City of Camas

Comprehensive Stormwater Drainage Plan

Submitted to:

City of Camas, Washington

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Abbreviations and Acronyms

303(d) List	An EPA-mandated listing of streams that do not meet water quality standards. It includes the contaminant type and source, stream segment length, and other information.
BMP	Best Management Practice: A Best Management Practice is an activity, device, or structure that serves as a means of reducing or eliminating the generation of pollution or the movement of pollution towards stream, rivers, and lakes.
CIP	Capital Improvement Project or Capital Improvement Plan
Collection and conveyance system	means the drainage facilities, both natural and man-made, which collect, contain, and provide for the flow of surface and stormwater to a receiving water or infiltration facility. The natural elements of the conveyance system include, but are not limited to, small drainage courses, streams, rivers, lakes, and wetlands. The human-made elements of the collection and conveyance system include, but are not limited to, gutters, inlets, ditches, pipes, channels, and retention/detention facilities.
CWA	Clean Water Act
DMA	Designated Management Agencies
Detention	To hold runoff in a basin (pond) for a short period of time, thereby delaying the introduction of its volume (quantity) of stormwater to the neighboring stream.
Ecology	Washington State Department of Ecology
EIA	Effective Impervious Area: Refers to impervious area that is directly connected to a collection system, as opposed to running across grass or some other type of pervious system before entering the collection system.
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESC Plan	Erosion and Sediment Control Plan

Abbreviations and Acronyms
Continued

Flood Control Facility	A detention, retention or other storage facility that reduces the flow rate of stormwater runoff and retains and releases storage volumes.
Flood Plain	The land bordering a stream subject to inundation when the stream is at flood stage.
Flow Control Exempt	Large water bodies shown in Appendix I-E of the 2012 Stormwater Management Manual for Western Washington are exempt from Minimum Requirement 7.
FTE	Full-time Equivalent Employee
Ground Water	The water under the surface of the earth that is found within the pore spaces and cracks between the particles of soil, sand, gravel and bedrock.
Hydraulic Connectivity	Similar to EIA, where runoff from impervious surfaces are directly connected to a collection system. Reducing Hydraulic connectivity refers to discharging stormwater to pervious areas rather than a collection system.
IDDE	Illicit Discharge and Detection Elimination Program
Illicit Discharges	Any discharge to a storm sewer that is not composed entirely of stormwater and is not allowed per the NPDES permit and C.M.C. 14.04
Injection Well	Means a "well" into which "fluids" are being injected.
LEED	Leadership in Energy and Environmental Design.
LID	Low Impact Development
MS4	Municipal Separate Storm Sewer System: The Municipal Separate Storm Sewer System is an EPA-mandated program that requires municipalities to initiate activities to reduce its quantity and improve its quality of stormwater.
NFIP	National Flood Insurance Program
NMFS	National Marine Fisheries Services
NOAA	National Oceanic and Atmospheric Administration

NPDES	National Pollutant Discharge Elimination System: A permit required from EPA for the discharge of stormwater into rivers, streams, and lakes. It is the permit that governs the activities under the MS4 program.
NRCS	Natural Resource Conservation Service
Non-Point Source	Water pollution that does not come from a specific pipe, but is derived from stormwater runoff and flows to streams, rivers, and lakes directly from adjacent properties.
NUGA	North Urban Growth Area
Non–Structural BMP	A BMP that does not include the use of a structural device, such as public education.
O & M	Operations and Maintenance
Point Source	Water pollution that is released from a specific pipe into a stream, river, or lake.
SDC	System Development Charges
SEPA	State Environmental Policy Act
SFHA	Special Flood Hazard Areas
SMMWW	The 2012 Stormwater Management Manual for Western Washington, prepared by the Washington State Department of Ecology.
Storm Sewer	A system of below-ground pipes that convey stormwater to its discharge point.
Stormwater	Stormwater is rainwater that accumulates on land as a result of storms and runoff from urban areas such as roads and roofs.
Structural BMP	A BMP that involves the use of a structure, such as a vegetated filter strip or catch basin with sump.
Surface Water	Surface water includes stormwater, and water in a stream, river, lake, wetland, or ocean.
SWMP	Stormwater Master Plan

Abbreviations and Acronyms
Continued

SWPPP	Stormwater Pollution Prevention Plan
TMDL	Total Maximum Daily Load: Total maximum daily load is a measurement of the maximum concentration of a specific contaminant possible in stream water without causing harm to the stream.
TSS	Total Suspended Solids
UIC	Underground Injection Control: means the Underground Injection Control program under Part C of the Safe Drinking Water Act, which regulates injection wells.
Waters of the State	Includes those waters as defined as "waters of the United States" in 40 CFR Subpart 122.2 within the geographic boundaries of Washington State and "waters of the State" as defined in Chapter 90.48 RCW, which includes lakes rivers, ponds, streams, inland waters, underground waters, salt waters, and all other surface waters and water courses within the jurisdiction of the State of Washington.
WLA	Wasteload Allocation
WQ	Water Quality

Section 1—Introduction

1.1 Introduction

As with many communities across the country, the City of Camas is facing the challenge of balancing growth and development with quality of life and environmental stewardship. Recent information regarding the impact of urban stormwater on the environment has prompted new regulations, including National Pollutant Discharge Elimination System (NPDES) permitting, Underground Injection Control (UIC) regulations, and the Endangered Species Act (ESA). These regulations have forced jurisdictions to fund ever-expanding stormwater programs. And, the implementation of water quality and flow control regulations finds jurisdictions with a need to manage and maintain an ever larger list of stormwater infrastructure components.

As with all utilities, stormwater infrastructure requires routine inspection and maintenance. Some pipelines in the downtown core are well over 70-years old, and repairs become more frequent to properly maintain these assets. Some stormwater facilities such as detention ponds and biofiltration swales have been in place for 20 years or more, and these facilities require routine maintenance and repairs such as re-grading and landscaping, fencing replacements, access road upkeep, or structural repairs.

The City's NPDES stormwater discharge permit with the Washington State Department of Ecology (Ecology) continues to consume more of the City's resources. Retrofit programs, monitoring, mapping, record-keeping and reporting, illicit discharge and detection, public education and outreach, and the myriad of other requirements takes more staff time and requires more capital projects to stay in compliance.

The current stormwater utility rate does not include a large capital. Financial Consulting Solutions Group (FCSG) conducted a rate study in 2009, and this study set the storm rate to recover the cost of basic operation and maintenance of the existing storm system and modest amounts for replacement of existing infrastructure. As part of the Fisher Basin Utility, some capital dollars have been available but that account has been depleted. To provide a secure long term capital fund, the FSCG study proposed implementation of a System Development Charge (SDC) with a methodology consistent with the current water and sewer SDC. The rate would capture both historical costs and future capital needs. Prior to considering an SDC the City is required to adopt a basis for the SDC.

For these reasons and others, the City proposes to develop a stormwater capital improvement program similar to those for their transportation, water, and wastewater systems. These well-established programs are used for developing, implementing, and funding projects necessary for the ongoing maintenance, repair, and upgrade of existing assets, and for the planning and construction of new facilities. This plan will provide the basis for the future capital component of a SDC.

Section 1—Introduction

Continued

This inaugural CIP provides a capital program list that can be used to plan and fund stormwater maintenance activities, retrofits, repairs, and new facilities to serve existing and new development. This list can be used to develop a six-year capital plan similar to other city infrastructure programs. The intent of this inaugural plan is to identify an initial list of maintenance and capital improvement projects necessary to adequately care for the city's stormwater infrastructure. This plan includes the following components:

- Section Two: A discussion of stormwater regulations that the city follows.
- Section Three: A discussion of the study area (City limits plus urban growth area) characteristics that influence stormwater management.
- Section Four: A discussion of future development potential and how the City's stormwater ordinance may be met with the future development.
- Section Five: A list of capital projects identified for correcting deficiencies with existing facilities or identifying future capital improvement needs.
- Section Six: A description of the City's stormwater funding through their stormwater utility. Future editions to this plan will include a plan to meet the City's ongoing funding needs for stormwater infrastructure.

1.2 Plan Goals

The City has initiated the development of a Capital Improvement Plan as part of their structured approach for implementing stormwater programs and projects, and maintaining the City's existing stormwater assets. This plan seeks to align itself with and ascribe to the goals of the City's mission statement:

> *The City of Camas commits to preserving its heritage, sustaining and enhancing a high quality of life for all its citizens and developing the community to meet the challenges of the future. We take pride in preserving a healthful environment while promoting economic growth. We encourage citizens to participate in government and community, assisting the city in its efforts to provide quality services consistent with their desires and needs.*

This mission statement describes the City's commitment to protecting the environment and quality of life for its citizens, while promoting economic development to maintain vitality in the urban area. With that in mind, the following goals have been developed for this stormwater capital program:

- Create a program for stormwater management that replicates capital programs for the City's other infrastructure systems and allows for capital program planning and funding.
- Develop a program that allows for adequate funding of stormwater projects that supports the City's transportation infrastructure program.

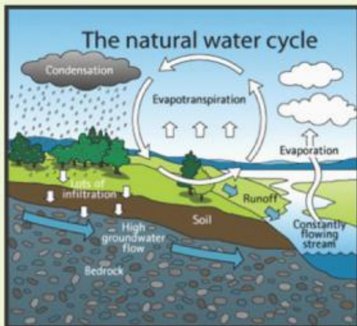
- Provide stormwater management in a way that is consistent with the City's mission statement in regard to environmental protection and economic development.

Figure 1-1 provides a discussion of stormwater runoff and how land use affects both the quantity and quality of the runoff. As this water is what feeds our creeks and streams, it has a direct affect on the quality of aquatic habitat. This discussion provides information on the framework from which stormwater management tools are developed.

The Importance of Stormwater Management

The Water Cycle

The earth's water continuously circulates between the atmosphere to the land in the forms of evapotranspiration (from earth to atmosphere) and rainfall where it becomes surface water and infiltrates into the soil to become groundwater. This is called the water cycle, or hydrologic cycle, and is key to understanding stormwater impacts.



In natural (undeveloped) conditions, rainfall infiltrates slowly into the ground. Natural biologic processes cleanse the water as it moves through vegetation and soil and into groundwater. Because most rainstorms are not large enough to fully saturate the soil, only a small percentage of rainwater flows over the surface as runoff. What does become runoff usually travels in a slow, meandering pace. Particles and sediments settle out along the way, ridding the water of impurities before it flows into rivers and streams.

The Effects of Development

Development drastically alters part of the natural water cycle. Impervious surfaces such as buildings and roads prevent rain from soaking into the ground. There is also less vegetation to soak up, store, and evaporate water. In addition, the natural soil structure is lost as a result of grading and compaction during construction. As a result, stormwater runoff greatly increases, flowing over land surfaces or through conveyance systems (such as pipes and ditches) into rivers and streams.

This alteration of the water cycle can have significant negative effects on surface water and groundwater, causing harm to fish and wildlife, drinking water supplies, property, recreation, and other beneficial uses.

- Increased runoff volume and speed may cause flooding and erosion and impairment of natural habitat in rivers and streams.
- Because less water infiltrates into the ground, less groundwater recharge may occur. This can reduce drinking water and irrigation supplies and may also reduce base flows in streams, which can be detrimental to fish and aquatic organisms.
- Developed surfaces retain heat, which increases runoff temperature during warm weather. This in turn may raise the temperature of the receiving waters, with potential negative impacts on aquatic life.
- Stormwater runoff picks up oil, fertilizers, pesticides, metals, chemicals, sediments, bacteria, debris, and other pollutants and may carry them into rivers and streams.

Mitigation through Stormwater Management

Stormwater management goals are intended to mitigate stormwater impacts created by typical development practices so new development and redevelopment maintain a better balance with the natural water cycle. This is achieved through the following approaches.

- Source control best management practices (BMPs) prevent stormwater from coming into contact with pollutants in the first place. Examples include sweeping instead of using water to clean an outdoor area and minimizing the use of chemicals for yard care. Source control BMPs are a cost-effective means of reducing pollutants in stormwater and should be a first consideration in all projects.

- Treatment BMPs reduce pollutant loads and concentrations in stormwater runoff through physical, biological, and chemical removal mechanisms. Examples include biofiltration, dispersion, constructed wetlands, and proprietary filter systems. These BMPs may accomplish significant levels of pollutant load reductions if properly designed and maintained.
- Flow control BMPs detain, retain, or infiltrate stormwater runoff to control the flow rate, frequency, duration, and volume of runoff leaving the site. Examples include detention ponds, infiltration systems, and constructed wetlands.
- Low impact development approaches emphasize capturing, treating, and infiltrating stormwater at the source. Techniques are used that mimic natural processes by allowing stormwater to slowly soak into the ground or filter through vegetation—for example, porous pavement, rain gardens, infiltration planters, and green roofs. Design and construction methods that preserve and take advantage of the site's natural features, such as open spaces, native vegetation, natural depressions, and wetlands are also considered LIDA. This approach provides multiple environmental, aesthetic, and cost benefits in addition to stormwater management.

Figure 1-1: The Importance of Stormwater Management (Courtesy of Clark County)

1.3 Previous Studies

The City has conducted stormwater studies to address specific problems or to provide master plans for specific areas. This Capital Improvement Plan includes a review of these past reports to identify opportunities for implementing projects developed with those studies. The key plans and studies are listed in Table 1.1.

Table 1.1: Past Stormwater and Drainage Studies		
Study Name (City Job No.)	**Date Published**	**Author**
Fisher Basin Sub-area Plan (S-253)	Early 1990's	Parametrix, Inc.
North Dwyer Creek Master Plan (S-370)	October 1998	David Evans and Associates
Technical Memorandum for Long-Term Assessment of North Dwyer Creek (S-370)	February 2001	David Evans and Associates
Fisher Basin Stormwater and Wetlands Master Plan, Phase 1 (S-370)	July 2001	David Evans and Associates
Lacamas Lake: Nutrient Loading and In-lake Conditions (NA)	April 2004	Clark County
Fisher Basin Hydrologic and Hydraulic Analysis (S-456)	October 2005	Maul, Foster, and Alongi
Monitoring Report Lacamas Lake Annual Date Summary for 2007(NA)	2007	Clark County

Section 1—Introduction

Continued

Section 2—Regulatory Environment

2.1 Introduction

The City of Camas is required to meet local, state and federal regulations applicable to its operations and activities. Environmental regulations that apply to the City are summarized in this section. While the primary focus of this CIP is stormwater, the impacted natural resources include surface waters and associated aquatic species and habitat as well as groundwater.

This section provides a description of each requirement with the majority of the narrative focusing on those regulations deemed to be the primary drivers that most influence City functions. Because it is a regulation that spans multiple environmental media, the State Environmental Policy Act (SEPA) is covered as an adjunct to other environmental regulations. Similar to SEPA, tribal input through the consultation and collaboration process spans multiple regulation and environmental media and is also an adjunct to the other listed regulations. Consequently, these two topics are treated separately and are discussed at the conclusion of this section.

2.2 The Clean Water Act (CWA)

The CWA is the primary federal law governing water pollution. The goal of the CWA is to eliminate releases of pollution into water and ensure that surface waters meet standards to protect fish, shellfish, wildlife and human health. Under the CWA, EPA has implemented pollution control programs including the National Pollutant Discharge Elimination System (NPDES) permit system which applies to industrial, municipal, and construction discharges to surface waters. In Washington State, EPA has delegated authority to administer the NDPES permit program to the Washington State Department of Ecology (Ecology). The NPDES Phase II Municipal Stormwater Permit applies to the City of Camas.

The CWA also regulates quality standards for surface waters and requires that water bodies not meeting standards be placed on the CWA section 303(d) list. Waters placed on the 303(d) list require the development of a water cleanup plan, also known as a Total Maximum Daily Load (TMDL). Following the issuance of a TMDL, NPDES permits are modified to include implementation of requirements to reduce pollutant loading.

The NPDES stormwater permit, standards, the 303(d) list and TMDLs and their applicability to the City are further described in the following sections.

