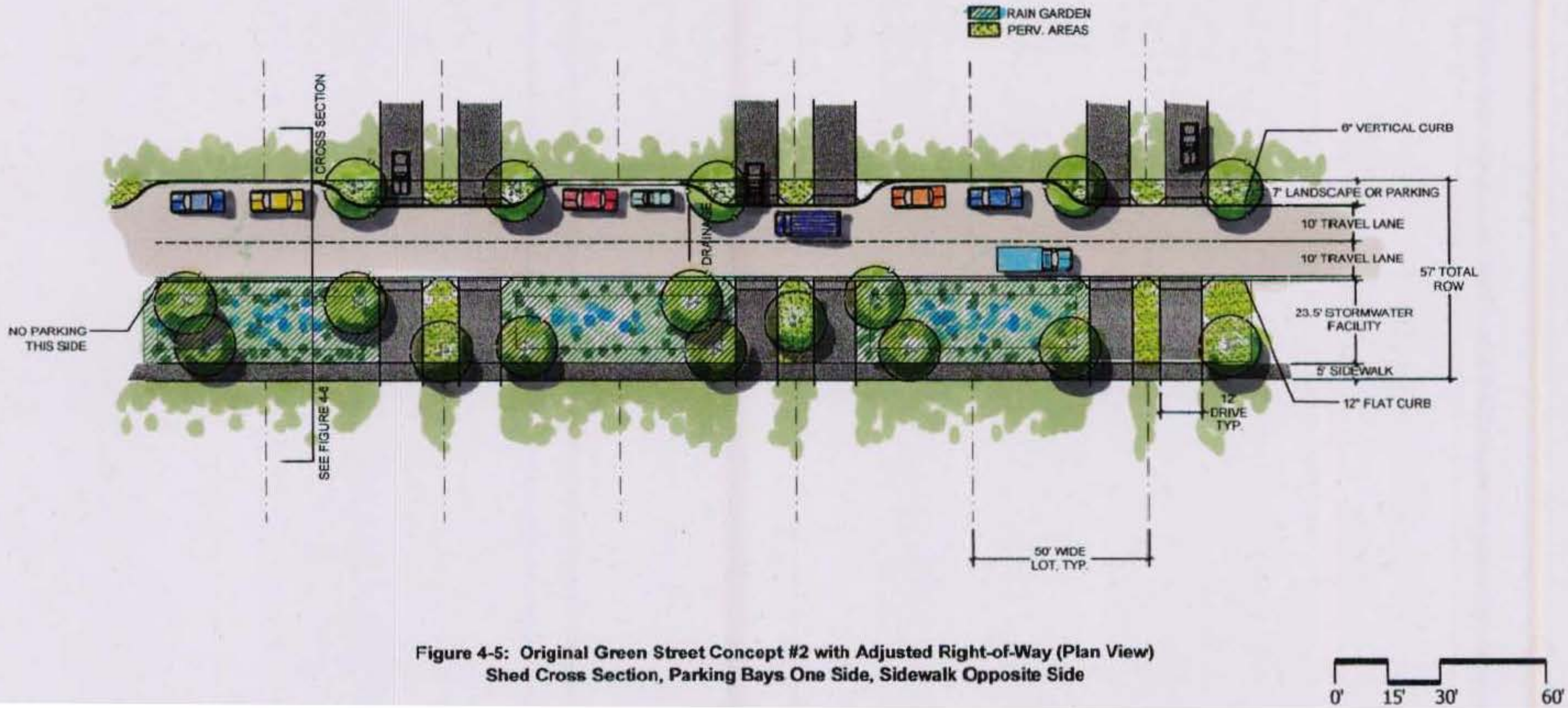


Figure 4-5: Original Green Street Concept #2 with Adjusted Right-of-Way (Plan View)
Shed Cross Section, Parking Bays One Side, Sidewalk Opposite Side

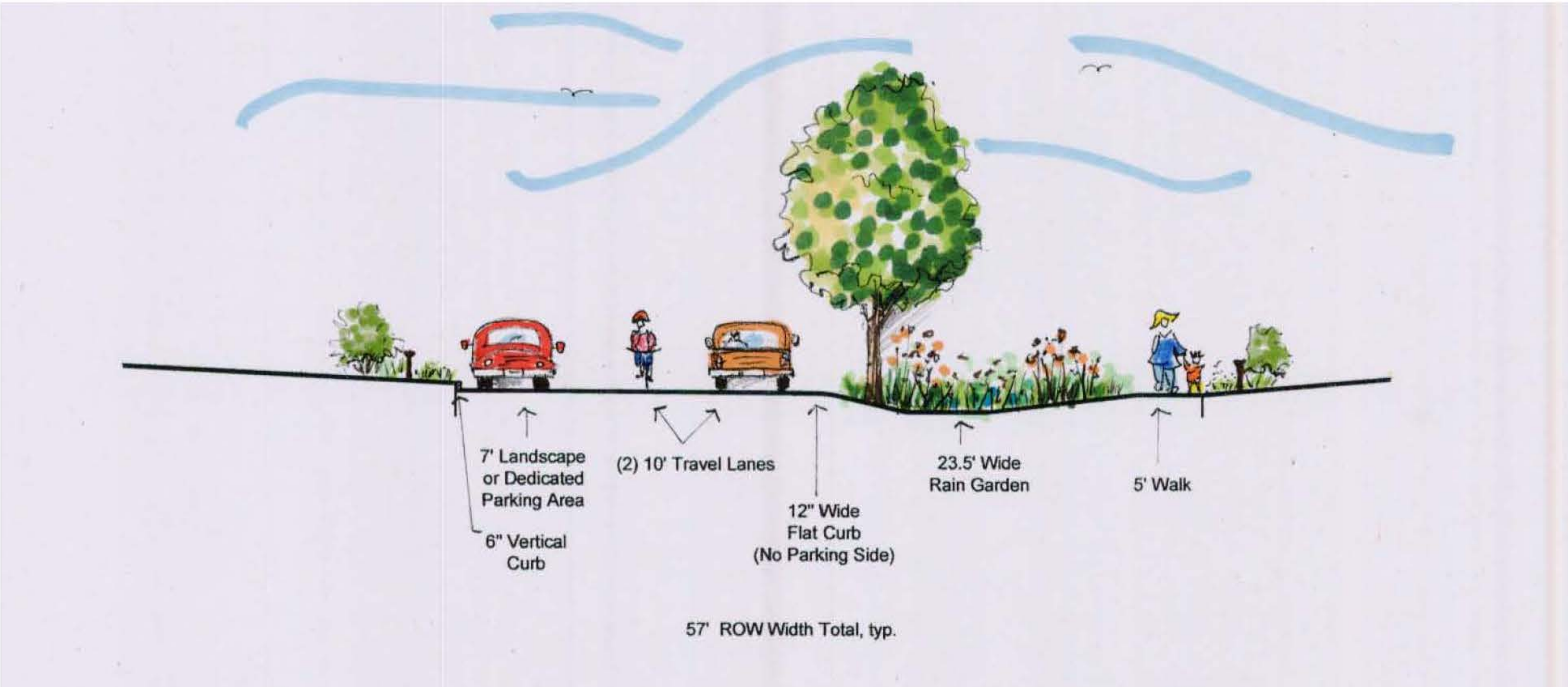


Figure 4-6: Original Green Street Concept #2 with Adjusted ROW (Section View)
Shed Cross-Section, Parking Bays One Side, Sidewalk Opposite Side

