Duvall SMP

Reconnecting with the Riverfront.

CITY OF DUVALL
SHORELINE MASTER PROGRAM
ADOPTED APRIL 19, 2016
RESOLUTION 16-07

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CHAPTER 1. INTRODUCTION

1.1 Purpose

Washington's Shoreline Management Act (RCW 90.58, as amended; hereafter referred to as 'the Act') was passed by the State Legislature in 1971 and adopted by the public in a referendum. The Act was created in response to a growing concern among residents of the state that serious and permanent damage was being done to shorelines by unplanned and uncoordinated development. The goal of the Act is "to prevent the inherent harm in an uncoordinated and piecemeal development of the state's shorelines." While protecting shoreline resources by regulating development, the Act is also intended to provide for appropriate shoreline use by encouraging land uses that enhance and conserve shoreline functions and values.

The Act has three broad policies:

1. Encourage water-dependent and water-oriented uses: "uses shall be preferred which are consistent with control of pollution and prevention of damage to the natural environment, or are unique to or dependent upon use of the states' shorelines...."

2. Promote public access: "the public's opportunity to enjoy the physical and aesthetic qualities of natural shorelines of the state shall be preserved to the greatest extent feasible consistent with the overall best interest of the state and the people generally."

3. Protect shoreline natural resources, including "...the land and its vegetation and wildlife, and the water of the state and their aquatic life...."

The intent of the City of Duvall Shoreline Master Program is to ensure comprehensive planning for Duvall's shorelines through implementation of goals and policies, and to ensure the adoption and implementation of use regulations developed in accordance with the policies adopted by the State.

1.2 Title

This document shall be known and may be cited as the City of Duvall Shoreline Master Program (the "Program", "Master Program" or "SMP").

1.3 Adoption Authority

This Program is adopted under the authority granted by the Act and its implementing guidelines in WAC Chapter 173-26, as amended.

1.4 Applicability

Except when specifically exempted from the Act and this Program by statue, all proposed uses and development occurring within shoreline jurisdiction must conform to chapter 90.58 RCW, the Act and this Program. The policies and regulations of this Program apply to all shoreline uses and developments within shoreline jurisdiction whether or not a shoreline permit or statement of permit exemption is required. The City of Duvall has the authority and responsibility to condition a project even if it is exempt from the requirement for a substantial development permit.

1.5 Liberal Construction

As provided for in RCW 90.58.900, Liberal Construction, the Act is exempted from the rule of strict construction; the Act and this Program shall therefore be liberally construed to give full effect to the purposes, goals, objectives, and policies for which the Act and this Program were enacted and adopted.

1.6 Severability

The Act and this Program adopted pursuant thereto comprise the basic state and City law regulating use of shorelines in the City of Duvall. Should any section or provision of this program be declared invalid, such decision shall not affect the validity of this Program as a whole. In the event provisions of this Program conflict with other applicable City policies or regulations in the shoreline, the provisions of this Program shall prevail.

1.7 Urban Growth Area

The policies and regulations of this master program do not apply to the City's Northwest Urban Growth Area. The Northwest Urban Growth Area is designated and regulated under the King County shoreline master program. The City does not anticipate annexation of the Northwest Urban Growth Area, and accordingly has not pre-designated, or established polices and regulations, for the area.

1.8 Shoreline Jurisdiction

Shoreline Management Act jurisdiction includes all "shorelines of the state" as defined in RCW 90.58.030. In Duvall, the shoreline area to be regulated by the City's Program includes:

- The Snoqualmie River within the City's municipal boundary;
- The upland area landward 200 feet of the ordinary high water mark (OHWM) of Snoqualmie River;
- All associated wetlands;
- The mapped floodway areas associated with the River as identified within the Federal Emergency Management Agency's Preliminary Flood Insurance Study for King County, Washington and Incorporated Areas and accompanying flood insurance rate map (FIRM) (dated November 6, 2012), or a more recent Federal Emergency Management Agency adopted Flood Insurance Study and accompanying flood insurance rate map (FIRM) for the Snoqualmie River consistent with DMC Chapter 14.84 – Floodplain Regulations, section DMC 14.84.040.A; and
- Contiguous floodplain areas within 200 feet of the mapped floodway as identified within the Federal Emergency Management Agency's Preliminary Flood Insurance Study for King County, Washington and Incorporated Areas and accompanying flood insurance rate map (FIRM) (dated November 6, 2012), or a more recent Federal Emergency Management Agency adopted Flood Insurance Study and accompanying FIRM for the Snoqualmie River consistent with DMC Chapter 14.84 – Floodplain Regulations, section DMC 14.84.040.A.

The policies and regulations of this program shall apply to the waters of the Snoqualmie River and adjacent "shorelands" within the Duvall City Limits. See the official Shoreline Environment Designation Map (Section 3.5, Figure 1) for depiction of the area regulated by this Program. The official Shoreline Environment Designation Map does not necessarily identify or depict the exact lateral extent of

shoreline jurisdiction or all associated wetlands. The lateral extent of the shoreline jurisdiction shall be determined at the responsibility of the applicant on a case-by-case basis based on the location of the OHWM, floodway and/or the presence and boundaries of associated wetlands.

Associated wetlands, floodways and floodplains that are included in the shoreline jurisdiction are those that influence or are influenced by the Snoqualmie River.

The Act further designates some shorelines as "shorelines of statewide significance". The Snoqualmie River is designated a "shorelines of statewide significance" within the City of Duvall.

1.9 Document Organization

This Shoreline Master Program establishes long-term planning goals and policies, specific development standards and use regulations, and permitting and administrative procedures. As such, this Program is a stand-alone document that is linked to other City planning documents such as the Duvall Comprehensive Plan and to the Duvall Municipal Code (DMC), as amended. The organization of this Program and the purpose for each chapter is explained below.

- Chapter 1. Introduction: provides background, purpose, legal authority, and identification of shoreline jurisdiction extent.
- Chapter 2. Shoreline Goals: provides a set of shoreline goals developed with the community.
- Chapter 3. Shoreline Environment Designations: establishes a purpose and identifies designation criteria and management policies for specific areas within the shoreline jurisdiction.
- Chapter 4. General Use Policies and Regulations: Provides general policies and regulations that apply broadly to uses and developments in all shoreline jurisdiction.
- Chapter 5. Shoreline Modification– Establishes policies and regulations of shoreline modification activities and structures.
- Chapter 6. Use Specific Policies and Regulations – Establishes policies and regulations of specific uses whenever they occur in shoreline jurisdiction.
- Chapter 7. Administrative Provisions: provides procedures and process for permit applications associated with shoreline development.
- Chapter 8. Definitions: provides definitions for terms used throughout this Program.

1.10 Common Acronyms

The following acronyms are commonly used in this Program:

DMC	Duvall Municipal Code
FIRM	Flood Insurance Rate Map
OHWM	Ordinary high water mark (defined in Chapter 8 of this Program)
RCW	Revised Code of Washington
WAC	Washington Administrative Code

CHAPTER 2. SHORELINE GOALS

The City of Duvall, by establishing this Program, intends to control and regulate future development in a manner consistent with the goals, policies and regulations of the Shoreline Management Act of 1971 (RCW 90.58340). Development and redevelopment in the shoreline area should occur in a manner that maintains a balance between competing uses, does not impair shoreline ecological processes and functions, and results in the overall improvement of natural resources in the shoreline. An over-arching goal of the master program is to ensure that future use and development of the City's shoreline results in no net loss of shoreline ecological functions.

The following shoreline goals are commensurate with the intent and objectives of the Act and the implementing guidelines (WAC 173-26, as amended) and provide the foundation and framework on which the balance of this Program has been developed.

Economic Development Goal: Promote healthy, orderly economic growth by encouraging economic activities that will be an asset to the local economy, which result in commercial uses that are compatible with the intent of the Act and the City, and which maintain the shoreline ecological functions.

Public Access / Recreation Goal: Provide opportunities for new and enhanced physical and visual public access to and water-oriented recreational opportunities within the City's shorelines when such access and/or recreation can be reasonably accommodated without human health or safety risks, without adverse effects on shoreline functions, and consistent with private property rights.

Shoreline Use Goal: Ensure that the land use patterns in the shorelines protect the existing character of the City and protect existing shoreline environments, habitats, and ecological functions.

Conservation and Restoration Goal: Preserve and protect ecological functions and processes necessary to maintain shoreline natural resources, protect public health and safety, and preserve beneficial uses of the shoreline; restore and enhance identified degraded ecological functions and processes over time.

Archaeological, Historical, Cultural, Scientific and Educational Resources Goal: Identify, protect, preserve and restore important archeological, historic, cultural sites located in shoreline areas for educational and scientific values and enjoyment of the general public.

Flood Hazard Management Goal: Protect shoreline resources and shoreline development and ensure public safety through land use controls and implementation of federal, state and local flood hazard programs.

CHAPTER 3. SHORELINE ENVIRONMENT DESIGNATIONS

3.1 Shoreline Environment Designations System

1. Shorelines are classified according to specific shoreline environment designations. The purpose of shoreline environment designations is to provide a uniform basis for applying policies and regulations in distinct shoreline areas having similar characteristics.

2. The extent of each shoreline environment designation is shown throughout the mapped extent of shoreline jurisdiction on the Official Shoreline Environment Designation Map (Section 3.5, Figure 1). The Official Shoreline Environment Designation Map does not necessarily identify or depict the lateral extent of each shoreline environment or all associated wetlands. The lateral extent of the shoreline jurisdiction and each shoreline environment shall be determined on a case-by-case basis compliant with Section 1.8 of this Program.

3. In accordance with the State's guidelines, Duvall's shoreline designations are based on:

    a. The existing land use pattern;

    b. The biological and physical character of the shoreline; and

    c. The goals and aspirations of the community as expressed through comprehensive plans as well as the criteria in WAC 173-26-211.

4. To accomplish the purpose of this Program the following shoreline environment designations have been established in the City of Duvall:

    a. South McCormick Park Passive Recreation and Conservancy

    b. North McCormick Public Recreation

    c. Riverside Village

    d. Taylor's Landing Public Recreation

    e. Aquatic

5. Shoreline Environment Designations are delineated on a map, and hereby incorporated as a part of this Program as the official Shoreline Designation Map (Section 3.5, Figure 1). The Official Shoreline Map is for planning purposes only and shall be used to depict Shoreline Environment Designations.

6. The City may, from time to time as new or improved information becomes available, modify the Official Shoreline Environment Designation Map consistent with state guidelines to more accurately represent, clarify, or interpret the true limits of the shorelines defined herein. The application of a shoreline management designation to a particular shore segment shall not change except through an amendment to this SMP.

3.2 Environment Designations Purpose, Criteria, and Policies

For each shoreline environment designation a purpose, designation criteria, and general management policies are provided. Any areas within the City's shoreline jurisdiction that have not been mapped and designated shall be designated Urban Conservancy in accordance with WAC 173-26-211 (2) (e) and will be managed and regulated under the identified goals, policies, and regulations of the Urban Conservancy designation in WAC 173-26-211 (5) (e).

3.2.1 South McCormick Park Passive Recreation and Conservancy

1. Purpose

The purpose of the "South McCormick Park Passive Recreation and Conservancy" environment is to protect those shoreline areas in the McCormick Park area that are ecologically intact. These areas are inappropriate for intense development and require that only low intensity uses be allowed in order to maintain the ecological functions and ecosystem-processes.

2. Designation Criteria

The "South McCormick Park Passive Recreation and Conservancy" environment designation is assigned to publicly owned and adjoining privately owned areas within the McCormick Park shoreline area with ecologically intact public open space and low intensity recreation as primary uses.

3. Management Policies

The "South McCormick Park Passive Recreation and Conservancy" environment should be managed consistent with the following policies:

a. Riparian forest cover should be protected and maintained through effective use of shoreline buffer standards and voluntary conservation and restoration practices.

b. New development throughout shoreline jurisdiction should be limited to recreational and utility uses appropriate for floodplain, floodway and channel migration zone environments.

c. New structural shoreline armoring should be prohibited, except as necessary for water-dependent recreational and water-dependent utility uses and developments.

d. Maintenance of public infrastructure should be allowed while minimizing and mitigating impacts to shoreline ecological functions.

e. Low intensity recreational use and development opportunities that enhance public access and enjoyment of shoreline jurisdiction should be encouraged; public access and public recreation objectives should be implemented whenever feasible and significant ecological impacts can be mitigated.

f. All allowed uses and developments should maintain or improve ecological functions and ecosystem-processes;

g. Restoration activities should be prioritized in this designation over other shoreline environment designations; the City should consider use of the South McCormick Park environment as a mitigation receiving area for impacts occurring elsewhere in the City.

3.2.2 Riverside Village

1. Purpose

The purpose of the "Riverside Village" environment is to accommodate moderate to high intensity residential and commercial uses within Duvall's Snoqualmie River shoreline extending north from McCormick Park to the NE Woodinville-Duvall Road Bridge.

2. Designation Criteria

The "Riverside Village" environment designation is applied to those areas of the City's shorelines that are characterized predominantly by existing and planned moderate density development, have moderately or highly impaired ecological functions and are planned and zoned for mixed use development.

3. Management Policies

The "Riverside Village" environment should be managed consistent with the following policies:

a. Standards for lot coverage, buffers, vegetation conservation, critical areas, and water quality standards should be set to ensure minimization of adverse impacts and to achieve no net loss of shoreline ecological functions.

b. Riparian corridor to the west of the existing Snoqualmie Valley Trail alignment should be protected and maintained through effective use of shoreline buffer standards and voluntary conservation and restoration practices.

c. Uses that result in restoration of ecological functions should be allowed if the use is otherwise compatible with the purpose of the environment and the setting.

d. Access, utilities, and public services should be available and adequate to serve existing needs and/or planned future development.

e. Public access objectives should be implemented whenever feasible and when significant ecological impacts can be mitigated.

f. Water-oriented uses should be given priority over nonwater-oriented uses.

3.2.3 North McCormick Park Public Recreation / Taylor's Landing Public Recreation

1. Purpose

The purpose of the "North McCormick Park Recreation" / "Taylor's Landing Public Recreation" environments is to protect and restore ecological functions of open space, floodplain and other sensitive lands where they exist in urban and developed settings, while allowing a variety of compatible uses, including water-related recreation.

2. Designation Criteria

The "North McCormick Park Recreation" / "Taylor's Landing Public Recreation" environments are appropriate for shoreline areas that provide existing public recreational access to the shoreline, including water-dependent recreation access, and retain desirable riparian characteristics such as minimal bank armoring, associated wetlands and tributary channels, and/or well developed streamside

vegetation. These areas can accommodate planned urban recreational development that is compatible with floodway and floodplain hazards and maintaining or restoring ecological functions.

3. Management Policies

The "North McCormick Park Recreation" / "Taylor's Landing Public Recreation" environment should be managed consistent with the following policies:

a. Uses should be limited to those which sustain the shoreline area's physical and biological resources; uses and structures within the floodway (west of the Snoqualmie Valley Trail) should be appropriate given associated hazards and ecological importance.

b. "North McCormick Park Recreation" / "Taylor's Landing Public Recreation" environment shorelines are suitable for ongoing use of existing and development of new trails, viewpoints, watercraft launches, or other types of generally low-impact public access and water-oriented recreational development as long as such uses are sited to minimize impacts on shoreline functions.

c. New development throughout shoreline jurisdiction should be appropriate for floodplain, floodway and channel migration zone environments.

d. Standards should be established for shoreline stabilization measures, vegetation conservation, water quality, and shoreline modifications to ensure that as new water-oriented recreational and utility uses and developments occur, there is not a net loss of shoreline ecological functions or further degradation other shoreline values.

e. Public access and public recreation objectives should be implemented whenever feasible and when significant ecological impacts can be mitigated.

f. Maintenance and upgrades of public utilities and other infrastructure should be allowed while minimizing and mitigating impacts to shoreline ecological functions.

g. Water-oriented uses should be given priority over nonwater-oriented uses.

3.2.4 Aquatic Environment

1. Purpose

The purpose of the "Aquatic" environment is to protect, restore, and manage the unique characteristics and resources of the areas waterward of the ordinary high-water mark.

2. Designation Criteria

The "Aquatic" environment designation is appropriate for lands and aquatic areas waterward of the OHWM.

3. Management Policies

The "Aquatic" environment should be managed consistent with the following policies:

a. New structures should be allowed in- or over-water only when necessary for approved water-dependent uses, utility crossings, public access, or ecological restoration.

b. The size of new in-/over-water structures should be limited to the minimum necessary to support the structure's intended use.

c. To reduce the impacts on shoreline functions and processes, new in-/ over-water structures should serve more than one approved use where feasible.

d. New in-/over water structures should be located and designed to minimize interference with surface navigation and to allow for the safe, unobstructed movement of fish and wildlife species that depend on the waters for migration, rearing or spawning.

e. New in-/over water structures should be located and designed to minimize impacts on water quality, sediment delivery and transport, productivity of aquatic vegetation, and shellfish productivity.

3.3 Use and Standards Tables

All uses and developments in the Duvall shoreline jurisdiction shall comply with the use regulations contained in Table 1. Refer to the text sections of this Program for all applicable provisions related to specific uses and development standards.

For each type of development or modification, a determination is made on whether it can be permitted by Substantial Development Permit, conditional use permit, or whether it is prohibited (dependent on type of use or activity and environment designation). The following table identifies allowed and prohibited shoreline uses and modifications (in each shoreline environment designation and under what circumstances).

"P" = Permitted - Permitted uses may require a letter of shoreline exemption (Section 7.3.4 of this Program) or a shoreline substantial development permit (Section 7.3.1 of this Program), and any other permits required by the DMC and/or other regulatory agencies. Permitted uses must be consistent with the applicable standards of this Program.

"CUP" = Conditional Use - Conditional uses require a shoreline conditional use permit (section 7.3.6 of this Program) and may require other permits required by the DMC and/or other regulatory agencies. Some uses that are considered exempt from a shoreline substantial development permit consistent with this Program and WAC 173-27-040 could still be required to obtain a shoreline conditional use permit.

"X" = Prohibited - Prohibited uses and activities are those which are not allowed within the shoreline jurisdiction.

Table 1. Permitted Use and Modification Table

Use/Modification	South McCormick Park Passive Recreation and Conservancy	N. McCormick Public Recreation / Taylor's Landing Public Recreation	Riverside Village	Aquatic (Snoqualmie River)
Agriculture	X	X	X	X
Boating facilities				
Boat launch ramps	CUP, hand launch only	P; hand launch only in McCormick Park; no more than 1 launch total in Taylor's Landing Park	X	Only where permitted in adjacent designation
Docks	X	X	X	X
Dry boat storage	X	CUP, only when hand launch-able, public, & associated with public use	X	X
Docks, Residential	X	X	X	X
Clearing and grading[1]	P, only in association with an allowed use	P, only in association with an allowed use	P, only in association with an allowed use	X
Commercial development				
Water-related	P[2]	P[2]	P	X
Water-enjoyment	P[2]	P[2]	P	X

[1] See bulk and dimensional standards (including impervious surface limits and riparian zone standards) in Table 3.

[2] Commercial development within the South McCormick Park Passive Recreation and Conservancy, North McCormick Public Recreation, and Taylor's Landing Public Recreation designations shall only be permitted to the east of the Snoqualmie Valley Trail when permitted by DMC Title 14 (Unified Development Regulations).

Use/Modification	South McCormick Park Passive Recreation and Conservancy	N. McCormick Public Recreation / Taylor's Landing Public Recreation	Riverside Village	Aquatic (Snoqualmie River)
Non-water-oriented	P[2]	P[2]	P	X
Dredging and dredge material disposal[3]				
Dredging	CUP	CUP	CUP	CUP
Dredge Material Disposal	CUP	CUP	CUP	CUP
Ecological restoration / enhancement / mitigation				
Ecological restoration / enhancement / mitigation	P	P	P	P
Shoreline habitat and natural systems enhancement	P	P	P	P
Wetland Mitigation Bank / Off-site mitigation	P	P	P	X

[3] All dredging and dredge material disposal shall require CUP approval – generally would only be allowed when associated with restoration projects (see Section 5.2 of this Program).

Use/Modification	South McCormick Park Passive Recreation and Conservancy	N. McCormick Public Recreation / Taylor's Landing Public Recreation	Riverside Village	Aquatic (Snoqualmie River)
Fill [4]				
Within floodway[5]	P, only in association with an allowed use	P, only in association with an allowed use	P, only in association with an allowed use	CUP
Outside floodway	P, only in association with an allowed use	P, only in association with an allowed use	P, only in association with an allowed use	N/A
Flood control works				
Levees	X	X	X	X
Flood curtain / wall protection for allowed uses E of the Snoqualmie Valley Trail	P	P	P	N/A
Forest practices	X	X	X	X
Industrial development	P[6]	X	X	X

[4] Any fill within floodplain cannot hydrologically decrease flood storage; fill may be allowed when hydrologically better compensatory flood storage is provided (see Section 4.4 of this Program).

[5] Any fill within the floodway shall be prohibited unless meeting DMC Title 14.K. requirements as well as this Program; see Section 4.4 of this Program for policies and regulations.

[6] Industrial development within the South McCormick Park Passive Recreation and Conservancy designation shall only be permitted to the east of the Snoqualmie Valley Trail when permitted by DMC Title 14 (Unified Development Regulations).

Use/Modification	South McCormick Park Passive Recreation and Conservancy	N. McCormick Public Recreation / Taylor's Landing Public Recreation	Riverside Village	Aquatic (Snoqualmie River)
In-stream structures[7]	CUP	CUP	CUP	CUP
Mining	X	X	X	X
Parking	CUP, only to the east of the Snoqualmie Valley Trail and only as accessory to an allowed use	P, only as an accessory to an allowed use, or as park & ride facility at existing King County Metro Duvall Park & Ride facility area in the Taylor's Landing Public Recreation environment	P, only as an accessory to an allowed use	X
Recreational development				
Trails	P	P	P	X
Temporary recreational uses	P	P	P	X
Water-dependent	P	P	p	P
Water-related	P, low-intensity only	P	P	X
Water-enjoyment	P, low-intensity only	P	P	X
Non-water-oriented[8]	CUP	CUP	CUP	X

[7] In-stream structures do not include shoreline stabilization structures or boating facilities and shall not include seasonal booms or buoy ropes associated with recreational use.; see 'In-stream structure' definition (Section 8.2). In-stream structures shall only be permitted with a CUP in association with a restoration project.

[8] Non-water oriented recreational development shall include but not be limited to off-leash dog areas and sports fields (soccer, baseball, or other level recreational sports field); see Section 6.3 of this Program.

Use/Modification	South McCormick Park Passive Recreation and Conservancy	N. McCormick Public Recreation / Taylor's Landing Public Recreation	Riverside Village	Aquatic (Snoqualmie River)
Residential development[9]	P[10]	X	P	X
Mixed use development	X	X	P	X
Shoreline stabilization				
Structural shoreline stabilization	CUP	CUP / P, only when incorporating ecological design	CUP	CUP / P, only when incorporating ecological design
Biostabilization / soft shore-bank stabilization	P	P	P	P
Signs	P, only in association of an allowed use	P, only in association of an allowed use	P, only in association of an allowed use	P, only in association with a water-dependent use
Stormwater Facilities (where allowed, only when accessory to an allowed use)	P	P	P	X
Transportation Facilities	X	X	P, only w/in existing ROWs	P (In-water supports prohibited)

[9] Residential development includes single-family and multifamily development, as well as continuation of existing mobile home use; allowed residential use shall be consistent with Section 6.4 of this Program and City Zoning (DMC Title 14).
[10] Residential development within the South McCormick Park Passive Recreation designation shall only be permitted to the east of the Snoqualmie Valley Trail when associated with Main Street fronting uses; see Section 6.4 of this Program.

Use/Modification	South McCormick Park Passive Recreation and Conservancy	N. McCormick Public Recreation / Taylor's Landing Public Recreation	Riverside Village	Aquatic (Snoqualmie River)
Utilities				
Water-dependent	P	P	P	P
Non-water dependent (overhead)	CUP / P, in existing corridors	CUP / P, in existing corridors	CUP / P, in existing corridors	CUP / P, in existing corridors
Non-water-dependent (underground)	CUP / P, in existing corridors	CUP / P, in existing corridors	CUP / P, in existing corridors	CUP / P, in existing corridors
Unclassified Uses	CUP	CUP	CUP	CUP

Table 2 identifies standards for building height, impervious surface coverage, and riparian management zone by shoreline environment designation. Regulations for each standard are provided after the table.

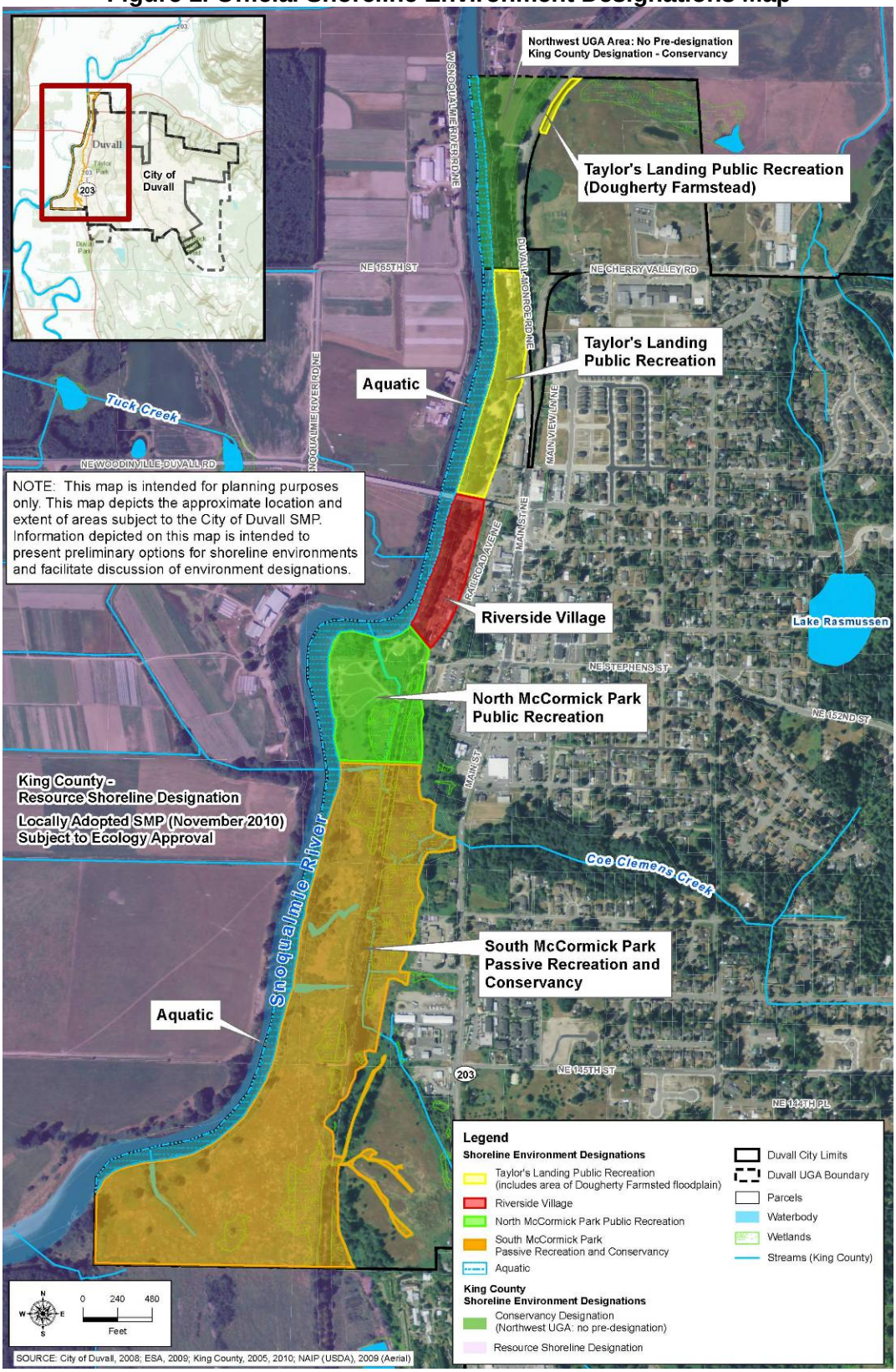
Table 2. Bulk Dimensional and Vegetation Standards

Bulk Dimensional and Vegetation Standards	South McCormick Park Passive Recreation and Conservancy	N. McCormick Public Recreation / Taylor's Landing Public Recreation	Riverside Village	Aquatic (Snoqualmie)
Maximum Impervious Surface Coverage[11]	10%	25%	60%	N/A
Maximum Building Height				
West of SVT[12]	15 feet[13]	15 feet	Buildings not allowed	N/A
East of SVT	15 feet[13]	25 feet	35 feet	N/A
Minimum Riparian Zone[14]	200 feet (additional 50 feet beyond DMC 14.42)	150 feet (Consistent with DMC 14.42.320)	West of existing SVT (Consistent with DMC 14.42.320)	N/A

[11] Determined for each lot of record; maximum impervious surface coverage shall be increased in the South McCormick Park, North McCormick Park, Riverside Village, and Taylor's Landing shoreline environments when Snoqualmie River riparian restoration is provided; see Section 4.1 of this Program for impervious surface regulations.
[12] Any allowed permanent structures within the floodway would be prohibited unless meeting DMC Title 14 requirements as well as this Program.
[13] 15 foot maximum building height allowed in the South McCormick Park Passive Recreation and Conservancy environment for shelters or similar recreational use structures meeting requirements of this Program.
[14] The Minimum Riparian Zone is proposed as the area landward of the Snoqualmie River OHWM to be maintained / enhanced with native riparian vegetation.

3.4 Official Shoreline Environments Designation Map

Figure 1. Official Shoreline Environment Designations Map



CHAPTER 4. GENERAL USE POLICIES AND REGULATIONS

The following shoreline policies and regulations apply to all shoreline environment designations.

4.1 Shoreline Use

4.1.1 Policies

1. Water-dependent uses that preserve shoreline ecological functions and processes are preferred shoreline uses. Secondary preference is given to water-related and water-enjoyment uses, and to those uses that enhance public access to the shoreline or include elements of shoreline restoration.

2. The design, density and location of all allowed uses and developments should reflect physical and natural features of the shoreline and should assure no net loss of ecological functions by avoiding and minimizing adverse effects on shoreline ecology.

3. Uses and development which include restoration of shoreline areas that have been degraded as a result of past activities is highly encouraged.

4.1.2 General Use Regulations

1. All uses in the shoreline shall comply with the City's Unified Development Regulations (DMC Title 14) and this Program.

2. In order to implement the directives of the Act, the regulations of this Program shall:

    a. Be sufficient in scope and detail to ensure the implementation of the Act, statewide shoreline management policies of WAC 173-26, and the policies of this Program;

    b. Include environment designation regulations that apply to specific environments consistent with WAC 173-26-210;

    c. Include general regulations, use regulations that address issues of concern in regard to specific uses, and shoreline modification regulations; and

    d. Design and implement regulations and mitigation standards in a manner consistent with all relevant constitutional and other legal limitations on the regulation of private property.

3. The shoreline use table (Table 1 in Chapter 3) defines those uses that are permitted outright and those uses that are only permitted as a conditional use. All unclassified uses shall be considered conditional uses and shall be governed by the policies and standards in WAC 173-26.

4. Specific shoreline use regulations are located in Chapters 6 of this Program.

5. Impervious surface coverage:

a. The maximum impervious coverage allowed for development and redevelopment of lot areas within shoreline jurisdiction shall be as specified by Table 2 in Chapter 3 of this Program. Impervious surface coverage limits shall be enforced independently for each lot of record.

b. The impervious surface coverage limits for each lot of record may be increased over the maximums included in Table 2 in Chapter 3 of this Program; increased impervious surface coverage limits shall never exceed the following:

   i. 20% for South McCormick Park Passive Recreation and Conservancy;

   ii. 35% for North McCormick Park Public Recreation and Taylor's Landing Public Recreation; and

   iii. 90% for Riverside Village

c. Increases in impervious surface coverage over the standard maximums included in Table 2 in Chapter 3 of this Program shall only be permitted by the Planning Director when restoration of the Snoqualmie River riparian buffer area is provided. Where permitted, the area of required riparian restoration should be determined relative to the square footage of impervious surface coverage proposed, consistent with the ratios provided in Table 3. Riparian restoration shall occur along the Snoqualmie River within the City at a location approved by the Planning Director.

Table 3. Required Snoqualmie River Riparian Restoration for Increases in Impervious Surface Coverage

Impervious surface coverage (determined for each lot of record)	Snoqualmie River riparian restoration
At or below the standard maximums included in Table 2	No riparian restoration required
Zero to ten percent (0% to 10%) above the standard maximums included in Table 2	Required at a one to one (1:1) ratio
More than ten percent (10%) above the standard maximums included in Table 2	Required at a two to one (2:1) ratio

4.2 Maintenance of Existing Public Recreation and Utility Uses and Structures

4.2.1 Policies

1. Normal and routine maintenance activities for public recreation and utility uses and structures should not qualify as development and should not require a shoreline substantial development permit whenever such normal and routine maintenance is

exempt from requiring a shoreline substantial development permit compliant with Section 7.3 of this Program and WAC 173-27-040 (List of Exemptions).

2. Normal and routine maintenance activities should be completed consistent with the policies and standards of this Program.

4.2.2 Regulations

1. The following normal and routine maintenance activities for public recreation and utility uses and structures do not qualify as development and shall not require a shoreline substantial development permit or shoreline conditional use permit; however shall be completed consistent with the policies and standards of this Program:

   a. Mowing and placement of landscaping mulch, compost, and other City approved soil amendments within existing and permitted landscaped areas.

   b. Clearing activities that do not qualify as significant vegetation removal; see Sections 4.6 (Vegetation Conservation), 5.2 (Fill, Ditching, Clear and Grade), and 8.2 (Definitions – 'pruning' and 'significant vegetation removal').

   c. Mowing and removal of volunteer vegetative growth within existing and legally established utility maintenance corridors and active use recreation areas. Removal of volunteer native growth under this allowance for normal and routine maintenance shall not include clearing of any trees over 4 inches diameter at breast height. Existing utility maintenance corridors and active use recreation areas are identified in Figure 2, included in subsection 4.4.2.3 of this Program.

   d. Mowing and removal of volunteer vegetative growth within stormwater ponds and stormwater conveyance swales. Removal of volunteer native growth under this allowance for normal and routine maintenance shall not include clearing of any trees over 4 inches diameter at breast height.

   e. Inspection, cleaning, and minor repair of catch basins, culverts, and outfall structures when activities are consistent with the exemption allowances adopted by reference within Section 7.3.2 of this Program, and/or do not exceed the monetary threshold for shoreline substantial development permit exemption established by reference within Section 7.3.2 of this Program. These allowed normal and routine maintenance activities shall not require excavation, grading, or placement of new fill.

   f. Inspection, cleaning, and minor repair of existing roads, sidewalks, trails, and parking lots when activities are consistent with the exemption allowances adopted by reference within Section 7.3.2 of this Program, and/or or do not exceed the monetary threshold for shoreline substantial development permit exemption established by reference within Section 7.3.2 of this Program. These allowed normal and routine maintenance activities shall not require excavation, grading, or placement of new fill. Minor repair of existing paved surfaces shall be limited to filling potholes, sealing / filling cracks, and resurfacing in-kind of previously improved areas. Repair of unpaved surfaces shall be limited to filling of potholes,

raking, and addition of surface material in-kind with the existing unpaved surface material.

g. Placement of clean sand at the McCormick Park swim beach to maintain existing public shoreline use, provided:

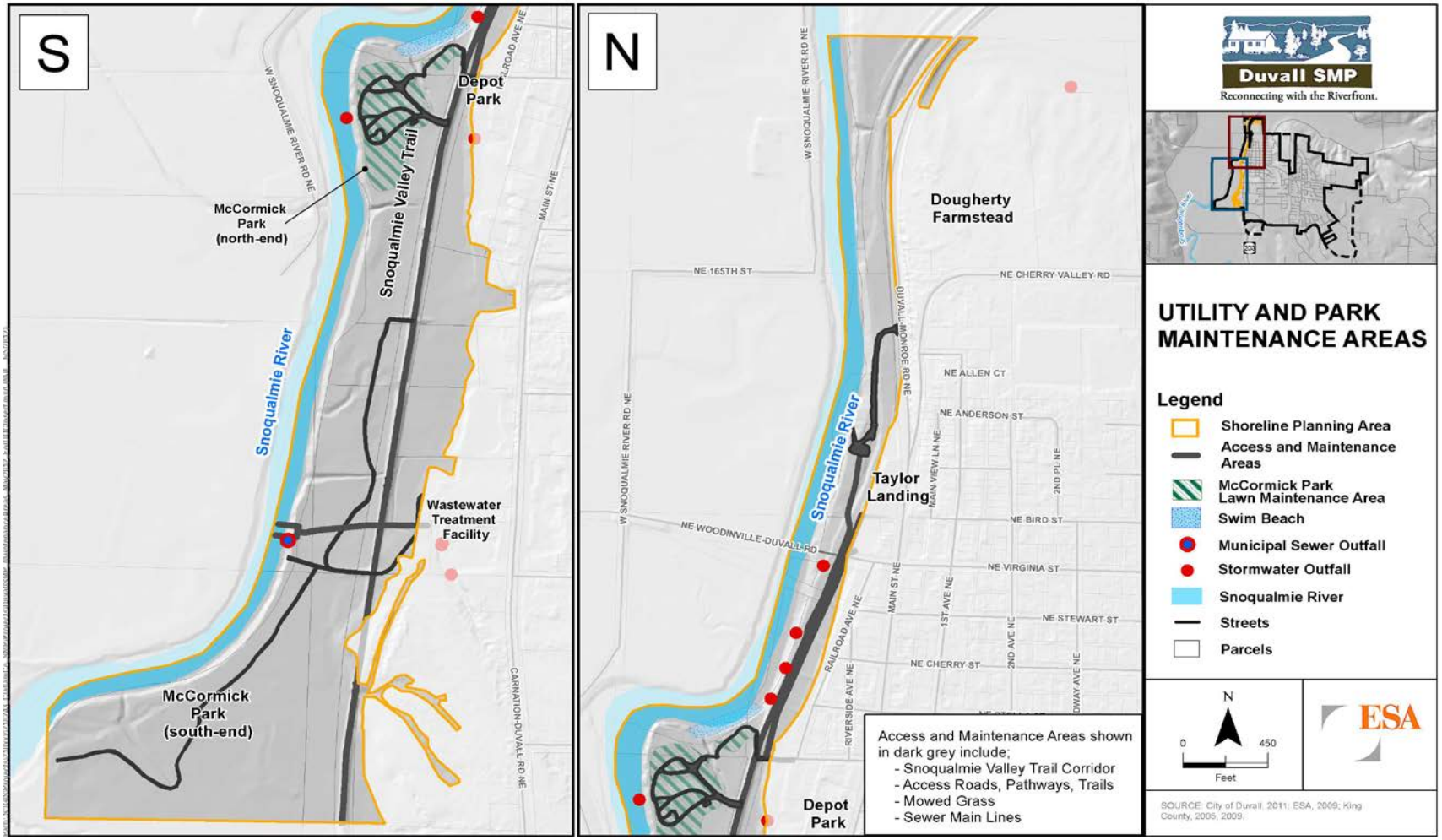
   i. All other required federal and state permits shall be obtained and made available to the Planning Director; and

   ii. The sand material shall be acquired from a source approved by the Planning Director.

2. The determination of shoreline substantial development permit exemption for all other normal maintenance activities shall be made by the Planning Director; decisions of exemption shall be based on the shoreline substantial development permit exemption criteria, included by reference in Section 7.3.2 of this Program. Maintenance and repair activities that require excavation or placement of fill material not specifically allowed by Section 4.2.2.1. shall require a shoreline substantial development permit.

3. Public Park and Utility Maintenance Areas Figure. Figure 2 identifies existing public park and utility maintenance areas, consistent with allowances provided in this section. The Planning Director shall use Figure 2 in reviewing requests made by Duvall Public Works for activities that may qualify as normal and routine maintenance but are not included within Section 4.2.2.1. The Planning Director may update the content of Figure 2 as new public park and/or utility infrastructure is permitted within shoreline jurisdiction. Any administrative updates to Figure 2 shall not alter requirements of this section, shall not require an amendment to this Program, and shall be made available to Duvall Public Works, Ecology, and other interested members of the public.

Figure 2. Public Park and Utility Maintenance Areas



4.3 Archeological, Historical and Cultural Resources

4.3.1 Policies

1. The location of cultural and archeological sites should not be disclosed to the general public, consistent with applicable state and federal laws.

2. Development on sites having or adjacent to historical, cultural and archeological resources should avoid and minimize impacts to the resource. The City should endeavor to involve tribal governments and the State Department of Archaeology and Historic Preservation in the review of development projects that could adversely affect such resources.