Section 2—Regulatory Environment

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2.2.1 NPDES Permit Description and Applicability

Phase II NPDES Municipal Stormwater Permit

NPDES Phase II permits, first issued in 1999, requires regulated small Municipal Separate Storm Sewer Systems (MS4s) in urbanized areas, as well as small MS4s outside the urbanized areas that are designated by the permitting authority, to obtain NPDES permit coverage for their stormwater discharges. Small MS4s are jurisdictions or agencies with populations under 100,000 that are not regulated by a Phase I program.

Small MS4s outside of a UA are required to obtain an NPDES permit if it is serving a jurisdiction with a population of at least 10,000 and a population density of at least 1,000 people per square mile.

Each regulated MS4 is required to develop and implement a stormwater management program (SWMP) to reduce the contamination of stormwater runoff and prohibit illicit discharges.

An MS4 is a conveyance or system of conveyances that is:

- Owned by a state, city, town, village, or other public entity that discharges to waters of the U.S.;
- Designed or used to collect or convey stormwater (including storm drains, pipes, ditches, etc.);
- Not a combined sewer; and
- Not part of a Publicly Owned Treatment Works (sewage treatment plant).

NPDES Permit terms run for five years. The current Municipal permit was issued January 17, 2007, went into effect on February 16, 2007, was modified on June 12, 2009, and expired on February 15, 2012. A draft permit for the next permit term is currently undergoing review, and Ecology has extended coverage for the existing permit until the new permit is reissued.

Implementing the City's NPDES permit requires a Comprehensive Stormwater Management Program that includes:

- Mapping stormwater systems
- Educating employees and the public
- Detecting and eliminating illicit discharges
- Controlling stormwater runoff from new development, redevelopment and construction

- An operations and maintenance program
- Annual reporting

NPDES Stormwater Permit – Construction General

The NPDES Construction Stormwater General Permit was originally issued in 1995 and regulated sites with greater than five acres of disturbance. It was re-issued by Ecology November 16, 2005, where coverage changed from 5 acres down to one acre and reissued again on December 10, 2010.

In general, the permit regulates clearing, grading and/or excavation that results in the disturbance of one acre or more for sites that discharge stormwater to surface waters of the state. In some cases, smaller sites may be subject to the permit if Ecology determines the site to be a significant contributor of pollutants or expects discharges from the site could reasonably cause a violation of water quality standards.

The requirements of the Construction General Permit include:

- Compliance with applicable state water quality and sediment management standards
- Monitoring Requirements
- Reporting and Recordkeeping
- Solid and Liquid Waste Disposal
- Additional Restrictions for Discharges to 303(d) listed or TMDL Water bodies
- Stormwater Pollution Prevention Plan (SWPPP)

The permit requires monitoring for turbidity and in certain cases for pH. When benchmark values for these constituents are exceeded, the SWPPP must be revised as needed, source control and treatment BMPs must be implemented, and all activities documented in the site log book. In addition, Ecology must be notified by phone and daily sampling continued until constituent levels are reduced to acceptable levels. Any discharges to TMDL or 303(d)-listed waters that exceed numerical effluent limits for turbidity and pH constitute a violation of the permit.

The Construction Permit applies to:

- land disturbing operations that disturb one or more acres, or
- Sites that are part of a larger common plan of development or sale that disturb less than one acre of total land area if the larger common plan will ultimately disturb one or more acres.

Section 2—Regulatory Environment

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2.2.2 303(d) List and TMDLs

303(d) List

Under Section 303(d) of the CWA, states are required to prepare a list of surface waters where beneficial uses have been impaired. These beneficial uses include industrial use, aquatic habitat, drinking water, and recreation. In Washington State, Ecology conducts biennial water quality assessments to determine whether surface waters are meeting state surface water quality standards. Ecology's assessment of which surface waters are placed on the 303(d) list is guided by federal laws, state water quality standards, and the Policy on the Washington State Water Quality Assessment. This water quality policy describes how the standards are applied, requirements for the data used, and how to prioritize TMDLs. The goal of the policy is to provide a guide for selecting which surface water is impaired by pollutants and how severely.

The 303(d) List represents polluted waters that require the development of a water quality improvement project or TMDL. A TMDL is the amount of pollutant loading that a given water body can receive and still meet water quality standards established to protect beneficial uses.

The Environmental Protection Agency (EPA) approved Washington's current water quality assessment and 303(d) list on January 29, 2009. In Camas, the water bodies and constituents include the following:

- Lacamas Creek (dissolved oxygen, temperature, bacteria and pH)
- Lacamas Lake (total phosphorous)
- Washougal River (fecal coliform)
- Dwyer Creek (dissolved oxygen)
- Lower Columbia River (temperature, total dissolved gas, dioxin)

Ecology expects to submit a new Freshwater Assessment and 303(d) list to the EPA for approval during the winter of 2012-2013.

TMDLs

Currently, the City has not been identified as a party with implementation responsibilities under any existing TMDLs. A new TMDL is currently under development by Ecology associated with the listings for Lacamas Creek on the current 303(d) List. Ecology's TMDL prioritization and scheduling process is a five-step, five-year process that includes public notice, public involvement, scoping, data collection and analysis, action plan development and implementation. Implementation requirements are included in NPDES waste discharge permits when issued or through permit modifications.

Under RCW 90.48 – Water Pollution Control, and in the absence of an established TMDL, Ecology has the authority to condition the Construction Stormwater General Permit with additional requirements to control discharge of pollutants to impaired water bodies listed on the 303(d) list.

2.3 The Safe Drinking Water Act (SDWA)

The SDWA is the primary federal law governing protection of drinking water and applies to all public water systems. Under the SDWA, the EPA has established National Primary Drinking Water Regulations that set standards for maximum contaminant levels to ensure drinking water quality. The SDWA also authorizes the EPA to regulate injection wells to protect underground drinking water supplies.

2.3.1 Underground Injection Control (UIC) Rule

To satisfy the intent and requirements of the SDWA and the Washington State Water Pollution Control Act, chapter 90.48 RCW, the Washington State Legislature adopted the UIC Program, chapter 173-218 WAC. Under this program UICs used for stormwater discharge and/or treatment are considered Class V UICs.

Class V injection wells are usually shallow injection wells that inject fluids above the uppermost groundwater aquifer. Some examples include dry wells, french drains used to manage stormwater, and drain fields. Examples of Class V injection wells that are allowed in Washington, and relate to stormwater, include drywells and infiltration trenches used to drain stormwater runoff into the ground surface.

All Class V injection wells must be registered with Ecology, except wells receiving residential roof runoff from a single family home or to control basement flooding at single family homes (including duplexes). These wells are exempt from the registration requirements.

To provide clarification on which stormwater infiltration techniques meet the Class V well definition, the Department of Ecology's UIC website includes a memorandum from the EPA which identifies specific infiltration practices/technologies and discusses whether or not they are constitute a Class V well (Boornazian, & Heare, 2008). The guidance information provided in the EPA memorandum is summarized in Table 2.1.

Table 2.1: Class V Well Identification Guide From EPA	
Infiltration Practice/Technology	**Considered a Class V Well?**
Rain Gardens & Bioretention Facilities	No.
Vegetated Swales	No.
Pocket Wetlands & Stormwater Wetlands	No.
Vegetated Landscaping	No.
Vegetated Buffers	No.
Tree Boxes & Planter Boxes	No.
Permeable Pavement	No.
Reforestation	No.
Downspout Disconnection	No – typically these are downspouts are redirected from sewers to permeable surfaces where runoff can infiltrate.
Infiltration Trenches	Yes – when they include an assemblage of perforated pipes, or are deeper than their widest surface dimension.
Commercially Manufactured Stormwater Infiltration Devices	Yes.- typically these constitute a subsurface fluid distribution system.
Drywells, Seepage Pits, Improved Sinkholes	Yes – typically these are deeper than their widest surface dimension.

The governing EPA criteria used to make the determinations in Table 2.1 includes:

- A Class V has a sub-surface distribution system
- A Class V well is a hole that is deeper than its widest surface dimension

If either one of these criteria apply to a particular stormwater infiltration practice or technology, then it would be considered a Class V well and would be subject to UIC regulations.

The following summary from Ecology's December 2006 *Guidance for UIC Wells that Manage Stormwater* speaks to the requirements for existing UIC wells and requirements for municipalities with NPDES stormwater permits.

Existing UIC Wells

UIC wells constructed before February 3, 2006 are considered by Ecology to be "existing" wells and have different requirements than wells constructed after.

Existing UIC wells must be registered with Ecology, except for wells receiving residential roof runoff from a single family home or to control basement flooding at single family homes (including duplexes).

An assessment of existing wells must be completed to determine if the existing UIC wells are a high threat to ground water. UIC wells that are high threat to ground water must be retrofitted to protect ground water quality.

New UIC Wells

UIC wells constructed after February 3, 2006 are considered by Ecology to be "new" wells and must meet Ecology's Non-endangerment standard. This can be done through the presumptive approach (following the guidelines in Ecology 2006, or through the demonstrative approach, where evidence is provided that the non-endangerment standard is met.

Requirements for Municipalities with NPDES Stormwater Permits

Municipalities that are under an NPDES stormwater permit may also have stormwater discharges to UIC wells. The Stormwater Management Program required by the NPDES stormwater permit includes best management practices that also may be applied to stormwater discharges to UIC wells. To avoid duplication, municipalities that are under an NPDES stormwater permit may meet UIC program requirements by applying their Stormwater Management Program to areas served by UIC wells. See Chapter 173-218-090(2) WAC.

Since the NPDES permit does not fulfill all the requirements of the UIC Program, the following must be added to the Stormwater Management Program (SWMP) and implemented:

- UIC wells must be registered
- New UIC wells must be constructed according to the specifications in this guidance
- A well assessment must be completed for all existing UIC wells
- Existing UIC wells that are determined to be a high threat to ground water must be retrofitted

More information on these procedures can be found in Ecology (2006).

Section 2—Regulatory Environment

Continued

2.4 Endangered Species Act (ESA)

The purpose of the federal ESA is to protect species and the ecosystems upon which they depend. Two primary goals of the ESA are to prevent the extinction of endangered plant and animal life and their critical habitats, and to pursue survival and recovery of these populations. It is administered by two agencies, the U.S. Fish and Wildlife (USFWS) (freshwater fish and all other species) and the National Oceanic and Atmospheric Administration (NOAA) (marine species). The ESA prohibits any "take" of species listed as endangered. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect. In 1999, 12 groups of Pacific Northwest salmon and several populations of bull trout were listed as threatened or endangered under the ESA, and in July 2000, NOAA NMFS adopted a rule governing the "take" of 14 groups of salmon and steelhead listed as threatened under the ESA.

Salmon Recovery

The ESA and Washington State law require development of plans to recover salmon. The Governor's Salmon Recovery Office was established by the Legislature to coordinate a statewide salmon recovery strategy.

The Lower Columbia Fish Recovery Board (LCFRB) is charged with coordinating salmon recovery in the lower Columbia River basin, including Camas. They have developed and documented a plan to support salmon recovery for Willamette/Lower Columbia River Evolutionary Significant Units (ESU) in Washington.

The City of Camas, along with other members of the Planning Unit, unanimously approved the plan developed by the LCFRB on December 13, 2004. The Watershed Management Plan was adopted by the parent counties of Clark, Cowlitz and Skamania counties on July 21, 2006. Detailed implementation planning was completed in June of 2008. Each implementing entity documents its commitment and approach to implementing specific actions in its Six-Year Implementation Work Schedule that addresses recovery plan and watershed plan actions. Camas is currently implementing actions and tracking its activities in a web-based data system called Salmon PORT accessed from the LCFRB website.

2.5 City of Camas Municipal Code Requirements

There are currently five sections of the City of Camas Municipal Code (CMC) that pertain to stormwater management and pollution prevention: Stormwater Drainage Utility, CMC 13.88; Stormwater Utility Service Charges, CMC 13.89; Stormwater Control, CMC 14.02; Illicit Discharge, Dumping and Illicit Connections, CMC 14.04; and Erosion and Sediment Control, CMC 14.06. These ordinances are discussed in detail below.

CMC Chapter 14.02 – Stormwater Control

This chapter applies to new development and redevelopment and includes requirements that address the following topics:

- Reducing and preventing stormwater pollution during construction
- Reducing the introduction of pollutants into surface water runoff
- Installing flow control and/or stormwater treatment facilities, depending on size and the character of the project, and implementing low impact development practices

This chapter also sets minimum standards consistent with Ecology's Stormwater Management Manual for Western Washington as modified by the City's Stormwater Design Standards Manual.

CMC 14.04 Illicit Discharges, Dumping and Illicit Connections

This chapter applies to all new and existing development, public and private. It defines prohibited, allowable, and conditional discharges to the municipal storm drain system, and/or surface and ground waters. It further prohibits illicit connections to the municipal storm drain system.

CMC 14.06 Erosion and Sediment Control

This chapter applies to any person undertaking any land-disturbing activity, with the exception of small parcel development which is regulated under the small parcel requirements of Chapter 3.03 of the City's Stormwater Design Standards Manual. Requirements include the development and implementation of an Erosion Prevention and Sediment Control Plan as well as the development and implementation of a Stormwater Pollution Prevention Plan for sites one acre or larger meeting certain criteria. Best management practices must be applied to the site and be maintained to prevent sediment from leaving the site.

CMC 13.88 Stormwater Drainage Utility/CMC 13.89 Stormwater Utility Services Charges

These chapters define the creation of the city-wide stormwater drainage utility, the creation of the stormwater drainage utility fund, and the rate structure and fee charged for the stormwater utility. See Section 6 for more information.

2.6 Growth Management Act (GMA)

The Washington State GMA was adopted in 1990 in response to concerns about unplanned and uncoordinated growth posing threats to the environment, sustainable economic development, and the quality of life in the state. The GMA requires state and local government to manage the state's growth by identifying and protecting critical areas and natural resource lands, designating urban growth areas, preparing comprehensive plans and implementing them through capital investment and development regulations.

Critical Areas Ordinances

The GMA identified five critical areas that each city and county in Washington State must identify, designate and protect:

- Wetlands (CMC 16.53)
- Areas with critical recharging effect on aquifers used for potable water(CMC 16.55)
- Frequently flooded areas(CMC 16.57)
- Geologically hazardous areas(CMC 16.59)
- Fish and wildlife habitat conservation areas(CMC 16.61)

Approaches to critical areas protection can incorporate both regulatory and non-regulatory methods and involve a spectrum of strategies. These range from conservation policies, designation of open space and regulation of land uses that may impact critical areas. The City's activities are subject to the City's Critical Areas Ordinance's including those regulations that relate to habitat conservation and restoration.

2.7 Shoreline Management Act (SMA)

The Washington State SMA applies to the "shorelines" of Washington, which are defined as marine waters, most lakes, streams, rivers, shorelands, wetlands and floodplains. It also designates "shorelines of statewide significance" including all waters of Puget Sound and certain Puget Sound shorelines. The Act is administered by the Department of Ecology and addresses three basic policy areas: shoreline use, environmental protection and public access.

Under the SMA, all cities and counties with "shorelines" must develop and adopt a Shoreline Master Program (SMP), which according to Ecology is "essentially a shoreline-specific combined comprehensive plan, zoning ordinance, and development permit system." The City's activities, as applicable, are subject to the Camas SMP, including those that relate to habitat conservation and restoration.

2.8 State Environmental Policy Act (SEPA)

The SEPA provides a process for identifying and evaluating possible environmental impacts that may result from governmental decisions and conditioning proposals when adverse impacts are anticipated. The SEPA process applies to state and local agency decisions that relate to projects, such as private development projects or construction of public facilities, or non-projects, such as adopting regulations, policies or plans.

Proposals are reviewed by the "lead" agency (state, city or county) based on information provided by the applicant, and environmental impacts are evaluated and documented in the areas of earth, air, water, plants, animals, energy, environment health, land use, transportation, public services and utilities. Following the review and evaluation, the lead agency will either issue a Determination of Non-significance (DNS), a Mitigated Determination of Non-significance (MDNS), or require the preparation of an Environmental Impact Statement (EIS). The DNS, MDNS and EIS can impose conditions on the proposal to address environmental impacts identified in the review and evaluation. These are tools used by the lead agency to provide information to all agencies that must approve the proposal. Proposals are rarely denied unless an EIS identifies likely significant environmental impact that cannot be mitigated to within acceptable limits.