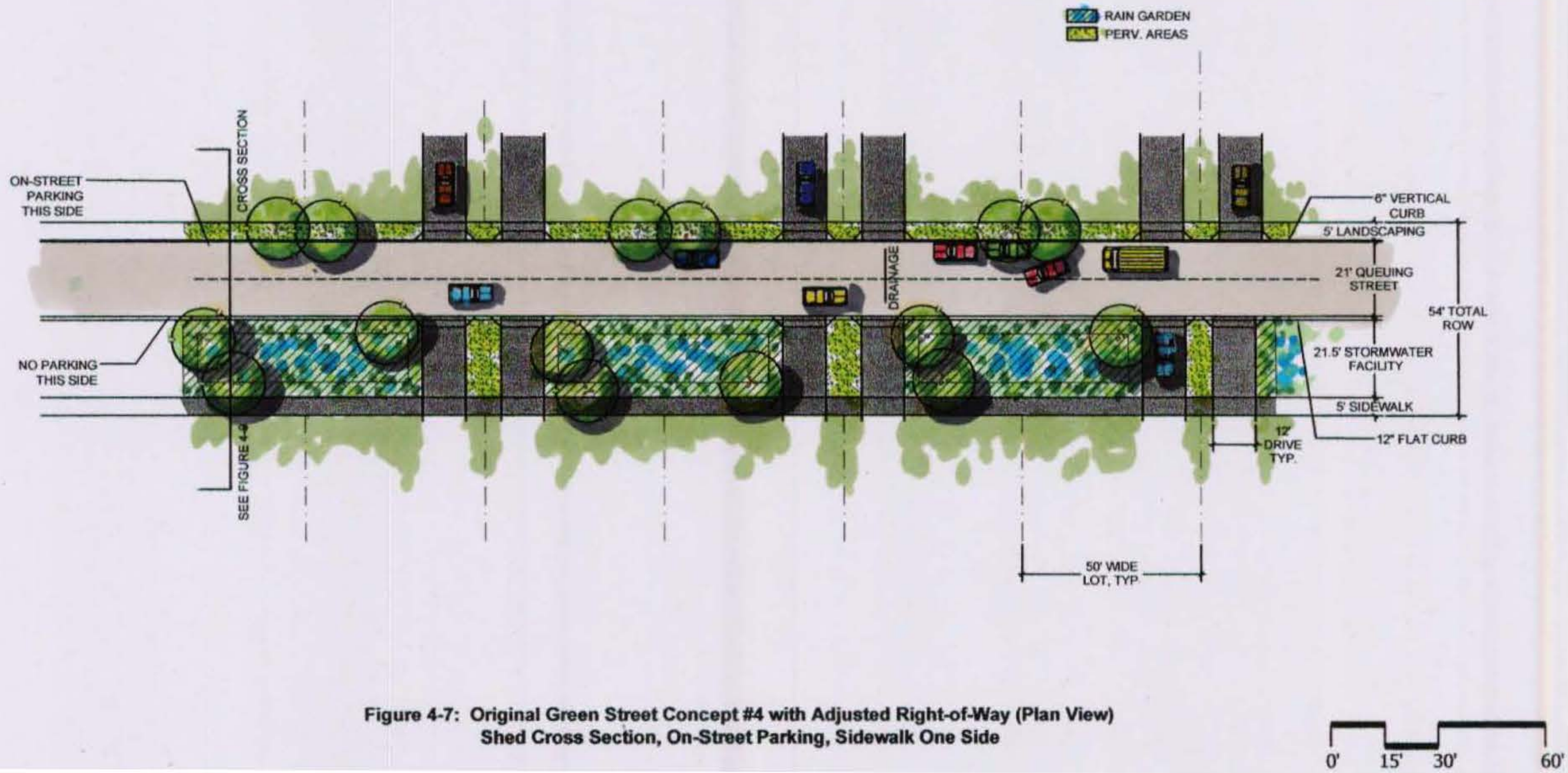


Figure 4-7: Original Green Street Concept #4 with Adjusted Right-of-Way (Plan View)
Shed Cross Section, On-Street Parking, Sidewalk One Side

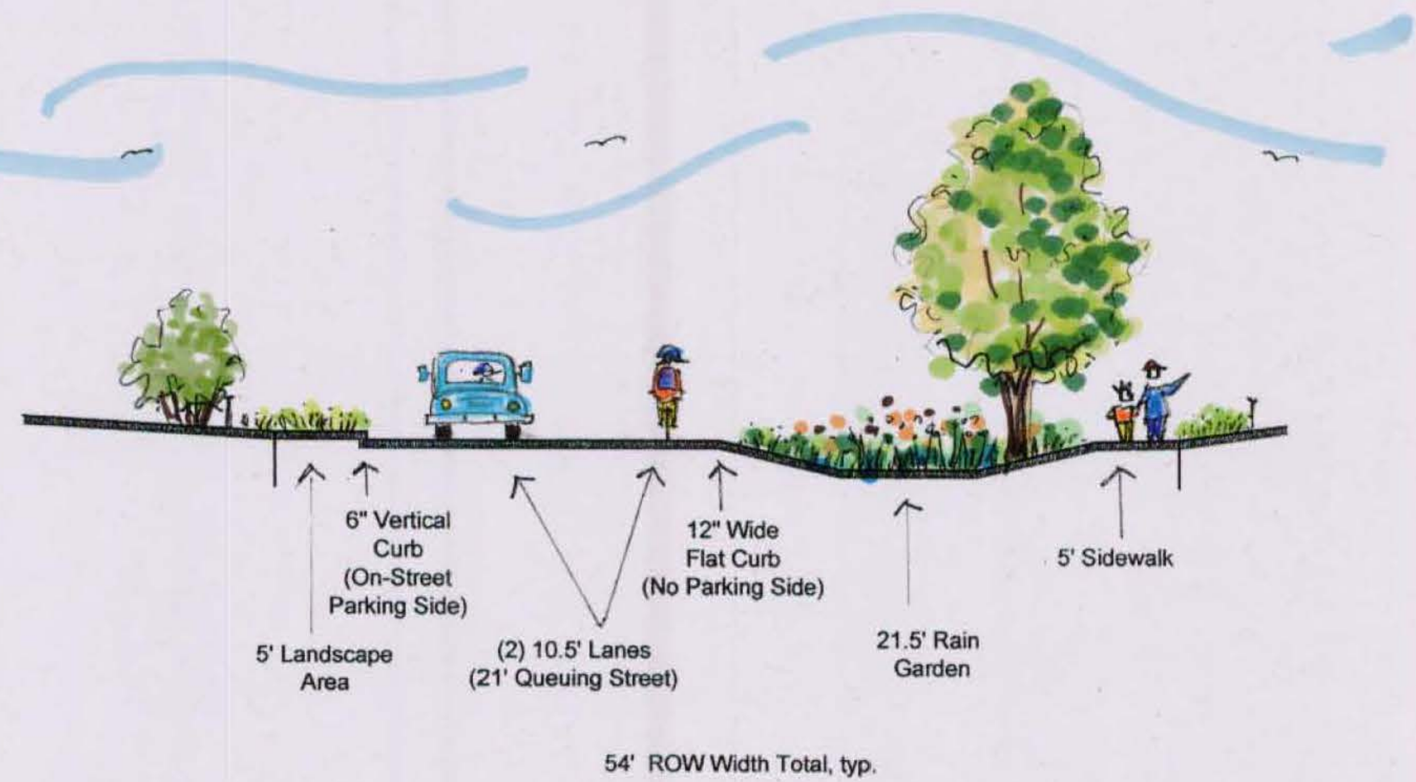


Figure 4-8: Original Green Street Concept #4 with Adjusted ROW (Section View)
Shed Cross-Section, On-Street Parking, Sidewalk One Side

0' 4' 8' 16'