3. The City should encourage educational projects and programs that foster a greater appreciation of the importance of shoreline management, local history, and environmental conservation.

4.3.2 Regulations

1. If any archeological artifacts are uncovered during excavations in the shoreline, work must stop and the City of Duvall, the Snoqualmie Indian Tribe, the Tulalip Tribe, the Muckleshoot Tribe, and the State Department of Archeology and Historic Preservation must be notified.

2. Proposed development projects in areas known or highly suspected to contain archeological artifacts and data shall have provisions providing for a site inspection and evaluation by an archeologist in coordination with Snoqualmie Indian Tribe, the Tulalip Tribe, and the Muckleshoot Tribe prior to initiation of disturbance and for monitoring of potentially disruptive activities. Cost for inspection and evaluation of the site will be the responsibility of the project proponent. Significant archeological data or artifacts shall be recovered before work begins or resumes on a project.

4.4 Environmental Protection and Sensitive Areas

4.4.1 Policies

1. The City should preserve, enhance, and/or protect critical areas in shoreline jurisdiction for their ecological functions and values, as well as their aesthetic, scenic, and educational qualities.

2. Development should provide a level of protection to sensitive areas within the shoreline that achieves no net loss of ecological functions, with project specific and cumulative impacts considered in assessing the potential for net loss of ecological functions.

3. This program should ensure that the City's shoreline ecological functions are maintained or improved in the long term through effective implementation of the City's Sensitive Areas Code.

4. Proponents of development should require mitigation proportionate and related to the expected impacts of the proposed development.

4.4.2 Regulations

1. The City of Duvall Sensitive Areas Ordinance, as adopted by Ordinance 1056 and codified in DMC 14.42, are herein incorporated into this Program except as noted. Exceptions to the applicability of the City of Duvall Sensitive Areas Code within the shoreline jurisdiction are as follows:

    a. Activities that are exempt from the Sensitive Area Code per DMC 14.42.040 shall comply with this Program. Such activities may require a shoreline letter of exemption, shoreline substantial development permit, shoreline variance or shoreline conditional use permit consistent with the administrative provisions in Chapter 7 of this Program.

    b. Procedural provisions, such as review per 14.42.030, appeals per 14.42.080, and enforcement per 14.42.140 within shoreline jurisdiction shall be governed by this Program and not the Sensitive Areas Code.

    c. The variance and reasonable use provisions of DMC 14.70.010 and DMC 14.42.070 shall not apply in shoreline jurisdiction. Projects that propose to vary from the standards of this Program and integrated Sensitive Areas Ordinance standards shall require a shoreline variance according to the provisions of this Program and WAC 173-27.

    d. Permitted activities provide in DMC 14.42.050 (allowed activities), 14.42.220 (wetland alterations) and 14.42.330 (Fish and wildlife habitat conservation areas—Streams—Allowed uses) shall be permitted and shall not require a shoreline variance when consistent with this Program and all applicable Sensitive Areas Ordinance standards. Such activities shall be reviewed and permitted consistent with this Program, and shall require a shoreline letter of exemption, shoreline substantial development permit, or shoreline conditional use permit consistent with the administrative provisions in Chapter 7 of this Program.

    e. Sensitive areas studies shall be provided consistent with requirements of DMC 14.42.060, except that the exception listed under DMC 14.42.060.C.2 shall not be applicable.

    f. Mitigation shall be provided consistent with this Program and DMC 14.42.130, except that both mitigation banking and use of an in-lieu fee program may be used as a form of compensatory mitigation for wetland and fish and wildlife habitat conservation area impacts, provided that the bank or in-lieu fee program sites have been certified/approved by the state and federal agencies and have mitigation credits available for sale.

    g. Wetland—Designation, rating and mapping standards within DMC 14.42.200 shall be superseded by the following:

i. Wetlands shall be designated in accordance with the approved federal wetland delineation manual and applicable regional supplements as set forth in WAC 173-22-035.

ii. Wetlands shall be rated according to the Washington State Department of Ecology wetland rating system found in the 2014 Washington State Wetland Rating System for Western Washington (Ecology Publication No. 14-06-029). Wetlands shall be rated based on categories that reflect the functions and values of each wetland, with categories based on the criteria provided in the 2014 Washington State Wetland Rating System for Western Washington, as follows:

Category I Wetlands. Category I wetlands are those wetlands of exceptional value in terms of protecting water quality, storing flood and stormwater, and/or providing habitat for wildlife as indicated by a rating system score of twenty three (23) points or more. These are wetland communities of infrequent occurrence that often provide documented habitat for sensitive, threatened or endangered species, and/or have other attributes that are very difficult or impossible to replace if altered.

Category II Wetlands. Category II wetlands have significant value based on their function as indicated by a rating system score of twenty (20) to twenty-two (22) points. They do not meet the criteria for Category I rating but occur infrequently and have qualities that are difficult to replace if altered.

Category III Wetlands. Category III wetlands have important resource value as indicated by a rating system score of between sixteen (16) and nineteen (19) points.

Category IV Wetlands. Category IV wetlands are wetlands of limited resource value as indicated by a rating system score of less than sixteen (16) points. They typically have vegetation of similar age and class, lack special habitat features, and/or are isolated or disconnected from other aquatic systems or high quality upland habitats.

h. Wetland buffer width standards within DMC 14.42.210.A shall be superseded by the followings:

i. Wetland buffers identified in Table 4 are based on the category of wetland and the habitat score as determined by a qualified wetland professional using the wetland rating system required by SMP 4.4.2.1.g. Wetland buffers have been established in accordance with the best available science.

Table 4. Standard Wetland Buffer Widths

Wetland Category	Minimum Buffer Width (Wetland scores 3-4 habitat points)	Buffer Width (Wetland scores 5 habitat points)	Buffer Width (Wetland scores 6-7 habitat points)	Buffer Width (Wetland scores 8-9 habitat points)
Category I: Based on total score	75 ft	105 ft	165 ft	225 ft
Category I: Bogs and Wetlands of High Conservation Value	190 ft	190 ft	190 ft	225 ft
Category I: Forested	75ft	105 ft	165 ft	225 ft
Category II: Based on score	75 ft	105 ft	165 ft	225 ft
Category III (all)	60 ft	105 ft	165 ft	225 ft
Category IV (all)	40 ft	40 ft	40 ft	40 ft

ii. The use of the standard buffer widths requires the implementation of the measures in Table 5, where applicable to a specific proposal, to minimize the impacts of the adjacent land uses. If an applicant chooses not to apply the mitigation measures in Table 5, than a thirty-three (33%) increase in the width of all buffers listed in Table 4 is required.

Table 5. Required Measures to Minimize Impacts to Wetlands

Disturbance	Required Measures to Minimize Impacts
Lights	• Direct lights away from wetland
Noise	• Locate activity that generates noise away from wetland • If warranted, enhance existing buffer with native vegetation plantings adjacent to noise source • immediately adjacent to the out wetland buffer

Disturbance	Required Measures to Minimize Impacts
Toxic runoff	• Route all new, untreated runoff away from wetland while ensuring wetland is not dewatered • Establish covenants limiting use of pesticides within 150 feet of wetlands • Apply integrated pest management
Stormwater runoff	• Retrofit stormwater detention and treatment for roads and existing adjacent development • Prevent channelized flow from lawns that directly enters the buffer • Use Low Impact Development techniques (per PSAT publication on LID techniques)
Change in water regime	• Infiltrate or treat, detain, and disperse into buffer new runoff from impervious surfaces and new lawns
Pets and human disturbance	• Use privacy fencing OR plant dense vegetation to delineate buffer edge and to discourage disturbance using vegetation appropriate for the ecoregion • Place wetland and its buffer in a separate tract or protect with a conservation easement
Dust	• Use best management practices to control dust
Disruption of corridors or connections	• Maintain connections to offsite areas that are undisturbed • Restore corridors or connections to offsite habitats by replanting

i. Wetland buffer reduction (DMC 14.42.210.B): Outright reduction of wetland buffer widths shall not be allowed within shoreline jurisdiction.

j. Wetland buffer averaging (DMC 14.42.210.C): No wetland buffer occurring in shoreline jurisdiction shall be reduced in any location by more than twenty-five (25) percent of the standard buffer width, regardless of wetland category, and only when reduction occurs as part of wetland buffer averaging.

k. The definitions of 'hydric soil' and 'delineation' included in DMC 14.42.700 shall not apply within shoreline jurisdiction; identification of hydric soils and identification and delineation of wetlands shall be done in accordance with the approved federal wetland delineation manual and applicable regional supplements. For wetland delineation purposes, the definitions of 'forested wetland' and 'mature forested wetland' provided in DMC 14.42.700 shall be superseded by definitions provided within wetland identification, delineation, and rating systems required by this Program.

l. Allowances for use of certain wetland buffers provided by DMC 14.42.220 F and G shall be applicable within shoreline jurisdiction, except that allowances for stormwater facilities shall only be approved within the outer twenty-five (25) percent of the standard wetland buffer width. Consistent with SMP 4.4.2.1.d., these allowances shall be permitted consistent with the administrative provisions in Chapter 7 of this Program.

m. Wetland mitigation ratios tables within DMC 14.42.240.B and DMC 14.42.240.C shall be superseded by the mitigation ratios in Table 6. Ratios for rehabilitation and enhancement may be reduced when combined with 1:1 replacement through creation or re-establishment (see Table 1a, *Wetland Mitigation in Washington State Part 1: Agency Policies and Guidance Version 1;* Ecology Publication #06-06-011a, Olympia, WA, March 2006 or as revised).

Table 6. Wetland Mitigation Ratios

Category and Type of Wetland	**Creation or Re-establishment**	**Rehabilitation only**	**Enhancement only**
Category IV	1.5:1	3:1	6:1
Category III	2:1	4:1	8:1
Category II	3:1	6:1	12:1
Category I: Based on functions	4:1	8:1	16:1
Category I: Mature and old growth forest	6:1	12:1	24:1
Category I: High conservation value / Bog	Not considered possible	Case by case	Case by case

n. As an alternative to mitigation ratios, mitigation requirements may also be determined using the credit/debit tool described in Calculating Credits and Debits for Compensatory Mitigation in Wetlands of Western Washington: Final Report (Ecology Publication #10-06-011, Olympia, WA, March 2012, or as revised) if approved by the director.

o. DMC 14.42.240.F, regarding buffers for replacement wetlands established pursuant to mitigation provisions, shall be applicable, except that the director shall not have the authority to approve a smaller buffer.

p. Use of allowances within DMC 14.42.240.G, regarding adjustments of wetland mitigation ratios, shall require a shoreline variance consistent with Chapter 7 of this Program.

q. Wetland mitigation timing provisions within DMC 14.42.24.J shall be superseded by the following: mitigation sites shall be constructed prior to or concurrent with wetland impacts. Delays in implementing the approved mitigation shall be reviewed on a case-by-case basis and may require additional mitigation to compensate for temporal loss of wetland functions.

r. The condition indicated by wetland mitigation monitoring standard DMC 14.42.260.A.3 shall be applicable to both scrub-shrub and forested plant communities.

s. Minimum riparian zones established in Table 2 of this Program shall be the standard buffers required for the Snoqualmie River, superseding the standard buffer indicated in 14.42.320.C.1. Stream buffer standards within DMC 14.42.300 through DMC 14.42.370 shall be applicable to minimum riparian zones for the Snoqualmie River, except where integrated Sensitive Areas Ordinance standards are in direct conflict with this Program.

t. Stream buffer reduction (DMC 14.42.320.F): No stream buffer occurring in shoreline jurisdiction shall be reduced in any location by more than twenty-five (25) percent of the standard buffer width.

u. Uses that are nonconforming with respect to Sensitive Areas Ordinance standards that occur within the shoreline jurisdiction shall be subject to this Program instead of the nonconforming provisions of Chapter 14.76 DMC.

2. Provisions of the Sensitive Areas Code that are not consistent with the Shoreline Management Act Chapter 90.58 RCW, and supporting Washington Administrative Code chapters shall not apply in the shoreline jurisdiction.

3. A proponent of any new shoreline use or development shall mitigate adverse environmental impacts whether or not the use/development requires a shoreline substantial development permit or is exempt from a shoreline permit. The mitigation sequence prescribed in DMC 14.42.700 ('mitigation' definition) shall be used in mitigating impacts from shoreline uses and development. Where this Program, including all applicable Sensitive Areas Ordinance standards, permit alteration to sensitive areas, the permitted activities shall be located, designed, and constructed to minimize and where possible avoid sensitive area disturbance to the maximum extent feasible, and so that all unavoidable impacts are fully mitigated.

4. If the provisions of the Sensitive Areas Code in DMC 14.42 and any part of this Program conflict, the provisions of this Program shall prevail.

4.5 Flood Hazard Reduction

4.5.1 Policies

1. Flood protection should be managed in accordance with the City's floodplains regulations, Stormwater Management and Erosion Control regulations, and the National Flood Insurance Program.

2. The City should participate in regional approaches to flood management issues within the Snoqualmie Watershed, coordinating with the Federal Emergency Management Agency, the State of Washington, King County, and other entities involved in reducing flood hazards.

3. Consistent with the City's floodplain regulations, DMC Title 14, the City should discourage development in floodplains and channel migration zones associated with the City's shorelines that would individually or cumulatively result in an increased risk of flood damage, channel erosion hazards, or further limit channel migration.

4. Non-structural flood hazard reduction measures should be given preference over structural measures. Non-structural measures include setbacks, land use controls prohibiting or limiting development in historically flooded area, removal or relocation of structures in flood-prone areas, or bioengineering measures. Structural flood hazard reduction measures should be avoided whenever possible, and when necessary should be conducted in a manner that assures no net loss of ecological functions and ecosystem-wide processes.

5. The City should not allow new uses, the creation of new lots, or the construction of new developments where the development or use would further require structural flood hazard reduction measures in the reasonably foreseeable future.

4.5.2 Regulations

1. All development in the shoreline shall comply with the City's floodplain provisions (DMC Title 14), floodplain regulations of the sensitive areas regulations (DMC 14.42.500), Storm Drainage Utility regulations (DMC 9.06), and the National Flood Insurance Program.

2. All development in the shoreline jurisdiction located within the floodplains and floodways designated on the Federal Emergency Management Agency's Preliminary Flood Insurance Study for King County, Washington and Incorporated Areas and accompanying flood insurance rate map (FIRM) (dated November 6, 2012). or a more recent Federal Emergency Management Agency adopted Flood Insurance Study and accompanying FIRM for the Snoqualmie River (consistent with DMC Chapter 14.84 – Floodplain Regulations, section DMC 14.84.040.A), shall be required to demonstrate no net loss to ecological functions consistent with WAC 173-26-201(2).

4.6 Public Access

4.6.1 Policies

1. The City should expand the amount and diversity of shoreline public access opportunities consistent with the character and ecological functions of the shoreline, private property rights and public safety. Specifically, expand a network of walking and biking trails along the Snoqualmie River throughout shoreline jurisdiction and maintain and improve existing water-dependent shoreline access opportunities in the North McCormick Park Public Recreation and Taylor's Landing Public Recreation environments.

2. The City should ensure that public access improvements and amenities (such as viewpoints, trails, etc.) be designed to provide for public safety, to respect individual privacy, and to avoid or minimize visual impacts from neighboring properties.

3. The City should ensure that public access is provided as part of any development project by a public entity except when such access is shown to be inappropriate due to reasons of safety, security, or adverse impacts to shoreline functions and processes.

4. The City should encourage commercial, multi-family residential, and mixed-use developments to provide public physical or visual access to the shoreline as a condition of approval for development within the City's shoreline. Public access should be commensurate with the impacts of such development and the corresponding benefit, and should be balanced with the need to protect ecological functions and preserve the rights of private property owners.

4.6.2 Regulations

1. Shoreline development shall not block or interfere with normal public use of, or public access to publicly owned shorelines and water bodies.

2. Public access provided by shoreline street-ends, public utilities corridors, and rights-of way shall not be diminished pursuant to RCW 35.79.035, Limitations on Vacations of Streets Abutting Bodies of Water; and RCW 36.87.130, Vacation of Roads Abutting Bodies of Water Prohibited unless for Public Purposes or Industrial Use.

3. Public access shall be located and designed to respect private property rights, be compatible with the natural shoreline character, ensure no net loss of shoreline ecological functions, and ensure public safety.

4. The City shall require public access for any of the following uses/developments:

    a. Where use/development occurs on public land or is undertaken by any public entity, including public parks and public utility districts; or

    b. Where land is developed for a non-water-dependant commercial, multifamily, or mixed use, provided that the public access is compatible with the proposed use and consistent with this Program; or

c. Where use/development will interfere with the public use of the lands or waters subject to the Act.

5. Where required public access is not feasible with uses/developments for safety reasons, or where site constraints would force public access requirements to result in an unreasonable burden on the proposed use/development, the City shall require:

   a. Consideration of all public access options available;

   b. Assessment of site alternatives that may better accommodate public access; and

   c. Agreement to an alternative public access plan where public access is provided or improved in an adjacent or nearby site.

6. Required public access sites shall be fully developed and available for public use at the time of occupancy of the use or activity.

7. Required public access shall consist of a dedication of land or a physical improvement in the form of a walkway, trail, bikeway, corridor, viewpoint, park, or other area serving as a means of view and/or physical approach to shorelines of the state.

8. Public access locations shall be clearly marked with visible signage.

9. Public access trails and structures shall be allowed within shoreline buffers subject to the requirements of this Program and the Sensitive Areas Code (DMC 14.42), provided that such trails and structures are necessary to provide physical and/or visual access to the shoreline; and provided that mitigation is provided for temporary and permanent buffer impacts.

10. Public access shall be located adjacent to other public areas, accesses and connecting trails, and connected to the nearest public street, where ever possible.

4.7 Shoreline Vegetation Conservation

4.7.1 Policies

1. All new shoreline development and/or uses should retain existing native shoreline buffer vegetation, with the overall purpose of protecting and maintaining functions and processes. Important functions of shoreline buffer vegetation include: stabilizing banks and attenuating erosion, providing shade to maintain cool temperatures, removing sediments and excessive nutrients, providing habitat for terrestrial and aquatic wildlife, and providing woody debris and other organic material inputs.

2. Vegetation conservation and management in shoreline areas should include removal of non-native invasive plant species and noxious weeds as needed to facilitate establishment of stable native plant communities.

3. Woody debris should be left in stream corridors to enhance wildlife habitat and shoreline ecological functions, except where it threatens personal safety or public infrastructure such as bridge pilings, roads or flood control structures.

4. Native shoreline vegetation should be integrated with bioengineering to stabilize streambanks and minimize erosion.

5. Vegetation clearing should be limited to the minimum necessary to accommodate shoreline uses/development.

4.7.2 Regulations

1. To conserve and maintain shoreline vegetation, shoreline use and development shall comply with the buffer and habitat conservation areas standards established in Section 4.4. Shoreline uses and developments shall also comply with the City's setback standards established in DMC 14.10 (zoning district regulations); landscaping regulations in DMC 14.38; tree protection in DMC 14.40; and storm drainage utility and erosion control regulations in DMC 9.06.

2. Proponents of all new shoreline uses or developments shall maintain existing native shoreline vegetation to the maximum extent practicable.

3. Vegetation clearing shall be limited to the minimum necessary to accommodate approved shoreline uses and developments and shall comply with the standards established in Tables 1 and 2 of Chapter 3 as well as the use-specific regulations contained in this Program.

4. Proponents of all new shoreline uses or developments shall demonstrate that site designs and layouts are consistent with the policies of this section.

5. A shoreline permit or written statement of exemption shall not mandate, nor guarantee removal of vegetation for the purpose of providing unobstructed horizontal or lateral visibility of the water or any specific feature near or far.

6. Vegetation conservation standards shall not limit or restrict the removal of hazard tree or non-native noxious weeds provided removal is consistent with landscaping regulations in DMC 14.38; tree protection in DMC 14.40; storm drainage utility and erosion control regulations in DMC 9.06 and critical areas regulations in DMC 14.42.

7. Vegetation conservation standards shall not limit vegetation removal not qualifying as significant vegetation removal, or otherwise restrict pruning, not including tree topping. Pruning of trees and shrubs shall be consistent with best management practices in the field of arboriculture and further the long-term health of the tree or shrub.

8. Permitted maintenance of Figure 2 designated utility maintenance corridors and active use recreation areas within the shoreline area shall include mowing and removal of volunteer vegetative growth.

4.8 Water Quality

4.8.1 Policies

1. Stormwater should be managed consistent with DMC 9.06, the City's stormwater management and erosion control regulations and the Comprehensive Plan.

2. Promote the use of low impact development techniques through incentives, permit requirements, and adopted City plans and policies.

3. Effective erosion/sedimentation controls for construction in shoreline areas should be required.

4. The City should discourage the use of fertilizers and herbicides adjacent to shorelines.

4.8.2 Regulations

1. Shoreline use and development shall incorporate all known, available, and reasonable methods of preventing, controlling, and treating stormwater to protect and maintain surface and ground water quantity and quality in accordance with Section 4.4, including integrated critical aquifer recharge area provisions, and the City's stormwater management and erosion control regulations (DMC 9.06).

2. All materials that may come in contact with water shall be composed of non-toxic materials, such as untreated wood, concrete, approved plastic composites or steel, that will not adversely affect water quality or aquatic plants or animals.

4.9 Restoration

4.9.1 Policies

1. The City should encourage and facilitate cooperative restoration and enhancement programs between local, state and federal public agencies, tribes, non-profit organizations, and landowners.

2. The City should implement approved restoration plans to facilitate the restoration of impaired ecological functions through a variety of techniques, including seeking restoration partners, incentives for projects that incorporate restoration components, and securing available restoration grants and funding.

3. The City should establish a public outreach and education program for property owners adjacent to the shoreline to promote shoreline-friendly practices.

4.9.2 Regulations

1. Restoration of ecological functions and processes shall be allowed on all shorelines and shall be located, designed and used in a manner compliant with critical area regulations as integrated through Section 4.4 and assures compatibility with other shoreline uses.

2. Ecological restoration projects shall be carried out in accordance with the City of Duvall Shoreline Restoration Plan (October 2011) and other applicable City-, County-, Tribal- or resource agency-approved restoration plans and in accordance with the policies and regulations of this Program.

4.10 Views and Aesthetics

4.10.1 Polices

1. Shoreline uses and development should be designed and maintained to minimize obstructions of the public's views of the water, including considerations of scale, arrangement, and modulation of site buildings and elements.

4.10.2 Regulations

1. New uses and developments shall conform to the dimensional standards of DMC Title 14 and this Program to maintain shoreline views.

2. Provision of visual access to shorelines shall be required consistent with Section 4.5 of this Program.

CHAPTER 5. SHORELINE MODIFICATION

5.1 Shoreline Stabilization

5.1.1 Policies

1. New permanent shoreline stabilization structures should be prohibited except in cases where an existing structure or public use is in imminent danger from water induced erosion and where associated with public recreational access facilities.

2. Where allowed, stabilization measures should use non-structural shoreline stabilization or biostabilization techniques.

3. Proposals to repair existing shoreline stabilization structures should include measures to enhance existing conditions for fish and wildlife, shoreline vegetation, water quality, and sediment transport.

4. Unless permitted by this Program as water-oriented, all new shoreline uses and developments should be located and designed to prevent the need for structural shoreline stabilization (bulkheads, riprap, etc.). The City should not allow new non water-oriented uses, the creation of new lots or the construction of new non water-oriented development where it would be reasonably foreseeable that the development or use would require structural bank stabilization.

5.1.2 Regulations

1. New or expanded structural shoreline stabilization shall be a conditional use in South McCormick Passive Recreation and Conservancy and Riverside Village designations, and shall be a conditional use when not incorporating bioengineering elements within the North McCormick Public Recreation, Taylor's Landing Public Recreation, and Aquatic designations. Structural shoreline stabilization shall be a permitted use when incorporating biostabilization elements within the North McCormick Public Recreation, Taylor's Landing Public Recreation, and Aquatic designations.

2. New structural shoreline stabilization shall only be allowed as a permitted or conditional use when consistent with this Program and incorporated critical area regulations as integrated through Section 4.4.

3. New development shall be located and designed to avoid the need for future shoreline stabilization to the extent feasible. Subdivision of land shall be regulated to assure that lots created will not require shoreline stabilization in order for reasonable development to occur.

4. New shoreline stabilization structures are prohibited except in cases where there is a demonstrated threat to an existing legally established primary structure or public use from erosion caused by natural processes, or in cases where new shoreline stabilization is needed to provide for permitted water-oriented public uses. New stabilization shall

be limited to the minimum size necessary and shall use biostabilization or soft shore armoring techniques wherever feasible.

5. The need for new structural shoreline stabilization to protect an existing legally established primary structure or public use shall be demonstrated by a geotechnical analysis, which includes, at a minimum, documentation that the structure or public use is in danger from shoreline erosion caused by currents or waves. The geotechnical analysis should evaluate on-site drainage issues and address drainage problems away from the shoreline edge.

6. An existing shoreline stabilization structure may be repaired or replaced if there is a demonstrated need to protect an existing legally established primary structure or use from erosion provided:

    a. The repair or replacement is designed, located, sized, and constructed to assure no net loss of ecological functions, including consideration of fish and wildlife, shoreline vegetation, water quality, water movement, and sediment transport.

    b. The repair or replacement structure does not encroach waterward of the ordinary high-water mark,

    c. Existing structures should be removed as part of the replacement measure unless documented that less ecological impact could occur by removing the structure.

    d. Biostabilization methods or soft stabilization measures that provide restoration of shoreline ecological functions may be permitted waterward of the ordinary high water mark (OHWM).

7. For purposes of this section "replacement" means the construction of a new structure to perform a shoreline stabilization function of an existing structure which can no longer adequately serve its purpose. Additions to or increases in size of existing shoreline stabilization measures shall be considered new structures.

8. Geotechnical reports pursuant to this section that address the need to prevent potential damage to an existing primary structure or public use shall address the necessity for shoreline stabilization by estimating time frames and rates of erosion and report on the urgency associated with the specific situation. As a general matter, hard armoring solutions should not be authorized except when a report confirms that there is a significant possibility that a primary structure will be damaged within three years as a result of shoreline erosion in the absence of such hard armoring measures, or where waiting until the need for armoring is so great that it would foreclose on the opportunity to use measures that avoid or minimize impacts to ecological functions. Where the geotechnical report confirms a need to prevent potential damage to a primary structure or public use, but the need is not as immediate as the three (3) years, that report may still be used to justify more immediate authorization to protect against erosion using soft shore stabilization measures.

9. In conjunction with any stabilization project, shoreline vegetation shall be protected and restored along or near shorelines to protect and restore the ecological functions and ecosystem-wide processes and to protect human safety and property.

10. Shoreline stabilization may be allowed for environmental restoration or if the City determines that there will be a net increase in desired shoreline ecological functions.

5.2 Fill, Excavation, Ditching, Clearing and Grading

5.2.1 Policies

1. Fill, excavation, ditching, clearing and grading in shoreline jurisdiction should be allowed only in association with a permitted use and where allowed should be the minimum necessary to accommodate the proposed use.

2. Shoreline fill, excavation, ditching, clearing and grading should be designed and located so there will be no significant degradation of water quality, no alteration of surface water drainage, flood water storage, or conveyance capacity and no further limitation to channel migration which would pose a hazard to adjacent property or natural resources.

5.2.2 Regulations

1. All filling, excavation, ditching, clearing and grading activities in the shoreline shall comply with the provisions of DMC 10.12 (Best Management Practices for Construction and Site Development) and 9.06 (Storm Drainage Utility Code) and this Program.

2. Fill, excavation, ditching, clearing and grading is allowed in the shoreline only in association with a permitted use. Where allowed, the activity shall be the minimum necessary to accommodate the development.

3. All fill activities within floodway areas shall comply with DMC 14.84 (Floodplain Regulations) and may only be allowed for restoration projects.

4. Development that involves fill, excavation, ditching, clearing and grading within the shoreline jurisdiction shall obtain a shoreline substantial development permit or shoreline conditional use permit (as specified in Table 1), unless exempt by RCW 90.58.030. Clearing activities that do not qualify as significant vegetation removal do not require a shoreline substantial development permit or shoreline conditional use permit, however must comply with applicable standards of this Program.

5. Fill shall be permitted only where it is demonstrated that the proposed action will not:

    a. Result in significant ecological damage to water quality, fish, and/or wildlife habitat; or

    b. Adversely alter natural drainage and circulation patterns, currents, creek/river flows or significantly reduce flood water capacities or inhibit channel migration.

6. Filling, and/or excavation waterward of the OHWM may be allowed when necessary to support the following:

    a. Publicly sponsored ecological restoration or enhancement projects;

    b. City-approved restoration and mitigation projects that involve removal of shoreline armoring or shoreline vegetation enhancement;

    c. Biostablization / soft shore-bank stabilization projects; and

    d. Publicly sponsored non-restoration projects that provide public access or improve access to the shoreline for a substantial number of people.

7. Before the City can permit any filling, excavation, clearing or grading activities, the applicant must demonstrate all of the following:

    a. Alternatives to filling, excavation, clearing and grading are infeasible;

    b. Normal surface water movement and drainage patterns shall be maintained to the maximum extent feasible;

    c. Fill materials shall not adversely affect water quality or aquatic life;

    d. Fill shall allow surface water penetration into the ground where such conditions existed prior to the fill;

    e. The filling, excavation, clearing or grading shall be timed to minimize damage to shoreline ecological functions and processes and aquatic life; and

    f. Fill within the one hundred-year (100-year) floodplain shall not reduce the floodplain water storage capacity, inhibit channel migration, or in any way increase flood hazard or endanger public safety.

8. Fill, excavation, ditching, clearing or grading shall not be located where structural shore stabilization will be required to maintain materials placed or removed. Disturbed areas shall be immediately stabilized and re-vegetated, as applicable.

9. A temporary erosion and sediment control (TESC) plan shall be provided for all proposed filling, excavation, clearing and grading activities, except for clearing activities that do not qualify as significant vegetation removal.

10. Unavoidable impacts of filling, excavation, clearing and/or grading shall be mitigated as required by this Program and WAC 173-26-201(2).

5.3 Dredging and Dredge Material Disposal

5.3.1 Policies

1. Dredging and dredge material disposal should be prohibited except when associated with an approved and adopted watershed management plan, surface water management plan, restoration plan, and/or flood hazard reduction plan.

5.3.2 Regulations

1. Dredging waterward of the OHWM shall only be allowed as a conditional use and when necessary to support the following:

    a. A publicly sponsored ecological restoration or enhancement project that improves shoreline ecological functions and processes benefiting water quality and/or fish and wildlife habitat;

    b. A City-approved restoration and mitigation project that involves removal of structural shoreline armoring and/or shoreline vegetation enhancement; or

    c. A biostabilization / soft shore-bank shoreline stabilization project, including biostablization associated with public projects.

2. Proposals for dredging and dredged material disposal shall include all feasible mitigation measures to protect freshwater habitats and to minimize adverse environmental impacts (e.g., turbidity, nutrient releases, heavy metals, sulfides, organic material or toxic substances, dissolved oxygen depletion, disruption of food chains, loss of benthic productivity and disturbance of fish runs and important localized biological communities).

5.4 In-stream Structures

5.4.1 Policies

1. In-stream structures should only be allowed for the purpose of environmental restoration and should provide for the protection and preservation of ecological functions and processes such as fish habitat.

2. Existing in-stream structures which are failing, unnecessary, harmful, or ineffective should be removed, and shoreline ecological functions and processes should be restored using non-structural methods.

3. Natural in-stream features such as large woody debris, snags, uprooted trees or stumps should be left in place unless it can be demonstrated that they are causing bank erosion, higher flood stages or safety hazards.

5.4.2 Regulations

1. In-stream structures shall not include shoreline stabilization structures, outfall structures, or boat launch ramps, which are regulated as separate shoreline modifications or shoreline uses within this Program.

2. In-stream structures shall only be allowed when associated with an adopted watershed management plan, surface water management plan or restoration plan.

3. In-stream structures shall be designed by a licensed professional engineer with experience in analyzing hydraulic information and systems.

4. In-stream structures shall be located and designed to minimize the need for structural shoreline stabilization. All debris, overburden and other waste materials from construction shall be disposed of in such a manner so as to prevent their entry into a water body.

5. Natural in-stream features such as snags, uprooted trees, or stumps should be left in place unless it can be demonstrated that they are actually causing bank erosion, safety hazards, or higher flood stages. Removal shall be done in coordination with Washington Department of Fish and Wildlife.

6. In-stream structures shall provide for adequate upstream or downstream migration of anadromous fish.

CHAPTER 6. USE SPECIFIC SHORELINE POLICIES AND REGULATIONS

6.1 Prohibited Uses

1. The following uses shall be prohibited in all shoreline environments:

    a. Agriculture (except as allowed in existing areas of agricultural use within the publically managed Dougherty Farmstead property).

    b. Forest Practices

    c. Mining

2. Other certain uses shall be prohibited in specific shoreline environments or portions of specific shoreline environments, as provided in Table 1 and Sections 6.2 through 6.8 of this Program.

6.2 Boating Facilities

6.2.1 Policies

1. New public hand-launch boat launch ramps should be permitted in the Duvall shoreline. If allowed, such facilities should be designed to accommodate public access and enjoyment of the shoreline location. Depending on the scale of the facility, public access should include walkways, viewpoints, and other recreational uses.

2. Trailer-launch boat launch ramp should be maintained as a permitted use in the Duvall shoreline at Taylor's Landing. If redevelopment of the Taylor's Landing boat launch is proposed and approved, such facilities should be designed to accommodate public access and enjoyment of the shoreline location. Depending on the scale of the facility, public access should include walkways, viewpoints, and other recreational uses.

3. Marinas, docks, piers, wet boat storage and private boat launch ramps should be prohibited within Duvall shoreline jurisdiction due to the specific nature and configuration of the Snoqualmie River shoreline in the City.

4. Locate, design, and operate public boat launch ramps to avoid adverse proximity impacts to adjacent land uses such as noise, light and glare, aesthetic impacts, and impacts to public visual access.

5. Dry boat storage should not be considered a water-oriented use and should only be allowed within the shoreline environment when approved through a conditional use permit, and only when providing public storage in the North McCormick Park shoreline environment for hand launch-able boats.

6.2.2 Regulations

1. Prohibited Boating Facilities: Marinas, docks, piers, extended moorage, wet boat storage and private boat launch ramps shall be prohibited within Duvall shoreline jurisdiction due to the specific nature and configuration of the Snoqualmie River shoreline in the City.

2. Public boat launches / boat ramps shall only be allowed in the Duvall shoreline jurisdiction when consistent with Section 3.3, Table 1 of this Program. Public boat launches / boat ramps are prohibited in the Riverside Village shoreline environment.

3. The City of Duvall shall require the following information in its review and evaluation of boating facility proposals in addition to the requirements of WAC 173-27-180 and Section 7.3, Shoreline Permits and Exemptions:

    a. A description of the existing natural shoreline features and uses;

    b. A description of the fluvial geomorphologic processes at the site including, accretion/erosion characteristics, flood levels, and surface drainage;

    c. A description of the ecological functions in the upland and aquatic environments;

    d. An estimate of the area of surface water to be appropriated;

    e. A description of any shoreline stabilization and/or flood control works proposed as part of the project;

    f. A description of any dredging that may be required as part of construction and maintenance; and

    g. Other information determined by the Planning Director to be relevant to the protection of the shoreline habitat and ecological functions and processes; and

    h. Other information determined by the Planning Director to be relevant to ensure protection of human health, safety, and welfare and to avoid or mitigate impacts to existing public uses and aesthetics.

    i. Boating facilities shall only be permitted if adequate mitigation measures ensure that there is no net loss of the functions or values of riparian habitat as a result of the facility.

4. Standards for Public Boat Launch / Boat Ramp:

    a. Boat launch ramps shall be located where water depths are adequate to eliminate or minimize the need for channel maintenance activities.

    b. Where boat ramps are permitted, associated parking shall be located as far from the shoreline OHWM and other sensitive shoreline resources as possible, and shall be oriented to avoid and minimize impacts to shoreline resources and ecological

functions. Associated parking facilities shall be consistent with Section 6.6 of this Program, and shall be located entirely outside of shoreline jurisdiction to the greatest extent feasible.

c. Siting of boat launch ramps shall consider bank stability and design shall minimize the need for shoreline stabilization.

d. Boat launch ramps shall avoid impediments to migrating fish and will not locate in spawning, feeding or rearing areas for salmonids.

e. Boat launch ramps shall be designed and constructed using methods/technology that have been recognized and approved by state and federal resource agencies as the best currently available. Rail and track systems shall be preferred over concrete ramps or similar facilities.

f. Launch access for hand-launch watercraft shall use gravel or other permeable material. Removal of vegetation for launch access shall be limited to twelve (12) feet in width. The boat launch ramp or pad shall be a maximum of ten (10) feet in width.

g. Removal of vegetation for launch access accessible by trailer shall be limited to eighteen (18) feet in width with four (4) feet of width revegetated and / or surfaced with permeable material once launch access has been constructed. The boat launch ramp shall be a maximum of fourteen (14) feet in width.

h. The boat launch shall be designed so that structures are aesthetically compatible with, or enhance, existing shoreline features and uses.

i. Redevelopment of the boat launch in Taylor's Landing shall include consideration of adequate restroom facility and waste disposal facility availability, with improvements to facilities provided as part of redevelopment if determined necessary by the Planning Director.

5. Standards for Dry Boat Storage:

a. Dry boat storage shall not be considered a water-oriented use and must be sited outside of all required shoreline and sensitive areas buffers.

b. Dry boat storage shall only be allowed within the North McCormick Park Public Recreation shoreline environment when approved through a conditional use permit.

c. Dry boat storage shall be prohibited in the South McCormick Park Passive Recreation and Conservancy, Riverside Village, and Taylor's Landing Public Recreation environments.

d. Dry boat storage shall only be permitted when providing seasonal, public storage for hand launch-able boats.

6.3 Commercial

6.3.1 Policies

1. Commercial development and use should be prohibited except within the Riverside Village environment, and within the South McCormick Park Passive Recreation and Conservancy and North McCormick Park Public Recreation environments when associated with commercial uses fronting Main Street.

2. Where permitted, the City should give first preference to water-dependent commercial uses over non-water-dependent commercial uses (where appropriate); and give second preference to water-related and water-enjoyment commercial.

3. Commercial development should be designed and located to prevent net loss of shoreline ecological functions and should not have adverse impacts on other shoreline uses, public access or recreation.

6.3.2 Regulations

1. Commercial uses and developments shall achieve no net loss of ecological functions.

2. Commercial uses and developments are prohibited except within the Riverside Village environment, and within the South McCormick Park Passive Recreation and Conservancy and North McCormick Park Public Recreation environments when associated with commercial uses fronting Main Street.

3. Water-oriented commercial uses and developments shall be permitted in shoreline jurisdiction when allowed by underlying zoning (DMC 14.10) and when consistent with this Program.

4. Commercial development, including all accessory structures shall be prohibited in, on, or over water or within floodways.

6.4 Industrial

6.4.1 Policies

1. Industrial development and use should be prohibited except when associated with industrial uses fronting Main Street within the South McCormick Park Passive Recreation and Conservancy environment.

2. Industrial development should be designed and located to prevent net loss of shoreline ecological functions and should not have adverse impacts on other shoreline uses, public access or recreation.

6.4.2 Regulations

1. Industrial uses and developments shall achieve no net loss of ecological functions.

2. Industrial uses and developments shall be prohibited throughout shoreline jurisdiction except when associated with industrial uses fronting Main Street within the South McCormick Park Passive Recreation and Conservancy environment.

3. Industrial uses and developments shall be prohibited within the Snoqualmie River floodway (west of the Snoqualmie Valley Trail).

6.5 Recreation

6.5.1 Policies

1. The City should provide diverse water-oriented recreation opportunities that are convenient and adequate for the community and that preserve shoreline resources and do not result in a net loss of ecological functions.

2. The City should plan for shoreline recreation facilities to serve projected growth and level of service standards, in accordance with the Comprehensive Plan.

3. Recreational uses in shoreline areas should be located where the uses would not result in adverse effects on shoreline functions and processes, and/or neighboring uses.

4. The City should encourage cooperation among public agencies, Tribes, non-profit groups and private landowners and developers to increase and diversify recreational opportunities.

6.5.2 Regulations

1. Recreational development shall include commercial and public facilities designed and used to provide recreational opportunities to the public.

2. Public water-oriented recreational development is a preferred shoreline use and shall be permitted when consistent with underlying zoning pursuant to DMC 14.10, this Program, and the Act.

3. Public recreational developments shall provide for non-motorized public access to the shoreline (e.g., pedestrian and/or bicycle paths), unless such access is infeasible due to public health and safety considerations.