2.9 Tribal Consultation and Collaboration

Pursuant to Federal Executive Order 13175 issued on November 6, 2000, executive departments and agencies of the federal government were charged with engaging in regular and meaningful consultation and collaboration with tribal officials in the development of federal policies that have tribal implications. The EPA's Region 10 Tribal Consultation Framework defines consultation to mean "respectful, meaningful, and effective two-way communication that works toward a consensus reflecting the concerns of the affected federally recognized tribe(s) before making decisions or taking action.

In Washington State, the Centennial Accord was executed on April 4, 1989, slightly ahead of the federal Executive Order. The Accord between the State of Washington and the federally recognized Indian tribes of Washington "encourages and provides the foundation and framework for specific agreements among the parties outlining specific tasks to address or resolve specific issues." Under the Ecology Centennial Accord Implementation Plan, "Ecology is committed to government consultation with tribes on all actions and issues of interest to tribes under Ecology's statutory authority."

At the local level, the City of Camas provides opportunities for tribal input through the SEPA and archaeological review process.

Section 2—Regulatory Environment

Continued

Section 3—Study Area Characteristics

3.1 Introduction

This section describes the study area for this plan and the current and planned zoning for areas within the study area. It also discusses the physical characteristics that influence stormwater management, such as climate, topography, and soil types. Lastly, this section discusses characteristics of the existing storm drainage system.

3.2 Study Area

The study area for this Comprehensive Stormwater Drainage Plan includes the Camas city limits and its current urban growth area.

Camas's Urban Growth Area encompasses the City limits plus areas north and west of the City that will be annexed for future expansion. The current City limits consist of approximately 9,717 acres, while the unincorporated areas of the UGA are approximately 2,110 acres

The city limits and urban growth area are shown in Figure 3-1.

3.3 Land Use and Zoning

How land is developed can affect both the amount of runoff generated from a project and the quality of the stormwater as it leaves the site. Commercial and industrial areas tend to create more impervious area than residential sites. Depending upon the exact use type, industrial areas potentially generate more pollutants in runoff than residential areas and may require a different type of treatment. Therefore, understanding land use can help determine what regulatory and management measures should take place within a basin.

Camas currently has 36 different zoning categories. These different categories have been summarized into more general land types as shown in Table 3.1.

Table 3.1: Camas Land Use Zoning

Project Zoning Category	City Zoning Classification
Single-Family Residential	R-5, R-6, R-7.5, R-10, R-12, R-15, R-20, R1-6, R1-10, R1-20
Multifamily Residential	R-12, R-18, MR-10, MF-24
Commercial	BP, CC, DC, GC, NC, OC, RC, CH, CV, MX, RGX,
Industrial	HI, LI, LI/BP, ML, A

Table 3.1: Camas Land Use Zoning	
Project Zoning Category	City Zoning Classification
Agriculture	AG-20
Special Districts	P/OS, P/WL, FR-40

These areas are shown in Figure 3-2. The special districts within the City of Camas consist of parks and open space.

3.4 Physical Characteristics

The analysis and management of stormwater is influenced by physical characteristics of the watershed, such as precipitation amounts, soil types, level and type of development, and topography. This section provides a description of these and other characteristics that influence stormwater management.

3.4.1 Climate

The City receives an average of 51 inches of rain per year according to the National Oceanic and Atmospheric Administration data. December is historically the wettest month, and July the driest, with normal precipitation varying from 0.5 to 6.5 inches per month.

The average annual temperature is about 53 degrees Fahrenheit (°F), with a summer time average of 65 °F and a winter average of 40 °F.

3.4.2 Topography

The City of Camas is characterized by varied topography including the flatter areas downtown on the banks of the Columbia, the ridge of Prune Hill running east-west through the City just north of downtown, the low lands of Grass Valley northwest of Prune Hill, and the valleys and hills surrounding Lacamas Lake, including the North Urban Growth Area (NUGA) on the northeast side of the lake.

The elevation within the City ranges from about 20 feet above sea level along the shores of the Columbia and Washougal Rivers, to approximately 750 feet at the top of Prune Hill. Much of the development is centered on the downtown area, on Prune Hill where the slopes allow, and along the southwestern shore of Lacamas Lake. Currently, the top and bottom of Lacamas Lake, along with much of the northeastern shore, is forested. Grass Valley is a patchwork of homes, businesses, open grassland, and stands of trees.

Figure 3-3 shows contour elevations for the City.

3.4.3 Soils

The type of soil - granular, sandy, clayey, etc. has a strong influence on stormwater management, mostly in the determination of whether stormwater can be infiltrated or whether it needs to be detained and conveyed to a surface water body.

The majority of the soils within the City are classified by the Natural Resource Conservation Service (NRCS) as Hesson, Powell, Olympic Lauren, and Dollar. These soils are mostly poorly drained and consist of medium to moderately fine textured terrace soil. Figure 3-4 shows a map of the soil types in the city, as mapped by the NRCS.

Except for isolated pockets and areas of Hillsboro soils in the west part of the city, soil conditions are generally not favorable for infiltration of stormwater. For this reason most developments built since flow control has been required use detention systems and do not infiltrate stormwater. However, as most soils have some infiltration capacity, the City's stormwater ordinance (CMC 14.02) requires testing for infiltration and the use of infiltration where possible. Even if detention is necessary, infiltration through the detention pond will affect the size of the facility.

3.4.4 Geologic Hazard Areas

There are approximately 891 acres within the City that are classified as steep and unstable slopes. The southern slope of Prune Hill is either historically or potentially unstable. Slopes along the drainage ways coming down Prune Hill, to the north and east, are also potentially unstable. The hill slopes in the natural area draining to Lacamas Creek are also active and potentially unstable. Figure 3-5 maps known and potentially unstable slopes as noted in the City's Geographic Information System (GIS).

3.4.5 Flood Hazard Areas

Flood hazard areas are areas adjacent to lakes, rivers, and streams that are prone to flooding during peak runoff periods. Construction of buildings and other development in these areas is regulated in accordance with the City's floodplain ordinance. Figure 3-5 shows mapped floodplains in the Camas area.

3.4.6 Wetlands

Wetlands are defined by the EPA as areas that are inundated by surface or ground water at a frequency and duration sufficient to support vegetation adapted for saturated conditions. Wetlands support valuable and complex ecosystems and development is severely restricted, if not prohibited, in most wetlands.

Section 404 of the Clean Water Act regulates discharge of materials to wetlands and a permit from the Army Corps of Engineers is required for most activities that potentially impact wetlands. Wetlands within the City of Camas are generally adjacent to the Columbia River and Lacamas Lake and in the low flat lands of Grass Valley on the west side. Figure 3-5 shows wetlands as listed in the City's GIS.

3.4.7 Surface waters

Major water features within the City include the Columbia River, the Washougal River, Lacamas Lake, Lacamas Creek, Fallen Leaf Lake, and Round Lake.

The Columbia River begins in Canada, enters the United States in northeastern Washington, and travels southwest through Washington to the Pacific Ocean. The river exits the Columbia River Gorge shortly before it travels past downtown Camas.

The Washougal River flows southwest from the Cascade Mountains to the City of Camas, where it empties into the Columbia River.

Upper Lacamas Creek (above Lacamas Lake) receives flow from 5 tributaries, only one of which is within the city limits (Dwyer Creek). The other tributaries - China Ditch, Matney Creek, Shanghai Creek, and Fifth Plain Creek - enter Lacamas Creek in rural Clark County.

Lacamas Lake is a 2.4 mile long lake that receives runoff from the surrounding hills and flow from Lacamas Creek. It is connected to Round Lake by a channel that runs under State Route 500. The water level in Round Lake is controlled by a dam at the south end of the lake, which is run by Georgia Pacific Consumer Products LLC. Lacamas Lake has significant algal growth in the summer time, which can impair the water quality.

Lower Lacamas Creek, below Round Lake, travels down a steep slope and over waterfalls to its confluence with the Washougal River.

Numerous streams and creeks discharge from Prune Hill, including Blue Creek and Forest Home Creek on the south side, and Dwyer Creek on the north side. The Fisher Swale follows the west limits of the city as it heads south to the Columbia River. See Figure 3-6 for the location of these creeks.

3.5 Existing Storm Drainage System

The City owns and maintains a stormwater conveyance system that drains approximately 7,500 acres. This storm system includes approximately 75 miles of stormwater conveyance pipe and 1,800 stormwater inlets and catch basins. It also includes numerous culverts and drainage channels. All storm pipelines are separate from the City's sanitary sewer system.

The City has a long standing policy of requiring commercial and residential stormwater facilities to be privately owned and maintained. As part of its March 2010 stormwater code update the City retained this policy and codified it under CMC 14.02.200 Ownership and Maintenance.

The City estimates that there are 110 private stormwater facilities within its boundaries. Private facility maintenance inspection occurs primarily on a complaint-driven basis. However, the city's current NPDES permit requires that all private stormwater facilities built after February 2010 be inspected yearly by the City. The City is now responsible for annual inspections of private stormwater facilities and for ensuring that property owners maintain their facilities.

At the time of this report the City owns and maintains approximately 25 facilities, including underground treatment vaults, detention ponds, biofiltration swales, and wet ponds, drainage ditches, and culverts. A list of these facilities is included in Appendix A. It is important to note that 23 of the 25 facilities on this list were constructed before February 2010 and are therefore not subject to the NPDES inspection requirements in the city's current NPDES permit.