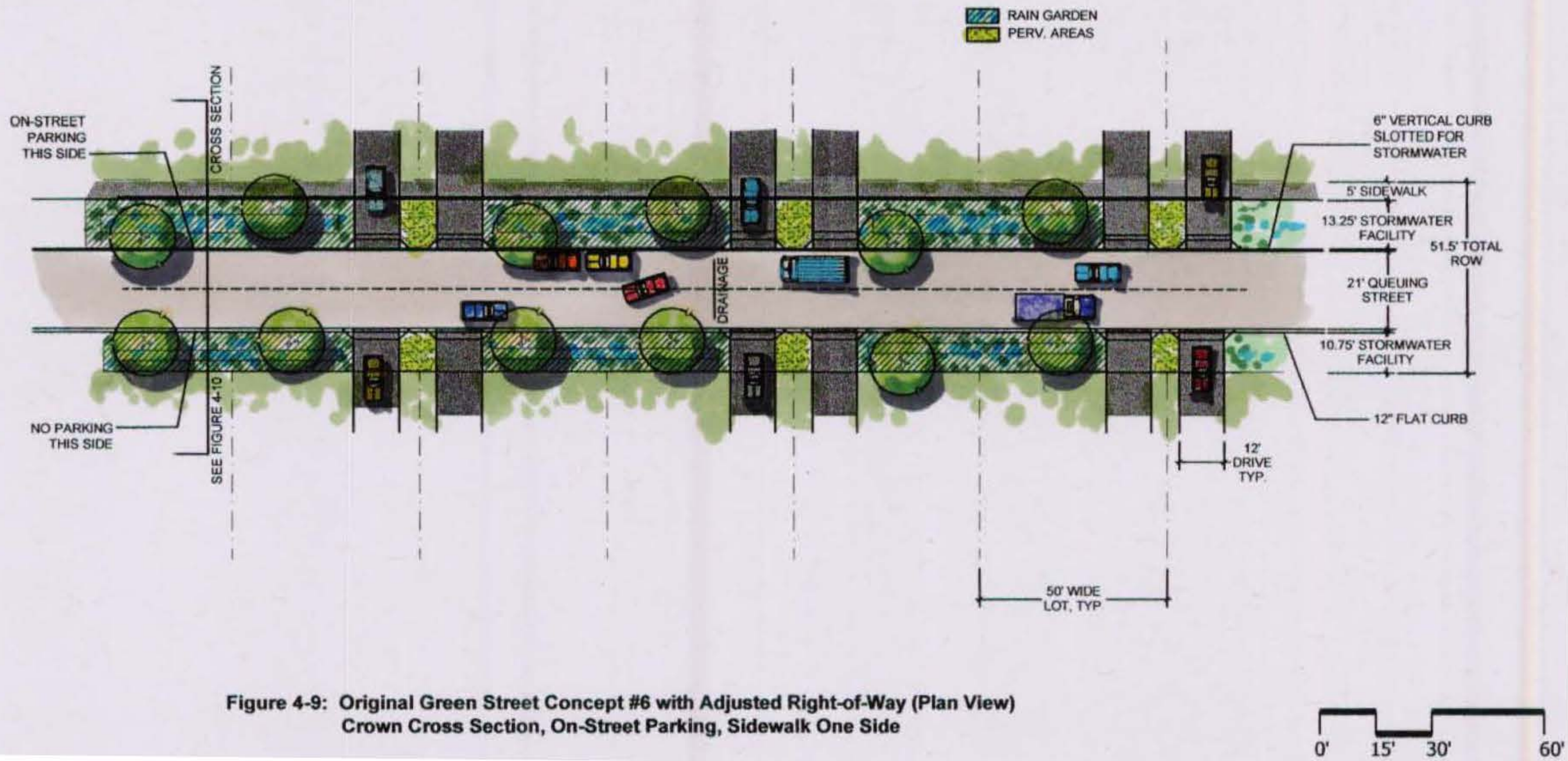
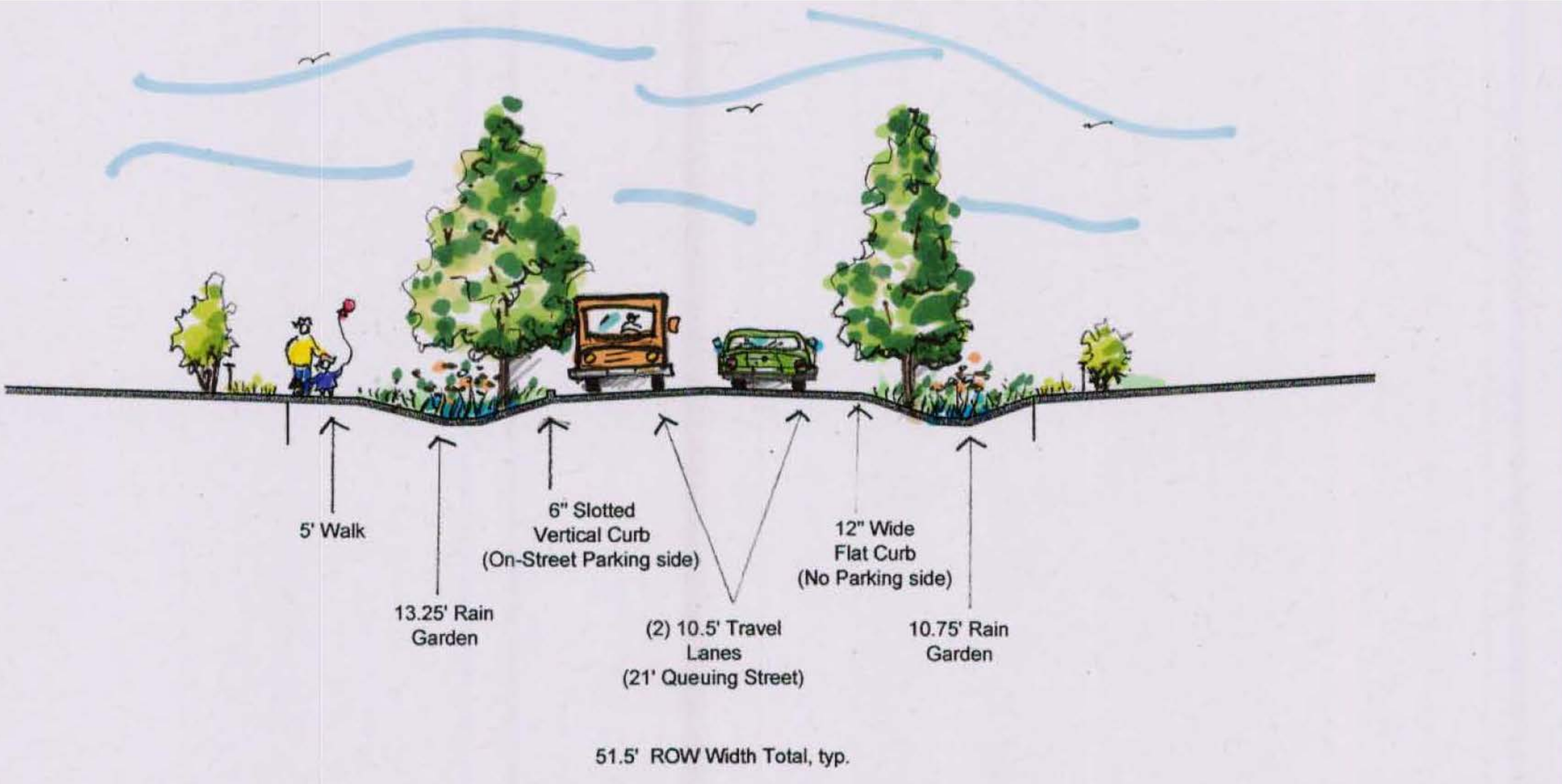
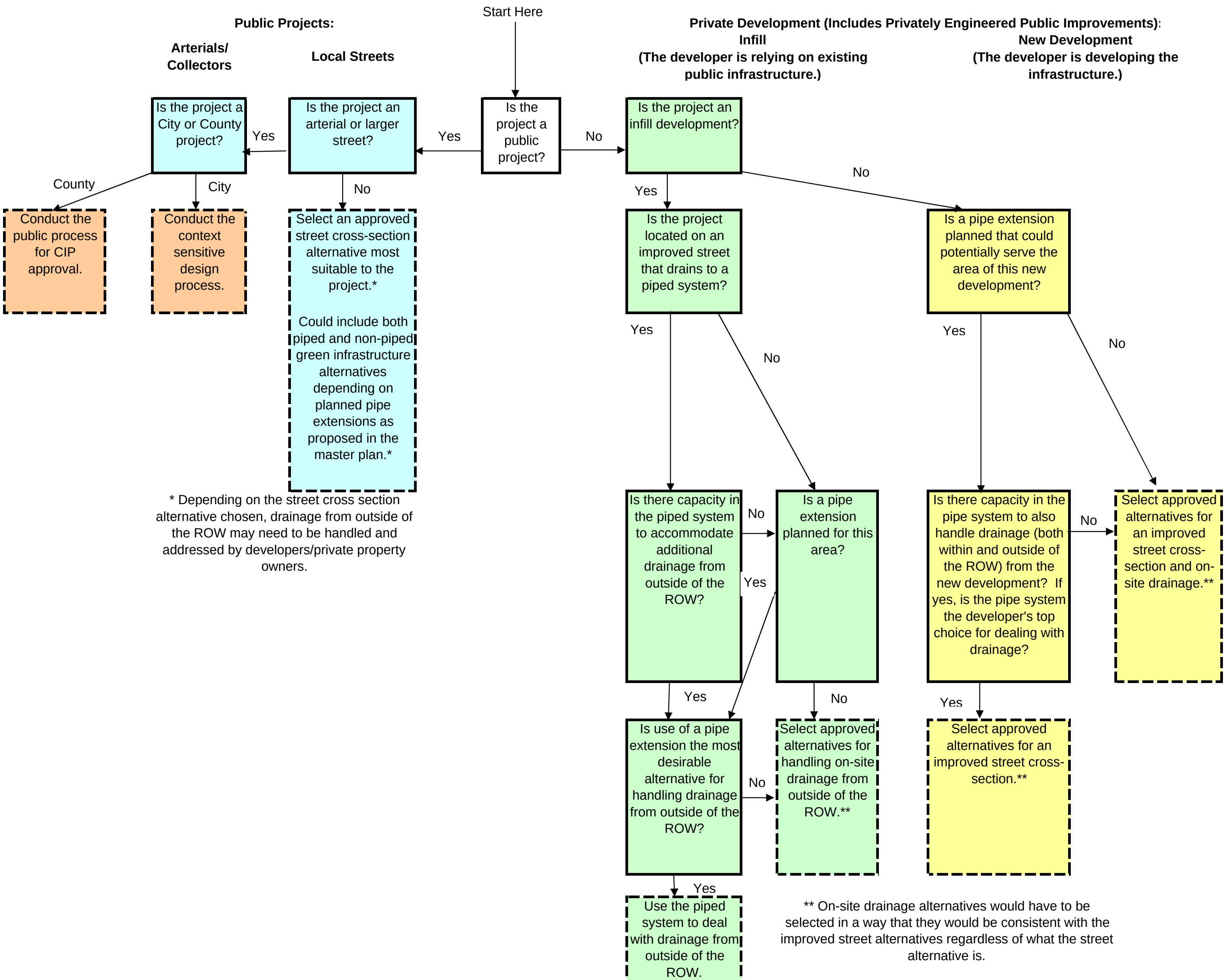