4. The removal of on-site native vegetation shall be limited to the minimum necessary for the development of picnic areas, selected views or other permitted structures or facilities. Any removal of vegetation shall comply with the regulations for vegetation conservation and all other provisions of this program.

5. Signs indicating the publics' right of access to shoreline areas shall be installed and maintained in conspicuous locations at recreational facility points of access and entrances.

6. All temporary and/or permanent impacts to the shoreline buffer required for development of recreational facilities shall meet standards of mitigation, as specified by

this Program and the incorporated sensitive areas standards as integrated through Section 4.4 so as to result in no net loss of ecological functions.

7. Non water-oriented recreational development shall require a shoreline conditional use permit. Activities and uses shall not be approved as a conditional use unless the applicant can demonstrate that:

    a. The basic project purpose cannot reasonably be accomplished on another site or sites in the general region while still successfully avoiding or resulting in less adverse impact to shoreline functions; and

    b. All on-site alternative designs that would avoid or result in less adverse impact to shoreline functions, such as a reduction in the size, scope, or configuration of the project, are not feasible.

8. Trails:

    a. Trails shall be a permitted use within all shoreline environments, except Aquatic.

    b. Trails shall be designed and located to avoid and minimize impacts to sensitive areas and shall comply with the sensitive areas standards as integrated through Section 4.4.

9. Temporary Recreational Uses: Temporary recreational uses and activities include uses that occur within the shoreline for less than 14 consecutive days, and do not require and grading, fill, or installation of structures with foundations.

    a. Temporary recreational uses and activities that occur in areas of maintained lawn, trails, or paved surfaces shall not require a shoreline substantial development permit or other shoreline permit under this Program.

    b. Temporary recreational activities shall be sited to avoid short term or long term impacts to ecological functions within shoreline jurisdiction.

10. Maintenance, repair and reconstruction to park facilities shall be permitted when best management practices are implemented to avoid and/or minimize impacts to shoreline ecological functions, and when consistent with all other provisions of this Program, including Section 4.2. Permitted maintenance and repair shall include:

    a. Maintenance, repair and reconstruction of paths, boat launches, parking lots, picnic sheds, buildings, decks, fencing, furniture and other associated park facilities;

    b. Resurfacing in-kind of previous improvements including trails and parks maintenance access corridors;

    c. Maintenance of seasonal swim beach, including nourishment of beach area with clean sand material from a documented source when approved by the Planning Director;

d. Fine grading, rotor-tilling, or other surface smoothing activities in established lawn areas with no material import or export;

e. Maintenance of established landscaping;

f. Soft-surface trail maintenance using non-mineral, untreated surfacing only; and

g. Transport, set up, and removal of temporary recreational use structures such as tents, booths, stages, movie screen, exhibits, and other temporary event equipment.

6.6 Residential

6.6.1 Policies

1. Existing single-family residences and their appurtenant structures should be permitted to continue use in the RV environment; and regulated in all other environments consistent with DMC Title 14 (Unified Development Regulations).

2. Residential development should be designed to preserve existing shoreline vegetation, control erosion, protect water quality using best management practices, and to use low impact development techniques where appropriate.

6.6.2 Regulations

1. Residential development shall achieve no net loss of ecological function.

2. Mobile home park use shall be prohibited in all shorelines except where currently occurring within the Riverside Village designation. Replacement of an existing manufactured / mobile home shall be allowed within the Riverside Village zoning area without a shoreline substantial development permit only when:

   a. The replacement manufactured / mobile home is of equal or lesser footprint and is located within the same footprint of the removed manufactured home.

   b. There is no increase in the total number of manufactured homes within the Riverside Village shoreline environment.

3. Single-family and multifamily residential development and mixed-use development with residential use components shall be permitted in the South McCormick Park Passive Recreation designation to the east of the Snoqualmie Valley Trail where consistent with underlying zoning designation (DMC 14.10).

4. Mixed-use development with residential use components shall be permitted in the Riverside Village designation where consistent with underlying zoning designation (DMC 14.10).

5. New residential development and accessory structures shall be prohibited to the west of the Snoqualmie Valley Trail.

6. New residential development, including all accessory structures shall be prohibited in, on, or over water or within floodways.

7. As mandated by the RCW 90.58.320, no shoreline permit may be issued for any new or expanded building or structure of more than thirty five (35) feet above average grade level on shorelines, except where overriding considerations of the public interest will be served.

6.7 Transportation and Parking

6.7.1 Policies

1. Transportation facilities, including new facilities and repair and improvement of existing facilities should be located, designed, constructed and maintained to have minimum impacts on shoreline resources and ensure no net loss of shoreline ecological functions.

2. New transportation facilities should be located outside of shoreline jurisdiction unless there is no reasonably feasible alternative alignment or location or they are required to access a permitted use and then, they should be the minimum width possible.

3. New transportation facilities should be located and designed to minimize the need for shoreline protection measures, modifications to natural drainage systems, and crossing waterways.

4. Shoreline restoration and public access should be considered with planning and funding of transportation projects.

5. Parking is not a preferred shoreline use and should be allowed only to support a use authorized under this Program; parking supporting a use authorized under this Program should be sited outside of Shoreline Jurisdiction or as far landward from the OHWM of the Snoqualmie River as is feasible.

6.7.2 Regulations

1. Transportation regulations shall apply to any use or development where transportation infrastructure is or is proposed to be a primary land use, including new or expanded roadways and parking facilities.

2. New transportation facilities may be located within shoreline jurisdiction only when alternative locations are not feasible, and if permitted, they should be designed to minimize impacts to ecological functions; mitigation shall be provided consistent with this Program and sensitive areas standards as integrated through Section 4.4.

3. Parking as a stand-alone use shall not be allowed in any shoreline environment, except that park & ride facility use shall be allowed within the existing King County Metro Duvall Park & Ride facility site.

4. Parking or loading facilities necessary to support an authorized shoreline use may be allowed in shoreline areas only when:

a. They are allowed by the underlying zoning and developed consistent with the City's sensitive areas regulations as integrated in Section 4.4.2;

b. The applicant can demonstrate that no other alternative location is feasible to serve the primary use of the site; and

c. The facility will not result in a net loss of ecological functions.

5. The following road and parking lot maintenance and repair activities are permitted provided that best management practices are implemented to avoid and/or minimize impacts to shoreline ecological functions and provided that activities are otherwise consistent with this program:

   a. Maintenance of existing roads, sidewalks, and parking lots provided that no work occurs outside of previously improved areas; and

   b. Resurfacing in-kind of previous improvements.

6.8 Utilities

6.8.1 Policies

1. The design and location of utility facilities should provide for no net loss of shoreline ecological functions.

2. New utility production and processing facilities, such as power plants and sewage treatment plants or parts of such facilities that are non-water oriented should not be located in shoreline areas unless there is no feasible alternative location.

3. Utility transmission facilities should be located outside of shoreline areas, to the maximum extent feasible.

4. Utility installation or maintenance projects in shorelines should restore areas to pre-project configuration, replant with native species and provide maintenance care until the newly planted vegetation is established.

5. Maintenance, repair, and reconstruction of existing utility infrastructure should be allowed when consistent with best management practices to minimize impacts to ecological functions and restore areas of temporary impact.

6.8.2 Regulations

1. New utility facilities shall be located outside of shoreline jurisdiction whenever feasible. When located within shoreline jurisdiction, utility facilities shall result in no net loss of shoreline ecological functions.

2. Utility facilities shall be designed and located as follows:

a. Above ground generating facilities, switching complexes, pumping stations, treatment plants, storage tanks, and substations shall be located outside of Shoreline Jurisdiction unless the Planning Director approves the necessity for a location within shoreline jurisdiction;

b. Utility transmission facilities shall be located in existing rights-of-way and cross shoreline jurisdiction by the most direct route feasible, unless an alternative route would result in less impact on shoreline ecological functions;

c. Utility facilities shall not parallel a water body unless located in an existing improved transportation or utility corridor, and provided that underground facilities do not adversely impact hyporheic exchange;

d. Underground utility lines shall be completely bored under the river bed in all river or stream crossings, where possible.

e. Underground stormwater utilities shall be designed to minimize need for additional future stormwater facilities and discharge points, and shall be designed to allow for immediate or future use of treated stormwater for ecological restoration projects wherever feasible.

3. Upon completion of utility installation within the shoreline area, shoreline areas and stream banks shall be restored to pre-project configuration, replanted, monitored and provided with maintenance care until the newly planted vegetation is well established and impacted functions have been restored. Plantings shall be comprised of native species appropriate for conditions in the temporary area(s) of impact, with landscaping completed consistent with the requirements of this Program including applicable sensitive areas requirements as integrated through Section 4.4.

4. Utility maintenance, repair, and reconstruction.

a. Activities qualifying as normal maintenance and/or repair of existing utility facilities and access corridors shall not be considered development. However, normal maintenance and/or repair activities shall be completed consistent with the requirements of this Program.

b. Repair and reconstruction of existing utility facilities not qualifying as normal maintenance and/or repair shall include any activity meeting the definition of development in Chapter 8 of this Program, including but not limited to activities requiring excavation, grading, fill, or construction of buildings or other structures.

c. Permitted public sanitary sewer utility maintenance activities:

i. Maintenance, repair and reconstruction of sewer lift stations, wastewater treatment facilities, force mains, conveyance pipe and associated infrastructure provided that no work shall occur outside of previously improved areas and that activities are consistent with all standards of this Program.

ii. Maintenance of sanitary sewer outfall manholes and outlet structures shall be allowed as normal maintenance and repair when occurring within outfall manholes and outlet structures.

iii. Maintenance of sanitary sewer outfall access road bridges and access routes as depicted on Map 2. Normal maintenance and repair of access routes shall include mowing. Fine-grading of existing access routes shall be allowed provided no grading exceeds 6-inches in depth, no grading occurs outside of the mapped access route corridor, and resurfacing is in-kind material.

d. The following stormwater system maintenance activities shall be permitted when best management practices are implemented to avoid and/or minimize impacts to shoreline ecological functions, and when consistent with all other provisions of this Program:

i. Maintenance, cleaning, and reconstruction of existing stormwater infrastructure, including: ditches, catch basins, stormwater ponds, bioswales, conveyance pipe, and outfall pipes and structures (provided infrastructure is not part of a stream or wetland).

ii. Maintenance and replacement of previously installed rock check dams within ditches or stormwater ponds.

iii. Maintenance and replacement of previously installed outfall pipe energy dissipaters or rock splash pads.

e. The following public water utility maintenance activities shall be permitted when best management practices are implemented to avoid and/or minimize impacts to shoreline ecological functions, and when consistent with all other provisions of this Program: maintenance and reconstruction of water system pipe, valves, hydrants, meters, appurtenances, and associated infrastructure provided that no work occurs outside of previously improved area.

f. Maintenance and repair to energy and communications utility facilities shall be permitted when best management practices are implemented to avoid and/or minimize impacts to shoreline ecological functions, and when consistent with all other provisions of this Program.

6.9 Unclassified Uses

Uses that are not classified or set forth herein may only be authorized as conditional uses provided the applicant can demonstrate that the criteria set forth in Section 7.3.6 of this Program are met. Unclassified uses approved as conditional uses should also remain consistent with the policies of this program and RCW 90.58.020.

CHAPTER 7. ADMINISTRATIVE PROVISIONS

7.1 General Compliance

1. To be authorized under this Program, all uses and developments shall be planned and carried out in a manner that is consistent with the DMC and this Program regardless of whether a shoreline substantial development permit, statement of exemption, shoreline variance, or shoreline conditional use permit is required.

2. The City shall not issue any permit for development within shoreline jurisdiction until approval has been granted pursuant to the adopted Program.

3. A development or use that does not comply with the bulk, dimensional and/or performance standards of this Program shall require a shoreline variance even if the development or use does not require a substantial development permit.

4. A development or use that is listed as a conditional use pursuant to this Program, or is an unclassified use, must obtain a conditional use permit even if the development or use does not require a substantial development permit.

5. Issuance of a statement of exemption, shoreline substantial development permit, shoreline variance or shoreline conditional use permit does not constitute approval pursuant to any other federal, state or City laws or regulations.

6. All shoreline permits or statements of exemption issued for development or use within shoreline jurisdiction shall include written findings prepared by the Planning Director, documenting compliance with bulk and dimensional policies and regulations of this Program. The Planning Director may attach conditions to the approval as necessary to assure consistency with the RCW 90.58 and this Program. Such conditions may include a requirement to post a performance bond assuring compliance with permit requirements, terms and conditions.

7. The City shall not issue a permit for any new or expanded building or structure that exceeds a height of thirty five (35) feet above average grade level that will obstruct the view of a substantial number of residences except with a shoreline variance.

8. The Planning Director is authorized to enforce the provisions of this title, the ordinances and resolutions codified in it, and any rules and regulations promulgated there under pursuant to the enforcement and penalty provisions of WAC 173-27.

9. The City will track all shoreline permits and exemption activities to evaluate whether this Program is achieving no net loss. A no net loss report shall be prepared every eight (8) years as part of the City's Shoreline Master Program evaluation or Comprehensive Plan Amendment process.

10. All references to the Duvall Municipal Code (DMC), Washington State Administrative Code (WAC) and Revised Code of Washington (RCW) included in this Program shall be referenced by the specific code cited or as amended.

7.2 Administration

7.2.1 General Standards

1. Unless otherwise stated, this Program shall be administered according to the standards and criteria in RCW 90.58 and WAC 173-27, including WAC 173-27-060.

7.2.2 Interpretation

1. Interpretation of the policies and regulations of this Program shall be consistent with DMC 14.04.060 (Unified Development Regulations – Interpretation – General) and 14.04.070 (Unified Development Regulations – Interpretation), except that the word "shall" is mandatory, the word "may" is discretionary, and the word "should" is generally used in polices and is interpreted to define the conditions under which shoreline use or development is allowed or not allowed. The City shall consult with Ecology as needed to ensure that any formal written interpretation are consistent with the purpose and intent of chapter 90.58 RCW and this Program.

7.2.3 Permit Process

1. Shoreline substantial development permits, shoreline variances and shoreline conditional use permits shall be subject to all of the applicable requirements of DMC 14.08, 14.68, and 14.70.

2. Appeals of the final decision of the City with regard to shoreline management shall be governed by the provisions of RCW 90.58.180.

3. Appeals to the Shoreline Hearings Board of a decision on a shoreline substantial development permit, shoreline variance or shoreline conditional use permit may be filed by the applicant/proponent or any aggrieved party pursuant to RCW 90.58.180.

4. The effective date of the City's decision (date of filing) shall be the date of actual receipt of the City's decision by the Department of Ecology as defined in WAC 173-27-130(6). For all approved shoreline substantial development permits, variances and conditional use permits, permit time requirements for construction commencement and/or authorization to conduct development activities shall be consistent with the provisions of WAC 173-27-090.

5. The effective date of decision involving approval or denial of a variance or conditional use permit shall be the date of transmittal of the Department of Ecology's final decision on a variance or conditional use permit to the City and the applicant, as defined in WAC 173-27-130(7).

6. Shoreline substantial development permits, shoreline variances and shoreline conditional use permits shall be filed with the Department of Ecology consistent with the provisions of WAC 173-27-130.

7. A permit revision shall be required whenever the applicant proposes substantive changes to the design, terms or conditions of a project from that which is approved in the permit. Revisions to any approved shoreline substantial development permit, shoreline variance and shoreline conditional use permit shall be governed by the provisions of WAC 173-27-100 (Revisions to permits).

7.2.4 Enforcement and Penalties

1. The Planning Director is authorized to enforce the provisions of this title, the ordinances and resolutions codified in it, and any rules and regulations promulgated there under pursuant to the enforcement and penalty provisions of WAC 173-27-270, 280, and 290.

2. This Program will be enforced by the means and procedures set forth in DMC 2.24.

7.3 Shoreline Permits and Exemptions

7.3.1 Shoreline Substantial Development Permit Required

1. Substantial development, as defined by this program and RCW 90.58.030, shall not be undertaken by any person on the shorelines of the state without first obtaining a substantial development permit from the Planning Director. A shoreline substantial development permit shall be required for all proposed use and development of shorelines unless the use or development is specifically identified as exempt from a substantial development permit, in which case a letter of exemption is required.

2. The Planning Director may grant a substantial development permit only when the development proposed is consistent with the policies and procedures of RCW.90.58; the provisions of this WAC 173-27; and this Program.

3. The Planning Director is authorized to grant a shoreline substantial development permit when all of the criteria enumerated in WAC 173-27-150 are met.

7.3.2 Exemptions from a Substantial Development Permit

1. Uses and developments that are not considered substantial developments pursuant to RCW 90.58.030(3)(e) and WAC 173-27-040 (List of Exemptions) shall not require a substantial development permit but shall conform to the policies and regulations of this Program.

2. The list of activities considered exempt from the requirement to obtain a shoreline substantial development permit are those listed in RCW 90.58.030(3)(e) and WAC 173-27-040 (List of Exemptions), so long as the activity is otherwise allowed by DMC Title 14 and this Program.

3. If any part of a proposed development is not eligible for exemption as defined in RCW 90.58.030(3)(e) and WAC 173-27-040, then a substantial development permit is required for the entire proposed development project.

4. Exemptions shall be construed narrowly. Only those developments that meet the precise terms of one or more of the listed exemptions may be granted exemptions from the substantial development permit process.

5. The burden of proof that a development or use is exempt is on the applicant or proponent of the development action.

7.3.3 Statement of Exemption

1. Any person claiming exemption from the substantial development permit requirements shall make an application to the Planning Director for such an exemption in the manner prescribed by the Planning Director.

2. The Planning Director is hereby authorized to grant or deny requests for statements of exemption from the shoreline substantial development permit requirement for uses and developments, consistent with Section 7.3.2 of this Program. The statement shall be in writing and shall indicate the specific exemption of this Program that is being applied to the development, and shall provide a summary of the Planning Director's analysis of the consistency of the project with this Program and the Act. The letter shall be sent to the applicant and the Department. Statements of exemption may contain conditions and/or mitigating measures of approval to achieve consistency and compliance with the provisions of the Program and Act.

7.3.4 Shoreline Variance

1. The purpose of a variance is to grant relief to specific bulk or dimensional requirements set forth in this Program where there are extraordinary or unique circumstances relating to the property such that the strict implementation of this Program would impose unnecessary hardships on the applicant/proponent or thwart the policies set forth in RCW 90.58.020 and this Program.

2. Shoreline variance permits should be granted in circumstances where denial of the permit would result in a thwarting of the policy enumerated in the Act (RCW 90.58.020). In all instances extraordinary circumstances shall be shown and the public interest shall suffer no substantial detrimental effect.

3. When a shoreline variance is requested, the hearing examiner shall have the authority to grant a variance consistent with the provisions of DMC 14.42 and 14.70. However, shoreline variances must have approval from the state. The State Department of Ecology shall be the final approval authority under WAC 173-27-200.

4. For development and/or uses located landward of the ordinary high water mark or outside if any wetland, the City is authorized to grant a variance from the performance standards of this Program only when all of the following criteria are met (WAC 173-27-170):

a. That the strict application of the bulk, dimensional or performance standards set forth in the applicable master program precludes, or significantly interferes with, reasonable use of the property;

b. That the hardship described in (a) of this subsection is specifically related to the property, and is the result of unique conditions such as irregular lot shape, size, or natural features and the application of the master program, and not, for example, from deed restrictions or the applicant's own actions;

c. That the design of the project is compatible with other authorized uses within the area and with uses planned for the area under the comprehensive plan and shoreline master program and will not cause adverse impacts to the shoreline environment;

d. That the variance will not constitute a grant of special privilege not enjoyed by the other properties in the area;

e. That the variance requested is the minimum necessary to afford relief; and

f. That the public interest will suffer no substantial detrimental effect.

5. For development and/or uses located waterward of the ordinary high water mark or within any wetland, the City is authorized to grant a variance from the performance standards of this Program only when all of the following criteria are met (WAC 173-27-170):

   a. That the strict application of the bulk, dimensional or performance standards set forth in the applicable master program precludes all reasonable use of the property;

   b. That the proposal is consistent with the criteria established under subsection (4)(b) through (f) of this section; and

   c. That the public rights of navigation and use of the shorelines will not be adversely affected.

6. Before making a determination to grant a shoreline variance, the City shall consider issues related to the conservation of valuable natural resources, potential for cumulative impact of additional requests for like actions in the area, and the protection of views from nearby public roads, surrounding properties and public areas.

7. A variance from City development code requirements shall not be construed to mean a shoreline variance from the use regulations of this Program and vice versa.

8. Shoreline variances may not be used to permit a use or development that is specifically prohibited in an environment designation.

7.3.5 Shoreline Conditional Use Permit

1. The purpose of the conditional use permit is to provide greater flexibility in varying the application of the use regulations of this Program in a manner which will be consistent with the policies of RCW 90.58, particularly where denial of the application would thwart the policies of the Shoreline Management Act.

2. When a conditional use is requested, the hearing examiner shall be the final approval authority for the City. However, shoreline conditional uses must have approval from the state. The State Department of Ecology shall be the final approval authority under WAC 173-27-200.

3. Conditional use permits shall be authorized only when they are consistent with the following criteria:

    a. The proposed use is consistent with the policies of RCW 90.58.020, WAC 173-27-160 and all provisions of this Program;

    b. The use will not interfere with normal public use of public shorelines;

    c. That the proposed use of the site and design of the project is compatible with other authorized uses within the area and with uses planned for the area under the comprehensive plan and this Program;

    d. The public interest will suffer no substantial detrimental effect;

    e. Consideration has been given to the cumulative impacts of additional requests for like actions in the area.

    f. The use will not cause significant adverse effects to the shoreline environment in which it is to be located.

4. Other uses not specifically set forth in the shoreline master program may be authorized through a conditional use permit if the applicant can demonstrate that other uses are consistent with the purpose of the shoreline environmental designation and compatible with existing shoreline improvements; however, uses specifically prohibited by this Program shall not be authorized.

5. The burden of proving that a proposed shoreline conditional use meets the criteria of this program in WAC 173-27-160 shall be on the applicant. Absence of such proof shall be grounds for denial of the application.

6. The hearing examiner is authorized to impose conditions and standards to enable a proposed shoreline conditional use to satisfy the conditional use criteria.

7.3.6 Ecology Review

1. Ecology shall be notified of any substantial development, conditional use or variance permit decisions made by the Planning Director, whether it is an approval or denial. The notification shall occur after all local administrative appeals related to the permit have concluded or the opportunity to initiate such appeals has lapsed. When a substantial development permit and either conditional use or variance permit are required for a development, the submittal of the permits shall be made concurrently. The Planning Director shall file the following with the Department of Ecology and Attorney General:

    a. A copy of the complete application per WAC 173-27-180;

    b. Findings and conclusions that establish the basis for the decision including but not limited to identification of shoreline environment designation, applicable Master Program policies and regulations and the consistency of the project with appropriate review criteria for the type of permit(s);

    c. The final decision of the City;

    d. The permit data sheet consistent with content in WAC 173-27-990;

    e. Affidavit of public notice; and

    f. Where applicable, the Planning Director shall also file the applicable documents required by the State Environmental Policy Act (RCW 43.21C).

2. When the project has been modified in the course of the local review process, plans or text shall be provided to Ecology that clearly indicates the final approved plan.

3. If Ecology determines that the submittal does not contain all of the documents and information required by this section, Ecology shall identify the deficiencies and notify the City and the applicant in writing. Ecology will not act on conditional use or variance permit application until the material requested in writing is submitted to them.

4. Ecology shall convey to the City and applicant its final decision approving, approving with conditions, or disapproving the conditional use or variance permit within thirty days (30) of the date of submittal by the City. The planning director will notify those interested persons having requested notification of such decision.

5. Ecology shall base its determination to approve, approve with conditions or deny a conditional use permit or variance permit on consistency with the policy and provisions of the Act and the criteria listed in this Program.

6. Ecology shall file shoreline substantial development permits, shoreline variances and shoreline conditional use permits consistent with the provisions of WAC 173-27-130.

7.3.7 Minimum Permit Application Submittal Requirements

1. Pursuant to WAC 173-27-180, all applications for a shoreline substantial development permit, conditional use or variance shall provide, at a minimum, the following:

    a. The name, address and phone number of the applicant. The applicant should be the owner of the property or the primary proponent of the project and not the representative of the owner or primary proponent.

    b. The name, address and phone number of the applicant's representative if other than the applicant.

    c. The name, address and phone number of the property owner, if other than the applicant.

    d. Location of the property. This shall, at a minimum, include the property address and identification of the section, township and range to the nearest quarter, quarter section or latitude and longitude to the nearest minute. All applications for projects located in open water areas away from land shall provide a longitude and latitude location.

    e. Identification of the name of the shoreline (water body) that the site of the proposal is associated with. This should be the water body from which jurisdiction of the act over the project is derived.

    f. A general description of the proposed project that includes the proposed use or uses and the activities necessary to accomplish the project.

    g. A general description of the property as it now exists including its physical characteristics and improvements and structures.

    h. A general description of the vicinity of the proposed project including identification of the adjacent uses, structures and improvements, intensity of development and physical characteristics.

    i. A site development plan consisting of maps and elevation drawings, drawn to an appropriate scale to depict clearly all required information, photographs and text which shall include:

        i. The boundary of the parcel(s) of land upon which the development is proposed.

        ii. The ordinary high water mark of all water bodies located adjacent to or within the boundary of the project. This may be an approximate location provided, that for any development where a determination of consistency with the applicable regulations requires a precise location of the ordinary high water mark the mark shall be located precisely and the biological and hydrological basis for the location as indicated on the plans shall be included in the development plan. Where the ordinary high water mark is

neither adjacent to or within the boundary of the project, the plan shall indicate the distance and direction to the nearest ordinary high water mark of a shoreline.

iii. Existing and proposed land contours. The contours shall be at intervals sufficient to accurately determine the existing character of the property and the extent of proposed change to the land that is necessary for the development. Areas within the boundary that will not be altered by the development may be indicated as such and contours approximated for that area.

iv. A delineation of all wetland areas that will be altered or used as a part of the development.

v. A general indication of the character of vegetation found on the site.

vi. The dimensions and locations of all existing and proposed structures and improvements including but not limited to; buildings, paved or graveled areas, roads, utilities, septic tanks and drainfields, material stockpiles or surcharge, and stormwater management facilities.

vii. Where applicable, a landscaping plan for the project.

viii. Where applicable, plans for development of areas on or off the site as mitigation for impacts associated with the proposed project shall be included and contain information consistent with the requirements of this section.

ix. Quantity, source and composition of any fill material that is placed on the site whether temporary or permanent.

x. Quantity, composition and destination of any excavated or dredged material.

xi. A vicinity map showing the relationship of the property and proposed development or use to roads, utilities, existing developments and uses on adjacent properties.

xii. Where applicable, a depiction of the impacts to views from existing residential uses and public areas.

xiii. On all variance applications the plans shall clearly indicate where development could occur without approval of a variance, the physical features and circumstances on the property that provide a basis for the request, and the location of adjacent structures and uses.

7.3.8 Non-conforming Shoreline Uses

1. Legally established uses and developments that are nonconforming with regard to the use regulations of this Program may continue as legal nonconforming uses, consistent with the requirements of this section and WAC 173-27-080.

2. No existing building, structure or land devoted to a nonconforming use shall be expanded, enlarged, extended, reconstructed, intensified or structurally altered unless the use thereof is changed to a use permitted in the shoreline and underlying zoning except as follows: When authorized by conditional use permit, a nonconforming use may be expanded, enlarged, extended, reconstructed, intensified or structurally altered on land under the same ownership.

3. If a nonconforming use is changed to a conforming use, the nonconforming use shall not be resumed.

4. A use which is listed as a conditional use but which existed prior to adoption of this master program or any relevant amendment and for which a conditional use permit has not been obtained shall be considered a nonconforming use.

5. A structure for which a variance has been issued shall be considered a legal nonconforming structure and the requirements of this section shall apply as they apply to pre-existing nonconformities.

6. A nonconforming structure which is moved any distance must be brought into conformance with this Program and the Act.

7. A nonconforming use or a nonconforming structure that is discontinued or abandoned for a period of twelve (12) continuous months, or for twelve (12) months within any twenty-four (24) month period, such use shall not be resumed, notwithstanding any reserved intent not to abandon such use. Any subsequent use shall be conforming. Normal seasonal cessation of use, or temporary discontinuance for purposes of maintenance or improvements, shall not be included in determination of the period of discontinuance.

8. A non-conforming use authorized through a conditional use permit shall be considered a conforming use for the purposes of this section.

9. A legally non-conforming structure damaged by fire, flood, explosion, wind, earthquake, war, riot or other natural disaster shall not be restored or reconstructed and used as before such happening; however, where the cost or extent of restoration does not exceed the thresholds established by DMC 14.76.070 (repair or reconstruction of nonconforming structure), it may be restored, reconstructed and used as before, provided consistency with DMC 14.76.070.

10. Such repairs and maintenance work as required to keep the structure in sound condition may be made to a nonconforming structure, provided no increase in nonconformity shall be allowed except as required by law or ordinance or authorized by the planning director.

CHAPTER 8. DEFINITIONS

8.1 Interpretation

The definitions included in Section 8.2 are derived from multiple sources. Definitions denoted with (1) are from the existing City of Duvall municipal code. Definitions denoted with (2) are from WAC 173-26-020 or RCW 90.58.030. Definitions denoted with (3) are derived from other sources or represent the best professional judgment of the authors.

8.2 Definitions

1. **Abandon[3]**. Abandon means to terminate the use of a structure by an affirmative act, such as changing to a new use; or to cease, terminate, or vacate a use or structure through non-action for a period exceeding six months.

2. **Accessory use[1]**. Accessory use means a use, activity, structure or part of a structure which is subordinate and incidental to the main activity or structure on the subject property. Specific accessory uses for each zoning district are addressed in DMC Chapters 14.12 through 14.32.

3. **Accessory Structure[1]**. Accessory structure means a detached, subordinate structure, the use of which is clearly incidental and related to that of the principal structure or use of the land, and which is located on the same lot or adjacent lot as that of the principal structure consistent with this title.

4. **Act[2]**. Act means the Shoreline Management Act of 1971 (RCW 90.58) as amended.

5. **Active Recreation**[3]. Active recreation means forms of play, amusement, or relaxation where the user is engaged, such as boating, fishing, and swimming. Active recreation frequently requires more intensive recreational development to provide access and allow for active use.

6. **Agriculture**[3]. Agriculture means any agricultural activity as defined by WAC 173-26-020(3).

7. **Allowed use**[3]. Allowed use means uses approved subject to the provisions of this Program, including meeting applicable performance and development standards. If a building permit or other development permit (e.g., stormwater permit) is required, the use is subject to the project review and approval process.

8. **Amendment[2]**. Amendment means a revision, update, addition, deletion, and/or re-enactment to the Duvall SMP.

9. **Appurtenance[2]**. Appurtenance means a structure or development which is necessarily connected to the use and enjoyment of a single-family residence. “Normal appurtenance” means a garage, boat house, deck, driveway, utilities, and fences, and grading which does not exceed 250 cubic yards (WAC 173-14-040 (1)(g) or its successor). Appurtenances must be landward of the ordinary high water mark OHWM.

10. **Associated Wetlands**[2]. Associated wetlands means those wetlands which are in proximity to and either influence or are influenced by tidal waters or a lake or stream subject to the Shoreline Management Act. In general, a wetland is "associated" if all or a portion of the wetland falls within that area that is 200 feet from the ordinary high water mark. A wetland outside of this area may also be associated if it is in proximity to the shoreline and there is a demonstrated influence between the wetland and the shoreline. Such influence can include hydraulic continuity, such as a surface or groundwater connection.

11. **Average Grade Level**[2]. Average grade level means the average of the natural or existing topography of the portion of the lot, parcel, or tract of real property which will be directly under the proposed building or structure: In the case of structures to be built over water, average grade level shall be the elevation of the ordinary high water mark. Calculation of the average grade level shall be made by averaging the ground elevations at the midpoint of all exterior walls of the proposed building or structure.

12. **Base Flood**[1]. Base flood means the flood having a one percent chance of being equaled or exceeded in any given year (also referred to as the "100-year flood"). Designated on flood insurance rate maps by the letter A or V.

13. **Best Management Practices**[1]. Best management practices means the physical, structural, and/or managerial practices that have been approved by city of Duvall, and that when used singly or in combination, provide the most effective means of preventing or reducing pollution of water or other undesirable effects.

14. **Biostabilization**[3]. Biostabilization means project designs or construction methods which use live woody vegetation or a combination of live woody vegetation and specially developed natural or synthetic materials to establish a complex root grid within the existing bank which is resistant to erosion, provides bank stability, and maintains a healthy riparian environment with habitat features important to fish life. Use of wood structures or limited use of clean angular rock may be allowable to provide stability for establishment of the vegetation.

15. **Boat Launch or Ramp**[3]. Boat launch or ramp means graded slopes, slabs, pads, planks, or rails used for launching boats by means of a trailer, hand, or mechanical device.

16. **Boating Facilities**[2]. Boating facilities include marinas, boat launch ramps (public and private), wet and dry boat storage, related sales and service for pleasure and commercial watercraft, and docks (piers) except docks serving four or fewer single-family residences are excluded from this definition (WAC 173-26-241).

17. **Channel Migration Zone**[2]. Channel migration zone means the area along a river within which the channel(s) can be reasonably predicted to migrate over time as a result of natural and normally occurring hydrological and related processes when considered with the characteristics of the river and its surroundings.

18. **City**[3]. City means the City of Duvall.

19. **Clearing**[3]. Clearing means limbing, pruning, trimming, topping, cutting or removal of vegetation or other organic plant matter by physical, mechanical, chemical, or any other means.

20. **Commercial Use**[3]. Commercial use means an occupation, employment or enterprise that is carried on for profit by the owner, lessee or licensee.

21. **Compatible**[3]. Compatible means uses or activities capable of existing together or in the vicinity of one another without disharmony or without generating effects or impacts which are disruptive to the normal use and enjoyment of surrounding property.

22. **Conservation**[3]. Conservation means the prudent management of rivers, streams, wetlands, wildlife and other environmental resources in order to preserve and protect them. This includes the careful use of natural resources to prevent depletion or harm to the environment.

23. **Conditional Use, Shoreline**[2]. Shoreline conditional use means a use, development, or substantial development which is classified as a conditional use or is not classified within the master program.

24. **Department**, or **Department of Ecology**, or **Ecology**. Department, Department of Ecology, and Ecology mean the Washington State Department of Ecology.

25. **Development**[1]. Development means any man-made change to improved or unimproved real estate, including, but not limited to, buildings or other structures, mining, dredging, filling, grading, paving, excavation or other structures. "Development" means a use consisting of the construction or exterior alteration of structures; dredging; drilling; dumping; filling; removal of any sand, gravel, or minerals; bulkheading; driving of piling; placing of obstructions; or any project of a permanent or temporary nature which interferes with the normal public use of the surface of the waters overlying lands subject to the act at any stage of water level;

26. **Development Regulations**[2]. Development regulations means the controls placed on development or land uses by a county or City, including, but not limited to, zoning ordinances, critical areas ordinances, all portions of a shoreline master program other than goals and policies approved or adopted under chapter 90.58 RCW, planned unit development ordinances, subdivision ordinances, and binding site plan ordinances together with any amendments thereto.

27. **Development Standards**[3]. Development Standards means regulations including but not limited to, setbacks, landscaping, screening, height, site coverage, signs, building layout, drainage, parking and site design and related features of land use.

28. **Dock**[3]. A dock or pier is a landing and moorage facility for watercraft that abuts the shoreline and does not include recreational decks, storage facilities, or other appurtenances.

29. **Dredging**[3]. Dredging is the removal of material from the bottom of a stream, river or other water body.

30. **Excavation[3]**.Excavation means the mechanical removal of earth material.

31. **Exempt Development[2]**. Exempt development means those uses, developments or activities set forth in Chapter 7 of the Duvall SMP which are not required to obtain a substantial development permit under RCW 90.58.030(3)(e) and WAC 173-27-040, but which must otherwise comply with applicable provisions of the Act and this Master Program.

32. **Fair Market Value[2]**. Fair market value of a development is the open market bid price for conducting the work, using the equipment and facilities, and purchase of the goods, services and materials necessary to accomplish the development. This would normally equate to the cost of hiring a contractor to undertake the development from start to finish, including the cost of labor, materials, equipment and facility usage, transportation and contractor overhead and profit. The fair market value of the development shall include the fair market value of any donated, contributed or found labor, equipment or materials

33. **Feasible[2]**. Feasible means that an action, such as a development project, mitigation, or preservation requirement, meets all of the following conditions: (a) The action can be accomplished with technologies and methods that have been used in the past in similar circumstances, or studies or tests have demonstrated in similar circumstances that such approaches are currently available and likely to achieve the intended results; (b) The action provides a reasonable likelihood of achieving its intended purpose; and (c) The action does not physically preclude achieving the project's primary intended legal use. In cases where this Program requires certain actions unless they are infeasible, the burden of proving infeasibility is on the applicant.

34. **Fill material[1]**. Fill material means any solid or semi-solid material, including rock, sand, soil, clay, plastics, construction debris, wood chips, overburden from mining or other excavation activities, and materials used to create any structure or infrastructure, that when placed, changes the grade or elevation of the receiving site.

35. **Flood Hazard Reduction[2]**. Flood hazard reduction activities include actions taken to reduce flood damage or hazards. Flood hazard reduction measures may consist of nonstructural or indirect measures, such as setbacks, land use controls, wetland restoration, dike removal, use relocation, bioengineering measures, and storm water management programs; and of structural measures, such as dikes, levees, and floodwalls intended to contain flow within the channel, channel realignment, and elevation of structures consistent with the National Flood Insurance Program.

36. **Floodplain[1]**. Floodplain means the total land area adjoining a river, stream, watercourse, or lake subject to inundation by the base flood.

37. **Floodway[1]**. Floodway means the channel of a river or other watercourse and the adjacent land area that must be reserved in order to discharge the base flood without cumulatively increasing the surface water elevation more than one foot. Also known as the "zero rise floodway."

38. **Functions**[1]. Functions means the processes or attributes provided by areas of the landscape (e.g., wetlands, rivers, streams, and riparian areas) including, but not limited to, habitat diversity and food chain support for fish and wildlife, groundwater recharge and discharge, high primary productivity, low flow stream water contribution, sediment stabilization and erosion control, storm and floodwater attenuation and flood peak desynchronization, and water quality enhancement through biofiltration and retention of sediments, nutrients, and toxicants. These beneficial roles are not listed in order of priority. [Also referred to as *ecological functions* or *shoreline functions*; see WAC 173-26-200(2)(c)].

39. **Geotechnical Report or Geotechnical Analysis**[2]. Geotechnical report or geotechnical analysis means a scientific study or evaluation conducted by a qualified expert that includes a description of the ground and surface hydrology and geology, the affected land form and its susceptibility to mass wasting, erosion, and other geologic hazards or processes, conclusions and recommendations regarding the effect of the proposed development on geologic conditions, the adequacy of the site to be developed, the impacts of the proposed development, alternative approaches to the proposed development, and measures to mitigate potential site-specific and cumulative geological and hydrological impacts of the proposed development, including the potential adverse impacts to adjacent and down-current properties. Geotechnical reports shall conform to accepted technical standards and must be prepared by qualified professional engineers or geologists who have professional expertise about the regional and local shoreline geology and processes.

40. **Grade**[1]. Grade means the vertical elevation of the ground surface.

41. **Guidelines**[2]. Guidelines means those standards adopted by the department to implement the policy of chapter 90.58 RCW for regulation of use of the shorelines of the state prior to adoption of master programs. Such standards shall also provide criteria for local governments and the department in developing and amending master programs. WAC 173-26

42. **Habitat Improvement**[3]. Habitat improvement means any actions taken to intentionally improve the overall processes, functions and values of critical habitats, including wetland, stream and aquatic habitats. Such actions may or may not be in conjunction with a specific development proposal and include, but are not limited to, restoration, creation, enhancement, preservation, acquisition, maintenance and monitoring.

43. **Hearings Board**[2]. Hearings Board means the shorelines hearings board established by the Shoreline Management Act of 1971.

44. **Height**[2]. Height is measured from average grade level to the highest point of a structure: Provided, That television antennas, chimneys, and similar appurtenances shall not be used in calculating height, except where such appurtenances obstruct the view of the shoreline of a substantial number of residences on areas adjoining such shorelines, or the applicable master program specifically requires that such appurtenances be included: Provided further, That temporary construction equipment is excluded in this calculation;

45. **Impervious surface**[1]. Impervious surface means a hard surface area that either prevents or retards the entry of water into the soil mantle as under natural conditions prior to development or that causes water to run off the surface in greater quantities or at an increased rate of flow compared to natural conditions prior to development. Common impervious surfaces may include, but are not limited to, roof tops, walkways, patios, driveways, parking lots or storage areas, concrete or asphalt paving, gravel roads, packed earthen materials, and oiled macadam or other surfaces which similarly impede the natural infiltration of stormwater. Impervious surfaces do not include surface created through proven low impact development techniques.