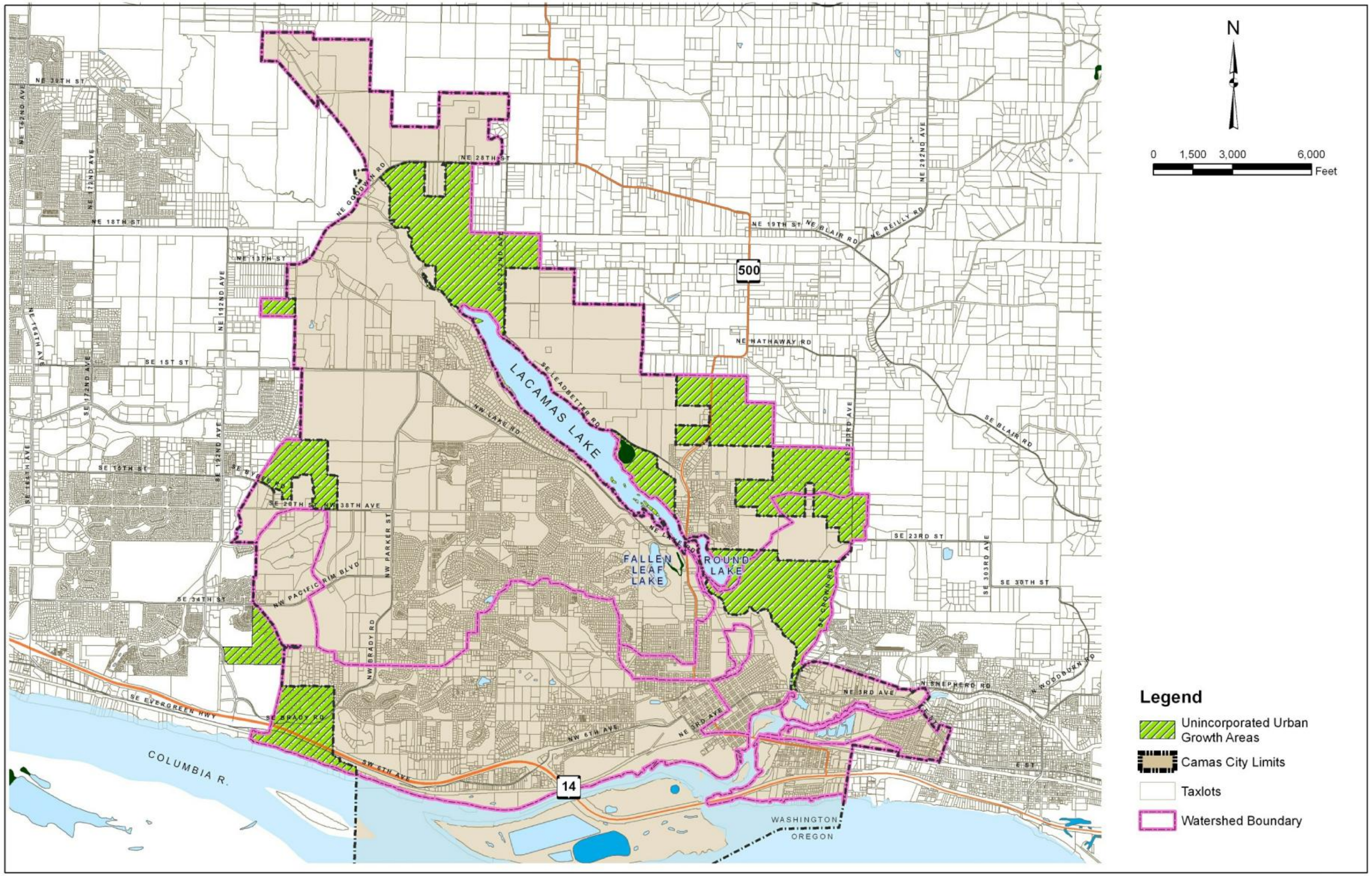

Figure 3-1: City Limits and UGA Boundaries

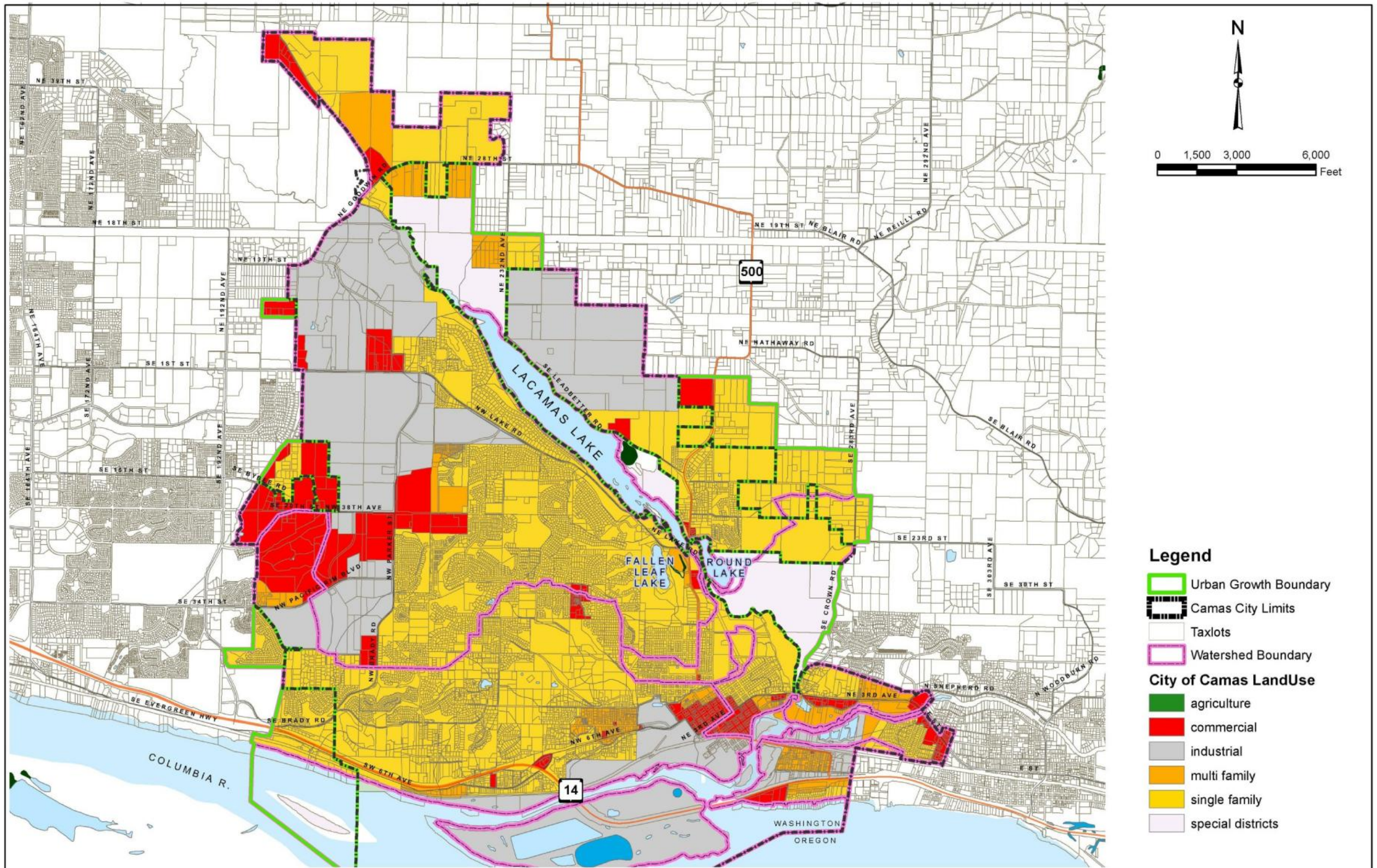

Figure 3-2: Current City Zoning

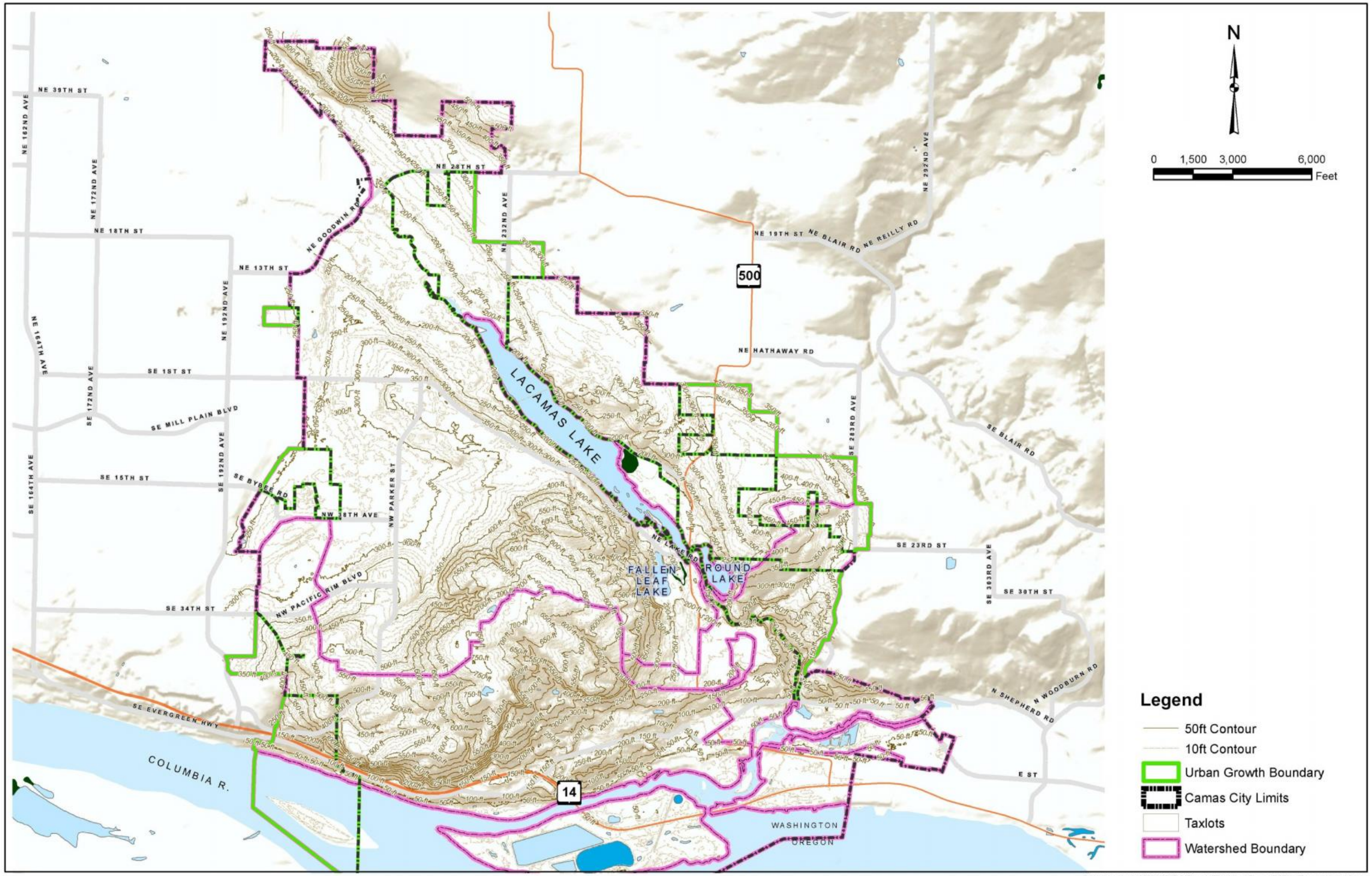

Figure 3-3: City Contour Map

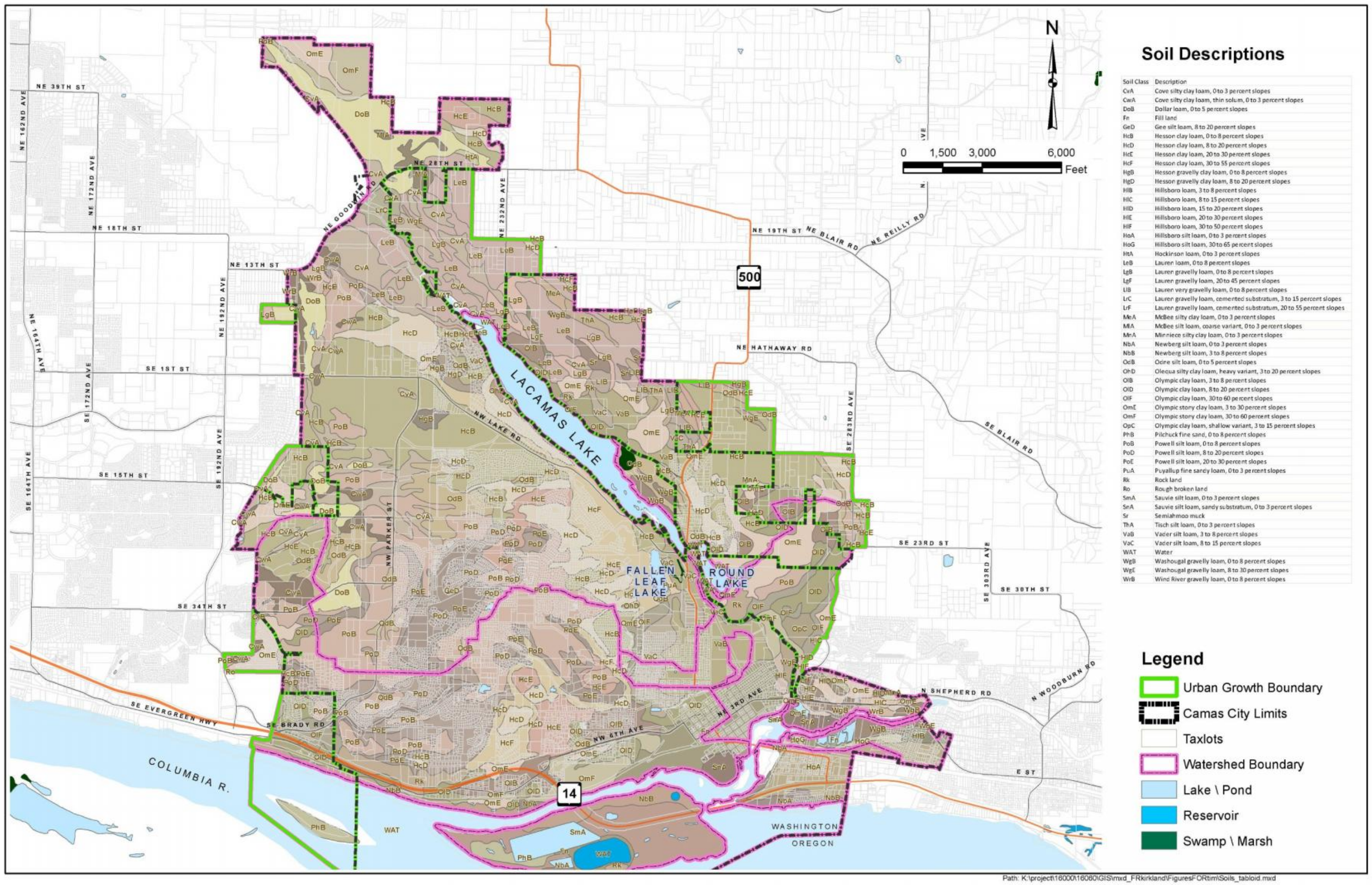

Figure 3-4: NRCS Soil Categories

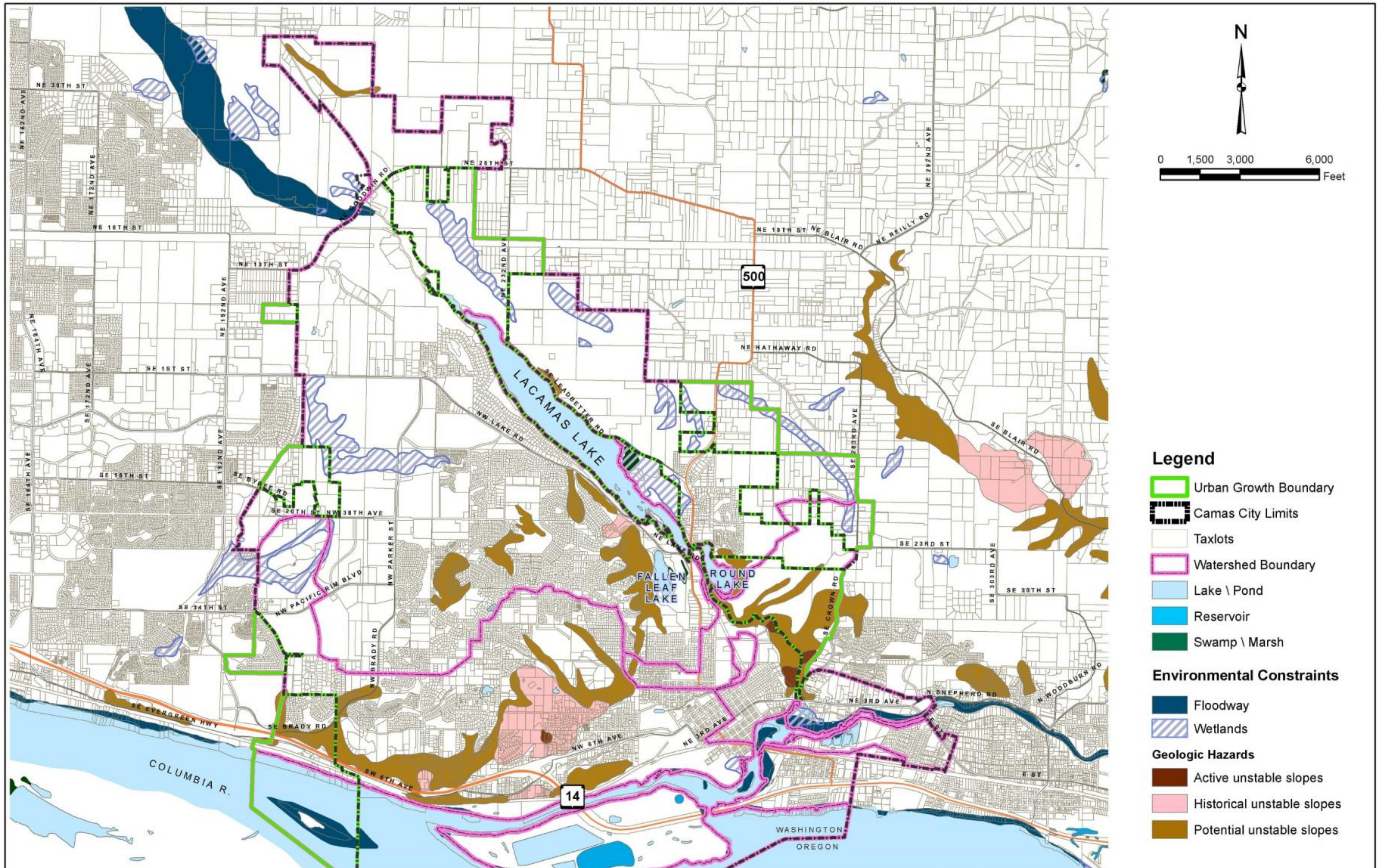

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Figure 3-5: Environmental Constraints and Unstable Slopes

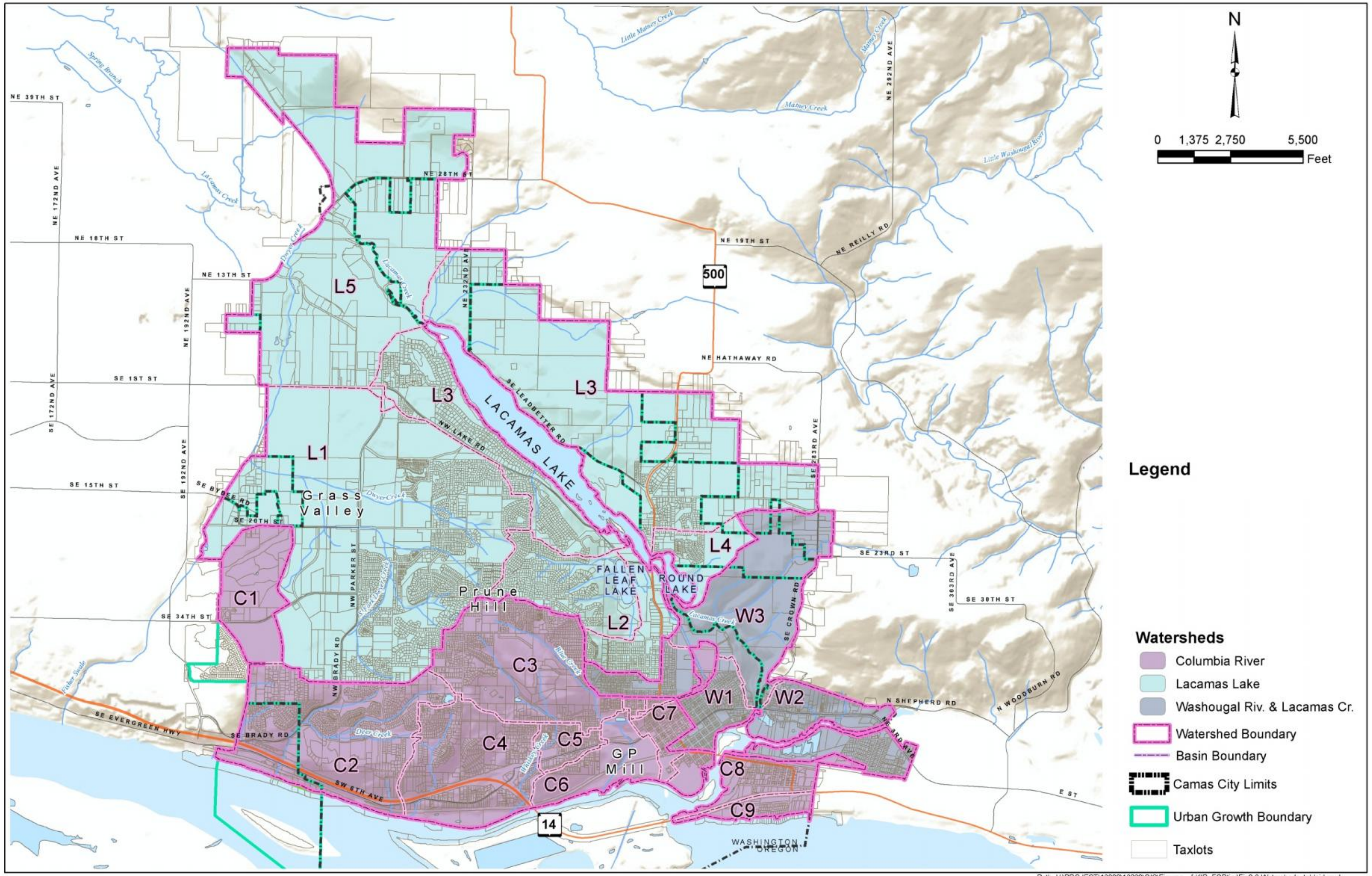

Figure 3-6: Watersheds and Basin Boundaries

Section 4—Study Area Watersheds

4.1 Introduction

The study area includes three major watersheds: Columbia River, the Washougal River, and Lacamas Lake. All surface water and piped stormwater conveyance systems drain to one of these water bodies through a network of interconnected drainage channels, creeks and storm pipes.