Figure 4-9: Original Green Street Concept #6 with Adjusted Right-of-Way (Plan View)
Crown Cross Section, On-Street Parking, Sidewalk One Side



Figured 4-10: Original Green Street Cross Section #6 with Adjusted ROW (Section View)
Crown Cross-Section, On-Street Parking, Sidewalk One Side

Figure 4-11
Destination Considerations for Project Planning Phase



* Depending on the street cross section alternative chosen, drainage from outside of the ROW may need to be handled and addressed by developers/private property owners.

** On-site drainage alternatives would have to be selected in a way that they would be consistent with the improved street alternatives regardless of what the street alternative is.

<u>Other Water Quality CPs</u>
In addition to the three CP options described above (i.e., pre-treatment associated with piped retrofits, neighborhood-scale rain gardens, and street side rain gardens associated with street improvements), CPs were developed to address results of the pollutant loads evaluation and to address observed stream stability issues. The pollutant loads evaluation showed that commercial and industrial land uses discharge relatively higher pollutant loads when compared to residential and open land uses. Therefore, a list of projects was developed to retrofit the piped systems in these high source areas to include structural water quality facilities such as sedimentation manholes and select proprietary stormwater treatment devices that incorporate filtration to reduce the pollutant load. As part of the basin planning process, a City-wide annual budget line item was included to construct these types of projects.

RRSC-1 - Citywide Annual Budget Line Item – Stream Bank Stabilization: This proposed project alternative includes using bioengineering techniques to stabilize the creek bank at locations where problems have been observed or are expected to occur as a result of future development.

RRSC-2 - Citywide Annual Budget Line Item – High Source Areas: Single or multiple facilities may be appropriate for these high source areas, and the facilities should be selected and designed to treat the particular pollutant of concern based on specific site conditions. The following ten potential locations for these retrofits were identified:

- Willamette Overflow major subbasin
  1) Node 68485
     18" diameter pipe that runs south along River Road
  2) Nodes 58315, 58314, 58313 and 58312
     27" diameter pipe that runs east along Division Avenue
  3) Nodes 72406 and 66531
     24" diameter pipe that runs east along Division Avenue
  4) Node 58319
     12" diameter pipe along Division Avenue
  5) Node 67014
     15" diameter pipe south of Beltline Road

- Spring Creek major subbasin
  1) 48" pipe east of River Road, north of River Loop 2, south of Swain Lane

- Flat Creek major subbasin
  1) Nodes 72206, 72210, 72215, 72218, 72223
     24" diameter pipe south of Irvington Drive
  2) Node 72321
     18" diameter pipe along Zinfandel Lane
  3) Node 72326
     10" diameter pipe along Napa Valley Lane

- A-1 major subbasin
  1) Nodes 59020, 59021
     54" diameter pipe that runs west along Maxwell between Bushnell Ln. and N. Park Ave.

RRSC-3 - Citywide Annual Budget Line Item - Outfall Stabilization: This proposed project alternative would include identification and retrofit of storm drainage system outfalls, which are creating localized erosion and bank stability problems.

4.3.2 Development Standards to Address Water Quality

Stormwater Development Standards

Potential development standards were considered for addressing water quality problems as part of the 2002 City-wide basin master planning efforts. As a result, development standards for water quality were adopted City-wide in June 2006. The Stormwater Development Standards include regulations for locating, designing, constructing, and maintaining water quality facilities for new development and significant re-development. These standards apply within the city limits and to properties within the urban growth boundary (UGB) that develop and annex to the City. Eugene developed a Stormwater Management Manual (July 2006) to assist developers with the design, operations, and maintenance of approved stormwater facilities. Eugene's Stormwater Management Manual is a modified version of Portland's Stormwater Management Manual. The Portland Stormwater Management Manual was reviewed and edited for accuracy and consistency with the City of Eugene's regulatory structure and to reflect policies and the Stormwater Department Advisory Committee's recommendations for a water quality design storm (i.e. 1.4 inches for volume-based analyses, 0.22 in/hr for in-line flow-based systems and 0.13 in/hr for off-line flow-based systems), flow controls, and maintenance responsibilities for public and private facilities.