46. **In-stream Structure**[2]. In-stream structure means a man-made structure within a stream waterward of the ordinary high-water mark that either causes or has the potential to cause water impoundment or the diversion, obstruction, or modification of water flow. In-stream structures may include those for hydroelectric generation, irrigation, water supply, flood control, transportation, utility service transmission, fish habitat enhancement, or other purpose. In-stream structures do not include shoreline stabilization structures, outfall structures, or boat launch ramps, which are regulated as separate shoreline modifications or shoreline uses within this Program.

47. **Lot**[1]. Lot means a physically separate and distinct parcel of property, which has been created pursuant to the provisions of these regulations; a fractional part of divided lands having fixed boundaries, being of sufficient area and dimension to meet minimum zoning requirements for width and area. The term shall include tracts or parcels.

48. **Low Intensity Use or Development**[3]. Low intensity use or development means a use or development that has limited impact upon the land, resources and adjoining properties in terms of the scale of development, and frequency, amount, or concentration of use. Low intensity uses are mostly passive uses that do not substantially consume resources or leave noticeable or lasting adverse effects.

49. **Master Program**[3]. Master Program means the comprehensive shoreline master program for the City of Duvall, including the use regulations together with maps, diagrams, charts or other descriptive material and text.

50. **May**[2]. May means the action is acceptable, provided it conforms to the provisions of WAC 173-26 and this Program.

51. **Mitigation**[1]. Mitigation means individual actions that may include a combination of the following measures, listed in order of preference:

    a. Avoiding an impact altogether by not taking a certain action or parts of actions;

    b. Minimizing impacts by limiting the degree or magnitude of an action and its implementation;

    c. Rectifying impacts by repairing, rehabilitating, or restoring the affected environment;

d. Reducing or eliminating an impact over time by preservation and maintenance operations during the life of the action;

e. Compensating for an impact by replacing or providing substitute resources or environments; and

f. Monitoring the mitigation and taking remedial action when necessary.

52. **Must**[2]. Must means a mandate; the action is required.

53. **Native shoreline vegetation**[3]. Native shoreline vegetation means vegetation comprised of plant species, other than noxious weeds, which are indigenous to Pacific Northwest lowlands and that reasonably could have been expected to naturally occur on the site.

54. **No Net Loss**[2]. No Net Loss means a standard intended to ensure that shoreline development or uses, whether permitted or exempt, are located and designed to avoid loss or degradation of shoreline ecological functions. The standard is met when proposed uses or developments are in compliance with the provisions of this master program. In cases where unavoidable loss results from allowed uses or developments, the standard is met through appropriate mitigation, consistent with the provisions of this master program.

55. **Nonconformance**[1]. Nonconformance means any use, improvement or structure established in conformance with the rules and regulations in effect at the time of establishment that no longer conforms to the range of uses permitted in the site's current zone or to the current development standards of these regulations due to the change in the code or its application to the subject property.

56. **Non-water Oriented Use**[2]. Non-water oriented use means any use that does not meet the definition of a water-dependent, water-related, or water-enjoyment use.

57. **Normal Maintenance or Repair**[2]. Normal maintenance or repair means interior and exterior repairs and incidental alterations. Normal maintenance and repair may include, but is not limited to, painting, roof repair and replacement, plumbing, wiring and electrical systems, mechanical equipment replacement and weatherization. Incidental alterations may include construction of nonbearing walls or partitions.

58. **Ordinary High Water Mark (OHWM)**[2]. Ordinary high water mark (OHWM) means that mark that will be found by examining the bed and banks and ascertaining where the presence and action of waters are so common and usual, and so long continued in all ordinary years, as to mark upon the soil a character distinct from that of the abutting upland, in respect to vegetation as that condition exists on June 1, 1971, as it may naturally change thereafter, or as it may change hereafter in accordance with permits issued by the City or the Department of Ecology. In any area where the ordinary high water mark cannot be found, the ordinary high water mark adjoining freshwater shall be the line of mean high water. On a site-specific basis, the Department of Ecology has the final authority on determining where the ordinary high water mark is located.

59. **Passive Recreation**[3]. Passive recreation refers to relaxation and activities focused on enjoying the natural beauty of the shoreline, shoreland open space areas, or wildlife. Passive recreation is associated with low impact recreational development such as trails, wildlife viewing platforms and areas, and interpretive signs.

60. **Permanent Structure**[3]. Permanent structure refers to a structure constructed with the intention to remain for an indefinite period of time.

61. **Permit**[2]. Permit means any substantial development, variance, conditional use permit, or revision authorized under chapter 90.58 RCW.

62. **Planning Director**[1]. Planning director means the director of the planning department of the city of Duvall or his/her designee.

63. **Preferred Shoreline Use**[2]. Preferred Shoreline Use is identified in the Act as a use that is unique to or dependent upon a shoreline location. Water-dependent, water-related, and water-enjoyment uses are preferred shoreline uses. Single-family residential development is also preferred use according to the Act.

64. **Prohibited**[3]. Prohibited means some developments and uses are viewed as inconsistent with the definition, policies or intent of the shoreline environment designation. For the purposes of this program, these uses are not considered appropriate and are not allowed, including by conditional use or Variance.

65. **Provisions**[3]. Provisions means policies, regulations, standards, guidelines, criteria, or environment designations.

66. **Pruning**[3]. Pruning means the removal of any of a tree's or shrub's living branches.

67. **Public Access**[2]. Public access means the public's ability to view, get to and/or use the State's public waters, the water/land interface and associated public shoreline area. It includes physical access that is either lateral (areas paralleling the shore) or perpendicular (an easement or public corridor to the shore), and/or visual access facilitated by scenic roads and overlooks, viewing towers and other public sites or facilities.

68. **Primary Structure**[3]. Primary structure means the structure associated with the principal use of the property. If more than one structure is associated with the principal use of the property, the one with the highest assessed value shall be considered the primary structure.

69. **Restoration**[2]. Restoration means the reestablishment or upgrading of impaired ecological processes or functions. This may be accomplished through measures including, but not limited to, revegetation, removal of intrusive shoreline structures, removal or treatment of toxic materials, and stream channel restoration. Restoration does not imply a requirement for returning the shoreline area to aboriginal or pre-European settlement conditions.

70. **Riprap**[3]. Riprap means broken stone placed on shoulders, banks, slopes, or other such places to protect them from erosion.

71. **Sediment**[3]. Sediment is material settled from suspension in a liquid medium.

72. **Sensitive Area**[1]. Sensitive area(s) means those areas listed in Ordinance 1056 and codified in DMC 14.42.

73. **Setback**[3]. Setback means the required minimum horizontal distance between the building line and the related front, side or rear property line.

74. **Shall**[2]. Shall means a mandate; the action must be done.

75. **Shoreline Armoring**[3]. Shoreline armoring or "structural shoreline armoring" refers to bulkheads, riprap and similar hard structures installed along the shore to stabilize the bank and prevent erosion. See shoreline stabilization.

76. **Shorelands or Shoreland Areas**[2]. Shorelands or shoreland areas means those lands extending landward for two hundred feet in all directions as measured on a horizontal plane from the ordinary high water mark; floodways and contiguous floodplain areas landward two hundred feet from such floodways; and all wetlands and river deltas associated with the streams, lakes, and river waters which are subject to the provisions of this chapter; the same to be designated as to location by the Department of Ecology.

77. **Shorelines**[2]. Shorelines means all of the water areas of the state, including reservoirs, and their associated shorelands, together with the lands underlying them; except (i) shorelines of statewide significance; (ii) shorelines on segments of streams upstream of a point where the mean annual flow is twenty cubic feet per second or less and the wetlands associated with such upstream segments; and (iii) shorelines on lakes less than twenty acres in size and wetlands associated with such small lakes.

78. **Shorelines of the State**[2]. Shorelines of the state are the total of all 'shorelines' within the City of Duvall.

79. **Shoreline Buffer**[23]. Shoreline buffer means the critical areas buffers assigned to 'shoreline of the state', including the Snoqualmie River. Buffers include an area contiguous to and required for protection of critical areas and shorelines.

80. **Shoreline Stabilization**[2]. Shoreline stabilization means actions taken to prevent or mitigate erosion impacts to property, dwellings, businesses, or structures caused by natural shoreline processes such as currents, floods, tides, wind or wave action. Shoreline stabilization includes structural armoring approaches such as bulkheads and revetments and nonstructural approaches such as biostabilization.

81. **Should**[2]. Should means that the particular action is required unless there is a demonstrated, compelling reason, based on policy of the Shoreline Management Act and this Program, against taking the action.

82. **Significant vegetation removal**[3]. Significant vegetation removal means the removal or alteration of trees, shrubs, and/or ground cover by clearing, grading, cutting, burning, chemical means, or other activity that causes significant impacts to ecological functions provided by such vegetation. The following do not qualify as significant vegetation removal:

    a. The removal of invasive or noxious weeds;

    b. The removal of hazard trees as documented consistent with the City Tree Protection Ordinance (DMC 14.40) where hazard tree removal would occur outside of shoreline minimum riparian zones and sensitive areas buffers and where it would not effect ecological functions;

    c. Pruning of trees and shrubs, not including tree topping, where pruning does not affect ecological functions

    d. Normal mowing of established public and private lawn / grass areas;

    e. Normal maintenance, including mowing and volunteer sapling clearing, of Figure 2 designated utility maintenance corridors and active use recreation areas within the shoreline area.

    f. Removal of racked flood debris as maintenance of established shoreline uses.

83. **Soft-shore bank stabilization**[3]. See bioengineering.

84. **Substantial Development**[2]. Shoreline development means any development with a total cost or fair market value of five-thousand seven hundred and eighteen dollars ($5,718.00) or more that requires a shoreline substantial development permit. The threshold total cost or fair market value of $5,718.00 is set by the state office of financial management and may be adjusted in the future pursuant to Shoreline Management Act requirements, as defined in RCW 90.58.030(3)(e) as now or hereafter amended.

85. **Transportation Facilities**[2]. Transportation facilities means a facility whose primary purpose is the movement and circulation of people, goods, and services. This includes, but is not limited to public roads, rails, parking areas, non-motorized travel corridors, trails, and similar features. It does not include driveways that are appurtenant to single-family residences.

86. **Utilities**[2]. Utilities are facilities which produce, store, collect, treat, carry, discharge, or transmit electric power, water, storm drainage, gas, sewage, reclaimed water, communications, or other public services. Accessory utility facilities are those associated with delivery of such public services to support individual uses and developments, such as distribution or service lines.

87. **Variance, Shoreline**[2]. A variance means a type of shoreline permit intended to grant relief from the specific bulk, dimensional, or performance standards set forth in this Program and not a means to vary a use of the shoreline.

88. **Vegetation Conservation[2]**. Vegetation Conservation includes activities to protect, enhance or and native vegetation along or near shorelines to minimize habitat loss, infestations of invasive plants, and erosion and flooding and therefore contribute to the ecological functions of shoreline areas.

89. **Water-dependent Use[2]**. means a use or portion of a use which requires direct contact with the water and which cannot exist in any other location and are dependent on the water by reason of the intrinsic nature of the operation. Boat launches, public fishing piers, and swim beaches are examples of water-dependent uses. Residential development is not a water-dependent use but is a preferred use of shorelines of the state.

90. **Water-enjoyment Use[2]**. Water-enjoyment use means those uses which provide for recreation involving the water or facilitates public access to the shoreline as the primary characteristic of the use, or a use which provides for aesthetic enjoyment of the shoreline for a substantial number of people as a general characteristic of the use and, through location, design and operation assures the public's ability to enjoy the physical and aesthetic qualities of the shoreline. To qualify as water enjoyment, a use must be open to the general public and the waterward side of the project must be devoted to provisions that accommodate public enjoyment, and the project must meet the Shoreline Master Program public access requirements. Some examples of water-enjoyment uses include viewing towers, parks, trails and educational/scientific reserves. A restaurant, commercial use supporting water-oriented recreation activities, or similar use may qualify as a water-enjoyment use provided it includes public access to the shoreline.

91. **Water-oriented Use[2]**. Water-oriented use means any water dependent, water-related, or water enjoyment use.

92. **Water-related Use[2]**. Water-related use means a use or portion of a use which is not intrinsically dependent on a waterfront location but whose economic viability is dependent upon a waterfront location because:

    a. The use has a functional requirement for a waterfront location such as the arrival or shipment of materials by water or the need for large quantities of water; or

    b. The use provides a necessary service supportive of the water-dependent uses and the proximity of the use to its customers makes its services less expensive and/or more convenient.

93. **Water Quality[3]**. Water quality means the physical chemical, aesthetic, and biological characteristics of water.

94. **Wetland[1]**. Wetland means areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Wetlands do not include those artificial wetlands intentionally created

from non-wetland sites, including, but not limited to, irrigation and drainage ditches, grass-lined swales, canals, detention facilities, retention facilities, wastewater treatment facilities, farm ponds, and landscape amenities, or those wetlands created after July 1, 1990, that were unintentionally created as a result of the construction of a road, street, or highway. However, wetlands include those artificial wetlands intentionally created to mitigate wetland impacts.

8.3 Unlisted Words and Phrases

The definition of any word or phrase not listed in this SMP which is in question when administering this regulation shall be defined from one of the following sources which are incorporated herein by reference. Said sources shall be utilized by finding the desired definition from source number one (1), but if it is not available there, then source number two (2) may be used and so on. The sources are as follows:

1. City development regulations;
2. Any City resolution, ordinance, code or regulations;
3. Any statute or regulation of the state of Washington (i.e., the most applicable);
4. Legal definitions from applicable case law or a law dictionary; and
5. The Webster's Dictionary.

City of Duvall
Shoreline Master Program Update
Final Draft Shoreline Inventory and Characterization Report

Ecology Grant No. G100025
Deliverable for Task 2.3
December 2010, updated June 2011

ESA

Duvall SMP

Reconnecting with the Riverfront.

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ACRONYMS

cfs	cubic feet per second
CMZ	channel migration zone
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
FEMA	Federal Emergency Management Agency
GMA	Growth Management Act
GIS	Geographic Information Systems
HPA	Hydraulic Project Approval
km	kilometer
LWD	Large Woody Debris
NPDES	National Pollutant Discharge Elimination System
NWI	National Wetland Inventory
OHWM	ordinary high water mark
PHS	Priority Habitats and Species
RCW	Revised Code of Washington
ROS	rain-on-snow
SED	Shoreline Environment Designation
SMA	Shoreline Management Act
SMP	Shoreline Master Program
SPA	Shoreline planning area
SVT	Snoqualmie Valley Trail
UGA	Urban Growth Area
USFS	United States Forest Service
USGS	United States Geological Survey
USFWS	United States Fish and Wildlife Service
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WDNR	Washington Department of Natural Resources
WDOH	Washington Department of Health
WRIA	Water Resource Inventory Area

CHAPTER 1 INTRODUCTION

1.1 Background and Purpose

The City of Duvall (City) is conducting a comprehensive Shoreline Master Program (SMP) update with the assistance of a grant administered by the Washington State Department of Ecology (Ecology) (SMA Grant No. G100025). According to Substitute Senate Bill (SSB) 6012, passed by the 2003 Washington State Legislature, cities and counties are required to update their SMPs consistent with the state Shoreline Management Act (SMA), Revised Code of Washington (RCW) 90.58 and its implementing guidelines, Washington Administrative Code (WAC) 173-26 (also known as the State Guidelines).

An early step in the comprehensive update process is an inventory and characterization of shoreline conditions. The inventory and characterization provides a basis for updating shoreline management goals, policies, and regulations; applying shoreline environment designations; and identifying public access and shoreline restoration opportunities. For purposes of this report, the term "shorelines" refers to areas that meet the criteria for "shorelines of the state." In Duvall, the only shoreline of the state is the Snoqualmie River.

This report includes the shoreline inventory and analysis, which was completed in accordance with Task 2.2 of the City's grant agreement with Ecology. It includes a discussion of the ecosystem processes at the watershed scale that influence the Snoqualmie River, and it provides more detailed descriptions of the ecological functions and land use patterns along the shoreline. Accompanying this report, in Appendix A, is a series of maps depicting shoreline features and conditions. Map 1 depicts the regional and ecosystem context of the City's shorelines, and Map 2 displays the approximate extent of the Duvall shoreline planning area. See Table 2-1 for a list of maps in Appendix A.

Based on the findings of this report, the City will begin the next steps in the SMP update process, which include developing shoreline environment designations and updating SMP goals, policies, and regulations. The City will also prepare a separate restoration plan to more fully describe restoration goals and opportunities.

1.2 Regulatory Overview

Washington's Shoreline Management Act was passed by the State Legislature in 1971 and adopted by the public in a referendum. The SMA was created in response to growing concerns about the effects of unplanned and unregulated development on the state's shoreline resources. A central goal of the SMA is "to prevent the inherent harm in an uncoordinated and piecemeal development of the state's shorelines."

Ecology administers the SMA but gives primary permitting authority for shoreline development to local governments. Local governments are also charged with developing SMPs in accordance with the State Guidelines. The Guidelines give local governments

some discretion to adopt SMPs that reflect local circumstances and to develop other local regulatory and non-regulatory programs related to the goals of shoreline management as provided in the policy statements of RCW 90.58.020, WAC 173-26-176, and WAC 173-26-181.

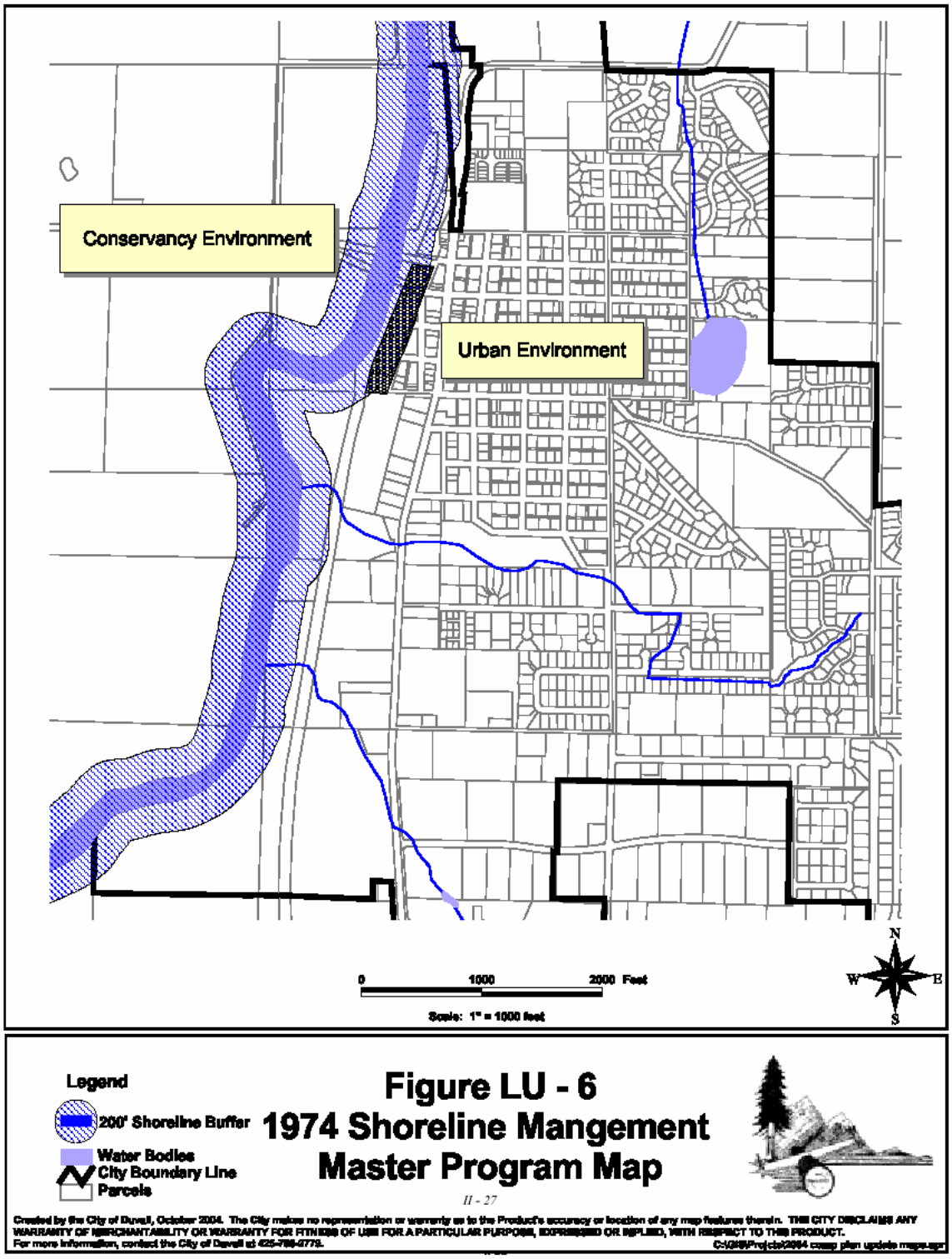
The City of Duvall adopted an SMP in 1974, three years after the SMA was passed. Rather than containing a detailed list of policies and regulations, the adopted SMP largely defers to the SMA implementing rules in WAC 173-26. However, it also has a system for classifying shoreline areas based on their biological and physical characteristics, their existing and planned land use patterns, and the goals of the community. Local SMPs are required to have such a system of "shoreline environment designations" (SEDs) to group areas that share similar characteristics so they can be managed in a uniform and consistent manner. SEDs function similarly to zoning overlays. That is, they do not change the underlying zoning or other applicable land use regulations, but provide an additional layer of policies and regulations that can be tailored to the designation. The City's current SMP describes two different environment designations. Table 1-1 shows the current SEDs and the criteria used to apply them, and Figure 1-1 shows the City's current SEDs map.

Table 1-1. Current Shoreline Environment Designations in the City of Duvall (DMC 14.78).[1]

ENVIRONMENT	DESCRIPTION
Shoreline Conservancy	All shoreline areas in the City of Duvall, including the Snoqualmie River, two hundred (200) feet on either side of the tops of the banks and their associated shorelands, exclusive of that area which is designated Urban and areas within unincorporated King County.
Urban	The area along the east bank of the Snoqualmie River within two hundred (200) feet on either side of the tops of the bank and their associated shorelands, from just north of the Depot Park building to the Woodinville-Duvall bridge.

[1] The City's current SMPs establishes a Shoreline Conservancy designation through portions of Duvall's northern urban growth area (UGA); the current King County SMP establishes a Conservancy designation for all northern UGA areas within shoreline jurisdiction.

Figure 1-1 Current City of Duvall Shoreline Environment Designations



1.3 Shoreline Jurisdiction

SMA jurisdiction includes all "shorelines of the state" as defined in RCW 90.58.030. Shorelines of the state include all of the water areas of the state and their associated "shorelands," together with the lands underlying them, except:

- Shorelines on segments of streams upstream of a point where the mean annual flow is 20 cubic feet per second (cfs) or less and the wetlands associated with such upstream segments; and

- Shorelines on lakes less than 20 acres in size and the wetlands associated with such small lakes.

The SMA further designates some shorelines as "shorelines of statewide significance." These "shorelines of statewide significance" include portions of Puget Sound and other marine water bodies, rivers with mean annual flow of 1,000 cfs or greater, and freshwater lakes 1,000 acres or larger. The mean annual flow of the Snoqualmie River through Duvall over the last 10 years is more than 3,500 cfs (USGS 1998), meaning that it meets the definition of a "shoreline of statewide significance". Consistent with RCW 90.58.020 and .090, the SMA increases the status of "shoreline of statewide significance" by establishing specific preferences for uses and calling for a higher level of effort in implementing the objectives of the SMA.

"Shorelands" or "shoreland areas" means those lands extending landward for 200 feet in all directions as measured on a horizontal plane from the ordinary high water mark (OHWM); floodways and contiguous floodplain areas landward 200 feet from such floodways; and all wetlands and river deltas associated with such streams, lakes, and tidal waters. In this context, "associated" wetlands means wetlands that are in proximity to shorelines or that influence or are influenced by waters subject to the SMA (WAC 173-22-030 (1)). These typically include wetlands that physically extend into the shoreline jurisdiction, and wetlands that are functionally related to the shoreline jurisdiction through a hydrologic connection and/or other factors.

SMA jurisdiction in Duvall includes the waters of the Snoqualmie River between the OHWM and the western City limits (approximately the centerline of the river) and shoreland areas lying landward (upland) of the OHWM as depicted on Map 2. The shoreland includes the large majority of the floodplain (Flood Hazard Area) associated with the river within the City, including all floodway areas. In addition, the shorelands include associated wetlands and those areas within 200 feet landward of the OHWM extending beyond the floodplain. The OHWM, which roughly corresponds to top of the east bank, was identified based on limited field investigation and Washington State Department of Natural Resources (WDNR) ShoreZone Inventory digital data (2000). A more precise depiction of the OHWM location would require field verification.

To the east and southeast of the mapped floodplain, several named streams drain across the City to the Snoqualmie River: Thayer Creek, Coe-Clemons Creek, and several

tributaries to Cherry Creek (Map 3). Cherry Creek, which drains the area to the north of the City and UGA, is also a shoreline of the state, but is located outside the City and UGA limits. Floodplain areas associated with lower Cherry Creek and the Snoqualmie River do extend into the City and UGA, and are includes as part of the Snoqualmie River shoreline planning area. Coe-Clemons and Thayer Creeks, the other tributary streams, have mean annual flows well below 20 cfs and do not qualify as shorelines of the state (USGS, 1998; King County, 2009 and RCW 90.58).

According to City and King County hydrography / water body GIS data (2005) and 2009 aerial photography, there are no large lakes in the City of Duvall. Lake Rasmussen, the largest open water feature within the City and UGA, is well below 20 acres in surface area, and is therefore not subject to the SMA.

1.4 Shoreline Planning Segments

For the purposes of this study, the City's Snoqualmie River shoreline planning area was split into three distinct segments based broadly on land uses and ecological conditions. Shoreline planning segments are described in Table 1-2, with segments depicted on Map 2.

Table 1-2. Shoreline Planning Segments in the City of Duvall

Segment	Description
South McCormick Park	The area south of the developed portions of McCormick Park and Depot Park. The area includes a wide floodplain, which is bisected by the Snoqualmie Valley Trail. Largely publicly owned with little development beyond trails and utility uses.
North McCormick Park / Depot Park Area	The active use areas of McCormick Park and Depot Park, including the shoreline at the major eastward bend in the Snoqualmie River.
Depot Village / Taylor's Landing / Northern Shoreline Area	The Snoqualmie River extending from the alignment of NE Stephens Street through to the alignment of NE Cherry Valley Road. The segment primarily includes a narrow floodplain, and is backed by the Riverside Village zoning district and Old Town areas of Duvall. This segment additionally includes open space floodplain area at the north end of the City (Dougherty Farmstead vicinity). The majority of this area is separated from the shoreline by SR 203.

1.5 Relationship to Other Plans and Programs

1.5.1 City Plans and Programs

The City's SMP works in concert with the Comprehensive Plan and a variety of other regulatory plans and programs to manage shoreline resources and regulate development near the shoreline. The Comprehensive Plan establishes the general land use pattern and provides an overall vision for growth and development for areas inside and outside shoreline jurisdiction. Various sections of the Duvall Municipal Code (DMC) also play a major role in how shorelines are managed. Some of the most important and compatible regulatory programs in Duvall include:

- **DMC Title 14 – Unified Development Regulations:**
    - **Chapter 14.10 Zoning** – Establishes zoning districts and regulates land use in the City of Duvall, including the shorelines.
    - **Chapter 14.40 Tree Protection** – Establishes regulations and standards aimed at preserving, maintaining and protecting the visual appearance and natural wooded character of the City of Duvall through protection of existing trees.
    - **Chapter 14.42 Sensitive Areas Regulations** – Establishes policies, regulations and land use controls to protect critical areas, including wetlands, fish and wildlife habitat (including streams), geologic hazards, aquifer recharge, and wellhead protection areas.
    - **Chapter 14.60 SEPA** – Establishes procedures and policies to implement the State Environmental Policy Act (SEPA). All non-exempt City actions require environmental review under SEPA.
    - **Chapter 14.84 Floodplain Regulations** – Establishes policies, regulations and land use controls to promote public health, safety and general welfare; reduce the annual cost of flood insurance; and minimize public and private losses due to flood conditions in specific areas.
- **DMC Title 9, Chapter 9.06 Storm Drainage Utility** – Establishes policies and regulations for the comprehensive management of surface and stormwater for land use proposals and development projects that could have impacts related to water quality, erosion, clearing and grading activities, flood hazard zones, or critical areas.

The SMA requires local governments and state agencies to review their plans, regulations, and ordinances that apply to areas adjacent to shoreline jurisdiction and modify those plans, regulations, and ordinances so they "achieve a consistent use policy"

in conformance with the SMA and the SMP[2]. This means that the City's Comprehensive Plan and development regulations must be consistent with the SMP overall. The City's current plan (adopted in 1974) far predates the City's Comprehensive Plan (City of Duvall, 2006). The Comprehensive Plan includes discussion, goals, and policies for protection of ecological functions, as well as for City subareas adjacent to the Snoqualmie River (including the subarea plan for Riverside Village zoning district, which was revised at roughly the same time) (City of Duvall, 2006).

One of the most important areas for consistency is between the SMP and the City's development standards and use regulations for environmentally sensitive (or critical) areas. Although sensitive areas in shoreline jurisdiction are to be identified and designated under the Growth Management Act (GMA)[3], they must also be protected under SMA. The Washington State Legislature determined that local governments must adopt SMPs that protect sensitive areas within the shoreline jurisdiction to "assure no net loss of shoreline ecological functions"[4].

1.5.2 State and Federal Programs

As stated in WAC 173-27, it is the intent of the SMA to integrate shoreline permitting into a consolidated environmental review and permit process. In achieving this goal, the shoreline policies and regulations contained in the updated SMP must work in concert with several state and federal permitting programs that relate to shorelines. These include:

- **Hydraulic Project Approval (HPA).** The HPA program applies to any construction activity in or near the waters of the state. The program is administered by the Washington State Department of Fish and Wildlife (WDFW). Permit applications must show that construction practices will prevent damage to the state's fish, and shellfish, and their habitats.

- **Clean Water Act Section 404 Dredge and Fill Requirements.** Section 404 of the federal Clean Water Act (USC 1394) regulates the discharge of dredged or fill material into waters of the United States. Any project that proposes discharging dredged or fill material into the waters of the United States, including special aquatic sites such as wetlands (non-isolated), must obtain a Section 404 permit. The U.S. Army Corps of Engineers (Corps) can authorize activities by a standard individual permit, letter-of-permission, nationwide permit, or regional permit. The Corps determines what type of permit is needed.

- **Clean Water Act Section 401 Water Quality Certification.** Applicants receiving a Section 404 permit from the Corps, a Coast Guard permit, or a license

[2] RCW 90.58.340
[3] RCW 36.70A
[4] ESHB 1933 and EHB 1653

from the Federal Energy Regulatory Commission (FERC) are required to obtain a Section 401 water quality certification from Ecology. Issuance of a certification means that Ecology anticipates that the applicant's project will comply with state water quality standards and other aquatic resource protection requirements under Ecology's authority.

- **Washington State Water Pollution Control Act.** All projects affecting surface waters in the state, including those that are not subject to the federal Clean Water Act Sections 404/401, must still comply with the provisions of the State's Water Pollution Control Act (RCW 90.48).

- **Federal Endangered Species Act (ESA).** All projects that have the potential to directly or indirectly impact wildlife species listed as endangered or threatened under ESA are subject to environmental review by the U.S. Fish and Wildlife Service (USFWS) or the National Oceanic and Atmospheric Administration Fisheries (NOAA Fisheries). Chinook salmon and bull trout are listed as threatened.

- **U.S. Army Corps of Engineers Section 10 Permit for Work in Navigable Waters.** The Corps has jurisdiction in all navigable waters of the state. Any work in, over, or under navigable waters of the U.S. requires a Section 10 permit. The purpose of Section 10 permitting is to prohibit the obstruction or alteration of navigable waters of the U.S.

- **U.S. Federal Emergency Management Agency (FEMA) National Flood Insurance Program (NFIP).** FEMA's NFIP provides flood insurance for participating communities for structures and uses within the floodplain. Although floodplain regulations are administered at the local level, the NFIP identifies minimum standards that must be met in order to maintain program participation. The minimum NFIP standards for the Puget Sound region are in the process of being revised to provide additional protection of natural floodplain functions and ESA listed species.

- **National Pollutant Discharge Elimination System (NPDES).** Authorized by the Clean Water Act, the NPDES permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Individual homes that are connected to a municipal system, use a septic system, or do not have a surface discharge do not need an NPDES permit; however, industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters. The City's Wastewater Treatment Facility maintains an NPDES permit for operation and discharge to the Snoqualmie River.

CHAPTER 2 METHODS

2.1 Determining Shoreline Planning Area Boundaries

The approximate extent of shoreline jurisdiction within the municipal limits of the City of Duvall is shown in Map 2 and is referred to as the shoreline planning area (SPA). In general this area represents:

- Lands within 200 feet of the OHWM of the Snoqualmie River within the municipal limits of the City and its UGA;
- Any mapped wetlands that lie adjacent and contiguous to the areas above;
- The floodplain associated with the Snoqualmie River within the municipal limits of the City and its UGA, including the entire extent of the mapped floodway; and
- The open water areas waterward of the OHWM to the western limits of the City (approximately the centerline of the Snoqualmie River).

The SPA is intended for planning purposes only. The actual regulated boundaries of the shoreline jurisdiction may differ from the area shown on Map 2, depending on information gathered on the ground at any specific location.

2.2 Inventory of Data Sources

The State Guidelines establish minimum requirements for the collection and use of scientific and technical information in developing the SMP updates. The standard for collection and use of scientific information is detailed by WAC 173-26-201(2). The following are the key points of the standard:

- Identification of the most current, accurate, and complete scientific and technical information available. Information should include scientific information, aerial photography, inventory data, technical assistance materials, and manuals and services from reliable sources.
- Any scientific research that is initiated for use as a basis for master program provisions shall use accepted scientific methods, procedures and review protocols.

Consistent with the standard, a number of local, regional, state and federal agency data sources, maps, and technical reports were reviewed to compile this inventory and characterization report. This includes information pertaining to watershed conditions and ecosystem-wide processes, as well as data on the land use patterns and ecological conditions of the City's shorelines. Assessing conditions at two distinct geographic scales (the watershed scale and the shoreline reach scale) is a key requirement of the SMP update process. A complete list of data sources used to compile the report is included in

Chapter 6, References. A series of maps depicting shoreline attributes accompanies this report as Appendix A. A list of the Appendix A map themes is shown in Table 2-1.

Table 2-1 Shoreline Map List (Appendix A)

Map Title	Map No.
Regional Context	1
Shoreline Planning Area	2
Topography and Hydrology	3
Flood and Geologic Hazard Areas	4
Fish Distribution	5
Zoning and Land Use	6
Parks, Open Space and Public Access Areas	7
Shoreline Processes and Impairments – North Extent	8a
Shoreline Processes and Impairments – South Extent	8b
Potential Restoration Opportunities – North Extent	9a
Potential Restoration Opportunities – South Extent	9b

2.3 Characterizing Ecosystem-wide Processes and Shoreline Functions

The State Guidelines require local jurisdictions to evaluate ecosystem-wide processes during SMP updates. The discussion of watershed processes in this report focuses on geology, soils, topography, and land cover. These watershed processes control the amount, type and extent of the smaller scale ecosystem processes at work in the Duvall shoreline planning area. Ecosystem processes include hydrology, sediment generation and transport, and water quality (see further discussion on the approach to characterizing ecosystem processes in Chapter 3).

Analyzing conditions and processes at the watershed scale informs local planning by providing a broad understanding of the influences on shoreline conditions and functions. Natural processes, and alterations to those processes, are described generally at the watershed scale based on existing reports and readily available mapping information.

2.4 Inventory and Characterization Approach for Shoreline Reaches

The inventory and characterization of Duvall's SPA is intended to describe conditions at a finer scale. The inventory is based on available documents, data and plans. It represents the most current and readily available information concerning the physical habitat of the City's shoreline. It includes information on land use, zoning, public access, water quality, priority habitats and species, critical areas, and shoreline modifications.

CHAPTER 3 ECOSYSTEM-WIDE CHARACTERIZATION

The purpose of this chapter is to provide a greater context within which to understand the ecological functions that are operating at the reach scale. This chapter informs the inventory assessment of conditions and functions at a reach scale in Chapter 5. This chapter is organized to provide:

- An overview of the watershed and regional landscape, including physical description, land use changes, and existing habitats;
- A discussion of the process controls that influence the form and ecological functioning of the Snoqualmie River watershed; and
- A discussion of key ecosystem processes and associated implications for assessment at a reach level and for shoreline management within the City.

3.1 Watershed and Regional Overview

The mainstem Snoqualmie River forms in the headwaters of the North, Middle, and South Forks of the Snoqualmie Rivers. The mainstem Snoqualmie River extends south and east from the City through unincorporated King County as well as the City of Carnation, the community of Fall City, and (above Snoqualmie Falls) the Cities of Snoqualmie and North Bend (Map 1).

The river branches into the three major forks to the east of North Bend. Other significant tributaries to the Snoqualmie River include (from upstream to downstream): the Raging River, which drains across the I-90 corridor through the Preston area before converging with the Snoqualmie River in Fall City; Patterson Creek, which drains the east side of the Sammamish Plateau before converging with the river between Carnation and Fall City; and the Tolt River, which converges with the mainstem within Carnation. Immediately downstream (north) of Duvall, Cherry Creek drains to the mainstem from the east. Cherry Creek is the lowest significant tributary of the Snoqualmie River, and the only significant tributary that drains areas of the City. The mainstem of Cherry Creek never passes into the City or UGA; non-shoreline tributaries to Cherry Creek drain the northeastern portion of the City.

The Snoqualmie River continues north from Duvall for approximately nine miles before joining together with the Skykomish River; downstream of the convergence, the rivers together are named the Snohomish River. The Snohomish River drains to Puget Sound at Everett. These three rivers—Snohomish, Skykomish, and Snoqualmie—and their tributaries together drain a watershed (Water Resource Inventory Area 7) of 1,856 square miles located in both Snohomish and King Counties (Snohomish County, 2006).

The geology of western King County, including the lowland areas of the Snoqualmie River, consists of bedrock underneath layers of sediments deposited by glaciers, as well as sand and gravel (alluvium) deposited recently by modern rivers (Krukeberg, 1991).

The region has a temperate, maritime climate. Winters are cool and wet, while there is typically a drought period in the summer and early fall. The climate is influenced by Puget Sound to the west and the Cascade Mountains to the east. Average annual precipitation ranges from approximately 30 inches near Puget Sound to 90 inches in the Cascade foothills, with the area surrounding Duvall averaging nearly 50 inches (Appendix B).

Higher human population densities in the Snoqualmie River watershed are focused within and around Duvall, Carnation, Fall City, Snoqualmie and North Bend. Outside of these urban growth areas, the Snoqualmie River valley consists primarily of agricultural production districts, with surrounding portions of the watershed including rural areas, forest production districts, and open space areas (preserved lands) (King County DDES, 2009). Over 80 percent of the population of King County lives in cities and UGAs, with less than 20 percent in rural areas (King County, 2008). This trend continues throughout the Snoqualmie watershed, with the majority of the population focused in designated Urban Growth Areas and incorporated cities.

The Snoqualmie River watershed contains a wide range of vegetation types, from wetland scrub/shrub and emergent areas in the valley floodplain to forests in the Cascade foothills. In general, the largest undeveloped areas are located at higher elevation, while lower areas tend to be the most urbanized.

The City of Duvall is located on the east side of the lower Snoqualmie River valley. The centerline of the river is the approximate western boundary of the City, with unincorporated areas of King County extending through the floodplain to the south, east, and north.

Prior to European settlement, the Snoqualmie River valley was used by several Coast Salish Indian tribes, including the Tulalip, Pilchuck, Snohomish, and Snoqualmie. Large, permanent winter villages were located along the Snoqualmie and Snohomish Rivers where people thrived by fishing for salmon, hunting mammals over land, and gathering native fruits, vegetables, and berries (City of Duvall, 2006).

Early Euro-American settlers were first drawn to the Duvall vicinity of the Snoqualmie River valley in the 1870s by vast timber resources, both in areas of the valley and the surrounding hills. Homesteading occurred in the region, primarily by Civil War veterans with homestead rights. The Duvall area was homesteaded and named after two brothers, Francis and James Duvall. The original town site, named Cherry Valley, occurred to the north of the existing center, near the convergence of Cherry Creek with the river. The Snoqualmie and Snohomish Rivers were used to transport logs to major downstream population centers, including Everett.