Previous studies have divided the City's watersheds into separate watersheds and basins. Table 4.1 lists the basins within each watershed and Figures 4-1 - 4-3 shows each watershed and basin.

Table 4.1: Camas Watersheds and Basins

Watershed	Basin	Area (AC)
Columbia	Fisher (C1)	340
	Brady Creek (C2)	687
	Blue Creek (C3)	593
	SW 6th (C4)	462
	Forest Home (C5)	76
	GP Mill (C6)	775
	Downtown (C7)	87
	Oak Park (C8)	137
	River Walk (C9)	66
Lacamas Lake	Dwyer Creek (L1)	2016
	Fallen Leaf (L2)	309
	Frontage (L3)	1822
	Round Lake (L4)	320
	Upper Lacamas (L5)	1463
Washougal	Downtown (W1)	151
	Frontage (W2)	360
	Lower Lacamas (W3)	522

The characteristics of each watershed that influence stormwater management are presented in this section. This includes soil types, geological hazards, steep slopes, current land use and future development potential. This section discusses existing stormwater systems within each watershed, and it also lists the number of outfall pipes larger than 24-inches, as these outfalls are regulated under the City's NPDES Stormwater permit.

Ecology's Stormwater Management Manual for Western Washington (SMMWW) and Camas's Stormwater ordinance requires water quality treatment and control of flows over pre-European conditions to be provided for all development activities that generate 5,000 square feet or more of impervious surface. The SMMWW emphasizes infiltration and low impact over traditional flow detention facilities. The use of these measures is influenced by land use and soil characteristics, along with how steep the slopes are and whether there are geological hazards. This section discusses stormwater management options with these factors in mind.

Stormwater Management strategies are designed to meet the city's goals and objectives, as described in Section One. The key strategy relating to stormwater is to support economic development while protecting the environment.

4.2 Columbia River Watershed

Watershed Boundaries

The Columbia River marks the southern boundary of the City. Although all runoff in the City eventually makes it to the Columbia River, this watershed as defined within the study area just includes areas that either drains directly to the river through manmade conveyance pipes, or areas that drain through small streams to the river. The limits of the Columbia River watershed, along with individual basin boundaries within the watershed, are shown in Figure 4-1.

This watershed lies primarily between Prune Hill and the Columbia River, extending to the City's east and west boundaries. This watershed includes a portion of downtown Camas, the Georgia-Pacific paper mill, and the neighborhoods west and northwest of downtown, including the southern slopes of Prune Hill. One area, Basin C1 (See Figure 4-1), lies on the west edge of the City northwest of Prune Hill. This area drains to the Columbia River through the Fisher Swale.

Soil Characteristics

NRCS mapped soil types in this watershed consist mostly of Powell, Hesson, Olympic, and Cove soils, with some pockets of Vador and Sauvie soils (see Figure 3-4). All of these soils have moderate to slow infiltration rates, and as such infiltration of stormwater throughout this area is very limited.

Current Stormwater Systems

The portion of the watershed encompassing downtown Camas (Basin C7) is primarily drained through manmade conveyance systems to the Columbia Runoff in these basins is discharged through small creeks and conveyance systems to the Columbia River. Since the development of these areas predates water quality regulations there are currently no water quality facilities.

Basin C6 encompasses the Georgia-Pacific paper mill. Blue Creek is piped under the mill site to the Columbia River, conveying stormwater from Basin C3. The mill has an industrial NPDES permit from Ecology that has its own requirements for discharges from the mill to the Columbia River.

Runoff from Basins C2-C5 is conveyed by small streams to the Columbia River.

Basin C1 drains west to the Fisher Swale. This swale runs south to the Columbia River (see Figure 4-1).

Current/Future Land Use Characteristics

Downtown is the traditional center of Camas and is the oldest and most developed part of town. It is a mix of commercial, light industrial, and some housing. As this area is densely developed, any future development activities would consist primarily of redeveloping existing properties or developing infill parcels.

The slopes of Prune Hill are zoned exclusively for single family residential development. Steep slopes and historically unstable areas may limit new development along the hill slopes.

The areas north and west of downtown, below Prune Hill (Basins C2, C3, C4, and C5), are more sparsely developed, and property improvements would consist mostly of infill and redevelopment. Drainage from these areas is conveyed to the Columbia River through Forest Home Creek and Blue Creek (which is piped through the George-Pacific paper mill site to the river).

Basin C1 (See Figure 4-1) is in this watershed, as it drains to the Fisher Swale, which drains to the Columbia River. This basin is primarily undeveloped, except for a recently constructed office complex and a small subdivision on the north side of NW Pacific Rim Boulevard at the City limits. This basin has large tracts with significant wetlands that have discouraged development to date. This basin has areas zoned for industrial, commercial, single-family and multifamily residential development (see Figure 3-2).

Stormwater Management

Stormwater management for development activities must meet the requirements in CMC 14.02 and follow the SMMWW. Options for meeting the most pertinent requirements, i.e. Minimum Requirements 5, 6 and 7 are described below and summarized in Table 4.2. The CIP projects that support these strategies are also listed in the table and complete descriptions are included in Section 5.

Table 4.2: Columbia River Watershed Stormwater Strategies	
On-site stormwater management	All projects must implement • BMP T5.13 (Post Construction Soil Quality and Depth); • BMPs T5.10A, B, or C (Downspout Full Infiltration, Downspout Dispersion Systems, Perorated Stub-out Connections); and • BMP T5.11 (Concentrated Flow Dispersion) or BMP T5.12 (Sheet Flow Dispersion) if feasible. Where required, bioretention facilities can be used with underdrains in areas where soil permeability is low. The use of permeable pavements in this area should review the requirements and exemptions in the 2012 SMMWW, and follow the guidelines in the “Low Impact Development Technical Guidance Manual for Puget Sound”.
Runoff Treatment	Development activities should provide their own facilities designed per the SMMWW and the city code.
Flow Control	Convey flow directly to the Columbia River through man-made conveyance systems where possible. Where man-made conveyance systems aren’t available, or where there are capacity constraints in existing systems, either upgrade the systems or provide on-site detention.
Related CIP Projects	SS02, Storm Sewer Conveyance Modeling SS05: Outfall Protection

On-site Stormwater Management

On-site stormwater management includes dispersion methods and Low Impact Development (LID) measures and are required to be used to the maximum extent feasible for all development activities that result in 2,000 square feet, or greater, of new, replaced, or new plus replaced hard surface area, or has land disturbing activities of 7,000 square feet or more.

All development will be required to amend their soils (BMP T5.13) and dispose of roof runoff in one of three methods (BMPs T5.10 A, B, or C). See the SMMWW for a complete description of these BMPs. All sites will also be required to implement concentrated or sheet flow dispersion BMPs where feasible.

Development activities required to meet flow control and runoff treatment must also meet an LID performance standard described on page 2-29, Volume I of the SMMWW.

Soils in the Columbia River Watershed have moderate to low infiltration potential. As such, some sites may be able to use LID measures to treat and infiltrate some portion of the site stormwater. Where rates are low or questionable, under-drains can be placed above the bottom of the rock chamber within bioretention facilities to convey water after being treated through the soil media. Placing the under-drain above the facility bottom will allow for some infiltration. The SMMWW provides criteria for the use of these systems.

Development activities that are exempt from Minimum Requirement #7 (Flow Control) do not have to meet the SMMWW's LID Performance Standard, nor are they required to implement bioretention, rain gardens, permeable pavement, and full dispersion. For the Columbia River Watershed, this means that if the development can discharge directly to the Columbia River through a man-made conveyance facility with available capacity, these facilities are not needed unless used for runoff treatment.

Runoff Treatment

Runoff treatment is required for any new development or redevelopment meeting the size thresholds listed in the City's stormwater ordinance. Existing dense development in downtown limits the ability to place water quality facilities; streetscape LID facilities (i.e. stormwater planters, pervious pavement, green roofs) and mechanical treatment systems will likely be the most feasible options. Although soil conditions are not conducive for infiltration, bioretention facilities can still be used with under drains. They will provide robust stormwater treatment and some flow attenuation.

New residential areas on Prune Hill can likely accommodate larger water quality and flow control facilities in addition to LID and onsite stormwater management options. Particular attention should be paid to sediment transport and downstream impacts since the creeks draining the hill are very steep and have potential to carry high sediment loads (see CIP projects BC 01 and BC 02 in Section 5).

Flow Control

The Columbia River is listed in the 2012 SMMWW as a flow control exempt water body, which means stormwater discharges to the river are exempt from the city's flow control requirement, provided runoff is conveyed directly to the river in a man-made conveyance system sized to convey the flow. Development activities that discharge stormwater to conveyance systems without sufficient capacity, or to other water bodies or creeks, must meet the City's flow control requirements.

The City's downtown core currently contains a storm sewer system that conveys runoff directly to the Columbia River. The system has been in place for many years, and the maintenance staff have not identified any areas of flooding or other signs of capacity issues. The capacity of the system will be quantified with *Capital Project SS02, Storm Sewer Modeling* (See Section 5). If capacity constraints are identified, the model can be used to determine pipe size upgrades.

Basins C1-C5 discharge to small streams that convey stormwater to the Columbia River. Development or redevelopment in these basins would need to provide detention. Basin C6 is the mill site, which is completely developed. Runoff from Basins C8 and C9 could discharge directly to the Columbia River if the conveyance system has capacity or if the system size was increased.

4.3 Lacamas Lake Watershed

Watershed Boundaries

This watershed encompasses the northern, mostly undeveloped, areas of the City as well as the north side of Prune Hill and lakeshore areas. Lacamas Lake is fed by Lacamas Creek, which in turn is fed by five different creeks, many conveying water from outside the City limits. Dwyer Creek, which conveys runoff from a large portion of northwest Camas, discharges to Lacamas Creek.

Note that all discharges to Lacamas Lake, either directly or indirectly, are required to treat for phosphorus.

The limits of the Lacamas Lake watershed, along with basin boundaries within the watershed, are shown in Figure 4-2.

Current/Future Land Use Characteristics

Large portions of Grass Valley and the north shore of Lacamas Lake are currently undeveloped. Grass Valley is zoned primarily for industrial and commercial development, and the Northern Urban Growth Area (NUGA) is zoned for multi-family and single family developments, along with some commercial and light industrial. The northern and eastern slopes of Prune Hill are zoned primarily for single-family residential development but there are some mixed-use areas with multifamily residential, commercial, and open space tracts. The south lakeshore areas are zoned primarily for single-family residential development with some industrial and park open spaces on the east end of the lake. Currently, the south side of the lake is developed as single-family residential properties but the north side remains mostly undeveloped. Please see Figure 3-2 for zoning.

The residential areas on Prune Hill and the south shore of Lacamas Lake are unlikely to see new development except infill or redevelopment. The industrially zoned areas in Grass Valley and northern parts of the City have many wetlands which limit the developable area. The land north of the lake is zoned for light-industrial, single family, and multifamily development.

Soil Characteristics

NRCS mapped soil types in this watershed consist mostly of Hesson, Powell, Olympic, and Vader soils with some areas of Odne, Dollar, Cove, Lauren, Puyallup, Hockinson, McBee, Semaihmoo and Tisch soils (see Figure 3-4). Most of these soils are moderately to poorly drained and limit the infiltration of stormwater, except for Lauren soils, which are present in the NUGA area. This soil is generally moderate to rapidly draining and may support infiltration of stormwater. Lenses of moderately-draining Puyallup, Olympic, and Hesson soils are present near Round Lake and Fallen Leaf Lake, and infiltration facilities have been installed in these areas (see Figure 4-2).

Current Drainage System

Grass Valley and the northwest slopes of Prune Hill drain to Dwyer Creek. Most of the residential areas on Prune Hill were developed in the 1990s and include privately-owned stormwater treatment and flow control facilities. Information on the stormwater infrastructure in the industrial and commercial areas is incomplete but some private water quality facilities exist. There are two NPDES regulated outfalls to Dwyer Creek (see Figure 4-2). Developments along the south side of Lacamas Lake do not include flow control facilities, as direct discharges to the lake are exempt.

There is one mapped NPDES regulated outfall on the west side of Lacamas Lake (see Figure 4-2).

Most of the area on the west side of Round Lake lack runoff treatment and flow control facilities. A small area in the far western corner of the basin as well as the eastern side of the basin was developed during a time when treatment and flow control facilities were required (see Figure 4-2).

Stormwater Management

Stormwater management for development activities must meet the requirements in CMC 14.02 and follow the SMMWW. Options for meeting the most pertinent requirements, i.e. Minimum Requirements 5, 6 and 7 are described below and summarized in Table 4.3. The CIP projects that support these strategies are also listed in the table and complete descriptions are included in Section 5.

Table 4.3: Lacamas Lake Watershed Stormwater Strategies	
On-site stormwater management	All projects must implement • BMP T5.13 (Post Construction Soil Quality and Depth); • BMPs T5.10A, B, or C (Downspout Full Infiltration, Downspout Dispersion Systems, Perorated Stub-out Connections); and • BMP T5.11 (Concentrated Flow Dispersion) or BMP T5.12 (Sheet Flow Dispersion) if feasible. Where required, bioretention facilities can be used with underdrains in areas where soil permeability is low. The use of permeable pavements in this area should review the

Table 4.3: Lacamas Lake Watershed Stormwater Strategies	
	requirements and exemptions in the 2012 SMMWW, and follow the guidelines in the "Low Impact Development Technical Guidance Manual for Puget Sound".
Runoff Treatment	Development activities should provide their own facilities designed per the SMMWW and the city code.
Flow Control	Convey flow directly to Lacamas Lake through man-made conveyance systems where possible. Where man-made conveyance systems aren't available, or where there are capacity constraints in existing systems, either upgrade the systems or provide on-site flow control. This may be met through detention or through infiltration, depending upon the results of on-site infiltration testing.
Related CIP Projects	ULB 01: Leadbetter Road Culvert Capacity Review ULB 02: North Urban Growth Area Stormwater Plan

On-site Stormwater Management

On-site stormwater management includes dispersion methods and Low Impact Development (LID) measures and are required to the maximum extent feasible for all development activities that result in 2,000 square feet, or greater, of new, replaced, or new plus replaced hard surface area, or have land disturbing activities of 7,000 square feet or more.

All development will be required to amend their soils (BMP T5.13) and dispose of roof runoff in one of three methods (BMPs T5.10 A, B, or C). All sites will also be required to implement concentrated or sheet flow dispersion BMPs where feasible.

Development activities required to meet flow control and runoff treatment must also meet an LID performance standard described on page 2-29, Volume I of the SMMWW.

Soils in the Lacamas Lake Watershed have moderate to low infiltration potential, except in the NUGA area where the potential for infiltration may be higher. As such, some sites may be able to use LID measures to treat and infiltrate some portion of the site stormwater. Where rates are low or questionable, under-drains can be placed above the bottom of the rock chamber within bioretention facilities to convey water after being treated through the soil media. Placing the under-drain above the facility bottom will allow for some infiltration. The SMMWW provides criteria for the use of these systems.