The Eugene Stormwater Management Manual provides developers and design professionals with specific tools to meet the City's requirements for reducing the impacts of stormwater runoff quantity and pollution resulting from new development. The Manual is to provide guidance for developers subject to the stormwater development standards adopted by City ordinance.

As an extension of stormwater development standards adoption, in September, 2008, the Eugene City Council reviewed and directed efforts to increase use of Low Impact Development practices for stormwater management through administrative adjustments, additional integration of LID practices with other initiatives, development of proposals for land use code amendments, and development of proposals for other program enhancements.

Implementation of the stormwater development standards is underway, including a 2008 update to the Stormwater Management Manual, plan review and inspection of private water quality facilities, and the incorporation of water quality facilities into public capital improvement project design. Following up from 2008 City Council direction related to increasing the use of LID practices, specific administrative adjustments, incentives and other LID-related actions are being identified and prioritized for implementation.

Water Quality Protected Waterways

Waterway protections for addressing water quality problems were also considered as part of the 2002 City-wide basin master planning efforts. In June 2006, the City initiated a proposal for protecting waterways for water quality purposes. Under the initial (2006) proposal, nearly 90 miles of waterways were proposed for protection, including 75-foot setback areas along each side of the waterways. The waterways originally identified for protection were determined to have a direct relationship to those that are on the State of Oregon's 303(d) list as water quality impaired.

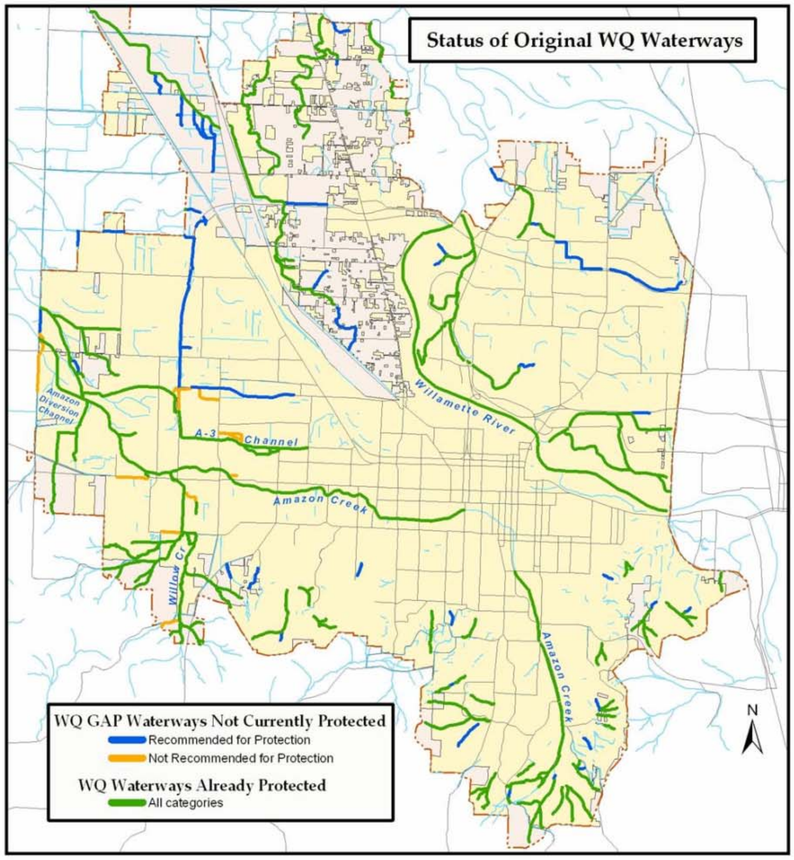
A public outreach process on the initial proposal was conducted including an open house where affected property owners, interested persons, and the general public attended and provided feedback. As a result of the issues raised, significant revisions were made to the proposal. The revised proposal would apply protections only to the original waterways of concern that have no existing protections under Goal 5 wildlife habitat regulations (Water Resources Conservation Overlay Zone, referred to in Section 2.5.1). The revised proposal recognized the significant incidental water quality protection already provided by the Goal 5/Water Resources Overlay Zone, and became a proposal to "fill the gaps" in protection on a system of waterways that are water quality impaired.

In March 2009, the Eugene City Council adopted the Water Quality Overlay Zone requirements, the revised waterway protection proposal, and the adopted regulations became effective on June 10, 2009. Approximately 13.5 miles of waterways are protected by the Water Quality Overlay Zone, including: 40-foot setbacks on each side of certain headwater streams (measured from the centerline of the waterway) and 25-foot setbacks on each side of all other specifically identified waterways (measured from the top of high bank). More specifically, the regulations:

- Establish a Water Quality Overlay Zone and related water quality protection measures;
- Apply the new zone to specifically identified lots within the Eugene city limits that contain or are adjacent to waterways identified for protection on the Water Quality Protected Waterways map; and
- Identify certain properties outside the city limits (inside the urban growth boundary) that contain or are adjacent to Water Quality Protected Waterways, and that will be rezoned to apply the Water Quality Overlay Zone upon annexation to the City of Eugene if and when annexation occurs.

Figure 4-12 provides an overview of the City's waterway protections, and the specifically identified Water Quality Protected Waterways. Some of the waterways affected by the new Water Quality Overlay Zone are located in the River Road Santa Clara basin, including portions of the Upper Flat Creek and tributaries to the A1 Channel.

Figure 4-12
Water Quality Protected Waterways Map



Postscript Note to Section 4.0: 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 CPs. To comply with their respective National Pollutant Discharge Elimination System (NPDES) permits for stormwater discharges, both the City and the County have also been 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. In addition to the proposed CPs and the City of Eugene's stormwater development standards implemented in 2006, these include BMPs under the following general categories:

- Illicit Discharge Detection and Elimination
- Operations and Maintenance and Good Housekeeping (e.g., street sweeping, catch basin cleaning, vegetation management, spill prevention and response)
- Public Education and Outreach
- Public Participation and Involvement
- Planning and Administration (e.g. basin planning, data management)
- Construction Site Management Controls

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 for the other six stormwater basins in Eugene, and partially completed for this River Road Santa Clara basin plan. Section 5.1 also describes 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 selected for addressing these problems and opportunities.

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 River Road Santa Clara 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 for the River Road Santa Clara basin including the following:

- The following information was compiled and reviewed to assess the location, condition, and function of the River Road Santa Clara 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 River Road Santa Clara 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 River Road Santa Clara 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:

- Urbanization within the River Road Santa Clara basin has caused significant changes to the open waterway systems.
- There are about 48 miles of remaining open waterways in the basin, the majority of which are now protected through either FEMA Floodway restrictions, the City’s Water Resources Conservation Overlay Zone (adopted in November 2005), or the City’s Water Quality Overlay Zone (adopted in March 2009).
- While some of the remaining waterways are large conveyance channels characterized by a trapezoidal shape with moderate riparian functions, three of the basins waterways (Flat Creek, Spring Creek and the East Santa Clara Waterway) are somewhat more naturally configured with meanders and riparian vegetation.
- Significant channels include the Highway 99 Roadside Channel, A1 Channel, A2 Channel, North Beltline Floodway, Spring Creek, Flat Creek and the East Santa Clara Waterway.
- Efforts to protect, rehabilitate and/or restore the East Santa Clara waterway and its floodplain functions have occurred in the northern portion of the basin.