The river remained the primary means of transportation until the 1890s, at which time the construction of railroad lines through to the town of Snohomish allowed a more intensive timber industry to become established in the immediate area. The railroad was constructed along the east side of the river, adjacent to Duvall's Main Street, on a 12- to

15-foot-tall fill berm that stretches along the river valley. In the following decades, bridges over the Snoqualmie River and roads linking through to Lake Sammamish and Lake Washington were constructed. Bridges and roadways were also built on fill berms in the floodplain, in most instances stretching east-west across the valley. The developed transportation infrastructure led to rapid population growth in Duvall, as well as other valley communities. The growth of the timber industry and the expanded population brought about rapid changes in vegetative cover (forest to agricultural fields) and vegetative character (old growth forest to second growth forest) during this period. Population growth continued through the 1920s, after which the decline of the timber industry in the area minimized the need for laborers.

After the 1920s the pattern of alterations to the valley landscape was characterized by clearing of native shrub and riparian vegetation, ditching of streams and land to create pasture, and hardening of the Snoqualmie River shoreline. Shoreline hardening was in most instances informal, likely occurring as placement of hardening materials and structures along the rivers, as well as documented placement of automobiles and other structures along the banks of the river as part of public agency-sponsored efforts (see Photo 5-1 in Chapter 5, page 32).[5]

In the last 50 years, modern roadways and expanding suburban growth from the Seattle urban area has led to additional growth in the City and throughout the valley – this has primarily occurred in the last 20 years. Agricultural activities remain a significant regional economy and floodplain-wide land use, with cattle and dairy operations, produce and crop farms, and greenhouse operations extending up and down the valley. However, residential housing and associated service businesses have come to characterize Duvall and other urbanized areas of the watershed.

The Snoqualmie River watershed and the entire WRIA 7 area support a variety of fish and wildlife species. Wildlife habitat types that are common in the vicinity include freshwater aquatic areas and associated riverine habitats; wetlands and associated riparian areas; lowland conifer-hardwoods; agricultural and pasture areas; and urban areas.

The Snoqualmie River watershed supports Chinook, chum, coho, and pink salmon; bull trout and Dolly Varden; cutthroat, steelhead, rainbow, and brook trout; and warmwater fish such as smallmouth and largemouth bass, yellow perch, bluegill, and green sunfish (City of Duvall, 2006).

Federally and state listed species known or presumed to occur in King County, although not necessarily in the Duvall area, include orca whale, spotted owl, gray wolf, grizzly

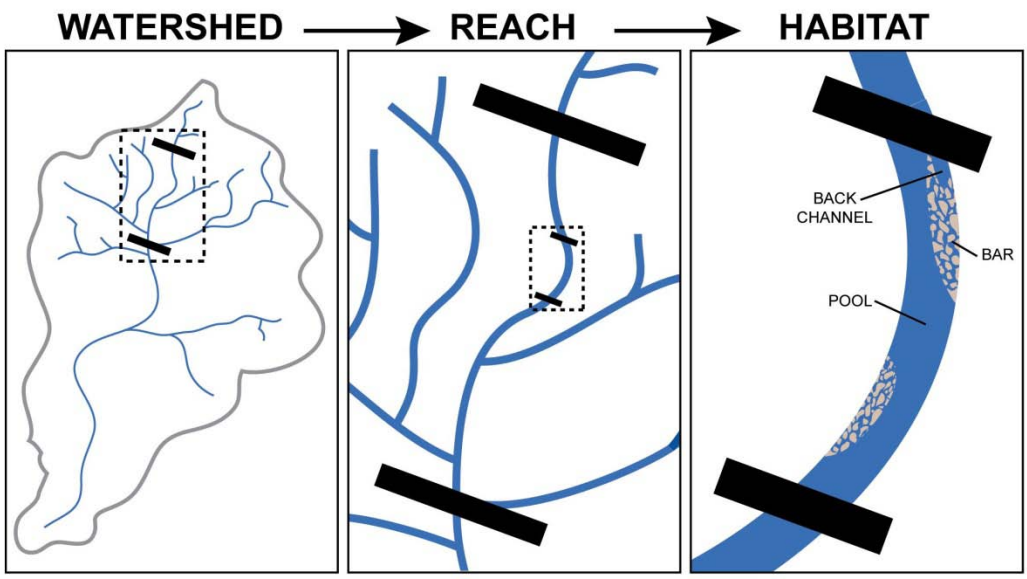
[5] The riparian corridor along the Snoqualmie River throughout McCormick Park, and much of the River reach upstream and downstream of the City, is characterized by a gradual and relatively narrow berm elevated +2 to +5 feet above the surrounding floodplain. The berm like features, while potentially modified or expanded (heightened) by historical human activities in some locations, are generally a natural formation created through sediment deposition during flood events. There is no record of levee structures, informal or otherwise, built along the Snoqualmie within Duvall.

bear, Oregon spotted frog, sandhill crane, bald eagle, marbled murrelet, bull trout, and Chinook salmon (WDFW, 2010).

3.2 Ecosystem Processes

The State Guidelines require that local jurisdictions evaluate ecosystem-wide processes and their relationship to shoreline ecological functions. Ecosystem-wide processes are the processes within a watershed that relate to hydrology, sediment transport, water quality, and habitat. These ecosystem processes control the physical form of the landscape and the types of habitats that occur throughout the ecosystem. Ecosystem processes are formed and function at multiple scales, from the watershed to site-specific or habitat scale (Figure 3-1).

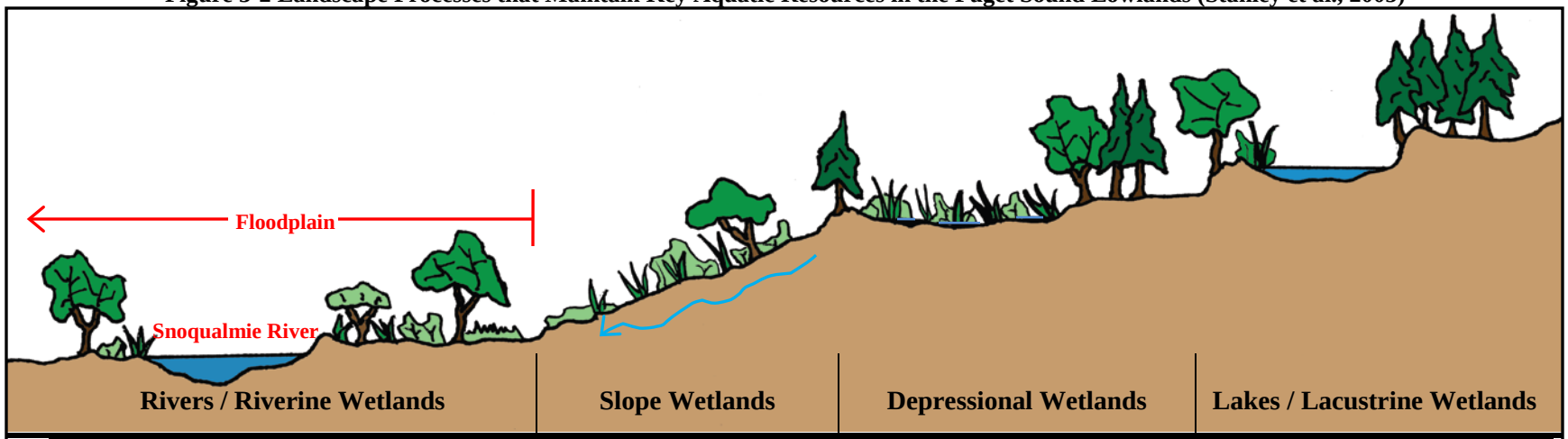
Figure 3-1 Relationship of Scales



A Landscape Analysis was developed for Duvall to support the City's sensitive area ordinance update (Parametrix, 2005; included as Appendix B). Other watershed studies and plans have been developed in the last five years, including the Snoqualmie Watershed Water Quality Synthesis Report (Kaje, 2009) and the Snohomish Basin Ecological Analysis for Salmonid Conservation (SBSRTC, 2005), developed as part of the Snohomish River Basin Salmon Conservation Plan (SBSRTC, 2005).

The City's Landscape Analysis focuses primarily on the role of water movement across the landscape and how water flow in the watershed shapes the form and functions of the shorelines. For example, the flow regime of a river, including modifications to natural flow such as levees, weirs, dams, and other devices, will determine the habitats and shoreline types in that system. Figure 3-2 identifies key landscape processes as they relate to aquatic resources within the Snoqualmie River watershed, including the subbasin areas within Duvall (adapted from Stanley et al., 2005).

Figure 3-2 Landscape Processes that Maintain Key Aquatic Resources in the Puget Sound Lowlands (Stanley et al., 2005)



Rivers / Riverine Wetlands	Slope Wetlands	Depressional Wetlands	Lakes / Lacustrine Wetlands
KEY LANDSCAPE PROCESSES[6]			
• Hydrology o **Surface water runoff (peak flow)** o **Groundwater movement** • **Sediment supply** • **Water quality (nutrients, pathogens, toxins/metals), contaminant cycling** • **Large Woody Debris (LWD) delivery**	• Hydrology: **Groundwater movement**	• Hydrology o Surface water runoff o **Groundwater movement** • **Sediment supply** • **Water quality (nitrogen and phosphorous cycling),** contaminant cycling • LWD delivery	• Hydrology o Surface water runoff o **Surface water storage** o Groundwater movement • Sediment supply • **Water quality (nitrogen and phosphorous cycling),** contaminant cycling

[6] Processes in bold are most important for maintaining the integrity of the aquatic resource.

Ecosystem processes are significantly affected by four underlying controls: geology, climate, vegetation, and land cover / use (Appendix B).

- Geology provides a foundation for landscape processes, as it influences topography, landform stability, and substrate permeability and reactivity.

- Climate determines the amount, form, and timing of water inputs. Plant cover and communities in any given habitat influence the residence time of surface water and shallow groundwater.

- The roles of vegetation as related to aquatic resources are identified in Appendix B and include: intercepting precipitation (reducing sediment transport and erosion); recirculating water through transpiration; providing shade (moderating temperature and humidity); stabilizing soil structure; and providing organic input, nutrient enrichment, and habitat structure.

- Land use activities related to agriculture, forestry, and residential/commercial development can alter vegetation and, to a lesser extent, surficial geology. These changes can in turn affect landscape processes. Land use acts as a stressor on natural processes, disrupting the interception and uptake of precipitation and nutrients and the proportion of water distributed via surface and subsurface flows (Appendix B).

Compared with geology and climate, vegetation cover and land use are easily altered. The process controls for Duvall and the Snoqualmie Watershed are summarized in Section 3.1 (Watershed and Regional Overview) and detailed in Appendix B.

3.3 Alterations to Key Ecosystem Processes

Table 3-1 summarizes the key factors or natural controls that typically contribute to these processes under natural conditions. The table also summarizes the mechanisms through which these processes act and the important locations where they occur. Important areas consist of landscape environments, typically associated with aquatic or wetland habitats, that provide a central role in maintaining landscape-scale processes. The sections following the table then provide an inventory of landscape processes and how changes to these processes have occurred in the Snoqualmie River watershed as a result of human activities. The discussion focuses on the watershed area surrounding and influencing the vicinity of Duvall. Further information can be found in Appendix B.

Table 3-1. Summary of Landscape-Scale Processes – Controls, Mechanisms and Important Areas

Process	Natural Controls	Mechanisms	Types of Important Areas*	Description of Important Areas in Duvall and Vicinity
Hydrology (surface and ground water)	• Climate and precipitation patterns • Timing of snowmelt • Soils and geology • Vegetation	Infiltration/ recharge	Permeable soils, ***riparian areas***, ***floodplains***	Moderate levels of infiltration and recharge are mapped as occurring primarily within the Cherry Valley floodplain, as well as within the Snoqualmie River floodplain at lower levels. Areas of significant infiltration and recharge are located in the vicinity of Fall City and above the Snoqualmie Falls.
		Surface water storage	***Depressional wetlands***, ***lakes***, ***floodplains***	As Thayer, Coe-Clemons, and Cherry Creek tributaries reach the floodplain, surface flows distribute across the valley, with surface water stored in several large depressional wetland areas. Entire Duvall floodplain area serves as storage during overbank flood events. One small (under 20 acres) lake is located within the Cherry Creek basin of Duvall; other moderately sized wetland areas also mapped outside of shoreline area in Duvall.
		Peak flows	***Impervious surfaces***, rain-on-snow (ROS) zone, ***forest cover***	Impervious surfaces limited within shoreline area, however rapid development throughout town over the last 2 decades has converted agricultural and forest land to commercial and residential development associated with moderate levels of impervious surfaces. Heightened levels of impervious surface correspond with reduced forest cover – a mechanism change that primarily occurred through logging and agricultural land use changes primarily between 1880 and 1950.
		Groundwater movement (baseflow)	**Permeable deposits**, fissured bedrock	Groundwater moves through the Duvall area hillside near the surface, encountering the surface as seeps and slope wetlands near the break between the hillside and the Snoqualmie River floodplain. Detailed assessment of bedrock conditions has not occurred in Duvall.
Sediment Supply	• Topography • Soil erodibility • Vegetation cover	Erosion	***Erodible soils (especially on steep slopes)***, ***Channel Migration Zones (CMZs)***	For purposes of SMP planning, potential CMZ and associated erosion areas extend through the Duvall shoreline area to the west of the Snoqualmie Valley Trail. Review of historical mapping and aerial photography suggest that mainstem channel migration occurs relatively slowly within the lower Snoqualmie River valley. Erodible soils along steep slopes are mapped along the reach of Coe-Clemons Creek immediately east of Main Street. Active bank failure is noted within this reach, as is resultant sedimentation within the downstream shoreline area.
		Mass wasting	***Slopes prone to landslides***	Steep slopes susceptible to landslide are mapped along the reach of Coe-Clemons Creek immediately east of Main Street. Steep slope areas are mapped along the northern boundary of the City, where tributary streams to Cherry Creek cut through the hillside to the valley to the north.
Water quality (nutrients, toxins, pathogens)	• Climate patterns • Geology and soil characteristics • Hydrologic regime • Biotic cover and composition • Wildlife • Factors that kill pathogens (UV radiation, pH, etc.)	Physical properties (temperature, turbidity)	***Forest cover***, ***riparian zones***	Forest cover is largely limited within Duvall, constricted to areas at the eastern, northeastern, and southeastern limits of Duvall, small pockets, and corridors along certain reaches of mapped streams. Forest cover within the Snoqualmie River shoreline area, including the 50 to 100 foot riparian area along the river, is also significantly reduced due to historic land clearing for agricultural activities.
		Chemical properties (pH, nutrient levels)	***Depressional wetlands***, wetlands with organic soils, ***riparian zones***, ***hyporheic zones***, ***floodplains***	Depressional wetlands with significant storage capacity occur in the Duvall shoreline area, providing an environment for chemical and biotic mechanisms that improve water quality. The entire shoreline area is a floodplain, as is the shoreline area for the Snoqualmie River extending outside of Duvall into King County jurisdiction. Riparian function within the City and surrounding area function at moderate to low levels, however existing land use and development within the City's shoreline areas do not prohibit or hinder potential future enhancement of riparian functions. Hyporheic zones are assumed to extend through much of the City's Snoqualmie River floodplain area.
		Contaminants (toxins, pathogens)	***Depressional wetlands***, ***riparian zones***, ***hyporheic zones***, ***floodplains***	
Organic imputs (large wood)	• Water energy • Riparian vegetation • Soil erodibility • Topography • Climate • Biotic interactions	Riparian vegetation	***Riparian zones***, forested CMZs	Riparian function within the City and surrounding area function at moderate to low levels. Riparian vegetation generally consists of a narrow band of mixed forest backed by herbaceous and shrub vegetation communities. Existing land use and development within the shoreline areas do not prohibit or hinder potential future enhancement of riparian functions. Riparian cover along tributary streams provides moderate organic input function, including landslide and erosion hazard areas along Coe-Clemons Creek, however these sources of large woody debris are disconnected from the shoreline by undersized culverts (Main Street, Snoqualmie Valley Trail, and other transportation and trail infrastructure).
		LWD recruitment	***Riparian zones***, forested CMZs, ***landslide hazard areas***	

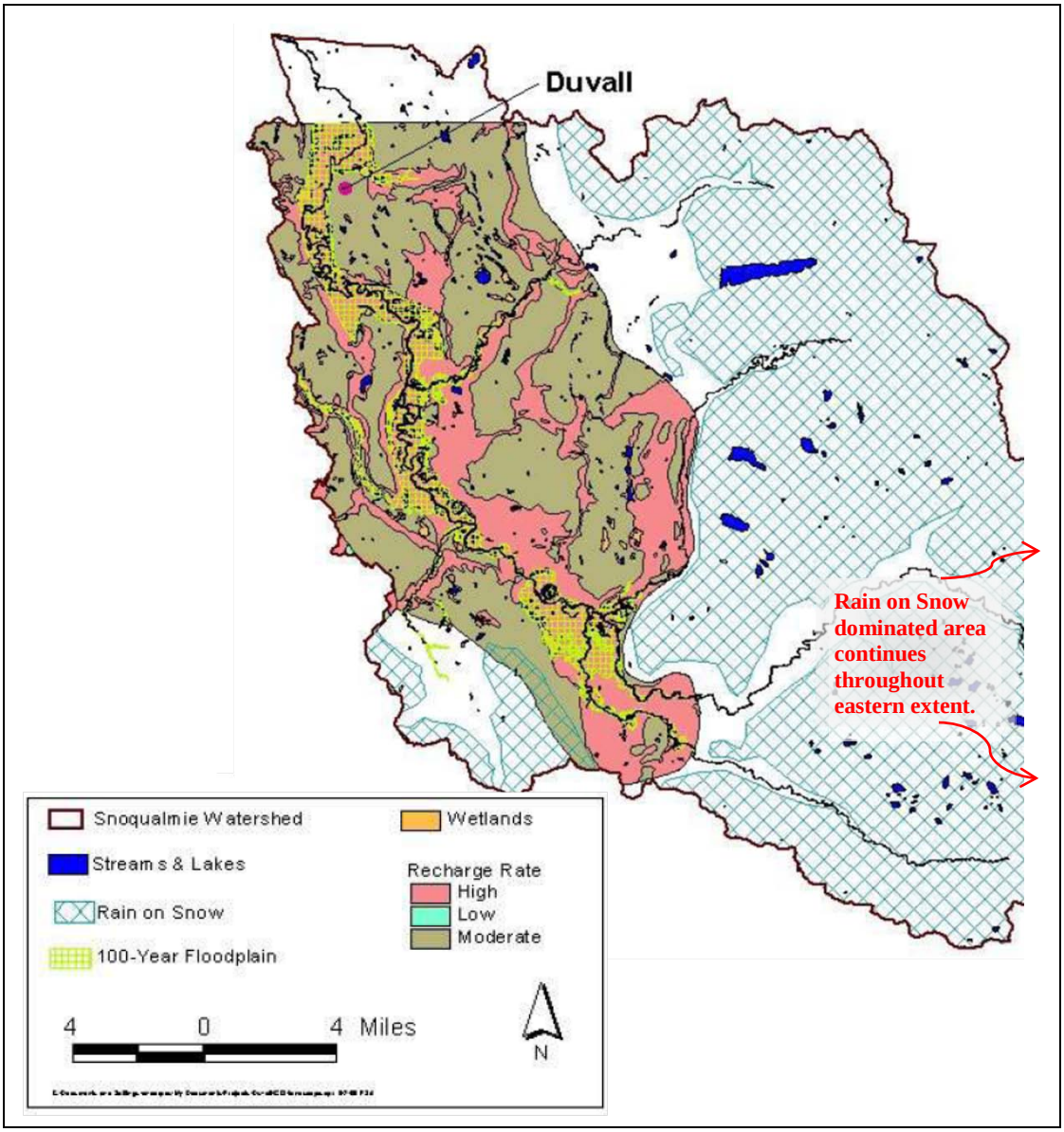
Source: Summarized from Stanley et al. (2005) and Parametrix (2005)

*Important areas in bold are those areas found within the Duvall vicinity. Important areas also in italics are found within the Duvall shoreline planning area (SPA)

3.3.1 Hydrology

The City's Landscape Analysis identifies important areas for hydrologic mechanisms across the Snoqualmie watershed (Figure 3-3; Appendix B).

Figure 3-3. Hydrologic Mechanisms and Important Areas Across the Snoqualmie Watershed – from Parametrix 2005 (Appendix B).



Water quantity functions were assessed for the Puget Sound, including basins of the Snoqualmie Watershed, by the Department of Ecology (Ecology, 2010). For purposes of the assessment, basins overlapping the City include Mainstem Cherry Creek and Mainstem Snoqualmie River. The Mainstem Snoqualmie basin combines the drainage areas of Coe-Clemons Creek, Thayer Creek, and several other relatively small basins surrounding the mainstem to the east and south of the City; as such, results for the

Mainstem Snoqualmie basin are not as applicable to the City's subbasin areas as a more refined analysis and assessment discussed in subsections below. The results of the water quality functional assessment do, however, verify the urbanizing character of Duvall. The overall water quantity functional rating for the Mainstem Snoqualmie area suggests that the basin is moderately impaired (highly impaired for groundwater recharge) with moderate to low levels of importance for functional recovery. The overall rating for the Mainstem Cherry Creek basin suggests restoration and protection as priorities both for mechanisms that are impaired (surface storage, water flow) and those that are functionally intact (recharge, discharge).

Infiltration and Recharge

Two major geologic formations in the Snoqualmie watershed create hydrologic infiltration and groundwater recharge conditions: porous soils (outwash) above relatively impermeable subsurface strata; and alluvium along major streams. Deep recharge is facilitated in areas where bedrock is fissured, including areas within and adjacent to the Snoqualmie River and tributary floodplains (Turney et al., 1995, Adolfson Associates, 2004, King County Groundwater Protection Program, 2004). A large contiguous area of recharge extends along the Snoqualmie River from the vicinity of North Bend to the King – Snohomish County boundary. Along significant tributary streams, including Cherry Creek, areas of high recharge extend out of the river floodplain into contributing basins. The entire area of the City is mapped as having a high or moderate level of recharge (primarily moderate). Compared to rates mapped in upstream areas (as high as 90 inches annually), however, the recharge rates throughout much of Duvall are relatively low (10 to 20 inches annually). Areas of high recharge in Duvall are focused in the shoreline environment, within the Snoqualmie River floodplain and the Snoqualmie / Cherry Creek floodplain extending along the north side of the City.

Groundwater Flows

Recharge replenishes deep groundwater (aquifers) with surface water and shallow groundwater. Two large aquifers have been mapped in the Snoqualmie River valley, the largest of which (the Snoqualmie Aquifer) lies beneath the North Bend area (river mile [RM] 45-50) well upstream of Duvall. The Snoqualmie Aquifer has been identified as significant enough to warrant high protection and consideration as a source of municipal water and/or low flow augmentation to the Snoqualmie River (East King County Ground Water Advisory Committee, 1998, King County Ordinance 14214, Seattle Public Utilities, 2001, Adolfson Associates, 2004). Risks of contamination to Snoqualmie watershed aquifers are most severe in areas of high infiltration well to the south and east of Duvall, although the relatively shallow groundwater table (approximately 40 feet above mean sea level within the floodplain) and higher rates of recharge in the City’s floodplain areas warrant protection (Turney et al., 1995, Parametrix, 2005).

Throughout Duvall, groundwater has been mapped as intermediate to shallow. Relatively impermeable soils through the hillside of the City (above the floodplain) do not allow high levels of infiltration and keep groundwater relatively shallow. Groundwater at intermediate to shallow levels generally follows surface topography. There are a number

of hillside seeps in Duvall where shallow groundwater surfaces at topographical breaks. (Turney et al., 1995)

Surface Water Storage

As it flows along the west side of the City, the Snoqualmie River is already carrying large volumes of water compared to quantities contributed by the Duvall area subbasins. The City landscape provides storage for river waters only during flood events, when overbank flows are detained and stored within the floodplain. At other times, storage within the Duvall landscape and other lowland areas surrounding the valley is provided by the small lakes and depressional wetlands.

Approximately 200 acres of area throughout the City (low elevation) are available for surface water storage (Appendix B). Storage areas are focused around the 100-year floodplain (133 acres), wetlands within the tributary basins above the floodplain, and Rasmussen Lake (approximately 5.3 acres).

Peak Flows

Peak flows in the Snoqualmie watershed, like other Puget Sound basin watersheds, typically occur November through January (rain on snow events) and again in May through June (snow melt). Peak flow events result in regular overbank flooding along the Snoqualmie River and the significant tributary streams. Coe-Clemons Creek and Thayer Creek have relatively small contributing basins and are rarely subject to significant overbank flows except when inundated by Snoqualmie River overbank water within the floodplain.

Influences of peak flow events on the channel of the Snoqualmie River as well as all tributary streams are significant. Along the mainstem and significant tributary streams, overbank flooding and erosion from peak flows can lead to significant channel migration events. Along smaller tributary streams, peak flows can cause bank failures and rapid channel erosion.

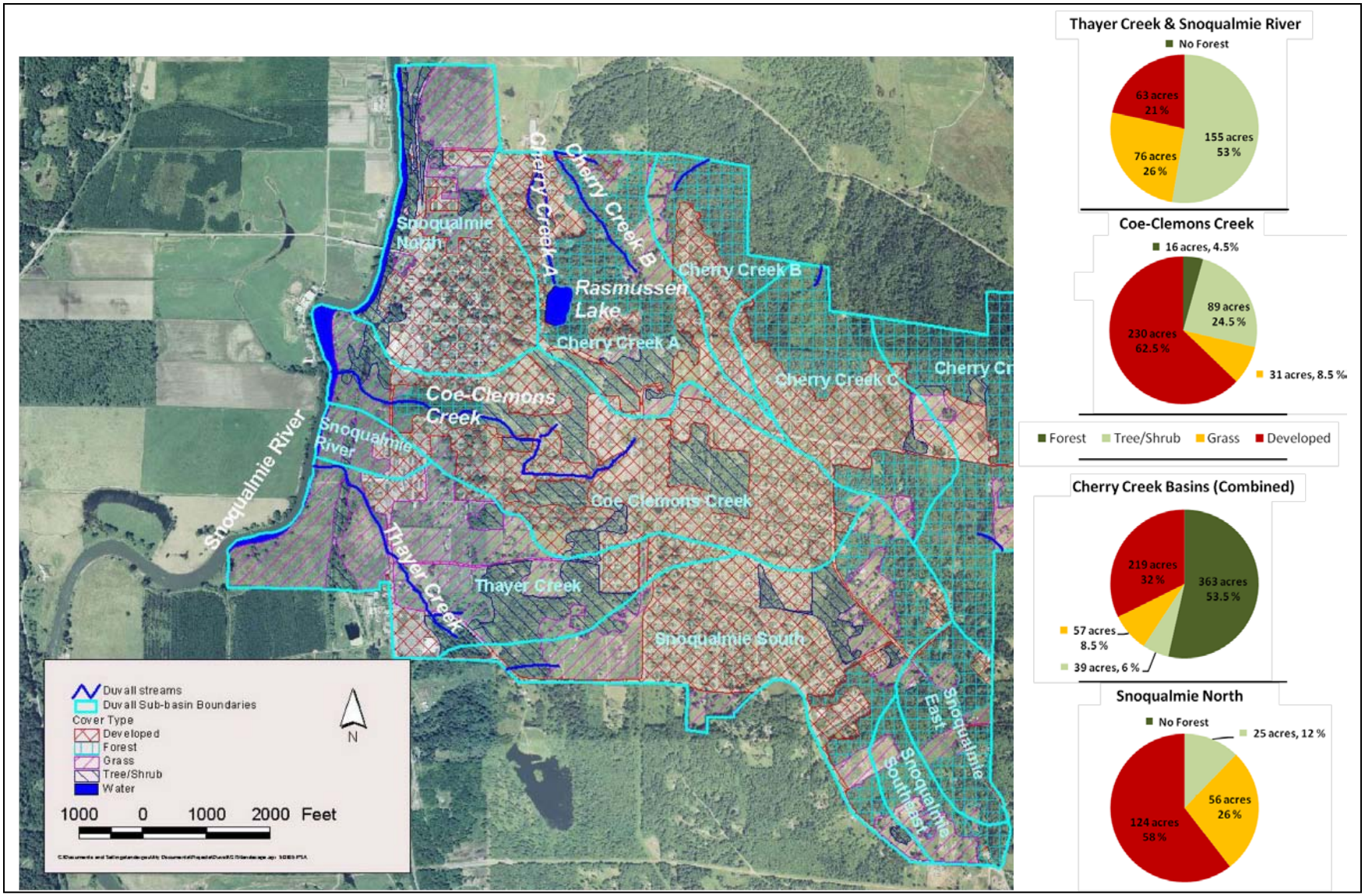
Hydrologic Alterations

Alterations to hydrologic mechanisms in the Snoqualmie watershed include decreased infiltration/recharge because of increases in impervious surface, channelization, and disconnection of streams from their floodplains; decreased storage capacity due to bank armoring, channelization, and wetland loss; increased peak flows resulting from vegetation clearing and an increase in impervious surface; and groundwater withdrawals and groundwater contamination (Parametrix, 2005, Solomon and Boles, 2002, Collins and Sheikh, 2003).

As assessed from 2002 aerial photography in the City's Landscape Analysis, developed land use in the Coe-Clemons and Cherry Creek tributary subbasins exceeds 35 percent of land cover and is 20 percent of the Thayer Creek subbasin (Figure 3-4). Forest cover is also low (less than 50 percent) in all of the City's primary subbasins, and is less than 20

percent (0 percent for Thayer Creek) of the mapped cover within 200 feet of mapped streams.

Figure 3-4. 2002 Land Cover by Subbasin within Duvall – Map and Data (Parametrix, 2005.)



Decreasing proportions of forest cover and increasing development (impervious surfaces) are associated with higher peak flows; increased peak flow frequency and duration affects channel morphology. Herrera Environmental Consultants (2002) assessed stream habitat in Thayer, Coe-Clemons, and two Cherry Creek tributaries within the city limits and identified reaches within all of these streams with deeply incised channels and bank failures caused by altered runoff patterns. Excessive sedimentation was also seen in reaches of Thayer Creek and Cherry Creek Tributary B system (see Figure 3-4 for approximate location).

3.3.2 Sediment

"Sediment delivery to aquatic ecosystems is a natural phenomenon with a natural range of variability; however, excessive amounts of sediment can undermine the condition of many types of aquatic ecosystems" (Stanley et al., 2005). Under natural conditions, sediment reaches aquatic ecosystems through surface erosion, mass wasting, and erosion from within the stream channel. Excess sediment can result from human activities that expose soils and increase runoff without providing adequate erosion control measures. Bank erosion above a natural background level can indicate hydrologic or sediment conditions that are out of balance.

Sediment is generally transported through high gradient (steeply sloping) streams and deposited in lower gradient reaches. Other areas where erosion naturally occurs at high rates include transitions from plateaus to terraces, alluvial fans, and upland canyons formed by streams. Areas of sediment supply and deposit within and in the vicinity of Duvall include the Coe-Clemons Creek riparian corridor and areas of the Cherry Creek basin on the northern edge of the City.

3.3.3 Water Quality (Nutrients, Toxins, Pathogens)

A complex array of chemical and physical processes governs the movement of nutrients (phosphorous and nitrogen), toxins, and pathogens through the watershed. Human activities can directly affect how much of these materials are delivered to the watershed (e.g., overapplication of fertilizers resulting in excess nutrients). Human alterations also indirectly influence how these materials are stored or released in the environment (e.g., draining or filling of wetlands changes adsorption to soil particles or reduces areas available for denitrification).

In Duvall, primary water quality concerns include: surface water temperature within tributary streams, especially as they flow into the large wetland areas within the shoreline environment; fecal coliform levels within the Snoqualmie River, likely primarily from agricultural uses of the floodplain outside of Duvall; and the potential for elevated levels of key nutrients, including phosphorus and nitrogen. Runoff from agricultural and residential areas is a significant source of fecal coliform bacteria and nutrients entering rivers and streams in the Snoqualmie watershed. The contribution of excess nutrients and pathogens is exacerbated by the removal of riparian vegetation and loss of wetlands that would otherwise capture or slow the entry of these pollutants into water bodies. The

mainstem reach extending through and upstream of the City has been listed on the Ecology 303(d) list as a Category 4(a) water for fecal coliform for more than a decade. A Category 4(a) listing indicates that tested levels have been in excess of water quality standards and that a total maximum daily load (TMDL) plan is in place to maintain or improve water quality within the listed water.

3.3.4 Organic Materials (Large Wood)

Large woody debris (LWD) reaches water bodies as trees are transported via landslides, windthrow, and bank erosion (Stanley et al., 2005). Large wood provides habitat structure, shade, and nutrients to aquatic systems. Human activities in the Snoqualmie valley area that have altered the process of moving organic materials (large wood) through the watershed include clearing of riparian vegetation, removal of debris jams, and diking of floodplain areas.

Historical clearing of forests from the Snoqualmie River floodplain removed a major source of woody debris. Out of 107 miles of riparian area surveyed in the Snohomish basin, Pentec (1999) found that nearly two-thirds of the riparian vegetation consisted of grass, brush, or sparse trees.

The loss of riparian vegetation on the Snoqualmie River has impacted salmonid habitat by reducing the food supply for fry, increasing solar heating of the water, and reducing cover and refuge habitat. Fish habitat features such as complex channels, overhanging cover, and pools have declined in the lower Snoqualmie watershed, including contributing basins. This is due in part to the loss of LWD in the river, which has reduced the amount of wood available to create pools and to collect sediment and gravels.

Terrestrial wildlife is also affected because many species depend on wetlands and riparian zones. For example, riparian forests are used by songbirds for nesting and foraging, by big game for forage and calving areas, and by other forest species as movement corridors between rivers and upland habitats (Pentec, 1999).

CHAPTER 4 LAND USE ANALYSIS

This chapter describes land use trends and plans in and near the shorelines of the City of Duvall.

4.1 Shoreline Development Trends

The City has issued fewer than four shoreline substantial development permits in the last decade, and very few exempt shoreline development projects have occurred during this timeframe. The large majority of the shoreline area is publicly owned; as such private development has been extremely limited. Permits have been issued for relatively small parks development projects involving enhancement of upland (non-shoreline) facilities, and for construction of utility easements (primarily stormwater) through the shoreline environment.

The City has undertaken significant planning for parks, trails, and open space areas involving public recreation areas along the shoreline (EDAW / AECOM, 2008). Projects and improvements to McCormick Park, Depot Park, and Taylor's Landing are identified in the City's Parks, Trails and Open Space Plan, including refurbishment and development of water dependant uses, specifically boat launches and other recreational access facilities. None of these water dependent projects are anticipated or planned for the near future.

4.2 Anticipated Future Development and Use

Parks and open space planning within publicly owned lands are the most significant and likely anticipated future development and use. Areas of active park use and recreation within the SPA are maintained with trails, lawn, benches, picnic tables, and interpretive signage. Depot Park provides additional community meeting space and wildlife viewing platforms, and Taylor's Landing provides direct access to the Snoqualmie River via a boat ramp. Enhancement of existing shoreline recreation opportunities and park facilities is identified in the Parks, Trails and Open Space Plan (see Chapter 6 for more details). The City has no recreation development projects within the SPA that are currently underway or immediately anticipated.

In addition to active parks areas, there are significant City and County owned open space areas within the Duvall SPA. Duvall has prioritized conservation and restoration of publicly owned shoreline areas and has undertaken comprehensive stream habitat restoration planning (Herrera, 2002) and is implementing several mitigation /restoration projects within the SPA (ESA Adolfson, 2009).

Outside of publicly owned parks and open space areas, the most significant existing land use is within the Riverside Village zoning subarea. The Comprehensive Plan establishes the subarea as a linear strip between the Snoqualmie Valley Trail and the mixed uses associated with the Main Street corridor immediately to the east. Specific land use plan and zoning standards are used for planning and permitting development within this area

(Map 6, DMC 14.24). Although Depot Village is only partially within the SPA, redevelopment of this area under the Riverside Village zoning district standards could substantially change and intensify land use patterns.

Of the few shoreline substantial development permits that have been issued in the last 10 years, the majority were for utility rights-of-way. A new utility use is currently in permit review by the City (stormwater conveyance). Many of the existing utility uses and corridors in the shoreline drain to the Snoqualmie River. The City's Wastewater Treatment Plant discharges treated effluent directly to the river. Several stormwater outfalls additionally discharge to the river, as well as to the tributary streams within shoreline jurisdiction (Maps 9a and 9b). Stormwater discharge without discharge directly to the Snoqualmie River is permitted by Duvall stormwater utility regulations[7].

Limited utility uses of the Snoqualmie River SPA are anticipated in the near future. Land use changes to the east, and in limited instances west, of Main Street NE are expected. Although subdivision and development will primarily be outside of the SPA, the proximity of land uses to the river would allow for additional discharge of treated stormwater.

Duvall Public Works maintains the municipal wastewater effluent conveyance and outfall. No expansions or changes to this facility are anticipated within the next decade.

4.3 Potential Use Conflicts

Potential use conflicts are identified for each shoreline area in Chapter 6.

[7] The City's Stormwater Regulations adopt the King County Stormwater Manual by reference, which includes the Snoqualmie River as a receiving body for direct discharge for uses within a specified proximity of the river.

CHAPTER 5 REACH SCALE INVENTORY AND ANALYSIS

5.1 Shoreline Conditions

This chapter identifies existing conditions within the Snoqualmie River shoreline area of Duvall and describes attributes of the shoreline that inform SMP management decisions. Inventory and analysis of the shoreline environment is focused on three major elements:

- Physical Characteristics – detailing the physical setting and processes, including water quality;
- Biological Resources – detailing the flora, fauna, and habitats;
- Shoreline Modifications – detailing how the shoreline bank and riparian area have been modified to support historic and existing land uses; and
- Land Use – detailing existing land use, anticipated land use, public access, and infrastructure.

Throughout the City's shoreline area, many of these key elements are largely uniform. Common conditions are highlighted in this section (5.1.1 and 5.1.2). In addition, three geographic areas were differentiated by physical characteristics, existing land uses, and anticipated future development. These include: (1) the South McCormick Park area; (2) the North McCormick Park / Depot Park Area; and (3) the Depot Village / Taylor's Landing / Northern Shoreline Area. Specific conditions for each area are described where appropriate.

5.1.1 Physical and Biological Characterization

Channel Form and Bank Conditions

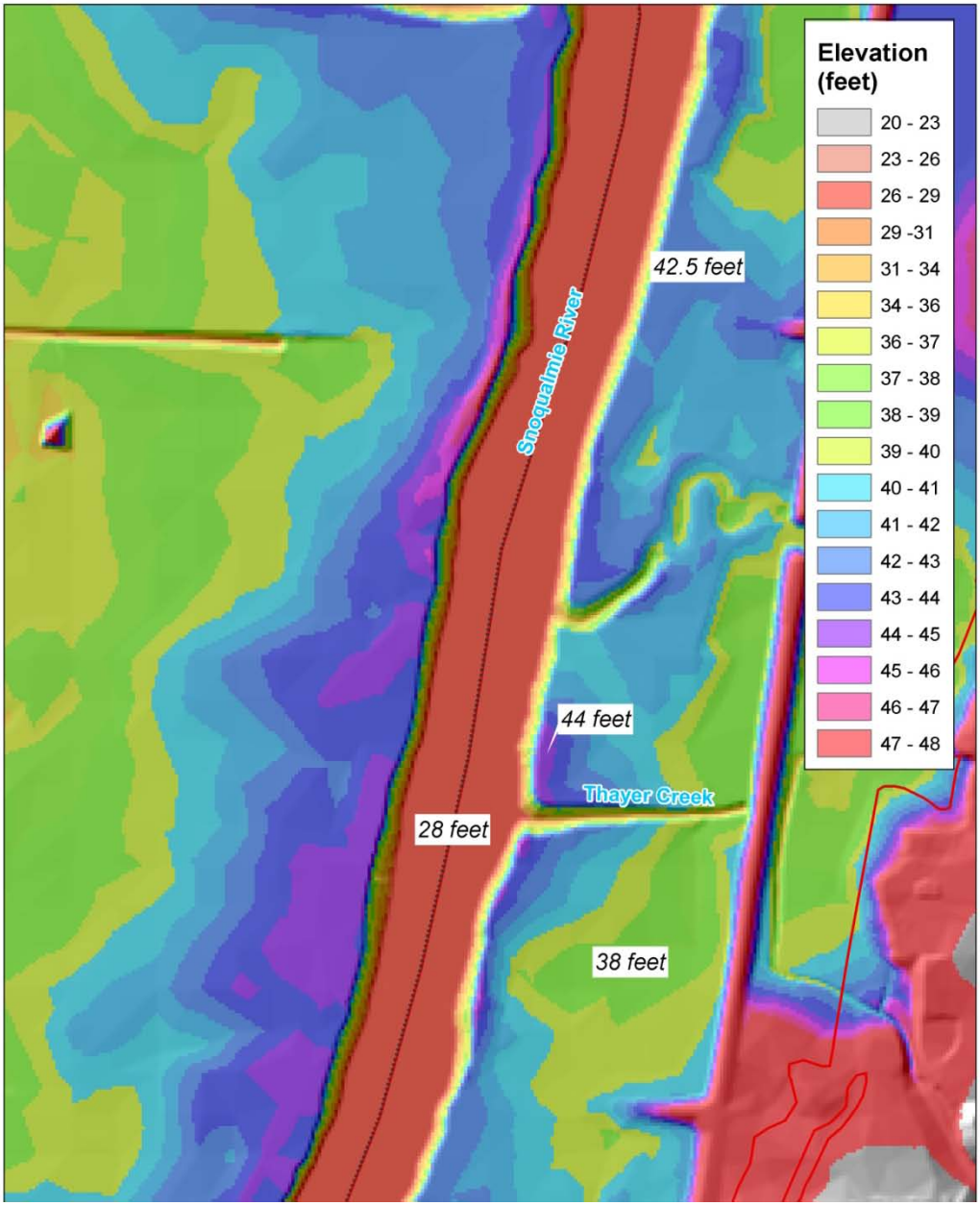
The Snoqualmie River along its entire extent through the City is incised into the alluvial valley (Figures 5-1 and 5-3; Photo 5-1). During normal flows, the river is a low energy system characterized as a glide stream environment with a relatively slow flow rate and no pooling or riffle area (ESA Adolfson, 2009 – *Draft McCormick Park Reconnaissance and Opportunities and Constraints Assessment*, included as Appendix C).