Development activities that are exempt from Minimum Requirement #7 (Flow Control) do not have to meet the SMMWW's LID Performance Standard, nor are they required to implement bioretention, rain gardens, permeable pavement, and full dispersion. For the Lacamas Lake Watershed, this means that if the development can discharge directly to Lacamas Lake through a man-made conveyance facility with available capacity, these facilities are not needed unless used for runoff treatment.

A capital project has been are defined and is included in Section 5 to determine what is needed for the NUGA area to meet the flow control exemption. This project (ULB 01) has two components:

- One is to prepare a stormwater basin plan
- The second is to assess the capacity of the culverts under Leadbetter Road, as these could be used to convey water from the NUGA to Lacamas Lake to meet the flow control exemption. If the culverts are found to be too small to convey the developed site runoff, appropriate pipe sizes can be determined.

Runoff Treatment

Runoff treatment is required for any new development or redevelopment meeting the size thresholds listed in the City's stormwater ordinance. LID measures or more traditional treatment measures as described in the SMMWW can be used. Note that discharges above the dam at Round Lake are required to treat for phosphorus.

Flow Control

Lacamas Lake is listed in the 2012 SMMWW as a flow control exempt water body, which means stormwater discharges to the lake are exempt from the city's flow control regulation provided runoff is conveyed directly to the lake in a man-made conveyance system sized to convey the flow. Development activities that discharge stormwater to conveyance systems without sufficient capacity, or to other water bodies or creeks, must meet the City's flow control requirements.

The north side of Prune Hill and Grass Valley will need to meet the flow control standard. Regionally based facilities may be a feasible option for Grass Valley if private partners are willing to pool efforts.

The NUGA may have soils suited for infiltration. As such, flow control requirements may be met through installation of UICs or shallow LID facilities. If UICs are used, these should be registered with Ecology and rule-authorized before acceptance by the city. This report includes a capital project to generate a stormwater basin plan for the NUGA area.

Section 4—Study Area Watersheds

Continued

4.4 Washougal River & Lower Lacamas Creek Watershed

Watershed Boundaries

The Washougal River watershed drains the southwestern portion of the City (see Figure 4-3). Within the City limits this watershed encompasses both sides of the Washougal River, portions of downtown Camas, and tributaries to Lower Lacamas Creek. The watershed boundaries are approximately SR-14 on the south, 3rd Avenue and Garfield Street to the west in downtown Camas, and approximately SE Nourse Road to the north (the watershed extends east beyond the City limits).

Current/Future Land Use Characteristics

The downtown area in Basin W1 is zoned primarily for single-family residential development with some commercial and multifamily residential areas. The downtown was mostly developed between the 1920s and 1950s. Some infill and redevelopment may occur, but the existing development is fairly dense. The riverfront areas along the Washougal River in Basin W2 are zoned for industrial, commercial, and multi-family and single-family residential. Development in this basin is from the 1940s to 1970s with some infill in the last 15 years. Additional infill is likely, especially in the areas zoned for multifamily residential properties. Most of the large tracts that border the Washougal River will not be developed because they belong to Camas (Parks) or are encumbered by other facilities.

The Lower Lacamas Creek Basin W3 is located within the urban growth area and is zoned for single-family residential development and park open space. This area is currently undeveloped and will likely see new development. See Figure 3-2 for zoning. Much of this is park property owned by Camas & Clark County. It won't be developed.

Soil Characteristics

NRCS mapped soil types in this watershed consist of Olympic and Vader soils with large areas of fill near downtown Camas and pockets of Hesson, Powell, Rockland, Hillsboro, Washougal and Sauvie soils throughout the watershed (see Figure 3-4). The soils are rated as moderate to poorly draining and will not likely support the infiltration of stormwater.

Current Drainage System

Stormwater from the downtown area (Basin W1) is piped without treatment or flow control to discharge to the Washougal River on the south side of the basin through an NPDES regulated outfall (see Figure 4-3).

Stormwater from some of the newer residential developments in Basin W2 is routed though runoff treatment and flow control facilities prior to discharging to Lower Lacamas Creek just upstream of its confluence with the Washougal River. This basin includes one NPDES regulated outfall, as shown in Figure 4-3.

Stormwater Management

Stormwater management for development activities must meet the requirements in CMC 14.02 and follow the SMMWW. Options for meeting the most pertinent requirements, i.e. Minimum Requirements 5, 6 and 7 are described below and summarized in Table 4.4. There are no CIP projects identified in Section 5 that support stormwater strategies in this watershed.

Table 4.4: Washougal River/Lower Lacamas Creek Watershed Stormwater Strategies	
On-site stormwater management	All projects must implement • BMP T5.13 (Post Construction Soil Quality and Depth); • BMPs T5.10A, B, or C (Downspout Full Infiltration, Downspout Dispersion Systems, Perorated Stub-out Connections); and • BMP T5.11 (Concentrated Flow Dispersion) or BMP T5.12 (Sheet Flow Dispersion) if feasible. Where required, bioretention facilities can be used with underdrains in areas where soil permeability is low. The use of permeable pavements in this area should review the requirements and exemptions in the 2012 SMMWW, and follow the guidelines in the "Low Impact Development Technical Guidance Manual for Puget Sound".
Runoff Treatment	Development activities should provide their own facilities designed per the SMMWW and the city code.
Flow Control	Flow Control per CMC 14.02 and the SMMWW will be required. This may be met through detention or through infiltration, depending upon the results of on-site infiltration testing.
Related CIP Projects	None identified

On-site Stormwater Management

On-site stormwater management includes dispersion methods and Low Impact Development (LID) measures and are required to the maximum extent feasible for all development activities that result in 2,000 square feet, or greater, of new, replaced, or new plus replaced hard surface area, or have land disturbing activities of 7,000 square feet or more.

All development will be required to amend their soils (BMP T5.13) and dispose of roof runoff in one of three methods (BMPs T5.10 A, B, or C). All sites will also be required to implement concentrated or sheet flow dispersion BMPs where feasible.

Development activities required to meet flow control and runoff treatment must also meet an LID performance standard described on page 2-29, Volume I of the SMMWW.

Soils in this watershed are moderate to poorly draining. As such, some sites may be able to use LID measures to treat and infiltrate some portion of the site stormwater. Where rates are low or questionable, under-drains can be placed above the bottom of the rock chamber within bioretention facilities to convey water after being treated through the soil media. Placing the under-drain above the facility bottom will allow for some infiltration. The SMMWW provides criteria for the use of these systems.

Runoff Treatment

Similar to the downtown area in the Columbia River watershed, existing dense development limits the water quality treatment options in Basin W1 to LID facilities and mechanical systems. Residential infill in Basin W2 can likely accommodate larger water quality and flow control facilities in addition to LID techniques.

Water quality treatment must meet the TMDL standards since Lacamas Creek is a 303(d) listed water body; please see the discussion in Section 2.2.2 for more information.

Runoff treatment is required for any new development or redevelopment meeting the size thresholds listed in the City's stormwater ordinance. LID measures or more traditional treatment measures as described in the SMMWW can be used.

Flow Control

Discharges to the Washougal River and to Lower Lacamas Creek and its tributaries must meet the City's flow control requirements, as these water bodies are not included on the flow control exemption list in the 2012 SMMWW. Runoff treatment is required for any new development or redevelopment meeting the size thresholds listed in the City's stormwater ordinance.

The banks of Lower Lacamas Creek and its tributaries are steep with active and potentially unstable slopes. Meeting the flow control requirements for new development in Basin W3 will be essential to prevent further degradation.