Expected Future Waterway System Conditions:

- Future conditions for some “privately owned and maintained” waterways would be expected to deteriorate without 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 systems.

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

Existing Protection Measures

- The Water Resources Conservation Overlay Zone (EC 9.4900) applies to waterways within the basin with significant natural resources habitat. The Water Resources Overlay Zone, while primarily aimed at protecting natural resources habitat, provides significant incidental water quality protection for these waterways.
- The Waterside Protection Overlay Zone (EC 9.4700) applies within the West Eugene Wetlands Plan boundary and provides protection for channels, setbacks and contiguous riparian areas. The West Eugene Wetlands boundary does not extend into the River Road Santa Clara 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 in the River Road Santa Clara basinbut 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.
- The Water Quality Overlay Zone (EC 9.4770), adopted in March 2009 provides increased protection of waterways with water quality functions and a significant relationship to waterways listed as impaired under the federal Clean Water Act (see subsection 4.3.2 for more detail).

Other Related On-going Efforts

- Endangered Species/Salmon program developed strategies for responding to the *January 2001* listing of spring Chinook salmon. Strategies include incentives and regulatory measures for protection and restoration of salmon habitat in Eugene. Strategy options for Council consideration were developed.

Data Gaps

- There is little data as to existing aquatic habitat and species condition in the River Road Santa Clara basin waterways. This data would not only help further inform the condition of the waterways, but would also allow for better evaluation of the effects of any future 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 described in Section 5.1. 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. Development of these stormwater management tools was the result of an all-day basin assessment meeting, attended by a large multi-disciplinary group of people including staff with experience in water quality, engineering, maintenance, natural resources, planning, and groundwater resources, and a half-day multi-disciplinary meeting focused on underground injection controls. In both instances, preliminary ideas were developed based on the goals and objectives of the project. This section describes the capital projects and development standards that were considered 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:

RRSC – 4 - 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. The following corridor (shown on Figure 3-6) was identified for acquisition in the River Road Santa Clara Basin, in the 2000 Stream Corridor Acquisition Study:

- Willamette Overflow, also referred to as the East Santa Clara Waterway.

*RRSC – 1 - 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.

*RRSC – 3 - 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.

* These two CPs were also listed in the water quality section (subsection 4.3.1). It should be noted that Lane County is limited by Road Fund constraints and by the inability to spend money outside of the County road right-of-way. In addition, at the time of writing of this report, Lane County funding for CPs has not been identified.

5.2.2 Development Standards Alternatives

The following development standards were considered for addressing identified stormwater related natural resources problems and opportunities in the River Road Santa Clara basin.

- *Water Quality Waterway Protections* – Using this approach, criteria would be established for identifying waterways of significance to protect for their water quality functions. See Section 4.3.2 for more detail about the Water Quality Protected Waterways.

- *Require BMPs to reduce pollutants associated with stormwater runoff from new development and significant redevelopment* – This standard would require new development and significant redevelopment to control the quality of stormwater runoff by selecting, designing, constructing, and maintaining a water quality facility. It also emphasizes techniques to address impacts to open channels associated with increased quantities of runoff. This standard is covered in Section 4.3.2 of this plan.

The purpose of this section is to summarize the flood control, water quality, and stormwater related natural resource elements of the integrated stormwater management strategy for the River Road Santa Clara basin as they were presented in Sections 3.0, 4.0, and 5.0 respectively. The capital project elements of the stormwater management strategy are shown on Figures 3-2 through 3-8. These CPs and development standard strategies are summarized in subsection 6.1. Subsection 6.2 provides a summary of strategy benefits and subsection 6.3 provides a summary of strategy implementation and costs.

6.1 CP and Development Standard Strategies

Flood Control Strategy

Two categories of flood control capital projects were identified for implementation. The first category of flood control CPs were identified to address predicted capacity deficiencies. These projects are listed as follows:

- A1-1: Open Channel Improvements: Regrade the existing open channel segment (RSA1090B) from node 72789 to 78790 (18’).
- A1-2: Flood Control (Culvert Replacement) at Irving Road and Gent Road: Upsize and replace the existing 36” CMP culvert (RSA1090A) with a 48” CMP culvert.
- A1-3: Flood Control (Storage) at Prairie Road and Beltline Road: Construct storage facilities at nodes 72782 and 72102 to provide a total of 85 acre-ft of storage.
- A1-4: Flood Control (Culvert Replacement) at Prairie Road and Beltline Road: Upsize and replace the existing 24” CMP culvert (RSA1100I) with a 36” CMP culvert.
- A1-5: Flood Control (Culvert Replacement) South of Irving Road: Upsize and replace the existing 3-24” CMP culverts (RSA1090E) with a 2’ x 8’ box culvert.
- A1-6: Flood Control (Culvert Replacement) at Carol Avenue: Upsize and replace the existing 24” CMP culvert (RSA1060L) with a 2’ x 4’ box culvert.
- A1-7: Flood Control (Culvert Replacement) at Kelso Street: Upsize and replace the existing 18” and 24” CSP culverts (RSA1060G) with a 2’ x 4.5’ box culvert.
- A1-8: Flood Control (Storage) at Maxwell Road West of N. Park Avenue: Construct storage facilities at nodes 72725 and 59020 to provide a total of approximately 135 acre-ft of storage.
- A1-9: A1 Channel Survey: Conduct survey of open channel segments to identify available storage above the top of banks.
- FC-1: Flood Control (Culvert Replacement) at Calla Street: Upsize and replace the existing 3-12” CSP culverts (RSFC050D) with a 1.5’ x 5.0’ box culvert.
- SC-1: Flood Control (Culvert Replacement) at Katy Lane: Upsize and replace the two existing 30” CSP culverts (RSSC050B) with a 12’ long pedestrian bridge.
- WO-1: Flood Control (Culvert Replacement) East of Azalea Dr.: Upsize and replace the existing 18” CMP culvert (RSWO070D) with a 66” CSP culvert.
- WO-2: Flood Control (Culvert Replacement) East of Edgewood Dr.: Upsize and replace the existing 36” CSP culvert (RSWO110A) with a 60” CSP culvert.
- WO-3: Flood Control (Culvert Replacement) East of Yvonne St.: Upsize and replace the existing 48” CSP culvert (RSWO080A) with a 66” CSP culvert.

WO-4: Open Channel Improvements: Regrade the existing open channel segments (RSWO090Aa, RSWO090B, RSWO090C, and RSWO090D) from node 74405 to 78833 (724').

WO-5: Flood Control (Storage) at River Ave.: Construct a storage facility at node 77703 to provide approximately 124 acre-ft of storage.

The second category of flood control capital projects were identified to address new flows to the system that would result from the decommissioning of public drywells. As these projects have a significant water quality component, and to avoid duplication, these CPs are listed below under the water quality strategy.