The Snoqualmie River riparian corridor is characterized by a steep bank (due to the incised river) backed generally by a narrow deciduous forest corridor. The bank is vegetated with herbaceous trees and shrub species, with Himalayan blackberry as the dominant (invasive) shrub growing along most of the bank. The forested community ranges from 20 to 30 feet wide from the bank in the south-end open space area to 50 to 150 feet wide within portions of McCormick Park and Taylor's Landing.

Gradual, irregular and relatively narrow berms elevated +2 to +5 feet above the surrounding floodplain extend along both banks of the Snoqualmie in the vicinity of the City (Figure 5-1). The berms are natural formations (fluvial levees) created by rapid

sediment deposition during flood events. While modification and expansion (heightening) of fluvia l levees during past human development was common in many locations along the river corridor, there is no record of levee structures, informal or otherwise, built along the Snoqualmie within Duvall.

Figure 5-1. Snoqualmie River floodplain elevations from 2010 LiDAR data surrounding the Thayer Creek confluence; elevation information depicts incised river channel and fluvial levee formations along both banks of the river.within.



Floodplain, Floodway, and Channel Migration Areas

During significant flood events, the Snoqualmie River engages much of the valley, including most of the City's shoreline area. During a 2009 reconnaissance of the City's shoreline area, there was substantial evidence of the most recent significant flood event, which occurred in January 2009 (Photos 3 and 7 in Appendix C). The winter 2009 flood inundated the majority of the shoreline area throughout the City and included significant overbank flow emanating from the main channel approximately 5,000 feet south of the southern City limits. This flow continued north across the Snoqualmie River valley then spilled back into the main channel as flows receded, as evidenced by significant wrack deposition on the floodplain and on the floodplain (landward) side of riparian vegetation. This spill back was most evident within the northern portion of McCormick Park, where the river's eastern floodplain in Duvall narrows from a wide corridor (700 to 1,200 feet) to a relatively narrow corridor (100 feet wide) as the shoreline continues north into the Depot Village / Taylor's Landing reach. Local records of flood events indicate that the floodplain, extending through the south-end open space area into the developed portion of McCormick Park, is engaged, at least partially, in 50 percent of years. An interpretive flood pole in McCormick Park documents flood events over the last half-century, with detailed documentation over the last 20 years.

The 1 percent annual chance (100-year) floodplain and floodway area has recently been mapped for Duvall, and throughout the Snoqualmie River (FEMA Preliminary DFIRM, November 2010). In the Duvall vicinity the preliminary DFIRMs show an approximate 100-year flood elevation of 51 feet NAVD 88 (FEMA, 2010). The mapped floodplain extends to the edge of the Snoqualmie valley through the City, including the Snoqualmie River / Cherry Creek associated floodplain at the north end of the City within Dougherty Farmstead.

The floodway extends from the river to the Snoqualmie Valley Trail through the wide, southern half of the City's shoreline, and narrows through the vicinity of Depot Village / Taylor's Landing reach along the north edge of the City (Map 4; see Figures 5-3, 5-5, and 5-7 in the following sections).

For purposes of SMP planning, the approximate extent of potential channel migration is mapped as extending throughout floodplain areas to the west of the Snoqualmie Valley Trail (Map 4). Mapping of potential channel migration areas was completed consistent with Ecology guidance (summer 2010 Quarterly Shoreline Planners Meeting), but it does not represent a full channel migration study consistent with Ecology's *Framework for Delineating Channel Migration Zones* (Rapp and Abbe, 2003) or any other adopted method or manual. For purposes of SMP planning, the Snoqualmie Valley Trail is assumed to represent a barrier to channel migration; however, it is not a certified levee and is unpaved. The trail was historically constructed as a railroad corridor, occurs at or near the 100-year floodplain elevation, and is owned and maintained by King County as a regional transportation and recreational facility..

During investigation of the greater McCormick Park area in 2009, historic aerial photography (1936) and General Land Office (GLO) mapping (1870s) were assessed to

investigate the extent of channel movement over the last 130 years (Appendix C). Based on this assessment, limited east-trending channel migration has occurred in the south-end open space area, with channel migration apparent more extensively downstream within the developed portion of McCormick Park (see Figure 3 in Appendix C and Section 5.3).

Tributary Streams and Associated Wetlands

Existing conditions throughout Duvall on Thayer Creek, Coe-Clemons Creek, and Cherry Creek tributary streams were inventoried in 2006 (Herrera, 2006). The assessment included a detailed examination of the lower reaches of Thayer and Coe-Clemons Creeks within the SPA. Additional assessment was conducted in 2009 as part of the McCormick Park Reconnaissance and Assessment (Appendix C). Specifics on stream segments are provided within the reach summaries of this chapter.

Wetlands within Duvall's Snoqualmie River floodplain are limited to areas that receive surface and shallow subsurface flow from the tributary channels. Several small wetlands located on the slope above the Snoqualmie valley, immediately west of Main Street, receive shallow groundwater from hillside seeps (Map 3). Much of the shoreline area is dominated by relatively coarse soils that allow for rapid infiltration and percolation, which prevents development of wetland conditions. Some of the North McCormick / Depot Park areas and South McCormick Park area appear to have finer surface deposits, which result in perched water tables supporting several large depressional wetlands (see Appendix C, Table 1 for additional detail on inventoried wetland areas). Likewise, depressional wetlands are mapped within the floodplain within and around Dougherty Farmstead at the north end of the City.

The vegetation across all of the wetlands is similar, consisting of primarily herbaceous communities dominated by common velvetgrass, cattail, and soft rush. Reed canarygrass is a dominant invasive species throughout all of the palustrine emergent wetland areas. Limited areas of scrub/shrub and forest communities occur on the edges of wetland areas (along the edge of the floodplain, on both sides of the Snoqualmie Valley Trail, and along tributary streams). Shrub and tree communities are dominated by red alder and black cottonwood, salmonberry, vine maple, and willow species with an understory of soft rush, trailing blackberry, giant horsetail, skunk cabbage and lady fern. Himalayan blackberry is the primary invasive species in these areas, although Japanese knotweed also occurs.

Fish and Wildlife Use and Habitat

The Snoqualmie River in the vicinity of the City supports several salmonid species, including Chinook salmon (federally listed as threatened), coho salmon, chum salmon, pink salmon, sockeye salmon, bull trout/Dolly Varden (federally listed as threatened), and steelhead (federally listed as threatened) (Map 5). For all of these species, the mainstem river is used as a migratory corridor and habitat for juvenile rearing and outmigration (WDFW, 2010, Snohomish Salmon Recovery Forum, 2005). Due to the incised channel and lack of habitat complexity and/or significant overhanging vegetation, spawning habitat in the Snoqualmie River throughout the City is limited.

Rearing habitat for Chinook and coho salmon has been somewhat degraded by the reduction in accessible floodplain area due to channelization of tributary streams and historical shoreline armoring (conducted informally and/or through largely undocumented Corps projects) (Photo 5-4). Mapped use of tributary streams within the City's shoreline area is limited to the presence / migration of coho salmon within Coe-Clemons and Thayer Creeks (Map 5).

The WDFW maintains a list and mapping of priority habitats and species throughout the state. Priority habitats are those that have a high value to many fish and wildlife species and may be limited or vulnerable. Priority species are those requiring protection or management to ensure their survival (WDFW, 2008). Priority wildlife habitats mapped in the SPA of the Snoqulmie River and the adjacent floodplain include wetlands and riparian zones. The wetlands, open water areas, and shoreline trees provide foraging and nesting habitats for priority species such as waterfowl, bald eagle, bats, great blue heron, and pileated woodpecker. Beaver, mountain beaver, rabbit, skunk, black-tailed deer, black bear, and numerous other bird, resident fish, and amphibian species are assumed to use the south-end open space area.

5.1.2 Shoreline Modifications

Shoreline modifications refer to structural alterations of the shoreline's natural bank or construction of a physical element. Such modifications are typically used to stabilize the shoreline and prevent erosion, or to prepare the shoreline for a specific use. These modifications can include levees, dikes, floodwalls, riprap, docks, piers, or other in-water structures, but they can include other actions such as clearing, grading, application of chemicals, or significant vegetation removal (WAC 173-26-231(1)).

The Snoqualmie River shoreline area, throughout the City, was modified through historic land clearing and decades of agricultural use (Map 8b). King County Eastside Heritage Center historic photos include a 1955 picture of automobiles being used as shoreline armoring along the banks of the Snoqualmie River in Duvall (Photo 5-1). There is no current evidence of automobiles or other foreign debris used to stabilize the river shoreline.

Photo 5-1. Car bodies used as shoreline armoring along the banks of the Snoqualmie River in Duvall, noted by source as an Army Corps of Engineers project (King County, 2010).

From the Collections of Eastside Heritage Center

The south-end open space shoreline area contains a narrow forested riparian corridor, another result of historic agricultural uses. In 2006 the Stilly Snohomish Fisheries

Enhancement Task Force completed a series of riparian restoration projects, planting native plants along the shoreline (ESA Adolfson, 2009).

Other modifications to the Snoqualmie River within the south-end area are limited to several piped outfalls. A comprehensive assessment of shoreline outfalls has not occurred in the City, although stormwater outfalls and the wastewater treatment plant outfall are known to be located along this reach. The treatment plant outfall was constructed in the 1990s with updates completed in 2001, and enters the river below normal low flow water levels. The locations of known stormwater outfalls are included on Map 8b.

5.1.3 Land Use

Existing Land Use

Much of the eastern Snoqualmie River floodplain was used for agricultural activities though at least the first half of the 1900s. Currently, Duvall shoreline area is largely publicly owned open space and park lands, with limited development other than impervious surface trails, some of which additionally serve as access roads for utility maintenance and open space restoration activities. Trails through the open space areas are contiguous with developed park areas immediately to the north and Snoqualmie Valley Trail access points to the south, outside of the City. The open space area is actively used for walking, dog walking, and wildlife watching.

The most significant trail throughout the City's shoreline area is the Snoqualmie Valley Trail, a regionally significant facility linking Duvall with Fall City and beyond. The trail is built on the historic railroad corridor on a fill berm elevated 8 to 12 feet above the adjacent floodplain (Map 8b), and ends at Taylor's Landing park.

Construction of the railroad corridor through the floodplain significantly altered the interaction of the river and the floodplain during overbank flood events. The floodway is now constricted between the river and the railroad corridor. The railroad corridor berm also separates floodplain wetland areas that were historically linked, and constricts tributary streams to culverts and bridge crossings.

Other significant uses of the City's shoreline area include utility corridors throughout, as well as the Depot Village residential community and Duvall park-and-ride facility extending between Depot Park and Taylor's Landing, both to the east of the railroad tracks. Existing utilities are known to include stormwater outfall corridors, a wastewater outfall corridor, a gas main under the river at Woodinville Duvall Road, and high-voltage overhead electrical corridors.

Essential public facilities are detailed by Map 6 to highlight those facilities providing significant transportation, safety, and critical municipal services to the community that occur within or partially within the SPA. The Main Street (State Route 203) corridor is the only one of these listed facilities that extends adjacent to or within the entire length of the Duvall SPA. Other essential public facilities are detailed in the reach summaries of this chapter.

Shoreline Environment and Zoning Designations

The current SEDs and land use designations for the City's shoreline areas are shown in Table 1-1, as well as Figure 1-1 (current SEDs) and Map 6 (zoning and land use). The current SED for most of Duvall's shoreline area is designated Conservancy, with the Riverside Village zoning area (existing Depot Village development) designated Urban (City of Duvall, 1974).

The zoning designations, established by DMC 14.10, establish a Public Facility designation for the entire area to the west of the Snoqualmie Valley Trail. To the east of the trail, zoning is established based on existing or planned land uses fronting Main Street. Many of these areas are also zoned Public Facility. Other designations included Mixed Use (MU12), Light Industrial, a small area of Midtown, and Riverside Village. With the exception of developed areas of the Riverside Village subarea, existing primary uses associated and consistent with these zoning designations to the east of the trail corridor do not extend west into the floodplain and shoreline environment.

Existing Public Access

The large majority of the Duvall shoreline area is publicly owned recreation and open space and is generally accessible to the public for active uses (shoreline access, picnics and gatherings, wading, swimming, boating) and passive uses (walking / dog walking, horse / equestrian uses, wildlife observation, meditation) (Map 7). The King County owned and managed Snoqualmie Valley Trail extends through most of the shoreline area, linking many of the City owned parks and open spaces together, as well as to additional facilities to the south of Duvall. Specifics of existing public access areas and facilities are provided in the reach summaries of this chapter.

Historical and Cultural Resources

Historic and cultural resources are documented through a variety of sources. Official registers include the National Register of Historic Places, the Washington State Heritage Register, and the King County Landmarks and Heritage Commission. In 1996, the City adopted an ordinance to protect historic sites, buildings and structures through use of the County designation system (DMC 10.61). See reach description sections below for listed / catalogued sites within each reach. Cultural and historic use of the entire Snoqualmie River shoreline area is well documented.

Areas of Special Interest

According to Ecology guidelines, areas of special interest to be inventoried include priority habitats, eroding shorelines, developing or redeveloping harbors or waterfronts, dredge disposal sites, and toxic or hazardous waste clean-up sites (WAC 173-26-201(3)(c)(iv)). Priority habitats are discussed above in Section 5.1.2. Eroding shorelines are described in the context of channel and bank form also in Section 5.1.2. No developing or redeveloping harbors or waterfronts, dredge disposal sites, or toxic or hazardous waste clean-up sites are located within the Duvall shoreline area.

5.2 Reach Descriptions

5.2.1 South McCormick Park

South McCormick Park is largely made up of City-owned land within the Snoqualmie River floodplain (Figure 5-2). The area extends from the mouth of Coe-Clemons Creek to the southern city limits and is bisected by the Snoqualmie Valley Trail.

Figure 5-2. Aerial Photography (2009) of South McCormick Park; photo points shown for photos included in this section.

The entire area to the west of the Snoqualmie Valley Trail is generally described as McCormick Park. For purposes of this inventory, the largely undeveloped portion of McCormick Park is described separately from the active park area (discussed in Section 5.2.2). South McCormick Park includes the widest floodplain area within the City, between 700 and 1,200 feet wide.

Specific conditions that differentiate the south end open space area from overall reach conditions are illustrated in Figure 5-3 and detailed in Table 5-1.

Figure 5-3. Section across the Snoqualmie River SPA within South McCormick Park. Section location shown on Map 3 as Section C; elevation data from King County topographic information.

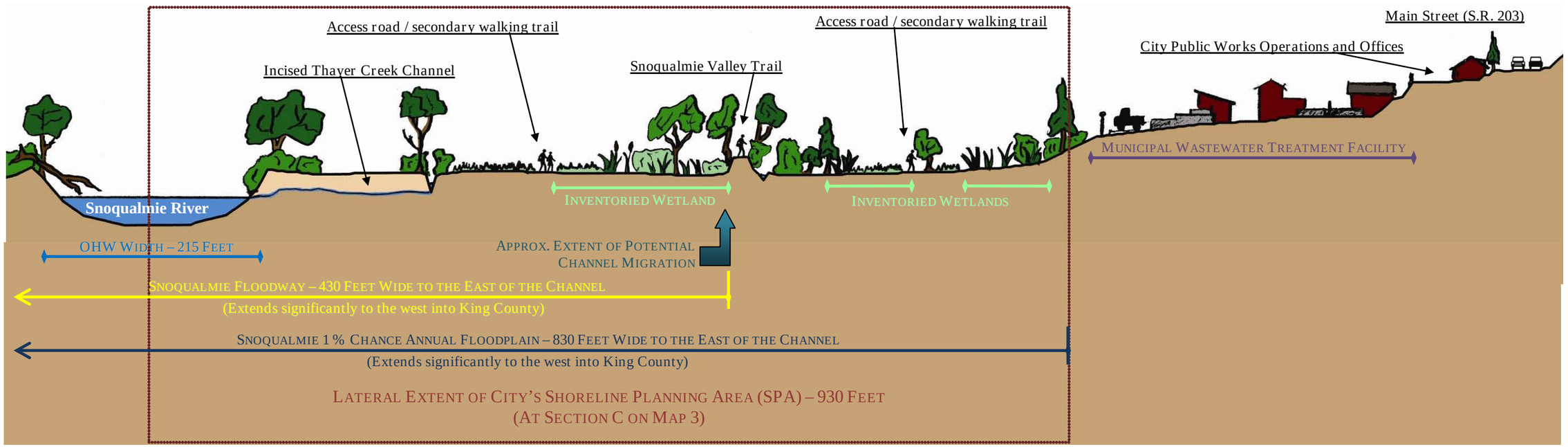


Photo 5-2. Steep banks and incised channel of the Snoqualmie River, facing south from South McCormick Park; photo location shown on Figure 5-1 (April 2009).

Photo 5-3. Steep banks and incised channel of Coe-Clemons Creek, immediately upstream of convergence with Snoqualmie River; photo location shown on Figure 5-1 (April 2009).

Photo 5-4. View across wetland and meandering Coe-Clemons channel to the west of trail corridor; significant wracked flood debris; photo location shown on Figure 5-1 (April 2009).

Table 5-1. Summary of reach conditions within South McCormick Park.

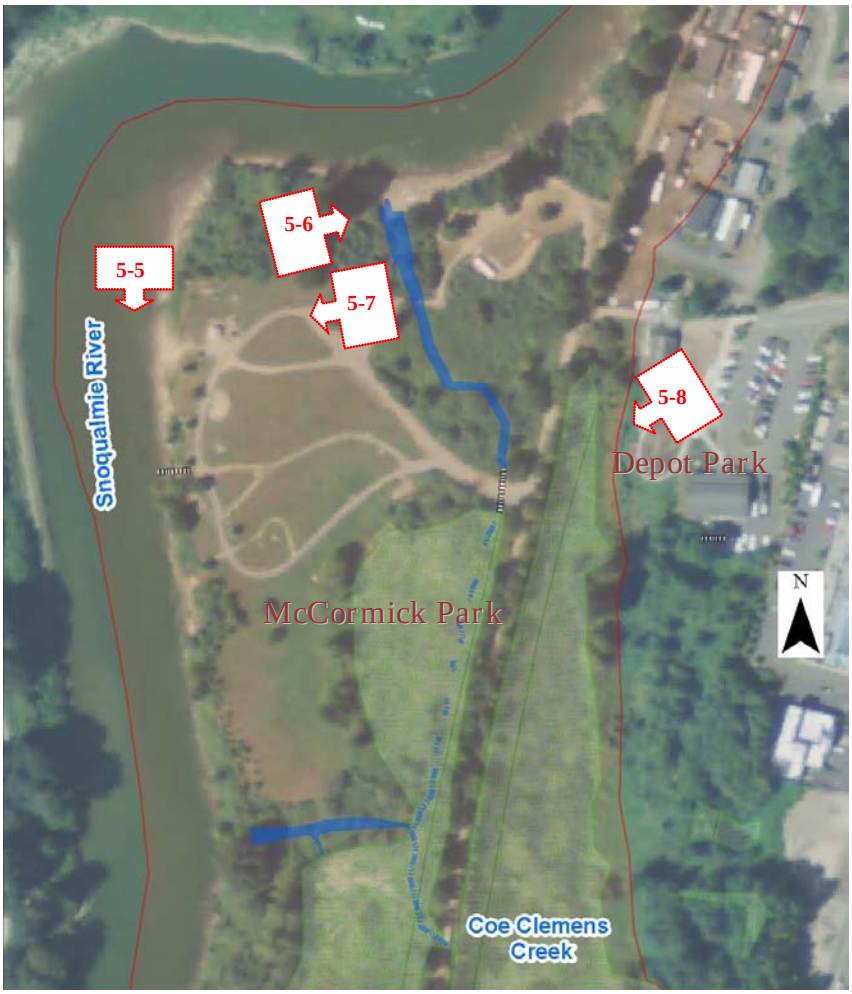
	Summary of Reach Condition
Physical and Biological Characterization	
Channel and Bank Form	Steep bank (due to incised river) as elsewhere in Duvall's shoreline reach.
Riparian Condition	Narrow (20 to 30 foot wide) deciduous forest corridor; the bank is vegetated with herbaceous trees and shrub species, with Himalayan blackberry as the dominant (invasive) shrub growing along most of the bank. Riparian forest 50 to 100 feet wide around the confluences with the Thayer and Coe-Clemons (southern) tributary channels, and in other short segments.
Floodplain, Floodway, and CMZ Areas	The mapped floodplain extends to the edge of the Snoqualmie valley through the south-end open space area, and the floodway extends from the river to the SVT (Map 4, Figure 5-2). Limited east-trending channel migration has occurred in the south-end open space area (see Figure 3 in Appendix C). Channel migration is apparent more extensively downstream within the developed portion of McCormick Park (Section 5.3).
Tributary Streams & Associated Wetlands	To the west of the SVT, segments of Thayer and Coe-Clemons Creeks consist of a series of runs, low gradient riffles, plunge pools formed by a clay layer, and dammed pools formed by small woody debris jams (Herrera, 2006). The lowest segments of both streams are confined through incised ravines that drop the tributaries to the normal surface flow elevation (approximately 30 feet above sea level) of the Snoqualmie River (Figure 5-2, Photo 5-3, Maps 2 and 3). Thayer Creek passes under a narrow bridge (for an access road) and through a culvert under the Snoqualmie Valley Trail approximately 370 feet and 430 above the confluence, respectively. To the east of the valley trail berm, the creek channel is straight, and flows directly along the toe of the trail berm for approximately 200 feet. Herrera (2006) notes this segment as the best Thayer Creek fish habitat within the shoreline area, although access to salmonid species except coho salmon is limited by the partial barrier created by the incised confluence channel. Thayer Creek enters the shoreline area from the southeast, where it passes near the southern and western edges of the City's wastewater treatment facility. Flow from Coe-Clemons Creek enters the shoreline area through a highly impounded culvert beneath Main Street. The channel meanders through a large wetland area, becoming braided, poorly defined, and intermittent to the east of the SVT (Maps 2 and 3). Flow from the creek disperses to the north, toward the ponded area immediately west of Depot Park (further discussed in Section 5.2.2), as well as to the south, where surface water eventually converges with Thayer Creek (see wetland and stream mapping on Map 3). The majority of flows from Coe-Clemons Creek spill over a beaver dam that has been augmented with an artificial inlet structure, both located directly below a bridge along the SVT corridor. There are additional beaver dams and inlet structures on the west side of the trail berm along the stream corridor. On the west side of the SVT, surface flow reaches the river via two channels. The northern channel, which flows north across the developed portion of McCormick Park, appears to be the mouth shown on the 1936 photo and the GLO maps (see Appendix C, Figures 4 and 5). The southern channel, at the northern edge of the south-end open space area, carries water directly west; this straightened channel was likely created during the land conversion to agriculture. Both channels are influenced by beaver activity. Both channels flow through the largest wetland area in the shoreline environment to the west of the trail corridor (Photo 5-2). Water levels in this wetland and relative outflow to the two convergence channels are likely dependent on flows from the upper (eastern) pond, and elevation controls at beaver dams within the west channel. An unnamed channel flows into the Snoqualmie River within South McCormick Park (Maps 2 and 3). This unnamed feature is a blind channel that extends for approximately 400 linear feet, but may have historically extended further to the south according to GLO mapping (Appendix C, Figure 4). The uppermost stretch of the channel is very narrow and ditched, widening and becoming incised closer to the Snoqualmie River. There was no flow within the channel during our site visit. The vegetation across all of the south-end wetlands (Map 3) is similar, consisting of primarily herbaceous communities dominated by common velvetgrass, cattail, and soft rush. Reed canarygrass is a dominant invasive species throughout all of the palustrine emergent wetland areas. Limited areas of scrub/shrub and forest communities occur on the edges of wetland areas (along the edge of the floodplain, on both sides of the Snoqualmie Valley Trail, and along tributary streams). Shrub and tree communities are dominated by red alder and black cottonwood, salmonberry, vine maple, and willow species with an understory of soft rush, trailing blackberry, giant horsetail, skunk cabbage and lady fern. Himalayan blackberry is the primary invasive species in these areas, although Japanese knotweed also occurs (Appendix C).
Fish and Wildlife Use and Habitat	Rearing habitat for Chinook and coho salmon has been somewhat degraded by the reduction in accessible floodplain area due to channelization of tributary streams and historical hardening of the shoreline (push-up levies above the banks and documented use of auto bodies as shoreline armoring, shown in Photo 5-1). Mapped use of tributary streams within South McCormick Park is limited to the presence / migration of coho salmon within Coe-Clemons and Thayer Creeks (Map 5). Section 5.1.3 of this chapter further details fish and wildlife use and habitat.

	Summary of Reach Condition
Shoreline Modifications	
Armoring	Shoreline armoring or hardening is minimal, and includes informal alteration associated with historical agricultural land uses; no maintained or formal armoring present (Map 8b).
Outfalls	Several piped outfalls, including stormwater outfalls and wastewater treatment plant outfall. The treatment plant outfall was constructed in the 1990s with updates in 2001 and enters the river below normal low flow water levels. The wastewater outfall receives treated effluent from the treatment plant (total rebuild completed in 2005). Locations of known stormwater outfalls are included on Map 8b.
Land Use	
Existing Land Use	Largely publicly owned open space with limited development beyond impervious surface trails. Some trails (with several small bridges over tributary streams) serve as access roads for utility maintenance and open space restoration activities. Trails through the open space areas are contiguous with the SVT. The open space area is actively used for walking, dog walking, and wildlife watching. Other uses of South McCormick Park include utility corridors and outfalls.
Current SED	Current SED is Conservancy for the entire area (City of Duvall, 1974) (Figure 1-1).
Zoning and Comp Plan Designations	Zoning for the area to the west of the SVT is Public Facility (DMC 14.10). To the east of the trail, zoning is established based on existing or planned land uses fronting Main Street. Designations included Mixed Use (MU12), Light Industrial, and a small area of Midtown. (Map 7) Comprehensive Plan designations are consistent with zoning.
Existing Public Access	Largely publicly owned open space – generally accessible to the public for passive recreation (Map 7). This includes all but one parcel between the Snoqualmie River shoreline and the SVT, and all parcels immediately adjoining the shoreline (Map 2). The open space area is bisected by the SVT (Figure 5-3). Additional improvements open to and used by the public include minimally maintained trails (also used as public works maintenance roads) passing through the open space area. Trails are contiguous to the SVT; open space area is actively used for walking, dog walking, and wildlife watching (including views of the Snoqualmie River); no physical shoreline access within reach.

5.2.2 North McCormick Park / Depot Park Area

The North McCormick Park / Depot Park area consists of two City-owned properties on opposite sides of the Snoqualmie Valley Trail within the Snoqualmie River floodplain (Figure 5-4). The area extends from the southern mouth of Coe-Clemons Creek to the north end of McCormick Park, with Depot Park to the east of the trail and McCormick Park to the west of the trail (along the river shoreline).

Figure 5-4. Aerial Photography (2009) of the McCormick Park / Depot Park Area; photo points shown for photos included in this section.



The entire area to the west of the Snoqualmie Valley Trail is generally described as McCormick Park. For purposes of this inventory, the active park area is described separately from the largely undeveloped open space extending to the south (discussed in Section 5.2). The floodplain in this area is narrower than in the south-end open space area, narrowing from approximately 700 feet wide at the south end of McCormick Park / Depot Park to less than 150 feet wide at the north end of the segment.

Specific conditions that differentiate the North McCormick Park / Depot Park area from overall reach conditions are illustrated in Figure 5-5 and detailed in Table 5-2.

Figure 5-5. Section across the Snoqualmie River SPA within the North McCormick Park / Depot Park area. Section location shown on Map 3 as Section B; elevation data from King County topographic information.

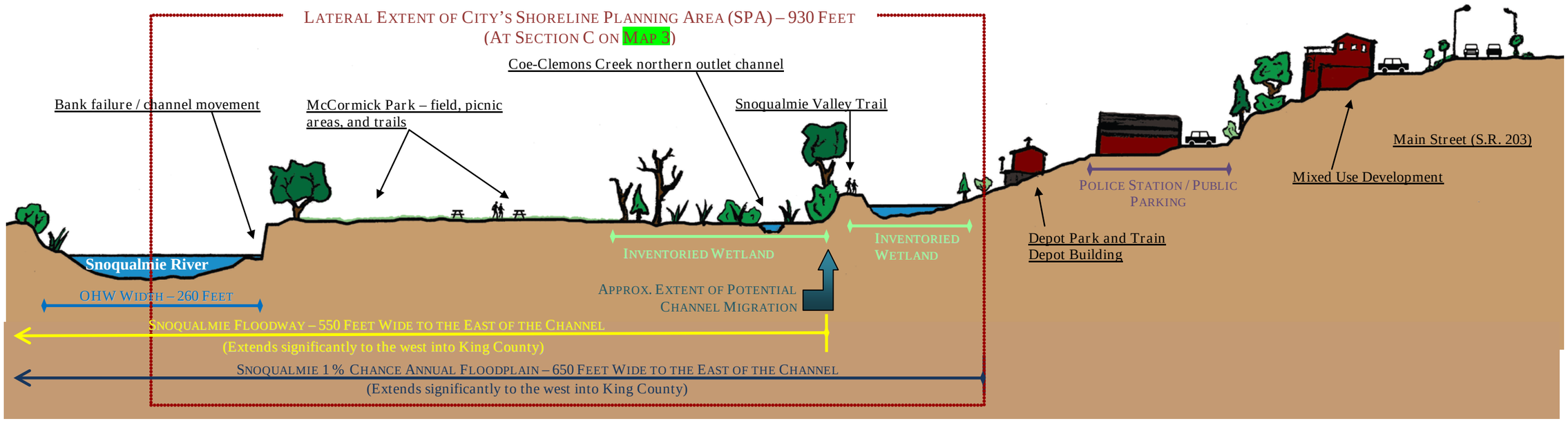


Photo 5-5. Failing banks along the Snoqualmie River, facing south at McCormick Park shoreline; photo location shown on Figure 5-3 (February 2010).

Photo 5-6. North shoreline of McCormick Park with sandy beach used for swimming and wading; photo location shown on Figure 5-3 (City of Duvall, 2008).

Photo 5-7. Interpretive flood elevation pole in lawn area of McCormick Park – red arrow notes the approx. height of the winter 2009 flood; photo location shown on Figure 5-3 (February 2010).

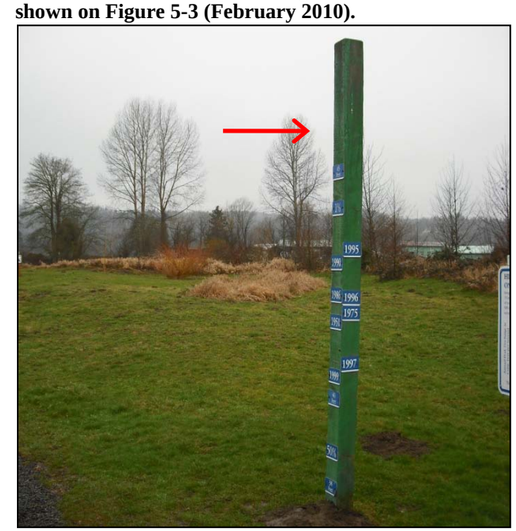


Table 5-2. Summary of reach conditions within the North McCormick Park / Depot Park area.

	Summary of Reach Condition
Physical and Biological Characterization	
Channel and Bank Form	Steep, failing bank (due to the incised river with east trending bank scour) backed by little to no forest cover (Photo 5-5; Appendix C). Where failure has not occurred, the bank is vegetated with shrub species. The area immediately surrounding the Coe-Clemons confluence consists of a narrow, sandy beach that is used in summer for swimming and wading (Photo 5-6).
Riparian Condition	Where bank failure has not occurred, the bank is vegetated with shrub species, with Himalayan blackberry as the dominant (invasive) shrub. Areas of riparian forest include canopy generally only 10 to 20 feet wide from the bank. Northwest and north shorelines of McCormick Park include a forest / shrub riparian area 50 to 150 feet wide, extending to the area around the Coe-Clemons (northern) tributary channel confluence
Floodplain, Floodway, and CMZ Areas	The mapped floodplain extends to the edge of the Snoqualmie valley through the park area, generally following the hillslope immediately west of the Depot Park / Police Station parking lot (Map 4, Figure 5-5). During investigation of the greater McCormick Park area in 2009, historic aerial photography (1936) and GLO mapping (1870s) were assessed to investigate the extent of channel movement over the last 130 years (Appendix C). Based on this assessment, east-trending **c**hannel migration has occurred along the west and northwest facing shorelines within McCormick Park (see Appendix C Figures 4 and 5, Map 8b). Bank scour and general eastward progression of the river's right bank is evident through recent observations of bank failure along this shoreline (Photo 5-7), and could potentially be exacerbated by the loss of the riparian forest / shrub zone.
Tributary Streams & Associated Wetlands	Coe-Clemons Creek is braided and contains multiple channels as it flows into the Snoqualmie valley (Maps 2 and 3). Enters the SPA within the south-end open space area and then disperses across floodplain, including to the north toward ponded area immediately west of Depot Park. Pond elevation largely controlled by beaver activity (damming) and the bypass structure located at the outlet through the SVT corridor. Pond (significant areas of open water and little overhanging vegetation) likely elevates Coe-Clemons Creek water temperatures during the summer; Snoqualmie River is listed on the 303(d) list for fecal coliform (with TMDL implemented), so reducing summer temperatures should be an overall goal. West of the SVT, Coe-Clemons Creek branches into two channels that converge separately with mainstem river. The northern channel flows across the developed portion of McCormick Park and appears to be the mouth shown on the 1936 photo and the GLO maps (see Appendix C). Wetlands within the McCormick Park / Depot Park area receive surface and shallow subsurface flow from Coe-Clemons Creek, and occasionally (once every 2-3 years) receive overbank floodwaters from river (Map 3). Wetland vegetation is consistent with communities seen across the Duvall shoreline area.
Fish and Wildlife Use and Habitat	Fish and wildlife use in the McCormick Park / Depot Park area is consistent with the use patterns across Duvall shoreline area (Section 5.1.1). See Map 5 for salmonid distribution and the City's 2006 Existing Stream Habitat Report for a detailed assessment of existing conditions within Coe-Clemons Creek (Herrera, 2006).
Shoreline Modifications	
Armoring	Shoreline armoring or hardening is minimal, and includes informal alteration associated with historical agricultural land uses; no maintained or formal armoring present (Map 8b).
Outfalls	One piped stormwater outfall is known to occur within the McCormick Park (Map 8b).
Land Use	
Existing Land Use	Used for agricultural activities though at least the first half of the 1900s; aerial photography from 1936 shows that the Depot Park area was largely open space through that period (Appendix C). Development of this area was probably challenging due to Coe-Clemons Creek and associated wetlands, as remains the case today. McCormick Park is one of the larger parks in Duvall (Map 7). The open field area is the site of several summer community events, and provides active and passive recreation activities year-round. The park is accessed by the public only on foot, horse, or bicycle through Depot Park and/or the SVT; includes open field areas, trails (with one small bridge over Coe-Clemons Creek), benches, picnic tables, shoreline access through the swim beach, interpretive signs about flooding and wildlife, as well as open space areas. Depot Park is partially within shoreline area, extending to the east up the hillside and out of the floodplain. Within the shoreline the park is largely open space; includes large ponded area in-line with Coe-Clemons Creek (Photo 5-8). Duvall's historic rail depot is located in the park, moved from the original location adjacent to the railroad corridor. The depot building, which is owned by the City, is used for community and private meetings and activities. Other park structures to the east of the shoreline area include a wildlife viewing platform / community deck, and a parking lot for both the park areas and the adjacent Police Station. The Duvall Police Station is the only essential public facility near the McCormick Park / Depot Park shoreline area, but it is entirely outside of shoreline jurisdiction (Map 6).

	Summary of Reach Condition
Land Use, Continued	
Current SED	The current SED for the entire area is Conservancy (City of Duvall, 1974). (Figure 1-1)
Zoning and Comp Plan Designations	Zoning designation is Public Facility for the entire shoreline extent of the McCormick and Depot Park areas (DMC 14.10) (Map 7). Comprehensive Plan designations are consistent with zoning.
Existing Public Access	The McCormick Park / Depot Park area is entirely publicly owned park and open space and is generally accessible to the public for active and passive recreation activities (Map 7). Parks are split by the SVT. A swimming and wading beach provides direct access to the Snoqualmie River shoreline along the northern edge of McCormick Park (Photo 5-6). McCormick Park also provides fishing access to the Snoqualmie River.
Historical and Cultural Resources	The Duvall Train Depot is documented as a historic structure (City of Duvall, 2010). The depot is directly adjacent to the shoreline area, but located east of the Snoqualmie River floodplain and all associated wetlands. See Section 3.1 of this report for cultural and historical background.

Photo 5-8. Depot Park open space area, including Coe-Clemons beaver pond, with Snoqualmie Valley Trail in the background, facing southwest; photo location shown on Figure 5-3 (February 2010).

5.2.3 Riverside Village, Taylor's Landing, and Northern Shoreline Area

The Riverside Village, Taylor's Landing, and Northern Shoreline area (called collectively the northern shoreline area) consists of a narrow corridor along the historic town frontage. The shoreline length is approximately 2,500 linear feet within the City, and approximately 1,400 linear feet within the Duvall UGA to the north of the City (Figure 5-6). The river channel is near the eastern edge of the valley through the northern shoreline area, resulting in a narrow floodplain (Map 4). At the northwestern extent of Duvall, the river enters the valley formed by the convergence with Cherry Creek, a significant tributary to the Snoqualmie River mainstem. In this area, the SPA extends over a wide floodplain to the east.

Specific conditions that differentiate the northern shoreline area from overall reach conditions are illustrated in Figure 5-7 and detailed in Table 5-3.

Figure 5-6. Aerial Photography (2009) of the Riverside Village, Taylor's Landing, and Northern Shoreline Area; photo points shown for photos included in this section.