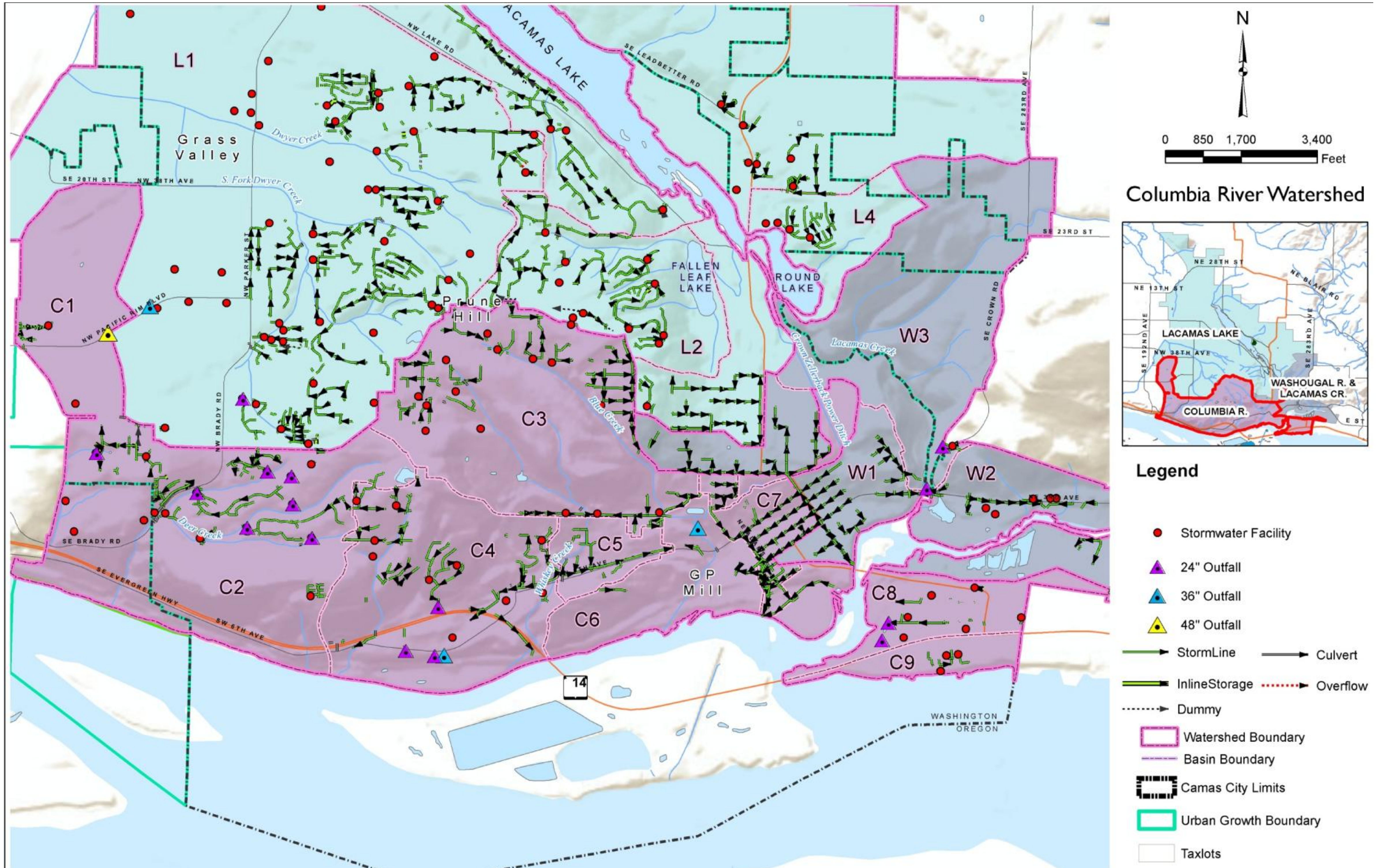

Figure 4-1: Columbia River Watershed and Basins

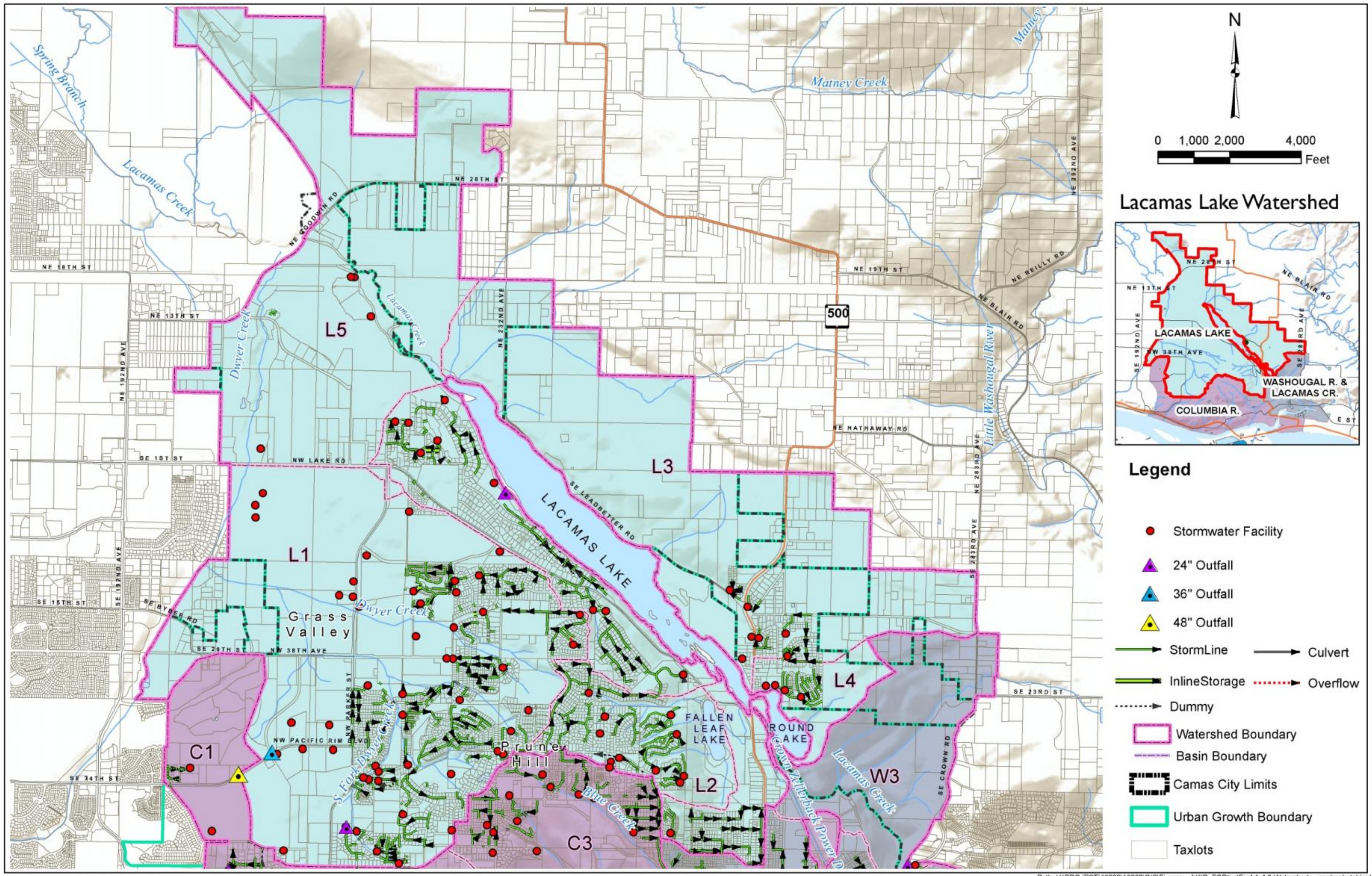

Figure 4-2: Lacamas Lake Watershed and Basins

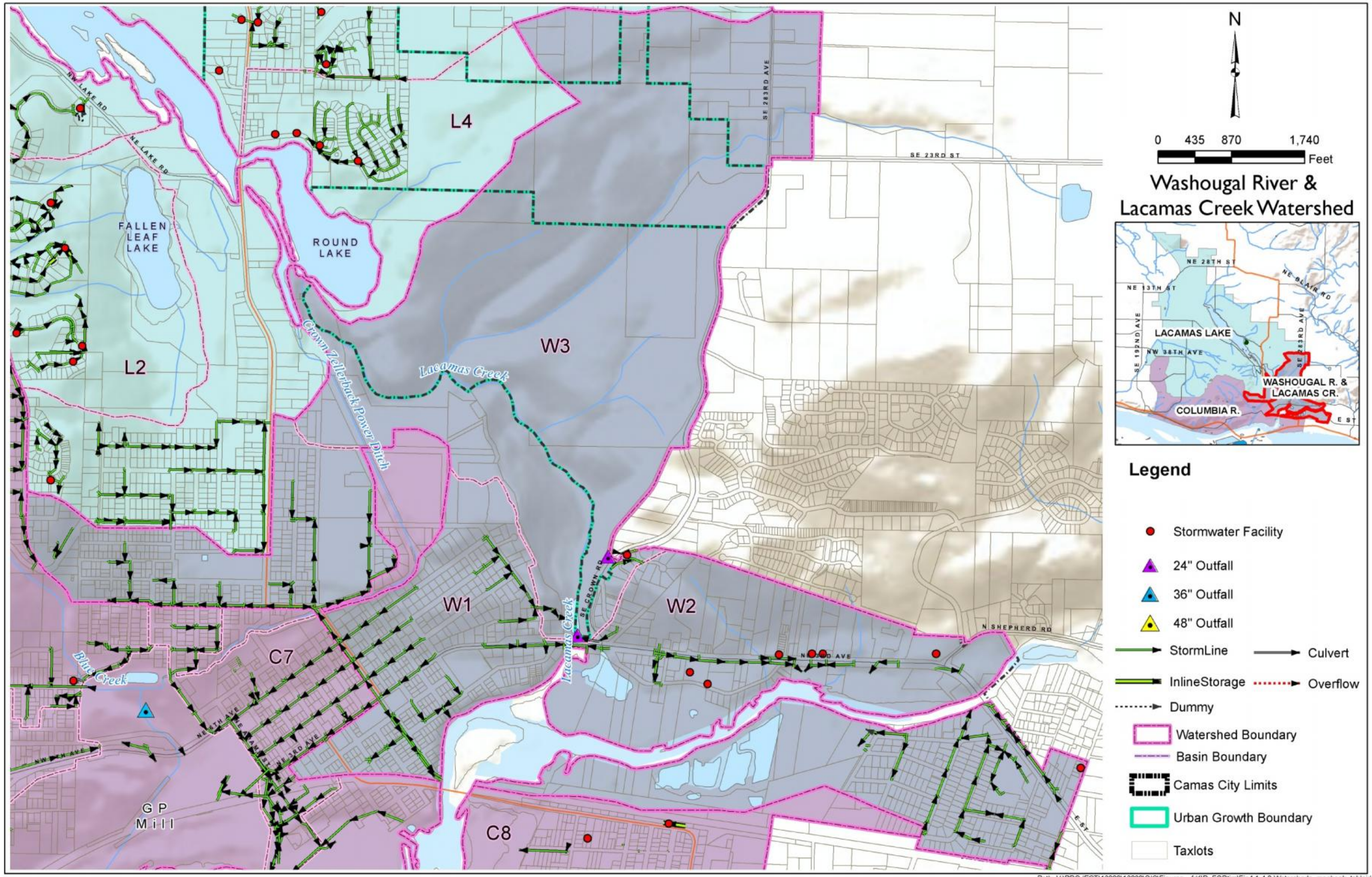

Figure 4-3: Washougal River & Lower Lacamas Creek Watershed and Basins

Section 5—Capital Improvements

5.1 Introduction

This section describes the capital improvement projects for this first version of the City's Stormwater Capital Improvement Plan. The projects described in this section were selected by City staff and are based on:

- Addressing existing facilities in need of repairs
- Addressing identified flooding concerns
- Coordinating stormwater facility design and construction with transportation project needs
- Reducing reoccurring maintenance activities
- Planning for future development and capacity needs

Table 5.1 lists the recommended CIP's, a priority assignment (low, medium, or high), and an estimated implementation cost. A City map with CIP locations is shown in Figure 5-1.

There are two basic categories of capital improvement projects; those that deal with the planning aspects of stormwater management, and those that involve the improvements of structures and facilities in the City's stormwater drainage system. The projects are broken out by watershed, and the project descriptions include the basin name and the location, where applicable.

The project numbering is based upon the basin the project is located in, except for projects that are City-wide. Referring to Table 5.1, "SS" stands for Storm Sewer and is used for City-wide projects. "DC" stands for Dwyer Creek and is used for projects in the Dwyer Creek basin. "ULB" stands for Upper Lacamas Basin, and "CR" is for Columbia River.

Table 5.1: CIP Summary

	Project Name
SS 01	Transportation Related Stormwater Facilities
SS 02	Storm Sewer Conveyance Modeling
DC 01	North Dwyer Creek Stormwater Basin Plan
DC 02	Grass Valley Stormwater Basin Plan

Section 5—Capital Improvements

Continued

Table 5.1: CIP Summary	
	Project Name
DC 03	Pacific Rim Boulevard Crossing
DC 04	Julia Street Stormwater Pond Retrofit
DC 05	Thomas/Carson Estates Runoff Control
ULB 02	North Urban Growth Area (NUGA) Stormwater Basin Plan
CR 01	Forest Home Road Sediment Basin
CR 02	Blue Creek Sediment Basin

Separate project sheets have been prepared for each project listed in Table 5.1. These sheets are included on the following pages and include a description of the problem to be addressed and a description of the proposed solution. The sheets also include a cost estimate and possible funding sources.

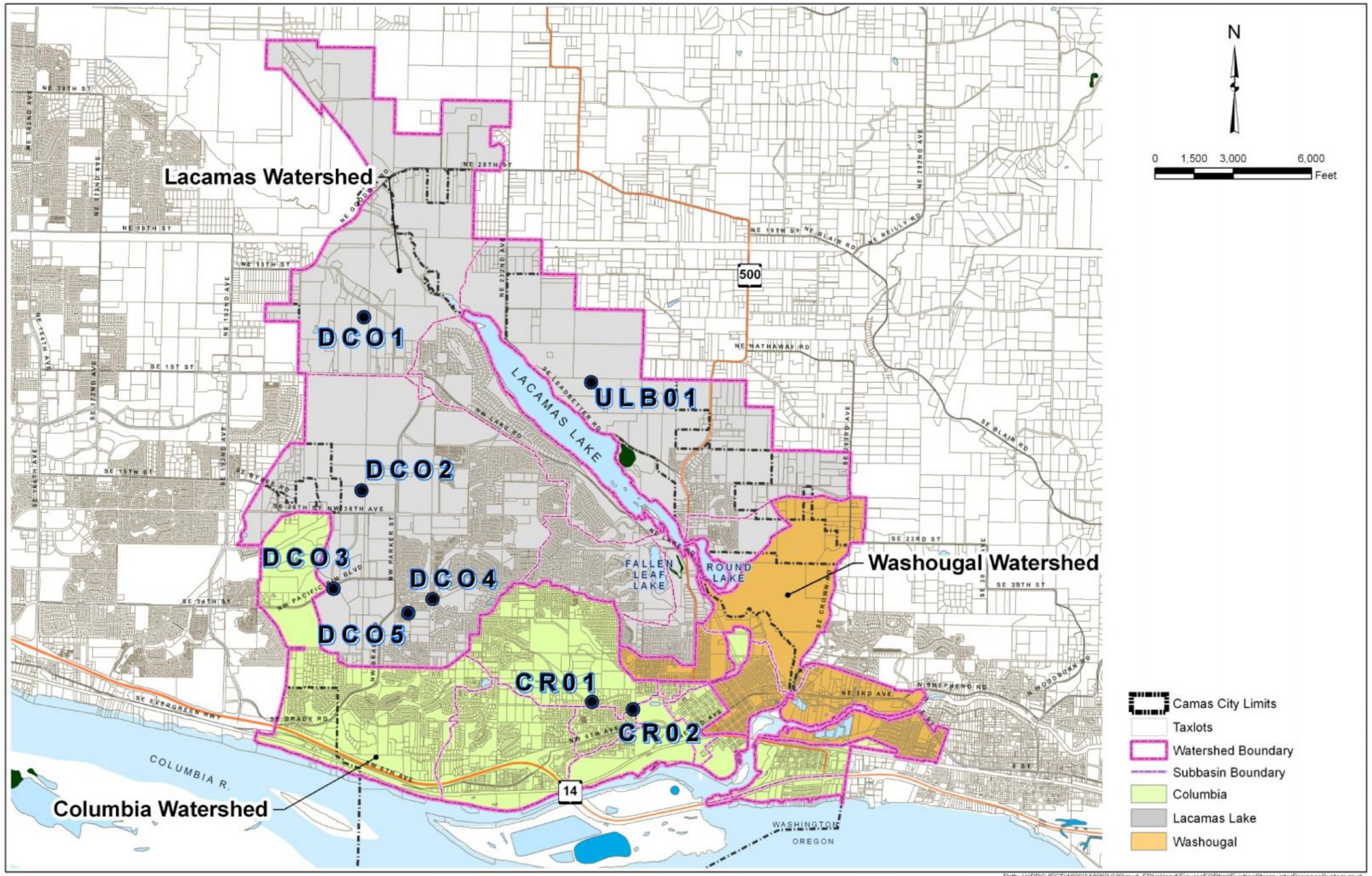

Figure 5-1: CIP Project Locations

Project Name: Transportation Related Stormwater Facilities

Project ID: SS 01

Watershed: City-Wide

Location: City-Wide

Description

As the City develops or improves their roadway network, they are finding that the construction of stormwater facilities to meet their NPDES Phase II permit adds significantly to the roadway costs. Stormwater treatment, conveyance and runoff control facilities, along with property acquisition, and design account for 20 to 30 percent of a new roadway. As such, these costs influence the City's road construction fund. The City is exploring options to establish a dedicated funding source for City stormwater construction costs.

The current storm utility is not designed for major capital improvements and has not been able to support the stormwater portion of new roadway construction. To adequately fund these capital improvements a System Development Charge (SDC) could be implemented. The SDC could be allocated at a rate of 67% Developer funded and 33% City to be consistent with the water and sewer SDC. This breakdown accounts for the developer responsibility per code to install the minimum requirements for their development and allowing a credit or providing funding for the regional component.

Proposed Project

This is for the creation of a funding source for the design, acquisition, and construction of facilities to convey, treat, and control the volume of runoff from public road projects as required in the City's stormwater ordinance. This fund will be used to support the regional component of the roadway improvements included in the City's Six Year Transportation Plan in conjunction with other funding sources such as Transportation Impact Fee (TIF).

Cost Estimate/Funding Sources

The City's transportation plan is embodied in two documents: the Six Year Transportation Plan and the TIF study. The adopted Transportation Impact Fee includes collection and conveyance storm water costs but not land acquisition or treatment/detention, which is estimated to be 11 percent of the total roadway cost.

Funding for stormwater facilities tied to transportation projects generally consists of developer contributions, loan, grants and city funding sources (REET and General Fund).

Section 5—Capital Improvements

Continued

The dollar amount shown in the table below represents the unfunded stormwater portion of the city's proposed transportation projects. They consist of the storm components from the TIF study (which include the land costs, and treatment/detention requirements) and any additional projects listed on the Six Year Street Plan (costs include design, collection, land, treatment and detention based on a 30 percent cost of construction).

Table 5.2: Transportation Related Stormwater Facilities Estimate and Funding Plan			
Cost Estimates			
TIF Eligible Routes			
Item	**Cost**	**Developer Share**	**Regional cost and SDC credit eligible if enacted**
Land	$4,000,000	$2,680,000	$1,320,000
Treatment/Detention	$4,000,000	$2,680,000	$1,320,000
Total	**$8,000,000**	**$5,360,000**	**$2,640,000**
Six Year Eligible Routes			
Item	**Cost total 30% of overall six year cost**	**Developer Share**	**Regional cost and SDC credit eligible if enacted**
Design			
Conveyance system			
Land			
Treatment/Detention			
Total	**$4,500,000**	**$3,015,000**	**$1,485,000**
Funding Source			
City	**Grant**	**Developer**	**SDC**
X	X	X	X

Project Name: Storm Sewer Conveyance Modeling

Project ID: SS 02

Watershed: City-Wide

Location: City-Wide

Description

The City's conveyance system is over 70 years old in some locations in the downtown core and the City anticipates the need to repair or replace some of these pipes. In addition, the carrying capacity of some of the City's stormwater pipelines has been reached or exceeded.

As systems age and replacement or upgrades are considered, it is important that new systems are sized properly to convey existing flows and to carry future flows that may result from new development or redevelopment. The City does not currently have a model for helping them decide how to size a replacement system.

New pipes can be sized fairly easily using simple models (i.e. Manning's Equation). These models can quickly determine the pipe size needed to convey flows assuming open channel flow. However, they can underestimate the capacity of existing systems, as they do not account for system surcharging. In addition, the hydraulics of existing pipe systems can be very complex. This is because flow enters the system from many different locations, and the interaction between these flows combined with the characteristics of the pipe system itself causes the water to do unpredictable things, even moving upstream. The equations and methods to model these systems are complex but are now routinely performed with computer models.

A hydrologic and hydraulic model of the city's conveyance system would provide them with a tool for planning and building necessary improvements. This can be used for existing systems to size upgrades, and for sizing new systems where planned by the city.

Proposed Project

Develop a hydraulic computer model of the City's storm sewer pipe system. This model can be built in phases and would only need to include the larger pipes which serve as system trunk sewers or backbones. Important systems to model include:

- Systems where excessive surcharging (water coming out of manholes or catch basins) occurs

Section 5—Capital Improvements

Continued

- Older systems where replacements are planned or likely
- Systems where proposed development will contribute runoff to existing conveyance pipes and may exceed the system capacity

Cost Estimate/Funding Sources

A cost estimate has been prepared assuming most of the storm system in the downtown core is modeled, along with limited areas outside the downtown core. The work includes sub-basin hydrologic modeling and hydraulic modeling of pipes 12-inches and larger.

Table 5.3: Storm Sewer Conveyance Modeling Estimate and Funding Plan			
Cost Estimate			
Item		**Cost**	
Hydrologic and hydraulic modeling		$50,000	
Funding Source			
City	**Grant**	**Developer**	**SDC**
X	X	X	X

Project Name: North Dwyer Creek Stormwater Basin Plan

Project ID: DC 01

Watershed: Lacamas Lake

Basin: Dwyer Creek

Location: North Dwyer Creek Basin

Description

The North Dwyer Creek study area is bounded by NW Lake Road on the south, Friberg Road on the west, NW Payne Road on the east, and the Camas Meadows development on the north (see Figure 5-1). The City developed a comprehensive land-use master plan for this area in 2001 and will be updating this plan in 2012.

The updated basin plan will include a stormwater management strategy that addresses flow control, water quality, and conveyance. This plan will be designed to meet the City's recently adopted stormwater ordinance and the Stormwater Management Manual for Western Washington (SMMWW).

Stormwater from this area is tributary to North Dwyer Creek, which runs north along the west edge of the study area, then east to Lacamas Creek, which flows to Lacamas Lake. Lacamas Lake eventually discharges to the Washougal River approximately one-half mile from its confluence with the Columbia River.

Lacamas Creek and five of its tributaries (Dwyer Creek, Fifth Plain Creek, Shanghai Creek, Matney Creek, and China Ditch) are listed on Washington State's 303(d) list of impaired water bodies for fecal coliform bacteria, temperature, dissolved oxygen, and pH. A Total Maximum Daily Load (TMDL) plan is currently being prepared by the Washington State Department of Ecology for Lacamas Creek and four of the five tributaries.

The City requires phosphorus treatment in the Lacamas watershed above the dam at the south end of Round Lake for all development sites exceeding one acre in size.

Proposed Project

This CIP is to provide funding for development of a stormwater basin plan in conjunction with the updated land-use master plan. This plan should include the following:

Continued

- An evaluation to determine the feasibility of using Low Impact Development BMPs in the study area. This determination should be made in conjunction with the development of road sections to determine if measures such as biorention planters can be placed within the right-of-way for treating roadway stormwater.
- An evaluation of the feasibility of providing regional detention for meeting flow control and/or runoff treatment requirements.
- A list of runoff treatment BMPs to be used in the study area that meets SMMWW requirements, TMDL requirements, and the City's phosphorus requirement to be used with private developments.
- Sizing of major stormwater conveyance pipes that serve multiple properties.
- Documentation of the stormwater portion of a larger master plan document.
- An evaluation of the ability to discharge to Lacamas Lake to access the flow control exemption.