Water Quality Strategy

Capital Projects: Two categories of water quality capital projects were identified for implementation. The first category of water quality CPs was identified to prevent water quality impacts that would be associated with the decommissioning of drywells. If not addressed, these impacts would include an increase in pollutant loads and impacts to the stream channels associated with the increased flows. The projects to address/prevent these impacts are listed as follows:

WO-1-UIC: Green UIC Cluster Pipe and Pre-treat
WO-2-UIC: Corliss/ Carolyn/ Onyx UIC Cluster Rain Garden
WO-3-UIC: Autumn, Ross, Moore/Oak UIC Cluster Rain Garden
WO-4-UIC: Taz UIC Cluster Pipe and Pre-treat
WO-5-UIC: Silver Meadows UIC Cluster Rain Garden
WO-6-UIC: Poplar UIC Cluster Pipe and Pre-treat
WO-7-UIC: Kendra UIC Cluster Pipe and Pre-treat
WO-8-UIC: Kent UIC Cluster Pipe and Pre-treat
WO-9-UIC: Baywood UIC Cluster Rain Garden
WO-10-UIC: Greenwood UIC Cluster Rain Garden
WO-11-UIC: Warrington UIC Cluster Rain Garden
A1-1-UIC: Crocker 1 UIC Cluster Pipe and Pre-treat
A1-2 UIC: Crocker 2 UIC Cluster Rain Garden
A1-3-UIC: Shirley 1 UIC Cluster Pipe and Pre-treat
A1-4-UIC: Shirley 2 UIC Cluster Rain Garden
A1-5-UIC: Hamilton UIC Cluster Pipe and Pre-treat
A1-6-UIC: Bushnell UIC Cluster Pipe and Pre-treat
A1-7-UIC: Anderson UIC Cluster Rain Garden
A1-8-UIC: Escalante UIC Cluster Rain Garden
A1-9-UIC: Greenleaf UIC Cluster Pipe and Pre-treat
A1-10-UIC: Grove UIC Cluster Rain Garden
A1-11-UIC: Exeter UIC Cluster Rain Garden
A1-12-UIC: Brentwood UIC Cluster Rain Garden
A1-13-UIC: Korbel UIC Cluster Pipe and Pre-treat
A1-14-UIC: Howard UIC Cluster Rain Garden
A1-15-UIC: South of Horn Lane UIC Cluster Street-Side Rain Gardens

SC-1-UIC: Zinnia 1 UIC Clusters Pipe and Pre-treat
SC-2-UIC: Zinnia 2 UIC Clusters Pipe and Pre-treat
SC-3-UIC: Zinnia 3 UIC Cluster Rain Garden
SC-4-UIC: Countryside UIC Pipe and Pre-treat
SC-5-UIC: Lodenquai UIC Cluster Pipe and Pre-treat
SC-6-UIC: Byron UIC Cluster Rain Garden
SC-7-UIC: Stark UIC Cluster Rain Garden
SC-8-UIC: Castrey UIC Cluster Rain Garden
SC-9-UIC: Calumet UIC Cluster Rain Garden
FC-1-UIC: Willowbrook 1 UIC Cluster Rain Garden
FC-3-UIC: Willowbrook 3 UIC Cluster Rain Garden
FC-2-UIC: Willowbrook 2 UIC Cluster Pipe and Pre-treat
FC-4-UIC: Maesner UIC Cluster Rain Garden

The second category of water quality capital projects includes line items in the City's annual budget towards the construction of projects to address stream bank stabilization, the reduction of existing pollutant loads, and outfall stabilization. The three capital projects under this category are as follows:

RRSC-1 Stream Bank Stabilization – Use bioengineering techniques to stabilize the creek bank at locations where problems have been observed or are expected to occur as a result of future development.

RRSC-2 Structural Facilities to Reduce Pollutant Loads in High Source Areas – The following ten locations were identified as potential sites for locating underground structural water quality facilities:

1) Node 68485 - 18" diameter pipe that runs south along River Road
2) Nodes 58315, 58314, 58313 and 58312 - 27" diameter pipe that runs east along Division Avenue
3) Nodes 72406 and 66531 - 24" diameter pipe that runs east along Division Avenue
4) Node 58319 - 12" diameter pipe along Division Avenue
5) Node 67014 - 15" diameter pipe south of Beltline Road
6) 48" pipe east of River Road, north of River Loop 2, south of Swain Lane
7) Nodes 72206, 72210, 72215, 72218, 72223 - 24" diameter pipe south of Irvington Drive
8) Node 72321 - 18" diameter pipe along Zinfandel Lane
9) Node 72326 - 10" diameter pipe along Napa Valley Lane.
10) Nodes 59020, 59021 - 54" diameter pipe that runs west along Maxwell between Bushnell Ln. and N. Park Ave.

RRSC-3 Outfall Stabilization – Identify and retrofit storm drainage system outfalls which are creating localized erosion and bank stability problems.

Development Standards: Potential development standards were considered for addressing water quality problems associated with future development as part of the 2002 City-wide basin master planning efforts. As a result, development standards for water quality were adopted City-wide in June 2006. These standards apply within the city limits and to properties within the urban growth boundary (UGB) that develop and annex to the City. These standards require developers to implement water quality best management practices to treat runoff from their sites.
In addition, following up from 2008 City Council direction related to increasing the use of LID practices, specific administrative adjustments, incentives and other LID-related actions are being identified and prioritized for implementation.

On-Street Rain Garden Concept Options for Local Streets: Street-side rain garden concept options for local street improvements were developed to address UIC decommissioning needs as described in Section 4.3.1. However, these options are envisioned to be employed for various circumstances beyond UIC-related projects. Implementing the street-side rain garden concepts will require modifications to the City's Local Street Plan under a separate process subsequent to completion of the River Road Santa Clara Basin Plan.

Water Quality Protected Waterways Ordinance: New regulations went into effect on June 10, 2009 that provides protection of approximately 13.5 miles of waterways through the use of a Water Quality Overlay Zone. The new regulations fill gaps in protections on a set of waterways of significance to water quality, and acknowledge the significant incidental water quality protection already provided by the Goal 5 Water Resources Overlay Zone.

Natural Resources Management Strategy

The proposed strategy, similar to the strategy for the six other stormwater basins in Eugene, is focused on the protection and enhancement of open waterways for their stormwater functions and benefits. The strategy includes both a capital project and development standards component.

Capital Projects: Three capital projects have been identified for implementation in River Road Santa Clara as follows:

> RRSC – 4 - Stream Corridor Acquisitions: Acquire the Willamette Overflow, also referred to as the East Santa Clara Waterway Corridor.

Capital projects RRSC – 1 – Streambank Stabilization and RRSC – 3 – Outfall Stabilization will also provide natural resource benefits. These projects were listed as part of the water quality strategy and are not listed separately here to minimize duplication.

Development Standards: Part of the strategy includes support for existing waterway protection standards (i.e., Water Resources Conservation Overlay Zone, Natural Resource Zone, Planned Unit Development 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. Lastly, waterway protection will occur under the implementation of the June, 2009 ordinance that will include a Water Quality Overlay Zone (this is included above under the water quality strategy).

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.

6.2 Summary of Strategy Benefits

The River Road Santa Clara integrated strategy, when finalized and implemented, is expected to provide the following benefits:

1. Provide the required level of flood protection basin-wide through capital projects.
2. Reduce existing pollutant loads through capital projects.
3. Reduce the potential for increased pollutant loads and erosive impacts to stream channels that would be associated with increased flows from drywell decommissioning.
4. Reduce pollutant loads associated with new developments through development standards.
5. Identify, protect and manage significant open waterways for their beneficial stormwater functions.
6. Address compliance issues associated with the Clean Water Act and Safe Drinking Water Act.

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 provides a summary of the estimated costs for each of the capital projects in the River Road Santa Clara Basin. It also describes the approach for capital project implementation.

The list of capital projects in Table 6-1 is a summary of the full list of projects identified from the basin planning process, and includes planning level cost estimates. Appendix A contains a more detailed fact sheet for each capital project, which includes a description of the project and assumptions made for purposes of estimating costs. Unit cost tables utilized for these estimates are provided in Appendix D.

The actual cost split for each project between the City and Lane County will be determined on a project-by-project basis, and was not estimated as a part of this planning process. At the time of completion of this report, there is no identified funding mechanism in the County to pay for the County's portion of the capital improvement projects identified in this basin plan. The City will fund its portion of the projects identified in this basin plan primarily through a combination of stormwater user fees and systems development charges.