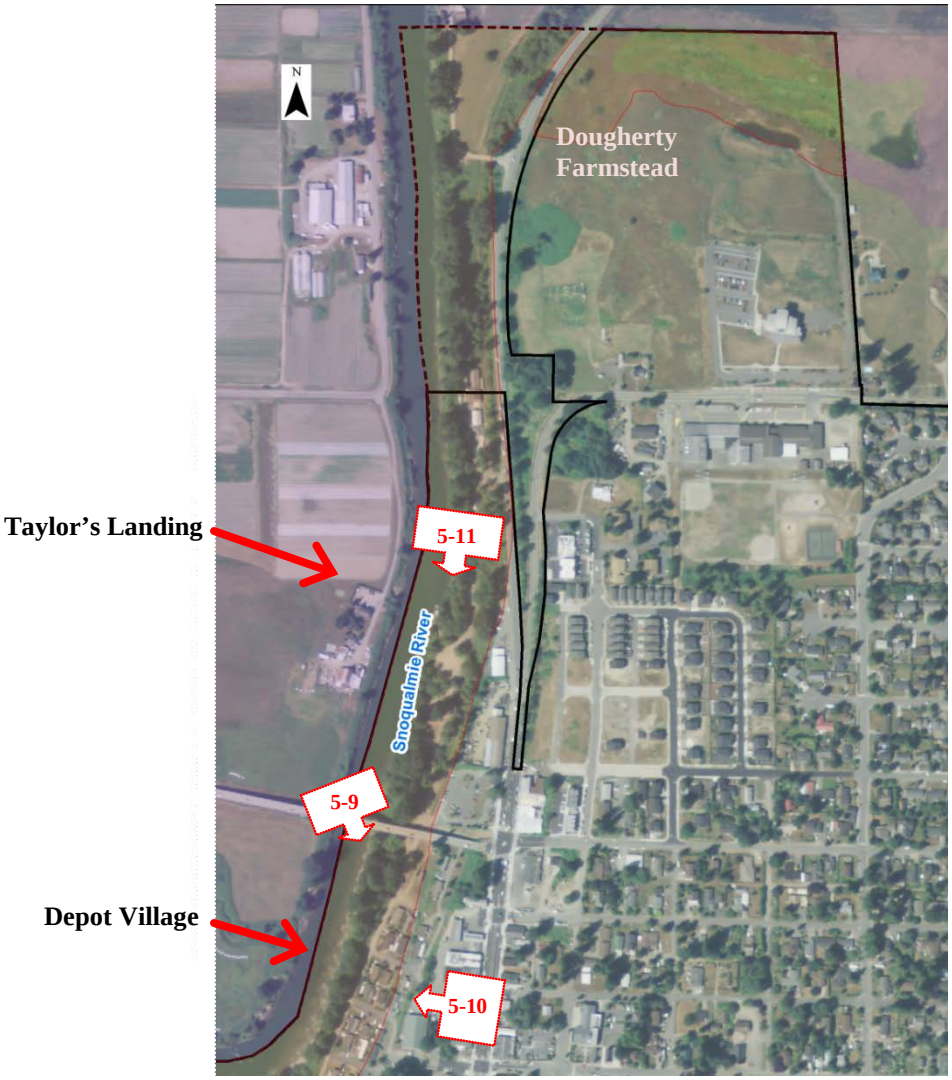


Figure 5-7. Section across the Snoqualmie River SPA within the Depot Village / Taylor's Landing / Northern Shoreline Area. Section location shown on Map 3 as Section B; elevation data from King County topographic information.

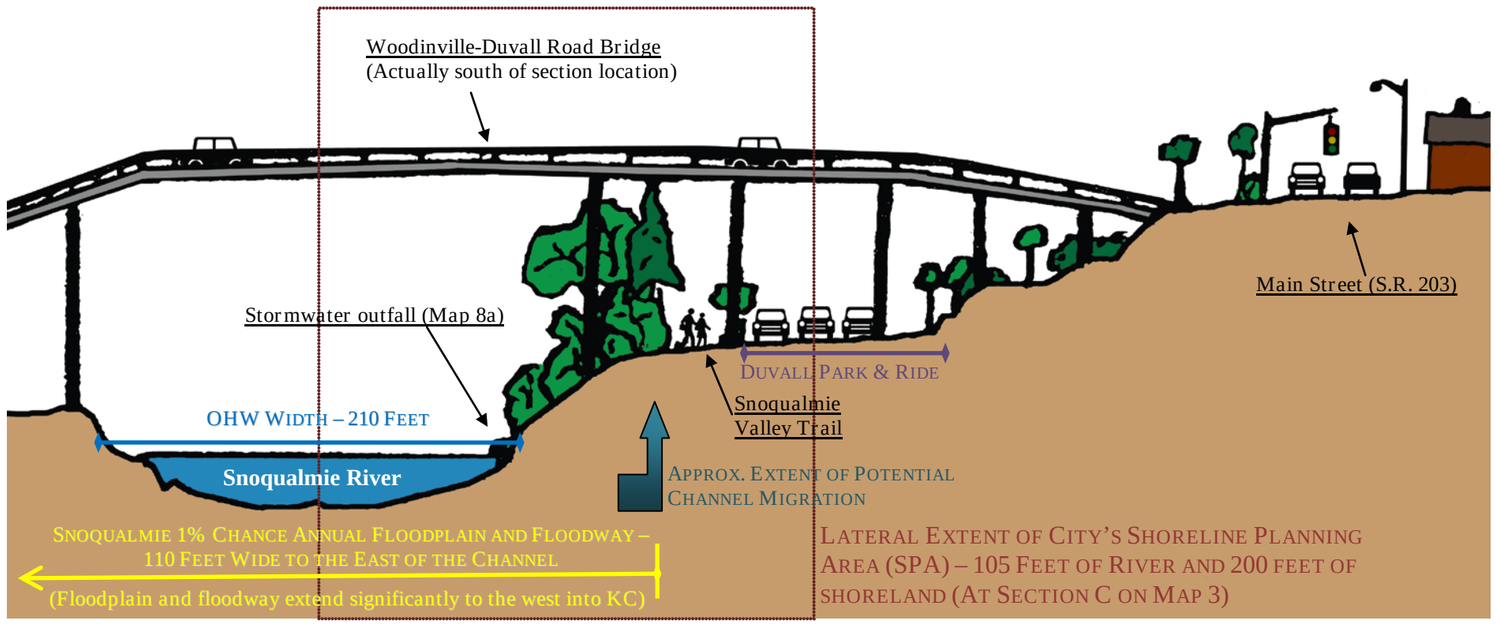


Photo 5-9. Snoqualmie River shoreline at Woodinville-Duvall Road Bridge. Note Riverside Village, Snoqualmie Valley Trail, and historic bridge footings; photo location shown on Figure 5-5 (King County, 2001).

Photo 5-10. Depot Village residential neighborhood immediately east of the Snoqualmie Valley Trail; photo location shown on Figure 5-5 (February 2010).

Photo 5-11. Taylor's Landing boat launch; ramp cuts into the bank, angling downriver to the north; photo location shown on Figure 5-5 (February 2010).

Table 5-3. Summary of reach conditions within the Riverside Village, Taylor's Landing, and Northern Shoreline area.

	Summary of Reach Condition
Physical and Biological Characterization	
Channel and Bank Form	Steep bank (due to the incised river) backed by little to no forest cover (Photo 5-5; Appendix C). Footings for the Woodinville-Duvall Road Bridge land at the edge of the OHWM on both sides of the river, modifying the bank form.
Riparian Condition	50- to 150-foot-wide riparian corridor (Photo 5-9). Limited overhanging vegetation is present along the northern shoreline, and several downed trees hanging into the river were noted during site reconnaissance. Bank understory is vegetated with shrub species, with Himalayan blackberry as the dominant (invasive) shrub. Areas of riparian forest include canopy generally only 10 to 20 feet wide from the bank. Northwest and north shorelines of McCormick Park include a forest / shrub riparian area 50 to 150 feet wide, extending to the area around the Coe-Clemons (northern) tributary channel confluence
Floodplain, Floodway, and CMZ Areas	Snoqualmie River channel is near the eastern edge of the valley through the northern area, resulting in a confined floodplain (Figure 5-7; Map 4). Compared with the wide floodplain and floodways associated with the southern open-space area and McCormick Park (500 to 1,200 feet wide), the northern shoreline area floodplain is narrow (ranging between 75 feet and 150 feet wide to the east of the river). Recent flood events have resulted in shallow floodwaters engaging the eastern edge of the Depot Village residential area (Photo 5-10). At the northern extent of Duvall's shoreline area, the Snoqualmie River engages with the Cherry Creek valley, creating a wide floodplain that extends to the east of SR 203 across the northern portion of the Dougherty Farmstead and Holy Innocents Catholic Church properties. The potential channel migration area is narrow along the northern extent of the shoreline, confined by the relatively narrow eastern floodplain corridor (Map 4). The potential channel migration area does not extend to the east of State Route 203 into the floodplain area at the northern end of the City.
Tributary Streams & Associated Wetlands	There are no mapped tributary streams within the northern shoreline area (Herrera, 2006). The floodplain shoreline area at the northern edge of the City is associated with Cherry Creek as well as the Snoqualmie River. No portions of the Cherry Creek mainstem or tributaries pass within the City's shoreline planning area, however depressional wetlands have been inventoried in this area (Map 3).
Fish and Wildlife Use and Habitat	Fish and wildlife use in the northern shoreline area is consistent with the use patterns across Duvall shoreline area (Section 5.1.1), although no tributary fish habitat occurs within the reach. See Map 5 for salmonid distribution.
Shoreline Modifications	
Armoring	Three primary structural modifications to east-bank shoreline through the northern shoreline area: (1) historic bridge supports located immediately south of the existing bridge; (2) current bridge supports landing at or near the OHWM of the river; and (3) a boat ramp angling downstream into the river at Taylor's Landing. Both the historic bridge and the current bridge supports are concrete (Photo 5-8). The boat ramp is one lane wide and is paved with rutted and cracked concrete. The shoreline immediately surrounding the ramp is armored with riprap (Photo 5-10). During storm events, it appears that sheet flow from the ramp approach and ramp runs directly down the ramp into the river.
Outfalls	Four piped stormwater outfalls are known to occur within the northern shoreline area (Map 8a).
Land Use	
Existing Land Use	Most of the northern shoreline area is publicly owned open space and park lands. Moving north from McCormick Park, the Snoqualmie Valley Trail extends along the shoreline to Taylor's Landing. The trail corridor fronts the shoreline, with the riparian open space area extending from the trail to the river within the trail right-of-way (Map 6). The Depot Village area is immediately east of the trail and south of the Woodinville-Duvall Road bridge. The Depot Village is one large (4.34 acre) parcel only partially within the SPA that is currently developed with 26 manufactured homes (Photo 5-9). Homes are generally located in three rows paralleling the shoreline, the lower two rows of existing structures within shoreline jurisdiction. A series of narrow private roads provide access to the residences. The Woodinville-Duvall Road bridge is located on a corridor of public right-of-way crossing the shoreline area; an additional right-of-way corridor approximately parallels the bridge corridor to the south, along the alignment of the historic Snoqualmie River bridge (Photo 5-9). The Duvall Park-and-Ride facility is located immediately north of the bridge (east of the trail corridor); owned by the City and is only partially within the shoreline area (Figure 5-7), the lot provides commuter parking. Taylor's Landing (2.2 acres) is the northern terminus of the SVT (Map 7). Along with McCormick Park, Taylor's Landing is the only public space that provides direct access to the Snoqualmie River within Duvall. The park includes a large parking area for park and trail users, as well as for boaters utilizing the boat ramp. See Existing Public Access in this table, below. North of Taylor's Landing, King County owned historic railroad corridor extends to the northern City limits. The corridor does not contain a developed trail to the north of Taylor's Landing; this undeveloped County corridor continues into the UGA directly north of the City, swinging to the east away from the river and paralleling SR 203. One large (7.61 acre) residential / agricultural property is located along the shoreline, extending to the northern limits of the UGA. This property is accessed by a private road extending from SR 203. To the east of SR 203, the northern portions of Dougherty Farmstead (publicly owned) and Holy Innocents Catholic Church (both properties within City limits) extend into the floodplain of the Snoqualmie River.

	Summary of Reach Condition
Land Use, Continued	
Current SED	The current SED for most of the northern shoreline area is Conservancy, with the segment around Depot Village designated Urban (City of Duvall, 1974) (Figure 1-1).
Zoning and Comp Plan Designations	Consistent with park, open space, and park-and-ride uses, the zoning and Comprehensive Plan land use designation for most of the northern shoreline area is Public Facility (DMC 14.10, City of Duvall, 2006). The Depot Village residential area is designated Riverside Village.
Existing Public Access	Taylor's Landing is designated as a Community Park within the City's Parks Plan (EDAW / AECOM, 2008) and provides significant public access to the Snoqualmie River shoreline (Map 7). The park is linked to the Snoqualmie Valley Trail, a regionally significant pedestrian, bicycle, and equestrian facility linking Duvall, Carnation, and Fall City. The trail also connects Taylor's Landing with McCormick and Depot Parks to the south. A boat ramp and associated facilities provide direct access to the Snoqualmie River shoreline within Taylor's Landing (Photo 5-10). The park also provides fishing access to the Snoqualmie River.
Historical and Cultural Resources	The Dougherty Farmstead is documented as a historic property, with the Duvall Historical Society providing guided public tours through the farmhouse and outbuildings (City of Duvall, 2010). See Section 3.1 of this report for cultural and historical background.

CHAPTER 6 SUMMARY OF SHORELINE MANAGEMENT ISSUES AND OPPORTUNITIES

The state Shoreline Guidelines require local jurisdictions to identify general opportunities for shoreline protection, enhancement and restoration, and potential impediments to the protection and restoration of ecological functions.[8] In addition, local governments are required to analyze current and projected shoreline use patterns, potential use conflicts, and current and potential future public access sites. This chapter summarizes overall protection, restoration and development potential at the watershed scale and describes specific management issues, use patterns and conflicts, restoration opportunities, and public access opportunities for each of the City's three shoreline areas.

6.1 Overall Protection, Restoration and Development Potential

There are numerous opportunities to protect, restore, and enhance shorelines throughout Duvall, including areas within and outside of shoreline jurisdiction. Many site-specific opportunities have been identified and discussed as part of past efforts, including: the 2006 Stream Habitat Assessment (Herrera, 2006); the 2002 Fish Habitat Restoration Plan (Herrera, 2002); the 2005 Landscape Analysis (Parametrix, 2005); and the 2010 McCormick Park draft assessment (ESA Adolfson, 2009). Examples of identified restoration opportunities include:

- Modifications to existing stormwater systems to improve integration with the City's natural drainage networks, with project identification in the upper and central Coe-Clemons basins;
- Riparian restoration along the Snoqualmie River mainstem, with plantings completed by the Stilly-Snohomish Task Force along portions of the McCormick Park and south open space area shorelines; and
- Removal of fish passage barriers along Thayer and Coe-Clemons Creeks, as identified in the Fish Habitat Restoration Plan.

The Landscape Analysis identified the important areas for ecosystem processes and the level of alteration present in each subbasin within the study area (see Chapter 3 and Appendix B). In addition, Ecology's Puget Sound-wide analysis provides further assessment of hydrologic conditions in Snoqualmie mainstem subbasins, verifying the 2005 assessment (Ecology, 2010, Parametrix, 2005). These analyses provide a framework for determining how development, protection and restoration could be prioritized throughout the subbasins in Duvall. Although a synthesis has not been fully completed, identification / mapping of important areas and alterations (Figures 3-5 and 3-6 in Appendix B) could be used to create a relative ranking of where development, protection and restoration should occur at the subbasin scale. Preliminary ranking will be applied to restoration and conservation opportunities during development of the full SMP restoration plan.

[8] The Guidelines also require a Restoration Plan, which will be prepared in a subsequent SMP update step.

The categories are not absolute or exclusionary, meaning that it is possible for development to occur within a protection area and for restoration to occur in a development area, and so forth. Within any subbasin there may be smaller areas that do not match the overall management recommendation. It is also important to note that the categories are not discreet but occur along a continuum from protection (highest ecological value, least altered) to development (lowest ecological value, most altered).

6.2 Reach-scale Management Summaries

Table 6-1 summarizes the impairments to ecosystem processes described in this inventory, and indicates whether the impairments are primarily at the large (basin) scale, or if they are primarily local, at the scale of a specific reach of the shoreline. In some cases, the impairments may be at both the basin and the reach scales. The summary table also includes some initial recommendations on how these impaired processes can be addressed. These recommendations are intended to inform the update to the City's SMP by identifying: (1) opportunities for ecological conservation and restoration, and (2) policy issues related to future shoreline use and development. Following the table, management issues and opportunities are identified for each of the three shoreline segments along the Snoqualmie River.

Table 6-1. Summary of Impairments to Shoreline Ecosystem Processes and Management Opportunities

Ecosystem Process	Causes of Impairment to Ecosystem Process	Scale of Alterations	Protection and Restoration Opportunities
Water Quality	Loss of riparian canopy has affected river temperature. Modifications to Coe-Clemons tributary stream has created pond, affecting tributary and localized water temperature. Changes in land use have increased input of pollutants to the river, including metals (roadway runoff) and potentially phenols and other pollutants. Fecal coliform and excess nutrients in runoff from agricultural and residential areas are likely due to livestock and possibly septic system sources outside of the City.	Basin and Reach Reach Watershed, Basin, and Reach Watershed	• Encourage low impact development during development and redevelopment activities throughout Duvall. LID strategies should focus on retrofit of existing residential stormwater systems, many of which are in-line with or discharge to tributary streams draining to the shoreline area. Additional focus areas should include management of land cover change in design of subdivisions and other major redevelopments that significantly alter land use. • Restore tributary streams within shoreline area to improve water quality functions; primarily focus on water temperature issues associated with the large open water (pond) areas to the east of the Snoqualmie Valley Trail. • Continue to seek funding sources for upgrades to the City's stormwater utilities, focusing on existing systems that drain into key tributary streams. Develop a comprehensive list of under-functioning systems, including prioritization for retrofit. • Provide education and incentives to property owners to address non-point water quality issues, including promoting use of commercial car-washes, development of rain gardens and/or rain barrels from roof downspouts, lawn and fertilizer alternatives, and reduction in property area impervious surface coverage. • Protect and restore riparian vegetation by enforcing critical areas regulations and implementing protection incentives and flexible development tools. • Explore creation of additional wetland areas within the shoreline environment to maximize surface water storage. • As feasible, support the County in partnering with agricultural properties on adjacent (western) Snoqualmie shoreline to promote better management of agricultural activities within the riparian buffer; potentially promote these partnerships as a regional example of stewardship.

Ecosystem Process	Causes of Impairment to Ecosystem Process	Scale of Alterations	Protection and Restoration Opportunities
Biological Resources	Historic and current development and bank stabilization have reduced shoreline vegetation and large woody debris. Loss of riparian canopy upstream and within City shoreline has affected river temperature and reduced quality of salmonid habitat. Water temperature problems (Coe-Clemons Pond) and physical barriers (channel incision and culverts) have reduced fish access to tributaries. Filling and draining of wetlands has reduced fish refuge habitat as well as habitat for amphibian and terrestrial species associated with the river. Construction of levees and dikes upstream of the City has disconnected the river from its floodplain and reduced off-channel habitat. There is no record of levee structures built along the Snoqualmie within Duvall. Beaver dams along tributary streams have resulted in impoundments, creating partial salmon migration barriers and altering habitat patterns (exaserbated especially when coinciding with human modification (for example, culverts under the Snoqualmie Valley Trail).	Basin and Reach Basin and Reach Reach Reach (likely Basin as well) Basin Reach (likely Basin as well)	• Restoration and enhancement of existing tributary • Restoration of the riparian zone along the Snoqualmie River and tributaries; focus of restoration should be establishment of a dense riparian corridor of native forest cover. Riparian plantings should fit within overall framework of restoration, allowing for structural and physical restoration activities to occur in identified areas. • Techniques in the Integrated Streambank Protection Guidelines could be used to incorporate vegetation and large wood into flood control structures. • Removing or relocating dikes would increase wood availability, shade, habitat complexity, and off-channel rearing areas. • Engineered logjams could help accumulate wood and form pools. • Remaining wetlands could be protected and wetland restoration encouraged through regulations and incentives.
Hydrology	In-stream gravel mining well above Duvall and other upstream basin development may have caused incision of the riverbed. Increased impervious surfaces in	Basin	• Identify and work with regional partners to restrict basin activities that may be causing changes to riverbed form. • Protect and restore riparian and upland wetlands by enforcing critical areas regulations and implementing protection incentives and

Ecosystem Process	Causes of Impairment to Ecosystem Process	Scale of Alterations	Protection and Restoration Opportunities
	developed areas have increased surface runoff and sedimentation. Construction of levees and dikes upstream of the City (both formal and informal) has disconnected the river from its floodplain and reduced off-channel habitat. There is no record of levee structures built along the Snoqualmie within Duvall.	Basin and Reach Basin	flexible development tools.
Sediment Generation and Transport	Disconnection of river from its floodplain and some associated wetlands has altered sediment transport. Changes in land use have increased input of sediment to the river through tributary systems.	Basin Basin and Reach	• Update shoreline development standards to control erosion, • Protect and restore riparian and upland wetlands by enforcing critical areas regulations and implementing protection incentives and flexible development tools,

6.2.1 South-end Open Space Areas

6.2.1.1 Summary of Ecological Functions and Management Issues

Urban development within the Thayer Creek and Coe-Clemons Creek contributing basins, and historical agricultural and transportation infrastructure development within the SPA, have impaired functions and degraded shoreline habitat. Five primary factors are driving the loss of functions:

1) Lack of riparian vegetation (primarily along Snoqualmie River mainstem)

2) Lack of large woody debris (along Snoqualmie River mainstem and lower tributary streams)

3) Lack of channel complexity (along mainstem and lower tributary streams)

4) High sediment loads (a subbasin impairment for both Thayer and Coe-Clemons Creeks)

5) Increased hydrologic disturbance (primarily a subbasin impairment for both Thayer and Coe-Clemons Creeks)

The riparian corridor along the Snoqualmie River mainstem has been moderately altered by historic agricultural development. The river lacks significant woody debris needed for forming pools and cover used by salmonid species for holding and rearing habitat. The lack of a well vegetated riparian corridor limits the ability of the river to recruit new woody material over time. Lack of riparian vegetation also allows increased water temperature. Historic and informal bank armoring has reduced channel complexity, concentrated flows, decreased floodplain connectivity, and caused higher flow velocity and water depths. On a watershed scale, this has likely caused some degree of channel incision through Duvall.

While the primary impairments along Coe-Clemons Creek and Thayer Creek extend throughout the subbasins, impacts on habitat, water quality, and hydrologic functions are most pronounced in the lower reaches of the streams. Urban density is most pronounced in the areas immediately upstream of the shoreline area. Upstream erosion and sediment loading have caused significant channel erosion and bank destabilization. This is primarily an issue in Coe-Clemons Creek; some areas of the south-end open space include habitats that are more intact, resulting in tributary systems that function somewhat better (Herrera, 2006).

Based on these existing conditions, the important management issues for the south-end shoreline area are:

- Application of a shoreline environment designation that:

    1) Establishes standards for activities within the south-end area that consider and appropriately restrict impacts associated with land clearing and grading, floodplain fill, and creation of impervious surface (especially pollution generating surfaces).

2) Provides standards to ensure allowed uses are consistent with overall goals of open space conservation, enhancement, and passive recreation.

3) Allows soft surface trails, certain utilities, pedestrian facilities (9 footbridges), and other uses deemed to be appropriate, and provides standards for allowed uses to ensure that design, location, and ongoing use are appropriate with overall goals.

- Inclusion of goals, policies, and standards within the SMP that will facilitate restoration and enhancement of the south-end shoreline area, consistent with restoration activities detailed by the SMP Restoration Plan (to be completed) and existing City environmental restoration plans.

- Preservation of riparian vegetation using setbacks, buffers, and / or restrictions on almost all uses within the floodway area.

- Vegetation and open space conservation standards through incorporation of existing City Sensitive Areas regulations (DMC 14.42).

- Inclusion of public access standards within the SMP intended to enhance appropriate (passive) access to the south-end area, by:

    1) Encouraging use of interpretive signs and sculpture intended to facilitate appreciation and understanding of open space functions while planning for restoration projects.

    2) Requiring enhancement of existing public access locations linking the Snoqualmie Valley Trail and south-end area directly to Main Street.

    3) Prioritizing trail improvement projects where they are necessary to meet open space restoration priorities, including improvement of stream crossings (especially culverts).

6.2.1.2 Future Use Patterns and Potential Use Conflicts

Current land use in the south-end shoreline area is dominated by publicly owned open space areas and trail corridors. Limited areas of open space also occur on privately owned properties used for light industry outside of shoreline jurisdiction.

There are no plans to significantly alter the existing open space use of City owned properties. Development of privately owned open space could occur, although there are significant existing regulatory challenges due to floodplain and wetland protections. Anticipated future development includes utility uses and further development of soft surface trails and boardwalks through the open space areas, with potential development of an off-leash dog park utilizing some of the south-end area. Additional access to the Snoqualmie Valley Trail and other south end trails may be provided during development of adjacent properties along State Route 203. New access points would likely include parking areas (most likely outside of the shoreline area) and connector trails. The SMP update should include goals and standards to minimize the potential adverse

effects that utility and trail development could have on shoreline functions. Potential impacts associated with land and hydrologic disturbance would have to be assessed and mitigated as part of park development planning, design, and construction in order to avoid conflicts with identified open space conservation and restoration goals.

Additional restoration activities are also anticipated. Restoration activities should be planned and prioritized in order to maximize benefits and implement restoration projects in a way that minimizes unintended impacts to resources.

6.2.1.3 Opportunities for Enhancing and/or Restoring Ecological Functions

The McCormick Park Reconnaissance and Assessment (ESA Adolfson, 2009) identified a series of conceptual restoration options intended to enhance wildlife habitat and functions (Appendix C). The assessment captures restoration options that span different levels of effort, and could be installed either all at once, or using a phased approach. Potential restoration opportunities identified for the south-end open space area are identified on Map 9b and include the following.

Coe-Clemons and Thayer Creek Channel Restoration

By creating new stream corridors with greater sinuosity and rerouting at least portions of the tributary channels through the site to the west of the trail corridor, the City could achieve the following goals:

- Increase channel length;
- Potentially increase wetland area;
- Increase channel stability; and
- Restore native riparian forest.

ESA Adolfson (2009) suggests that restoration of the Thayer Creek channel would be, in general, easier than restoration of the Coe-Clemons Creek channel. Coe-Clemons is more challenging as it is constrained by the existing developed portion of the park to the north, and it flows through the most significant wetland in the project area (the wetland complex to the east of the trail, including the ponded area; see Map 3).

Challenges with this option would include design of the SR-203 Crossing and the transition from the tributary to the river and the costs associated with significant excavation. See Appendix C for more details.

Southern Wetland Swale and Depressional Wetlands

Hydrology from the primary south-end wetland and tributary area (Wetland B on maps in Appendix C) supports the depressional wetland complex along the Snoqualmie Valley Trail berm. Hydrologically, this area appears to function at a high level. This area is noted as a potential area for wetland creation and/or restoration of more complex aquatic floodplain habitat.

Challenges associated with wetland creation due to existing system hydrology may suggest that enhancement of existing wetland areas through installation of native vegetation and habitat features may be a more successful approach.

Non-Native Plant Control

Non-native invasive plant species, most notably Himalayan blackberry and reed canarygrass, occupy significant portions of the south-end open space area; Japanese knotweed has also been identified along the shoreline and tributary streams. Managing these infestations will be key in the long-term success of native plantings.

One method for control of reed canarygrass is to establish dense "islands" of native tree and shrub vegetation in areas dominated by the invasive weed. This technique requires less soil disturbance than removal (eradication) of reed canarygrass and its root layer. Native plantings would not eradicate canarygrass, but over time they shade out the grass and create an opportunity for native vegetation to become established and successfully compete in the project area. This strategy is additionally recommended due to the large canarygrass seed sources from adjacent properties, which would limit the effectiveness of eradication.

Off-Channel Habitat

In general terms, the amount and quality of off-channel habitat all along this stretch has been reduced. Three ways that off-channel habitat could be created or enhanced through the south-end open space area are suggested:

- Enhance riparian vegetation throughout;
- Focus off-channel habitat at tributary confluences; and/or
- Excavate new off-channel features (e.g., oxbows).

The first option is by far the easiest, with initial implementation already begun by the Stillaguamish – Snoqualmie Task Force. Continued restoration of riparian vegetation should be included under any approach.

The second option could relatively easily be incorporated into the design of the tributary channel realignment. Under such an effort, the existing mouths could be left as off-channel habitat, rather than filling the entire existing channels. Excavating an entirely new off-channel feature, such as a secondary channel or an oxbow, would require the most design and construction effort.

Significant design challenges are associated with the second or third options. Additional feasibility-level design would be necessary and would need to assess river gauge data to determine elevation ranges where off-channel habitat creation efforts may be effective, and investigate reference standards to determine what parameters should be the design focus. See Appendix C for more details.

6.2.1.4 Public Access Opportunities

Significant existing open spaces along the south-end shoreline offer public access to the shoreline area and visual access to the shoreline (Section 4.2.2). Enhancement of public access to the shoreline in the south-end open space areas is identified in the 2008 Parks, Trails, and Open Space Plan (EDAW / AECOM, 2008). Improvements are limited to enhancement of existing

secondary trails and potential development of new trails (including boardwalks) to provide further passive recreation and wildlife viewing opportunities.

6.2.2 McCormick Park / Depot Park Area

6.2.2.1 Summary of Ecological Functions and Management Issues

Urban development within the Coe-Clemons Creek contributing basin has impaired functions and degraded shoreline habitat within the McCormick Park / Depot Park area. In addition, historical agricultural and transportation infrastructure development, as well as more recent development of park areas, have further impaired shoreline functions.

Based on these existing conditions, the important management issues for McCormick Park / Depot Park shoreline area are:

- Application of a shoreline environment designation (or designations) that:

    1) Establishes appropriate uses for park areas within the floodway, including recreational uses (including but not limited to river access, trails, multi-use lawn areas) that are compatible with the hazardous and dynamic environment.

    2) Provides standards to ensure allowed uses are consistent with overall goals of recreation and open space conservation and enhancement, as detailed in the City's Parks, Trails, and Open Space Plan (2008).

    3) Allows trails, certain utilities and other uses and structures deemed to be appropriate within the Depot Park area and other areas outside of the floodway, and provides standards for allowed uses to ensure that design, location, and ongoing use are appropriate with overall goals.

- Inclusion of public access standards within the SMP intended to enhance appropriate access and recreation within the Depot Park and McCormick Park area, by:

    1) Identifying recreational use types that will be appropriate within different zones of the shoreline area (ie: within the riparian buffer of the river, within the floodway, and within the remaining floodplain).

    2) Assessment and inclusion of goals and priorities from the 2008 parks plan.

    3) Encouraging use of interpretive signs and sculpture intended to facilitate appreciation and understanding of floodplain and shoreline functions while planning for parks improvements projects.

- Specification of bank stability strategies that facilitate development of bank protection along the Snoqualmie River, especially along the eroding portions of the shoreline; strategies should include consideration of water dependent shoreline recreation activities as well as channel dynamics and soft-shoreline armoring techniques.

- Prioritization of restoration of the ponded area of Coe-Clemons Creek to address potential water quality, water temperature, and habitat issues.

6.2.2.2 Future Use Patterns and Potential Use Conflicts

Current land use in the McCormick Park / Depot Park area is dominated by publicly owned park spaces and trail corridors.

There are no plans to significantly alter the existing recreation uses of McCormick and Depot Parks. Development of additional park facilities within McCormick Park could create a use conflict, as the entire area is within the river floodway. Anticipated future near-term development includes further development of soft surface trails, trail bridges across tributary streams, and potential development of a community stage area (EDAW / AECOM, 2008). The SMP update should consider how to minimize the potential adverse effects that trail and park developments may have on shoreline functions, and identify what park uses should be prohibited or significantly restricted within the floodway area.

Additional restoration activities are also anticipated. Restoration activities should be planned and prioritized in order to maximize benefits and implement restoration projects in a way that minimizes unintended impacts to resources.

6.2.2.3 Opportunities for Enhancing and/or Restoring Ecological Functions

Several conceptual restoration options intended to enhance wildlife habitat and functions within McCormick and Depot Parks are identified in Appendix C. Restoration options that span different levels of effort, and could be installed either all at once or using a phased approach are identified. Potential restoration opportunities identified for the McCormick Park / Depot Park area are identified on Map 9b and include the following:

Coe-Clemons and Thayer Creek Channel Restoration

By creating new stream corridors with greater sinuosity and rerouting at least portions of the tributary channels through the site to the west of the trail corridor, the City could achieve the following goals:

- Increase channel length;
- Potentially increase wetland area;
- Increase channel stability; and
- Restore native riparian forest.

ESA Adolfson (2009) suggests that restoration of the Thayer Creek channel would be, in general, easier than restoration of the Coe-Clemons Creek channel. Coe-Clemons is more challenging as it is constrained by the existing developed portion of the park to the north, and it flows through the most significant wetland in the project area (the wetland complex to the east of the trail, including the ponded area; see Map 3).

Challenges with this option would include design of the transition from the tributary to the river and the costs associated with significant excavation. See Appendix C for more details.

Snoqualmie River Bank Stabilization

A long stretch of the river shoreline within McCormick Park (the west facing shoreline) is actively failing. This appears to be part of a longer-term process where the river is migrating east in this location. The river migration process will likely continue. A successful strategy to stabilize the shoreline along this reach could include grading back the banks and planting the banks and riparian area with native vegetation. Shoreline stabilization in the northern portion of the project area would provide an additional buffer between the developed park and the river, reduce fine sediment loading from the failing banks, and improve riparian cover.

Coe-Clemons Pond

Installing trees around the pond, and placing shallow mounds of fill in the pond to allow shrubs and trees to grow, could help reduce water temperatures. The pond is also currently at least a partial migration barrier for fish (Herrera, 2002 and 2006).

The assessment recommended installing and monitoring temperature loggers through a spring and summer period to determine the magnitude of the temperature issue. If temperature is identified to occur at elevated levels that could impact salmonid use, restoration of the pond area by enhancing riparian conditions should be completed with a monitoring and adaptive management plan to ensure temperature issues are addressed.

Non-Native Plant Control

Non-native invasive plant species, most notably Himalayan blackberry and reed canarygrass, occupy significant portions of the project area. Managing these infestations will be key in the long-term success of native plantings.

One method for control of reed canarygrass is to establish dense “islands” of native tree and shrub vegetation in areas dominated by the invasive weed. This technique requires less soil disturbance than removal (eradication) of reed canarygrass and its root layer. Native plantings would not eradicate canarygrass, but over time they shade out the grass and create an opportunity for native vegetation to become established and successfully compete in the project area. This strategy is additionally recommended due to the large canarygrass seed sources from adjacent properties, which would limit the effectiveness of eradication.

6.2.2.4 Public Access Opportunities

As described in Section 4.3.2, McCormick Park and Depot Park offer significant public access to the shoreline area, as well as direct access to the shoreline at the McCormick Park swimming and wading beach. Enhancement of public access to the shoreline in the McCormick Park / Depot Park area is identified in the 2008 Parks, Trails, and Open Space Plan (EDAW / AECOM, 2008). Improvements include development of a boat launch, an environmental education center, enhancement of existing secondary trails, and other potential facilities not directly related to shoreline access.

6.2.3 Riverside Village, Taylor's Landing, and Northern Shoreline Areas

6.2.3.1 Summary of Ecological Functions and Management Issues

Inventory information highlights four primary factors driving the loss of functions:

1) Impervious coverage and urban development within areas fringing on the shoreline area and extending up the City hillside to the east.

2) Lack of large woody debris (along Snoqualmie River mainstem and lower tributary streams) and complex habitat / vegetation within the riparian corridor.

3) Lack of channel complexity (along mainstem).

4) Shoreline modification at the Taylor's Landing boat ramp.

The riparian corridor along the Snoqualmie River mainstem has been moderately altered by historic agricultural development and construction of the Snoqualmie Valley Railroad. Land uses within Depot Village and other areas east of the trail further degrade riparian habitat, although the trail corridor provides a riparian buffer. The river lacks significant woody debris needed for forming pools and cover used by salmonid species for holding and rearing habitat. The lack of a well vegetated, mature riparian corridor limits the ability of the river to recruit new woody material over time. Lack of riparian vegetation also allows increased water temperature. Historic and informal bank armoring has reduced channel complexity, concentrated flows, decreased floodplain connectivity, and caused higher flow velocity and water depths. On a watershed scale, this has likely caused some degree of channel incision through Duvall.

Urban density is most pronounced in the areas immediately upslope (east) of the shoreline area. Urban runoff and sediment drain to the river through sheet flow and stormwater discharge (see Map 8a). Based on these existing conditions, the important management issues for the northern shoreline areas are:

- Establishment of a shoreline environment designation (or designations) that preserve existing riparian vegetation and allow for the variety of existing and desired uses in the area to the east of the trail.

- Including polices and standards within the SMP that ensure preservation and encourage long term enhancement of riparian vegetation using setbacks and buffers along the mainstem.

- Detailing goals and policies within the SMP to encourage identification of basin stormwater system impairments and prioritization of system improvements.

- Detailing goals and policies which promote clearing, grading and developments resulting in loss of forest and/or increases in impervious surfaces in order to minimize downstream impacts to hydrology and sediment processes.

- Establishing standards for trail and park uses that allow for desired improvements to Taylor's Landing and extension of the Snoqualmie Valley Trail while ensuring potential impacts are mitigated.

6.2.3.2 Future Use Patterns and Potential Use Conflicts

Current land use in the northern shoreline area is dominated by publicly owned park spaces and trail corridors. Allowed uses within the Riverside Village area are detailed by DMC 14.10, and could include a variety of commercial and residential (upper floor) use types if redeveloped. There are no anticipated plans for redevelopment of the Depot Village. Any redevelopment would need to assess impacts on public access via the adjacent Snoqualmie Valley Trail. Environmental considerations would also be required, including the river floodplain and floodway areas.

There are no plans to significantly alter the existing recreation uses of Taylor's Landing, although remodel and enhancement of existing facilities is highlighted in the City's Parks Plan. The SMP update should consider how to minimize the potential adverse effects that trail and park developments may have on shoreline functions, and identify what park uses should be prohibited or significantly restricted within the floodway area.

6.2.3.3 Opportunities for Enhancing and/or Restoring Ecological Functions

Potential restoration opportunities identified for the northern shoreline area are identified on Map 9a and include the following:

Riparian Enhancement

Restoration of riparian vegetation to establish a mixed-forest native community should be a priority throughout the City's Snoqualmie River shoreline, including the northern shoreline areas. Open space areas of Taylor's Landing and adjacent to the Snoqualmie Valley Trail should be targeted for riparian enhancement.

Non-Native Plant Control

Non-native invasive plant species, most notably Himalayan blackberry and reed canarygrass, occupy significant portions of the project area. Managing these infestations will be key in the long-term success of native plantings.

One method for control of reed canarygrass is to establish dense "islands" of native tree and shrub vegetation in areas dominated by the invasive weed. This technique requires less soil disturbance than removal (eradication) of reed canarygrass and its root layer. Native plantings would not eradicate canarygrass, but over time they shade out the grass and create an opportunity for native vegetation to become established and successfully compete in the project area. This strategy is additionally recommended due to the large canarygrass seed sources from adjacent properties, which would limit the effectiveness of eradication.

6.2.3.4 Public Access Opportunities

Taylor's Landing offers significant public access to the shoreline area, as well as direct access to the shoreline via the boat ramp (Section 4.4.2). Enhancement of public access to the shoreline is identified in the City's 2008 Parks Plan, including retrofit of the deteriorating boat ramp, parking area, and other park facilities.

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A Framework for Delineating channel migration zones. Ecology Final Draft Publication #03-06-027.	Rapp, C.F and T.B. Abbe. 2003.	http://www.ecy.wa.gov/biblio/0306027.html
Geohydrology and Ground-Water Quality of East King County, Washington. Water-Resources Investigations Report 94-4082.	Turney, G.L., Kahle, S.C., and Dion, N.P. 1995. Prepared in cooperation with Seattle - King County Dept. of Public Health. Tacoma, Washington.	