Cost Estimate/Funding Sources

Table 5.4: North Dwyer Creek Estimate and Funding Plan			
Cost Estimate			
Item		**Cost**	
Stormwater Component of Master Plan		$30,000	
Funding Source			
City	**Grant**	**Developer**	**SDC**
X	X	X	X

Project Name: Grass Valley Stormwater Basin Plan

Project ID: DC 02

Watershed: Lacamas Lake

Basin: Dwyer Creek

Location: Grass Valley (vicinity of NW 38th Street and Parker Road)

Description

The Grass Valley Area of Camas is bordered by Pacific Rim Boulevard on the south, NW Dahlia Road on the east, Lake Road on the north, and the City limits on the west. The center of Grass Valley is roughly at the intersection of Parker Road and 38th Avenue. The area contains both homes and many light industrial and technology businesses.

The Grass Valley area contains many acres of low-quality wetlands. Because of this wetland designation, these properties have remained undeveloped and are used for grassland farming.

The headwaters of Dwyer Creek are on the northwest slopes of Prune Hill. The creek runs north to NW 38th Avenue, then west along the south side of the road until it reaches Parker Road. From there it crosses the road diagonally from the southeast to northwest where it then travels along the north side of NW 38th Avenue for approximately 1,200 feet. At that point it turns north through private properties.

Where Dwyer Creek turns north an intermittent stream carries runoff from south to north under NW 38th Avenue and joins with Dwyer Creek. At this location along NW 38th Avenue, nuisance flooding that impacts NW 38th Avenue occurs on a frequent basis.

Proposed Project

This project is to develop a plan that will:

- Develop a plan for the property owners' that consolidates and enhances the portions of the delineated wetlands on these properties, allowing other portions of the properties to be developed.
- Develop a concept for a regional stormwater facility to meet the city's flow control requirement. This facility could be integrated with the wetland enhancement area and could provide flow control for the private parcel's and for the city's planned improvements to NW 38th Avenue.

Cost Estimate/Funding Sources

Table 5.5: Grass Valley Estimate and Funding Plan			
Cost Estimate			
Item		**Cost**	
Conceptual Designs		$75,000	
Funding Source			
City	**Grant**	**Developer**	**SDC**
X	X	X	X

Project Name: Pacific Rim Boulevard Crossing

Project ID: DC 03

Watershed: Lacamas Lake

Basin: Dwyer Creek

Location: Pacific Rim Boulevard west of NW Fisher Creek Drive

Description

Pacific Rim Boulevard experiences routine flooding in a low spot west of NW Fisher Creek Drive and the entrance to Sharp Electronics (See Figure 5-1). The stormwater conveyance system that collects stormwater in Pacific Rim Boulevard comes from both directions to this low point and discharges north to a tributary of Dwyer Creek. In addition, there are two culverts under the road that carry stormwater from properties south of the street to the north side.

The land adjacent to Pacific Rim Boulevard rises steeply to the south. The area contains shallow groundwater and surface water that runs towards Pacific Rim Boulevard. The property owner has attempted to collect this water with French drains and surface trenches. This water is directed to culverts that carry it under NW Pacific Rim Boulevard.

Proposed Project

Determine the cause of the flooding at this low spot and develop a plan for alleviating this problem. This should include:

- A hydrologic study that includes the private parcel south of Pacific Rim Boulevard
- The development of a model of the system to determine capacity
- Development of a conceptual design and construction cost estimate

Section 5—Capital Improvements

Continued

Cost Estimate/Funding Sources

Table 5.6: Pacific Rim Boulevard Estimate and Funding Plan			
Cost Estimate			
Item		**Cost**	
Hydrologic and hydraulic model		$5,000	
Conceptual Designs and Cost Estimate		$15,000	
Total		**$20,000**	
Funding Source			
City	**Grant**	**Developer**	**SDC**
X	X	X	X

Project Name: Julia Street Stormwater Pond Retrofit

Project ID: DC 04

Watershed: Lacamas Lake

Basin: Dwyer Creek

Location: East of cul-de-sac at intersection of NW Julia Street and NW 26th Avenue

Description

The Julia Street Stormwater Facility lies at the bottom of a steep canyon at the end of a cul-de-sac east of the NW Julia Street and NW 26th Avenue intersection. A small intermittent stream in the bottom of the canyon runs in a 36-inch diameter pipe around this pond. The pond was constructed in the late 1990's as a detention facility, and it detains flow from two subdivisions that sit on top of each side of the canyon - Columbia Ridge on the south side and Oak Ridge Estates on the north side.

Stormwater is discharged from several subdivisions into the intermittent stream upstream of the detention facility. Sediment from upstream development and landslides in the steep canyon walls is carried in this intermittent stream and deposited at the entrance to the pipe. The pipe routinely gets filled in from this sediment, causing the stream to overflow into the detention pond.

Figure 5-3: Julia Street Pond in a spring 2012 flood event

Although the facility is privately-owned and maintained, it sits on City-owned property. Occasionally the City has removed sediment from the pipe and from the bottom of the pond. Although there is an access road leading to the pond, access to the storm pipe and pond bottom is challenging.

Proposed Project

An evaluation should be performed to determine if this pond can be reconstructed and retrofitted to eliminate these issues. Consideration should be given to the following:

- Installation of a debris collection structure where the stream enters the pipe to prevent the pipe from clogging
- Remove the bypass pipe and allow the stream to flow through the pond
- Enlarge the pond to the northwest to allow more flood storage
- Construct a forebay for trapping sediment
- Construct a maintenance road for access to the forebay and all parts of the facility

Cost Estimate/Funding Sources

Table 5.7: Julia Street Stormwater Retrofit Estimate and Funding Plan			
Cost Estimate			
Item		**Cost**	
Alternatives Analysis		$5,000	
Conceptual Designs and Construction Cost Estimate		$20,000	
Construction		$210,000	
Construction Management		$20,000	
Total		**$255,000**	
Funding Source			
City	**Grant**	**Developer**	**SDC**
X	X		

Project Name: Thomas/Carson Estates Flooding

Project ID: DC 05

Watershed: Lacamas Lake

Basin: Dwyer Creek

Location: Thomas and Carson Estates, along NW Maryland Street

Description

These two subdivisions sit near the bottom of the northwest slope of Prune Hill. Runoff from the hillside above these subdivisions streams down the hillslope and floods nearby roads and lawns. Various ditches and swales provide some collection and routing of stormwater to stormwater facilities located in these subdivisions; however, these conveyance facilities are overtopped in large storm events.

Proposed Project

Design and construct a conveyance system capable of adequately conveying the upstream stormwater flows safely downstream around these two subdivisions.

Cost Estimate/Funding Sources

Table 5.8: Thomas/Carson Estates Flooding Estimate and Funding Plan

Cost Estimate

Item	Cost
Alternatives Analysis	$5,000
Construction Drawing Preparation	$10,000
Construction	$100,000
Construction Management	$12,000
Total	**$127,000**

Table 5.8: Thomas/Carson Estates Flooding Estimate and Funding Plan			
Funding Source			
City	**Grant**	**Developer**	**SDC**
X	X	X	

Project Name: North Urban Growth Area (NUGA) Stormwater Basin Plan

Project ID: ULB 01

Watershed: Lacamas Lake

Basin: Upper Lacamas Basin

Location: NUGA (North of Lacamas Lake)

Description

The City's urban growth boundary includes an area on the north side of Lacamas Lake called the North Urban Growth Area (NUGA). The NUGA is bounded by NW Leadbetter Road and Lacamas Lake on the south, NE 232nd Avenue on the west, State Route 500/Everett Street on the east, and varying roads and properties on the north. The City will be developing a long-term plan for this area, including the establishment of detailed zoning and a street layout for arterials and collectors.

The city's planning effort for NUGA includes development of a stormwater basin plan that addresses water quality, flow control and conveyance. This plan will be designed to meet the City's recently adopted stormwater ordinance that follows the Stormwater Management Manual for Western Washington (SMMWW).

The City's code exempts Lacamas Lake from flow control requirements if the following criteria are met:

- The project site is drained by a conveyance system that is comprised entirely of manmade conveyance elements (e.g., pipes, ditches, outfall protection, etc.) and extends to the ordinary high water line of the exempt receiving water; and
- The conveyance system between the project site and the exempt receiving water shall have sufficient hydraulic capacity to convey discharges from future build-out conditions (under current zoning) of the site, and the existing condition from non-project areas from which runoff is or will be collected.

The conveyance systems for the NUGA area will be sized to carry undetained runoff so detention of stormwater will not be required.

There are multiple culverts under Leadbetter Road that convey runoff from the north side of the road to Lacamas Lake. If these culverts can convey runoff from the NUGA then flow control facilities will not be required. This project will determine the capacity of these culverts and whether or not they need to be upsized to convey the runoff from the NUGA to the lake.

Lacamas Lake is on the state's 303(d) list for total phosphorus. Lake eutrophication occurs most summers and restoration efforts have focused on reducing phosphorus loadings. The City requires phosphorus treatment in the Lacamas watershed above the dam at the south end of Round Lake for all development sites exceeding one acre in size.

Proposed Project

This CIP is to provide funding for development of a stormwater basin plan for the NUGA. The stormwater master plan should include the following:

- An evaluation to determine the feasibility of using Low Impact Development BMPs in the study area. This determination should be made in conjunction with the development of road sections to determine if measures such as biorention planters can be placed within the right-of-way for treating roadway stormwater.
- A list of runoff treatment BMPs to be used in the study area that meet SMMWW requirements, and the City's phosphorus requirement.
- Sizing of major stormwater conveyance pipes that serve multiple properties.
- An evaluation of the existing culverts under Leadbetter Road to determine their hydraulic capacity to convey the discharges from the estimated build-out of the NUGA area. Recommendations for upsizing the culverts should be included.

Cost Estimate/Funding Source

Table 5.9: NUGA Estimate and Funding Plan			
Cost Estimate			
Item		**Cost**	
Alternatives Analysis/Conceptual Designs/Plan development		$100,000	
Hydrologic and Hydraulic Modeling		$75,000	
Total		**$175,000**	
Funding Source			
City	Grant	Developer	SDC
X	X	X	X

Project Name: Forest Home Road Sediment Basin

Project ID: BC 01

Watershed: Columbia River

Basin: Blue Creek

Location: Intersection of NW 10th Avenue and NW Ivy Drive

Description

Forest Home Road travels from the top of Prune Hill at NW Astor Street to NW 10th Avenue. This road drops close to 400 feet over less than a mile in length. A creek parallels Forest Home Road until it reaches NW 10th Avenue, where it enters a pipe. Because it is so steep and heavily vegetated, this creek carries a lot of sediment and debris, which collects at the entrance to this pipe. The City has built a sediment collection facility that allows them to excavate out this debris; they are called to this site to load out debris frequently during the winter months.

Proposed Project

Design a system for sediment and debris collection that will allow the entrance to the pipe to remain clear and requires city crews to clean the facility less frequently.

Cost Estimate/Funding Sources

Table 5.11: Forest Home Road Sediment Basin Estimate and Funding Plan	
Cost Estimate	
Item	**Cost**
Design	$25,000
Construction	$75,000
Total	**$100,000**

Funding Source			
City	Grant	Developer	SDC
X	X		

Project Name: Blue Creek Sediment Basin

Project ID: BC 02

Watershed: Columbia River

Basin: Upper Blue Creek

Location: Intersection of NW 10th Avenue and NW Drake Street

Description

Blue Creek travels steeply down the south east slope of Prune Hill until it reaches NW 10th Avenue, where it enters a pipe. Because it is so steep and heavily vegetated, this creek carries a lot of sediment, sticks, and debris with it, which collects at the entrance to this pipe. The City has built a sediment collection facility that allows them to excavate out this debris; they are called to this site to load out debris frequently during the winter months.

Figure 5-4: Sediment collection facility at Blue Creek.

Proposed Project

Design a system for sediment and debris collection that will allow the entrance to the pipe to remain clear and requires city crews to clean the facility less frequently.

Cost Estimate/Funding Sources

Table 5.12: Blue Creek Sediment Basin Estimate and Funding Plan			
Cost Estimate			
Item		**Cost**	
Design		$25,000	
Construction		$75,000	
Total		**$100,000**	
Funding Source			
City	Grant	Developer	SDC
X	X		

Section 6—Financing

6.1 Introduction

The Camas stormwater utility was formed to fund the city's stormwater program and to meet their first NPDES permit requirements. The utility is responsible for the upkeep of the publicly-owned stormwater system, including conveyance pipelines, manholes, catch basins, detention ponds, and treatment systems. It is also responsible for street sweeping, as this is a regulatory requirement that reduces the amount of sediment that enters the City's creeks and streams (FCSG 2010). The utility collects monthly rates to fund operations and maintenance of the existing stormwater system and to fund capital improvements.

Historically, the Fisher Basin has had a stormwater utility fee collected to fund projects in that basin. However, with the formation of the new citywide utility, this fee was discontinued, and the funds collected will be retired in 2013.

A utility rate study conducted by Financial Consulting Services Group (FCSG) in 2009 set the stormwater utility rates from 2009 through 2013. Those rates were adopted by the city council, are included in CMC 13.89 and are shown in Table 6.1.

Table 6.1: Stormwater Utility Rates

2010	2011	2012	2013
$7.65	$8.49	$9.00	$9.27

The current rates do not have a large capital component built in to the structure. The FSCG 2009 rate study set the storm rate to cover the cost of the operation and maintenance of the existing storm system and modest amounts for replacement of existing infrastructure. As part of the Fisher Basin Utility, some capital dollars have been available but that account has been depleted. To provide a secure long term capital fund, the FSCG study proposed implementation of a System Development Charge (SDC) with a methodology consistent with the current water and sewer SDC. The rate would capture both historical costs and future capital needs. .

To be consistent with the water and sewer SDC, the SDC could be allocated at a rate of 67% Developer funded and 33% City. This breakdown accounts for the developer responsibility per code to install the minimum requirements for their development and allowing a credit or providing funding for the regional component. If Council chooses not to implement the SDC, other funds would be responsible to implement this capital plan.

Future versions of this plan will include a rate study that will be developed to ensure the future rate structure is suitable for continued funding of both O&M activities and capital construction projects.

Section 6—Financing

Continued

The city is scheduled to conduct a utility rate study in 2013. A policy decision should be made on funding critical stormwater system capital needs through adoption of SDC's or through rates. The utility currently has no debt associated with the rates.

Section 7—References

Boornazian & Heare, 2008. Memorandum: Clarification on which stormwater infiltration practices/technologies have the potential to be regulated as "Class V" wells by the Underground Injection Control Program. United States Environmental Protection Agency. June 13, 2008.

FCSG 2010. City of Camas; Final Report for Utilities Rate Study. January 2010.

DEA 2001(a). Phase I Fisher Basin Stormwater and Wetlands Master Plan. David Evans and Associates. July 13, 2001. (Camas Project No. S-370).

DEA 2001(b). Technical Memorandum for Long-Term Assessment of North Dwyer Creek. David Evans and Associates. February, 2001. (Camas Project No. S-370).

DEA 1998. North Dwyer Creek Master Plan. Technical Memorandum #1: Inventory of Existing Conditions. David Evans and Associates. October 14, 1998. (Camas Project No. S-370).

Ecology 2006. Guidance for UIC Wells that Manage Stormwater. Washington State Department of Ecology. Publication Number 05-10-067. December 2006.

Washington Department of Ecology UIC Website. Retrieved January 28th, 2013. http://www.ecy.wa.gov/programs/wq/grndwtr/uic/registration/reginfo.html.

MFI 2005. Fisher Basin Hydrologic and Hydraulic Analysis. Maul, Foster, and Alongi. October 4, 2005. (Camas Project No. S-456).