With respect to implementation of City of Eugene capital projects, the City will use its recently updated 2009 stormwater capital project prioritization criteria for initial prioritization of stormwater projects. Projects listed in the River Road Santa Clara Basin Plan will be added to the full list of City public projects, and then will be scored and ranked using the prioritization criteria. An overall prioritized project list will be established, from which an initial sub-set of projects will be selected for future six-year capital improvement program (CIP) development and review process. The CIP forecasts the City's capital needs over a six-year period based on various City-adopted long-range plans, goals and policies. Development of the City's CIP is typically a nine-month process, beginning in August of even-numbered years and ending the following spring with adoption by City Council. Following adoption of the CIP, the projects become the basis for preparation of the upcoming fiscal year's capital budget. The capital budget is submitted to the Budget Committee in the spring of each year following the CIP process, and adopted by the City Council in June. Projects in the second fiscal year of the CIP become the basis of the subsequent fiscal year's capital budget. The final list of projects identified in the CIP for implementation may be different than the initial list as a result of input from the CIP public involvement and budget adoption process.

Table 6-1
Summary of Capital Project Costs and Funding

Capital Project Identification	Total Estimated Capital Project Implementation Cost[1]
A-1 Channel	
A1-1 – A1 Open Channel Improvements	$7,500
A1-2 – Culvert Replacement at Irving Road and Gent Road	$131,400
A1-3 – Storage at Prairie Road and Beltline Road	$12,160,200
A1-4 – Culvert Replacement at Prairie Road and Beltline Road	$18,400
A1-5 – Culvert Replacement South of Irving Road	$26,400
A1-6 – Culvert Replacement at Carol Avenue	$21,600
A1-7 – Culvert Replacement at Kelso Street	$16,600
A1-8 – Storage at Maxwell Road	$16,879,800
A1-9 – A1 Channel Survey	$50,000[2]
A1-1-UIC – Pipe and Pre-treat Crocker 1 UIC Cluster	$530,000
A1-2-UIC – Rain Garden Crocker 2 UIC Cluster	$271,200
A1-3-UIC – Pipe and Pre-treat Shirley 1 UIC Cluster	$777,200
A1-4-UIC – Rain Garden Shirley 2 UIC Cluster	$1,070,600

1 Total estimated capital project implementation cost includes construction, site acquisition (if applicable), and engineering and administrative costs.
2 Reflects a baseline cost estimate for planning purposes only and is not included in the unit cost tables (Appendix D) nor CP fact sheets (Appendix A).

Capital Project Identification	Total Estimated Capital Project Implementation Cost[1]
A1-5-UIC – Pipe and Pre-treat Hamilton UIC Cluster	$540,600
A1-6-UIC – Pipe and Pre-treat Bushnell UIC Cluster	$197,400
A1-7-UIC Rain Garden Anderson UIC Cluster	$2,936,000
A1-8-UIC Rain Garden Escalante UIC Cluster	$537,700
A1-9-UIC – Pipe and Pre-treat Greenleaf UIC Cluster	$111,600
A1-10-UIC – Rain Garden Grove UIC Cluster	$537,700
A1-11-UIC – Rain Garden Exeter UIC Cluster	$404,400
A1-12-UIC – Rain Garden Brentwood UIC Cluster	$138,000
A1-13-UIC – Pipe and Pre-treat Korbel UIC Cluster	$140,400
A1-14-UIC – Rain Garden Howard UIC Cluster	$138,000
A1-15-UIC – South of Horn Lane Street-side Rain Gardens	$3,600,900
Subtotal:	**$41,243,600**
Flat Creek	
FC-1 - Flat Creek Flood Control at Calla Street	$13,400
FC-1-UIC – UIC Decommissioning Willowbrook 1 UIC Cluster	$404,400
FC-2-UIC – UIC Decommissioning Willowbrook 2 UIC Cluster	$135,300
FC-3-UIC – UIC Decommissioning Willowbrook 3 UIC Cluster	$937,400
FC-4-UIC – UIC Decommissioning Maesner UIC Cluster	$670,900
Subtotal:	**$2,161,400**
River Road Santa Clara	
RRSC-1 – River Road Santa Clara Streambank Stabilization	-
RRSC-2 – Water Quality Facilities for High Source Areas	-
RRSC-3 – River Road Santa Clara Outfall Stabilization	-
RRSC-4 – River Road Santa Clara Stream Corridor Acquisition	-
Subtotal:	-
Spring Creek	
SC-1 – Spring Creek Flood Control at Katy Lane	$18,000
SC-1-UIC – UIC Decommissioning Zinnia 1 UIC Cluster	$249,000
SC-2-UIC – UIC Decommissioning Zinnia 2 UIC Cluster	$263,400
SC-3-UIC – UIC Decommissioning Zinnia 3 UIC Cluster	$271,200
SC-4-UIC – UIC Decommissioning Countryside UIC Cluster	$436,000
SC-5-UIC – UIC Decommissioning Lodenquai UIC Cluster	$423,100
SC-6-UIC – UIC Decommissioning Byron UIC Cluster	$271,200
SC-7-UIC – UIC Decommissioning Stark UIC Cluster	$138,000
SC-8-UIC – UIC Decommissioning Castrey UIC Cluster	$271,200
SC-9-UIC – UIC Decommissioning Calumet UIC Cluster	$271,200
Subtotal:	**$2,612,300**
Willamette Overflow	
WO-1 – Willamette Overflow Flood Control East of Azalea Dr.	$145,600

Capital Project Identification	Total Estimated Capital Project Implementation Cost[1]
WO-2 – Willamette Overflow Flood Control East of Edgewood Dr.	$22,500
WO-3 – Willamette Overflow Flood Control East of Yvonne St.	$27,800
WO-4 – Willamette Overflow Open Channel Improvements	$521,200
WO-5 – Willamette Overflow Flood Control (Storage) at River Avenue	$15,630,200
WO-1-UIC – UIC Decommissioning Green UIC Cluster	$111,000
WO-2-UIC – UIC Decommissioning Corliss/Carolyn/Onyx UIC Cluster	$537,700
WO-3-UIC – UIC Decommissioning Autumn/Ross/Moore-Oak UIC Cluster	$1,337,100
WO-4-UIC – UIC Decommissioning Taz UIC Cluster	$124,500
WO-5-UIC – UIC Decommissioning Silver Meadows UIC Cluster	$404,400
WO-6-UIC – UIC Decommissioning Poplar UIC Cluster	$390,600
WO-7-UIC – UIC Decommissioning Kendra UIC Cluster	$75,600
WO-8-UIC – UIC Decommissioning Kent UIC Cluster	$397,000
WO-9-UIC – UIC Decommissioning Baywood UIC Cluster	$138,000
WO-10-UIC – UIC Decommissioning Greenwood UIC Cluster	$138,000
WO-11-UIC – UIC Decommissioning Warrington UIC Cluster	$138,000
Subtotal:	**$20,139,200**
TOTAL:	**$66,156,500**

Footnote to Summary of Strategy Implementation and Costs: Public outreach conducted in October 2009 included comments regarding the size and scope of the flood control capital projects based upon the basin planning modeling and recommended by the RR-SC Plan. The current model is the best fit based upon the best available information and professional engineering judgment, and is likely somewhat conservative for reasons notes in Section 3 as well as the degree of "informal" infiltration in the RR-SC basin. Resource and data limitations inherently limit the level of detail and resolution of the model, and further model refinement would not be appropriate in the absence of better data and additional resources to refine the model. The City and County believe that further refinement to the model based upon measured flow data would be beneficial to confirm capacity issues on the major system related to the larger capacity enhancement and storage CPs. Installation of a flow meter is planned in the RR-SC basin, and would realistically precede detailed design and implementation of these larger CPs.