Map Folio Data Themes	Data Source
Soils	NRCS: Digital Soil Survey data for King County
Geology	King County: Digital surface geology layer for (100K scale mapping from WDNR)
Critical Areas (wetlands, geologic hazard areas, flood hazard areas, aquifer recharge)	King County GIS data for geological hazards - published by KC 1997; City of Duvall GIS data for wetlands, Floodway, Aquifer Recharge Areas and Floodplain; Detailed wetland reconnaissance of McCormick Park area
Hydrography	USGS: 20 cfs points King County GIS data (streams, rivers, lakes); rivers, water bodies; WA Dept. of Ecology: WRIA boundaries; City of Issaquah: GIS data: Hydro, floodways, floodplains, and OHWM (partial, from McCormick Park Reconnaissance); FEMA, 2010 – Preliminary DFIRMs, including floodplains, floodways for Snoqualmie River
Drainage basin boundaries (surface water and or storm water basins)	King County GIS data: Basins update published KC 2006; City of Issaquah: Drainage Basins
Topography	Puget Sound LIDAR Consortium (PSLC) data 2005; King County 100' topographic contours. published KC 2002 ; USGS topographic maps; WDNR DEMs for King/Snohomish counties
Air Photos / Orthophotography	King County/USGS: NAIP imagery from (1ft) 2009
Historic air photos or scanned GLO maps (T-sheets)	UW River History Project
WDFW PHS / Streamnet	Included in ESA Adolfson on-call area
Parcels	King County GIS data: Tax parcels. Published 2009

Map Folio Data Themes	Data Source
	City data: parcels
Existing Land Use / Assessor data	King County Assessors Data, 2009
Zoning	City of Duvall: zoning data
Future Land Use / Comp Plan Land Use Designations	City of Duvall: Comprehensive Plan land use data
Shoreline Planning Area	ESA Adolfson derived, 2009
Impervious Area	NOAA (CCAP/NLCD), 2006
Vegetation / Land Cover	Land Cover data associated with NOAA (CCAP/NLCD), 2006
Utility lines (stormwater, sewer outfall, water, electric, natural gas, etc.)	DATA GAP
Contaminated Sites	Some data available from Ecology
2008 Water Quality Assessment (303d list)	WA Dept. of Ecology: 303d list
Historic / Cultural Resources	King County: 2004 Historic sites; Additional info. available from State through DAHP webportal.
Parks, Trails, Playfields, Designated Open Space (any public access location to the shoreline)	King County parks, park facilities, park property interests, trails, (2006); publicly-owned lands (*See Parcels* published 2009) City of Duvall: PTOS
Fish Usage (Fish Passage/Barriers)	SSHIAP (WDFW) City of Duvall
Transportation	King County: Major/Minor Roads - WSDOT

APPENDIX A: CITY OF DUVALL SHORELINE MAP FOLIO

APPENDIX B: CITY OF DUVALL *LANDSCAPE ANALYSIS FOR CRITICAL AREAS ORDINANCE UPDATE*
PARAMETRIX 2005

APPENDIX C: CITY OF DUVALL *DRAFT MCCORMICK PARK RECONNAISSANCE / OPPORTUNITIES AND CONSTRAINTS ASSESSMENT*
ESA ADOLFSON 2009

City of Duvall
Shoreline Master Program Update
Final Draft Restoration Plan

Ecology Grant No. G100025
Deliverable for Task 4.1
August 2011 (Updated October 2011 to address Duvall SMP Update Advisory Committee and King County comments)

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CHAPTER 1. INTRODUCTION

The City of Duvall (City) is conducting a comprehensive Shoreline Master Program (SMP) update with the assistance of a grant administered by the Washington State Department of Ecology (Ecology) (SMA Grant No.G100025). According to Substitute Senate Bill (SSB) 6012, passed by the 2003 Washington State Legislature, cities and counties are required to update their SMPs consistent with the state Shoreline Management Act (SMA), Revised Code of Washington (RCW) 90.58 and its implementing guidelines, Washington Administrative Code (WAC) 173-26 (Ecology SMA Guidelines). The City, along with other local jurisdictions, is required to develop a shoreline restoration plan as part of the SMP update process.

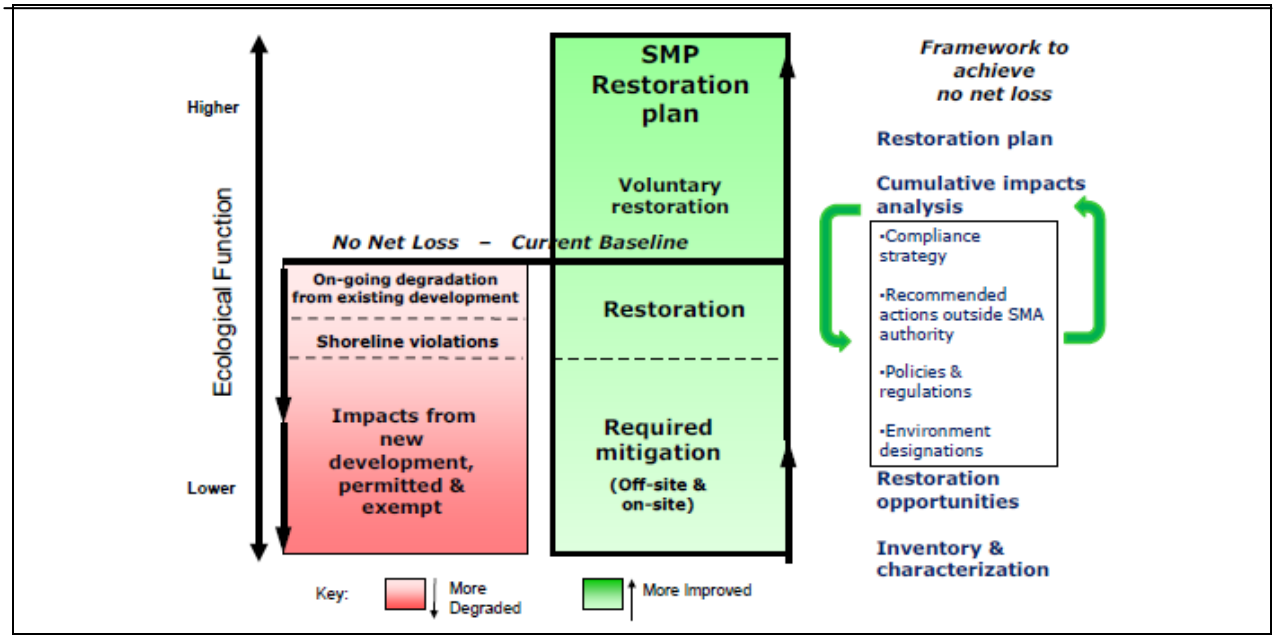
Regulatory Background

The State has directed local governments to develop SMP provisions "...to achieve overall improvements in shoreline ecological functions over time when compared to the status upon adoption of the master program." This overarching goal is accomplished primarily through two distinct objectives:

- **Protection** of existing shoreline functions through regulations and mitigation requirements to ensure "no net loss" of ecological functions from baseline environmental conditions; and
- **Restoration** of shoreline ecological functions that have been impaired from past development practices or alterations.

This distinction is illustrated in Figure 1 below.

Figure 1. Mitigation versus Restoration in Shoreline Master Programs



Source: Department of Ecology

The concept of no net loss of shoreline ecological function is embedded in the SMA and in the goals, policies and governing principles of the shoreline guidelines. The State's general policy goals for shorelines of the state include the "protection and restoration of ecological functions of shoreline natural resources." This goal derives from the SMA, which states, "permitted uses in the shoreline shall be designed and conducted in a manner that minimizes insofar as practical, any resultant damage to the ecology and environment of the shoreline area." The governing principles of the guidelines further clarify that protection of shoreline ecological functions is accomplished through the following (WAC 173-26-186):

- Meaningful understanding of the current shoreline ecological conditions;
- Regulations and mitigation standards that ensure that permitted developments do not cause a net loss of ecological functions;
- Regulations that ensure exempt developments in the aggregate do not result in net loss of ecological functions;
- Goals and policies for restoring ecologically impaired shorelines;
- Regulations and programs that fairly allocate the burden of mitigating cumulative impacts among development opportunities; and
- Incentives or voluntary measures designed to restore and protect ecological functions.

The restoration planning component of the SMP is focused on voluntary mechanisms, not regulatory provisions. However, the restoration framework developed for these non-compensatory mitigation projects can also be applied to compensatory mitigation projects. In this way, all efforts to improve ecosystem functioning are coordinated, and will be designed to work together.

Defining Restoration

There are numerous definitions for "restoration" in scientific and regulatory publications. Specific elements of these definitions often differ, but the core element of repairing damage to an existing, degraded ecosystem remains consistent. In the SMP context, the WAC defines "restoration" or "ecological restoration" as:

> *"…the reestablishment or upgrading of impaired ecological shoreline processes or functions. This may be accomplished through measures including, but not limited to, revegetation, removal of intrusive shoreline structures and removal or treatment of toxic materials. Restoration does not imply a requirement for returning the shoreline area to aboriginal or pre-European settlement conditions"* (WAC 173-26-020(27)).

The emphasis in the WAC is to achieve overall improvement in existing shoreline processes or functions, if these functions are impaired. Therefore, the goal is not to restore historic conditions, but rather to improve on existing, degraded conditions. In this context, restoration can be implemented through a combination of programmatic measures (such as surface water management; water quality improvement; public education) and site-specific projects (such as

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culvert removal and/or riparian plantings). This restoration plan focuses on the City as a whole rather than parcel by parcel, or permit by permit.

Key Elements of Restoration Planning in the SMP Update Process

The State guidelines provide six key elements for shoreline restoration planning as part of a local jurisdiction's master program, as outlined in WAC 173-26-201(2)(f). These elements are summarized below in Table 1-1, and provide the organization and content for this report.

Table 1-1. WAC Requirements for Restoration Plans

Key elements for the shoreline restoration planning process WAC 173-26-201(2)(f)	Where addressed in this report
Identify degraded areas, impaired ecological functions, and sites with potential for ecological restoration.	Chapter 2 – Summary of Existing Shoreline Functions
Establish overall goals and priorities for restoration of degraded areas and impaired ecological functions.	Chapter 4 – Restoration Goals, Priorities, Sites, Projects, and Programs
Identify existing and ongoing projects and programs that are currently being implemented which are designed to contribute to local restoration goals.	Chapter 3 – Existing Restoration Projects and Programs
Identify timelines and benchmarks for implementing restoration projects and programs and achieving local restoration goals.	Chapter 6 – Timelines, Benchmarks, and Measuring Effectiveness
Provide for mechanisms or strategies to ensure that restoration projects and programs will be implemented according to plans and to appropriately review the effectiveness of the projects and programs in meeting the overall restoration goals (e.g., monitoring of restoration project sites).	Chapter 6 – Timelines, Benchmarks, and Measuring Effectiveness
Identify additional projects and programs needed to achieve local restoration goals, and implementation strategies including identifying prospective funding sources for those projects and programs.	Chapter 4 – Restoration Goals, Priorities, Sites, Projects, and Programs Chapter 5 – Implementation Strategies and Funding Sources

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CHAPTER 2. SUMMARY OF EXISTING SHORELINE FUNCTIONS

Shoreline restoration planning begins with the identification of "degraded areas" or areas with "impaired ecological functions." The following summary relies on the *City of Duvall Shoreline Inventory and Characterization Report* (ESA, 2011) and the findings of the following reports: *Salmonid Habitat Limiting Factors Analysis: Snohomish River Watershed, WRIA 7* (Haring, 2002); *Stream Habitat Assessment for the City of Duvall* (Herrera Environmental Consultants, 2006); *Fish Restoration Plan for the City of Duvall* (Herrera Environmental Consultants, 2002); and *Landscape Analysis for Critical Areas Ordinance Update* (Parametrix, 2005).

Regional and Watershed Overview

The City of Duvall is situated in the lower Snoqualmie River Watershed in King County on the east side of the Snoqualmie River at river mile (RM) 9. From the mouth of the river to Snoqualmie Falls (RM 40.3), the main stem is a meandering, partially confined, low gradient river (Haring, 2002). Upstream of the falls, which is a barrier to anadromous fish, the stream gradient is much greater. The Snoqualmie River originates in the forested hills of the Cascade Mountain Range, flows for approximately 50 miles and is fed by several tributaries including the South, Middle, and North Forks of the Snoqualmie above the falls, and Tokul Creek, Raging River, Patterson Creek, Griffin Creek, Harris Creek, Tolt River, Tucker Creek, and Cherry Creek below the falls.

Immediately downstream (north) of Duvall, Cherry Creek drains to the mainstem from the east. Cherry Creek is the lowest significant tributary of the Snoqualmie River, and the only significant tributary that drains areas of the City. The Cherry Creek system provides significant Chinook spawning and juvenile rearing habitat within the lower Snoqualmie Watershed. The mainstem of Cherry Creek never passes into the City or UGA; non-shoreline tributaries to Cherry Creek drain the northeastern portion of the City.North of the City of Duvall, the Snoqualmie River flows through valley bottom, agricultural lands for approximately nine miles before joining the Skykomish River; downstream of the convergence, the rivers together are named the Snohomish River. The Snohomish River drains to Puget Sound at Everett. These three rivers—Snohomish, Skykomish, and Snoqualmie—and their tributaries together drain a watershed (Water Resource Inventory Area (WRIA) 7) of 1,856 square miles located in both Snohomish and King Counties (Snohomish County, 2006).

Existing Shoreline Ecological Functions in the City of Duvall

Shoreline habitat within the City of Duvall includes the east bank (or right bank) of the Snoqualmie River, floodplain wetlands, as well as Coe-Clemens Creek and Thayer Creek. The Cherry Creek drainages and Rasmussen Lake are not included in the shoreline habitat analysis, but they are discussed in later sections that discuss watershed restoration projects. Existing shoreline ecological functions for the City are summarized as follows:

- Riparian cover along the Snoqualmie River and tributary streams stabilizes banks, filters out pollutants, lowers water temperature due to shading, provides a source for woody

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debris that benefits fish habitat. Riparian vegetation along the Snoqualmie in Duvall has been described as in "better condition" than reaches upstream and downstream, however is also detailed as degraded (Solomon and Boles, 2002). Forested riparian vegetation varies along the City's shoreline, from non-existent to approximately 100 feet in width.

- The entire Duvall floodplain area provides water storage during overbank flood events, dampening downstream flooding effects.
- Permeable soils in the floodplain and in riparian areas provide infiltration and ground water recharge.
- Groundwater that moves through the Duvall hillside provides a source of hydrology for wetlands mapped at lower elevations which feeds into the larger network of the Snoqualmie River watershed.

Impairment of Shoreline Ecological Functions

An examination of impaired shoreline functions warrants a brief look at the historical conditions of Snoqualmie River from a watershed and reach perspective. Prior to European settlement, large, permanent Native American winter villages were located along the Snoqualmie and Snohomish Rivers where people thrived by fishing for salmon, hunting mammals over land, and gathering native fruits, vegetables, and berries (City of Duvall, 2006). Historical records indicate that the main stem river from RM 2 to 12 (including what is now Duvall) was a large scrub-shrub wetland that covered the valley floor and absorbed up to eight feet of flood waters for many months of the year (Haring, 2002). Another large wetland was located along the main stem between Duvall and Carnation. These wetlands were once important rearing habitats for juvenile salmon (Haring, 2002).

Beginning in the 1870s, when the first Euro-Americans settled in the Duvall vicinity, the Snoqualmie River Valley gradually transformed from vast forest land and scrub-shrub land to agricultural fields and, more recently, to expanding suburban growth from the Seattle urban area. Native vegetation was cleared, wetlands were diked and drained to create pastures and cropland; and the Snoqualmie River banks were hardened. Shoreline hardening and bank simplification was in most instances informal, likely completed by agricultural property owners, as well as documented placement of automobiles and other hardening structures along the banks of the river.

Agricultural activities remain a significant regional economy and floodplain-wide land use today, with cattle and dairy operations, produce and crop farms, and greenhouse operations extending up and down the valley. However, residential housing and associated service businesses have come to characterize Duvall and other urbanized areas of the watershed.

Table 2-1 summarizes impairments to the ecological functions of the shoreline habitat in the city caused by human activities. As indicated in the second column of the table, some of these changes are a result of urbanization across the entire watershed, while others can be linked more closely to local changes within the shoreline planning area.

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Table 2-1. Summary of Shoreline Ecological Processes and Impairments – City of Duvall

Ecosystem Process	Causes of Impairment to Ecosystem Process
Hydrology	Diking, draining, and bank armoring has reduced channel complexity, decreased floodplain connectivity and caused higher flow velocity and water depths. Snoqualmie River is incised through Duvall and banks are actively eroding. Increased impervious surfaces in developed areas have increased surface runoff and sedimentation. In-stream gravel mining upstream of Duvall and other upstream basin development may have caused incision of the riverbed.
Water Quality	Loss of riparian canopy and impoundments contribute to elevated water temperatures in tributary streams (Coe-Clemons Creek and Thayer Creek). Changes in land use have depleted forest resources and increased input of pollutants to the river, including metals (roadway runoff) and potentially phenols and other pollutants. Fecal coliform and excess nutrients in runoff from agricultural and residential areas are likely due to livestock and possibly septic system sources outside of the City.
Biological Resources	Construction of revetments and the railroad corridor has disconnected the Snoqualmie River from its floodplain and reduced off-channel habitat. (These changes also impair hydrologic functions) Filling and draining of wetlands has reduced fish refugia as well as habitat for amphibian and terrestrial species associated with the river. Channelization, undersized culverts, lack of riparian vegetation and LWD degrade fish habitat in Coe Clemens and Thayer Creeks.
Sediment Generation and Transport	Disconnection of river from its floodplain and some associated wetlands has altered sediment supply and transport. Changes in land use have increased input of sediment to the river through tributary systems.

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CHAPTER 3. EXISTING RESTORATION PROJECTS AND PROGRAMS

This chapter describes recent and ongoing projects and programs, undertaken by the City and other entities, to protect and restore aquatic resources in the City's Snoqualmie River shoreline area, as well as within the Coe-Clemons, Thayer, and Cherry Valley watersheds.

City of Duvall

Stormwater Management

The City manages the conveyance and treatment of stormwater runoff according to the 1997 City of Duvall Stormwater Management Plan and subsequent updates. New residential and commercial development and redevelopment follows the standards of the adopted stormwater regulations. Stormwater improvements planned for 2011 to 2016 are outlined in the City's Capital Facilities Element (2010), which is a 6-year, comprehensive capital improvement plan. Coe-Clemens Creek from 3rd Street to Main Street is targeted to receive $300,000 in local funds for stormwater improvements.

The City received a Phase II municipal stormwater permit in 2007 under the National Pollutant Discharge Elimination System (NPDES) program administered by Ecology in conjunction with the U.S. Environmental Protection Agency. The City complies with the education, maintenance, mapping, and monitoring elements of the NPDES Phase II permit. Additionally, the City incorporates operation and maintenance measures such as street sweeping, catch basin and pipeline cleaning, detention pond and tank cleaning, and emergency spill response to benefit the water quality of downstream receiving waters. Details of the NPDES permit and permit compliance are summarized in the City's NPDES Annual Report which can be found at the City's website or City Hall.

Coe-Clemens Creek and Wetlands Restoration

The City is restoring lower Coe-Clemens Creek and associated wetlands in a multi-phased, long-term approach. The first phase involved planting approximately 200 lineal feet of native vegetation in the Coe-Clemons wetland complex and 600 lineal feet of native vegetation along Coe-Clemons Creek. Two beaver deceiver devices were installed to discourage beaver dam construction that may impede fish migration in the stream. The upstream end of the devices were submerged and protected from beaver blockage by wire fencing. The next phase of this project are in need of funding; restoration components under consideration for the next phases include enhancing 165 feet of stream channel upstream of the Snoqualmie Valley Trail, installing large wood structures, preparing a sediment budget survey, and acquiring land.

In 2009, the City of Duvall (utilizing a Snoqualmie Watershed Forum-King Conservation District grant) planted a half acre of wetland and stream buffer along Coe Clemmons Creek in Depot Park. The project also showcased interpretive signage and a pervious concrete walkway.

Thayer Creek Culvert Removal

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In 2003 and 2004, the City removed two Thayer Creek culverts within the Snoqualmie floodplain, restoring the channel and surrounding riparian vegetation and replacing the culverts with precast concrete bridge spans. The one lane bridges maintained essential maintenance access to McCormick Park and City utility facilities, while improving fish passage through the lower portions of the stream. The project was completed primarily with King Conservation District (KCD) funds.

Invasive Plant Removal

The City received a minor grant ($4799) in 2010 from the Snoqualmie Watershed Forum for knotweed removal along the Snoqualmie River and in the floodplain. The City has utilized grant funding for implementing knotweed removal on publically owned lands, and has been coordinating and providing outreach to private property owners to extend control efforts.

Snoqualmie Watershed Forum

The Snoqualmie Watershed Forum is a partnership between King County, the Snoqualmie Tribe, and the cities of Duvall, Carnation, North Bend and Snoqualmie. These partners have entered into an agreement to work together on watershed recovery issues. Members include elected officials from each of the six jurisdictions, three citizen representatives, a non-profit representative and a KCD representative. The Forum provides a mechanism for coordinating and implementing water resource and habitat projects in the Snoqualmie and South Fork Skykomish Watersheds. In collaboration with KCD, Forum provides nearly $700,000 annually in conservation grants to habitat restoration, acquisition, stewardship and education projects in the Snoqualmie and South Fork Watersheds. The Snoqualmie Watershed Forum has been an active partner in the Snohomish Basin (WRIA 7) Salmon Recovery Forum since 1998 and was a core contributor to the Snohomish Basin Salmon Conservation Plan.

Several restoration projects for the Snoqualmie Watershed are outlined in *Snoqualmie 2015: Building for Salmon Recovery and Watershed Health* (King County, 2006), a 10-year visioning document for protecting and restoring natural resources that benefit salmon populations, including floodplain recovery and reconnecting off-channel habitat. The report provides descriptions, maps, status, budget and contact information for 41 restoration projects and 10 habitat protection projects in the Snoqualmie River Watershed. One of the identified restoration projects in the report is the Coe-Clemens Creek and Wetland Restoration project described above under the list of City efforts. Two other restoration projects in the Snoqualmie Watershed are noted, upstream of Duvall: floodplain restoration efforts along the lower Tolt River, immediately upstream of the confluence with the Snoqualmie, and at the Chinook Bend Natural Area, a 59-acre site immediately downstream of the Carnation Farm Road Bridge. .

Puget Sound Salmon Recovery

The City of Duvall is one of 44 jurisdictions participating in the Puget Sound Salmon Recovery Plan (Shared Strategy for Puget Sound, 2005). The plan provides regional strategies to address in-stream flow, water quality, forest management and other issues that affect salmon recovery across multiple watersheds. While the plan does not identify site-specific restoration actions

within the City of Duvall, restoration actions in the shoreline management area and surrounding areas have indirect benefits to salmon habitat in the Puget Sound basin.

Non-profit Organizations and Agricultural Landowner Partnerships

A number of non-profit organizations are active in restoration activities and public education in the vicinity of Duvall and in the greater Snoqualmie Watershed. **Stewardship Partners** work with agricultural landowners throughout the lower Snoqualmie Valley to implement habitat enhancement projects such as invasive species removal, native plant installation and maintenance, fish passage improvements, and wetland and riparian restoration. One of their projects partnered with the Snoqualmie Watershed Forum and HerbCo Farms, involving removal of Japanese knotweed and Himalayan blackberry on the west bank of the Snoqualmie River across from the City. Efforts extended along Tuck Creek, and included voluntary riparian plantings. Another local Stewardship Partners project is with Cherry Valley Dairy (agricultural landowner) and involves removing fish barriers on Rasmussen Creek and planting native vegetation along 1,200 feet of stream bank. This project is located at the north end of the City and is also being completed in partnership with the Washington Department of Fish and Wildlife (WDFW).

The **Wild Fish Conservancy** has completed stream habitat enhancement projects on Weiss Creek between Duvall and Carnation. Wild Fish Conservancy has completed extensive water quality and fish monitoring projects in Cherry Valley on the north boundary of Duvall. They are also planning restoration projects including: the Cherry Creek Relict Channel, Waterwheel Creek floodplain restoration, and Upper Waterwheel Creek stream restoration projects. The conservancy conducts research and monitoring projects in rivers, on lakes, and in near-shore marine habitats throughout the Pacific Northwest.

Sound Salmon Solutions (formerly the Stilly Snohomish Fisheries Enhancement Task Force) worked with the City of Duvall to re-establish native riparian vegetation, provide education on public land, and lead community-based habitat restoration. Community and student volunteers planted thousands of native trees and shrubs on 12 acres at McCormick Park, primarily within a 200 foot riparian zone along the Snoqualmie. Planting efforts extended throughout the majority of the riparian corridor within McCormick Park; however flood flows in late 2009 damaged and killed a significant portion of the installed vegetation. Funding for this project came from King County Conservation District, US Fish and Wildlife Service, and Hong Kong Shanghai Banking Corporation.

Restoration Logistics, a private restoration contractor, is currently implementing an invasive weed control and riparian restoration along Rasmussen Creek. The project encompasses private land and the City's 4th Ave. Open Space.

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CHAPTER 4. RESTORATION GOALS, PRIORITIES, PROJECTS, AND PROGRAMS

This chapter describes the shoreline restoration goals, objectives, and priorities for Duvall. These represent a combination of issues identified in: *Snohomish River Basin Salmon Conservation Plan* (Snohomish Basin Salmon Recovery Forum, 2005); *Salmonid Habitat Limiting Factors Analysis: Snohomish River Watershed, WRIA 7* (Haring, 2002); *Fish Restoration Plan for the City of Duvall* (Herrera Environmental Consultants, 2002); *Landscape Analysis for Critical Areas Ordinance Update* (Parametrix, 2005); and *McCormick Park Reconnaissance / Opportunities and Constraints Assessment* (ESA Adolfson, 2009), plus other degraded shoreline functions identified in the Inventory and Characterization Report.

By necessity, some of the goals and objectives extend beyond the City's shoreline jurisdiction to the entire Thayer, Coe-Clemons, and Cherry Valley subbasins draining the City. For example, restoration of hydrologic functions in lower reaches of Co-Clemons Creek will require continued efforts to address stormwater and recharge issues across the entirety of the stream basin. Likewise, Cherry Creek and many of the tributaries draining the northern portions of the City, provide important Chinook spawning and / or rearing habitat.

For each goal listed below, this plan provides potential restoration sites, projects, and/or programs that the City can use to achieve the objectives. Prioritization is provided for each objective. Prioritization is rated as 'high', 'medium', 'or 'low' based on emphasis within existing watershed- and city- focused restoration planning documents as well as best professional judgment. Potential restoration focus areas for each goal are depicted on Maps 9a and 9b in the Inventory and Characterization – Appendix A, Shoreline Map Folio.

High priority projects will typically:

a) Address multiple ecosystem processes and/or functions (e.g., habitat and water quality process);

b) Have substantial opportunity for multiple funding sources; and / or

c) Be included and highly prioritized in WRIA and City restoration plans.

Medium priority projects will typically:

a) Address limited ecosystem processes and/or functions;

b) Be eligible for multiple funding sources; and / or

c) Be included and moderately prioritized in WRIA and City restoration plans.

Low priority projects will typically:

a) Benefit single ecosystem functions;

b) Not be eligible for multiple funding sources due to minimal prioritization in WRIA and City restoration planning reports; and / or

c) Require property acquisition or be outside of the City's control (e.g., UGA).

In addition to prioritization, feasibility is identified for each restoration objective. Feasibility (rated as 'straightforward', 'moderately complex', and 'challenging') provides an assessment of the scale and potential length of time required to implement restoration opportunities.

- **Straightforward** restoration projects include those that could be implemented by local landowners and volunteers and could occur with minimal need for planning and agency (other than City) permitting. These projects could be implemented in the near term, depending on grant cycles and coordination with volunteer and community organizations.

- **Moderately complex** restoration projects include those objectives with high to moderate prioritization, however would require significant resources for planning, permitting and implementation.

- **Challenging** restoration projects could be those that require coordination with other jurisdictions or that cover larger land areas. These projects would be very difficult to implement and would require significant planning and permitting.

As detailed restoration assessment and prioritization occurs consistent with this plan, the initial assessment of timelines should be re-focused to create detailed schedules and benchmarks for those actions and areas with the greatest restoration potential. Partner organizations that can provide technical assistance or funding for restoration projects are discussed in the next chapter.

Goal 1: Protect, maintain, and enhance the existing shoreline and riparian functions along the Snoqualmie River

Objective 1-B: Restore shoreline bank conditions on the Snoqualmie River to enhance edge conditions.

Priority: High

Potential Restoration Sites, Projects, or Programs: Improving edge condition along the Snoqualmie River is identified as a high priority within the Snohomish Basin Salmon Conservation Plan (2005). Shoreline hardening and bank simplification is common along the City's Snoqualmie River shoreline. Existing bank protection consists primarily of rip rap and is focused along the Taylor's Landing Park and Riverside Village shorelines; minimal large woody structure is present along the shoreline throughout the City. One priority project could include removal of any unnecessary rip rap along the Snoqualmie River, such as the revetment located downstream of the Taylor's Landing boat ramp. Shoreline restoration projects could be completed near tributary stream mouths and during redevelopment of areas with existing hardened shorelines, and could incorporate bioengineering techniques to provide channel edge

Feasibility: Moderately complex

Objective 1-B: Remove invasive plants and install native riparian trees, shrubs, and groundcover.

Priority: Moderate (invasive plant control and removal) / High (riparian restoration)

Potential Restoration Sites, Projects, or Programs: Increase of riparian forest cover is identified as a high priority within the Snohomish Basin Salmon Conservation Plan (2005). The southern shoreline between Thayer Creek and the unnamed channel has been identified as lacking riparian cover (ESA, 2011). This area would benefit from dense native plantings of shrubs and trees to increase shading and a future source of LWD. Other locations that would benefit from riparian plantings include open space areas at Taylor's Landing, adjacent to the river within the northern portion of McCormick Park, and along the Snoqualmie Valley Trail corridor.

The shoreline throughout Duvall has patches of non-native invasive weeds such as Himalayan blackberry, Japanese knotweed (just upstream of NE Woodinville-Duvall Road as well as other locations), and reed canarygrass. For restoration efforts entirely focused on control and removal of invasive plants, removal of Japanese knotweed should be prioritized over the more established invaders (blackberry and reed canarygrass). Watershed-wide knotweed control efforts place higher priority on upstream areas (well south of Duvall); however, City efforts to control the spread of knotweed within the tributary streams will help control the prevalence of knotweed throughout the Duvall landscape. Native plant installation and establishment of a native canopy and understory should be the primary approach to suppress invasive species growth and prevent recolonization.

Feasibility: Straightforward

Goal 2: Enhance existing and evaluate creation of new off-channel habitat along the main stem river through Duvall for the benefit of salmon recovery.

Objective 2-A: Enhance fish habitat in Coe-Clemens Creek.

Priority: High

Potential Restoration Sites, Projects, or Programs: The City has begun restoration efforts in Coe-Clemens Creek to improve water quality and biological functions at the Coe-Clemens wetland complex. Herrera (2002) has identified several restoration options along Coe-Clemens Creek including two options for the lowest reach (Segment 1); the ambitious option involves significant re-grading to create channel sinuosity, stabilize the stream banks, and improve riparian habitat (see Figure 2 for existing Coe-Clemens channel locations). The lowest reaches of Coe-Clemens diverge into multiple channels, two of which (A and B on Figure 2) are currently the primary active pathways. Any channel creation or re-grading efforts within lower Coe-Clemens Creek would require significant additional planning and analysis to evaluate implications for associated wetlands and channels.

Feasibility: Moderately complex to challenging

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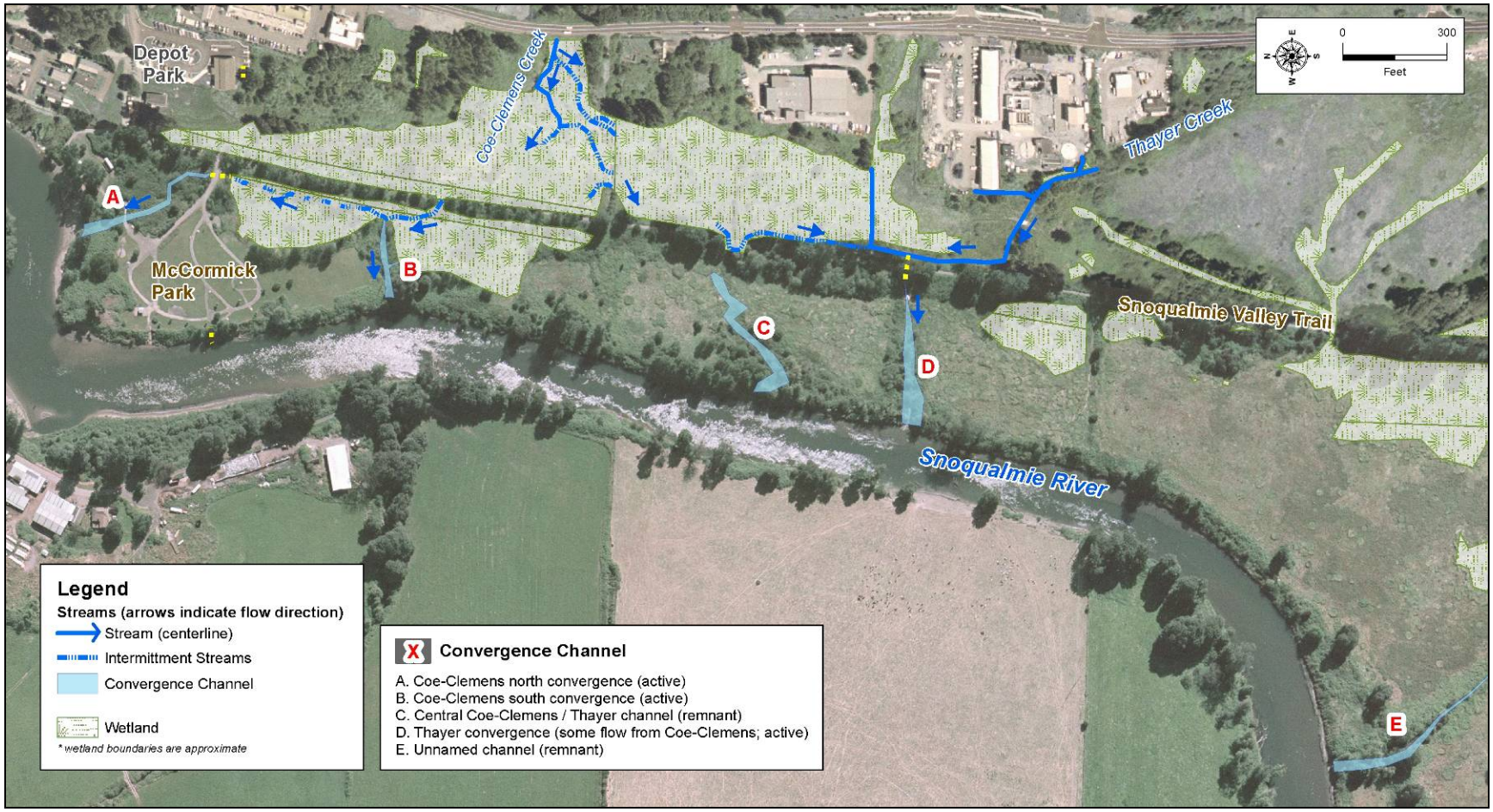
Figure 2. Convergence of tributary streams and remnant channels along the City of Duvall's Snoqualmie River shoreline.



Objective 2-B: Enhance fish habitat in Thayer Creek downstream of State Route 202 in a phased approach, beginning with the lowest reach first.

Priority: High

Potential Restoration Sites, Projects, or Programs: Herrera (2002) identified specific enhancement and restoration activities for three segments of Thayer Creek. Restoration for the lowest reach of Thayer Creek (identified asSegment 1) could enhance and/or create 440 linear feet of stream channel, remove two fish barriers, and enhance 2 acres of riparian habitat in the floodplain through native plantings. Restoring the natural channel configuration, floodplain function, and riparian function of lower Thayer Creek is also identified as a priority by Haring (2002).

Feasibility: Moderately complex

Objective 2-C: Evaluate the central Thayer / Coe-Clemens channel and the unnamed channel south of Thayer Creek for fish habitat enhancement opportunities.

Priority: Medium

Potential Restoration Sites, Projects, or Programs: The central Thayer / Coe-Clemens channel (currently without flow; 'Channel C' on Figure 2) and the unnamed channel south of Thayer (identified by Haring 2002 as Unnamed 07.0267Z; 'Unnamed Channel' on Figure 2), may provide some off-channel fish habitat opportunities. The central channel, more sinuous than any of the active tributary convergence channels within the City, appears to be a remnant channel from Coe-Clemens and/or Thayer Creeks. Evaluation of re-activating or enhancing the channel to improve fish habitat should be considered for both remnant channels. Higher restoration priority should likely be focused on the central Thayer / Coe-Clemens channel. Benefits from enhancing the unnamed southern channel, however, might not out-weigh the cost of design and implementation compared to other potential projects on Thayer Creek and Coe-Clemens Creek.

Feasibility: Moderately complex to challenging

Objective 2-D: Evaluate creation of new off-channel habitat in the Snoqualmie River floodplain.

Priority: Low

Potential Restoration Sites, Projects, or Programs: There are several potential opportunities for off-channel habitat in the open space area in southern McCormick Park due to the large amount of publically owned space; however, creating off-channel habitat would require significant design and construction effort. Additionally, feasibility-level design would be necessary and would involve in-depth hydrological analysis.

Feasibility: Challenging

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Goal 3: Improve and maintain water quality and hydrology functions in tributary streams

Objective 3-A: Protect existing riparian trees and shrubs and promote additional plantings along Thayer Creek, Coe-Clemens Creek, and Cherry Creeks A and B.

Priority: Medium

Potential Restoration Sites, Projects, or Programs: Several reaches in Thayer Creek (Segments 1 to 6), Coe-Clemens Creek (Segments 1, 3, and 6), and Cherry Creek A (Segments 1 to 5) and B (Segments 1 and 2) have limited or no riparian forest cover (Parametrix, 2005). Protect and restore vegetation by enforcing critical areas regulations and implementing protection incentives, as well as implementing riparian restoration projects.

Feasibility: Straightforward

Objective 3-B: Reduce sediment loading, erosion, and stormwater impacts to Thayer Creek, Coe-Clemens Creek, and Cherry Creeks A and B.

Priority: High

Potential Restoration Sites, Projects, or Programs: Restoration sites or projects to meet this objective would be located in the Thayer Creek, Coe-Clemens Creek, and Cherry Creek sub-basins where development or redevelopment is proposed. Programs to use to meet this objective include the City's stormwater management plan and development standards that promote the use of low impact development (LID) techniques. LID strategies should focus on retrofitting existing residential stormwater systems that discharge to tributary streams.

Feasibility: Straightforward to moderately complex

Objective 3-C: Educate residents and businesses in the watershed about methods to reduce erosion and use of chemicals (e.g., fertilizers, pesticides).

Priority: Medium-Low

Potential Restoration Sites, Projects, or Programs: Provide a link on the City's web page to resources on low impact development practices and non-chemical maintenance alternatives. Host a workshop or series of workshops on these practices for local residents.

Feasibility: Straightforward

Goal 4: Address shoreline erosion issues where adjacent to active park and public infrastructure areas while restoring shoreline and riparian conditions.

Objective 4-A: Stabilize banks along the Snoqualmie River within the northern portion of McCormick Park and at the Taylor's Landing boat ramp.

Priority: Medium (High with consideration of public shoreline access / public recreation)

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Potential Restoration Sites, Projects, or Programs: Stabilize the shoreline within McCormick Park (the west facing shoreline) that is actively failing and establish a vegetated buffer extending back from the bank. Bank protection along this reach could include grading back the banks and incorporating bioengineering techniques along with native plant installation in the riparian zone. Another location for bank stabilization is at the boat ramp within Taylor's Landing Park, where active erosion is occurring. The Snohomish River Basin Salmon Recovery Plan (2005) recommends that new bank stabilization only be allowed with geotechnical and/or hydrologic analysis when needed to provide protection from certain existing uses under imminent threat from shoreline erosion. The Plan goes on to suggest, "bioengineering techniques…[that] includes the use of vegetation and large woody debris, creating vegetated benches." Any stabilization plan should include elements to control public access, including use of a split rail fence, native vegetation, and planned shoreline access points / view areas.

Feasibility: Moderately complex

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CHAPTER 5. POLICY DEVELOPMENT

One mechanism for promoting the implementation of habitat protection and enhancement efforts is through the adoption of comprehensive plan goals that target multiple benefits. The following land use and natural resource management policies should be adopted into the Shoreline Master Program, and incorporated into the City Comprehensive Plan, in order to contribute to the maintenance, protection, and restoration of shoreline health.

Restoration Policies:

1. The City should continue to encourage and facilitate cooperative restoration and enhancement programs between local, state and federal public agencies, tribes, non-profit organizations, and landowners.

2. The City should continue to implement approved restoration plans to facilitate the restoration of impaired ecological functions through a variety of techniques, including seeking restoration partners, incentives for projects that incorporate restoration components, and securing available restoration grants and funding.

3. The City should formalize and expand a public outreach and education program for property owners adjacent to the shoreline to promote shoreline-friendly practices.

Water Quality Focused Policies

4. The City should continue to manage stormwater consistent with DMC 9.06, the City's stormwater management and erosion control regulations and the Comprehensive Plan.

5. The City should promote the use of low impact development techniques through incentives, permit requirements, and adopted City plans and policies.

6. The City should continue to require effective erosion/sedimentation controls for construction in shoreline areas.

7. The City should discourage the use of fertilizers and herbicides, both within the shoreline and throughout the City.

Shoreline Vegetation Conservation

8. The City should require that all new shoreline development and/or uses retain existing native shoreline buffer vegetation, with the overall purpose of protecting and maintaining functions and processes. .

9. The City should ensure that vegetation conservation and management in shoreline areas include removal of non-native invasive plant species and noxious weeds as needed to facilitate establishment of stable native plant communities.

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10. The City should require that large woody debris be left in stream corridors to enhance wildlife habitat and shoreline ecological functions, except where it threatens personal safety or public infrastructure such as bridge pilings, roads or flood control structures.

11. The City should ensure that native shoreline vegetation be integrated with bioengineering to stabilize streambanks and minimize erosion.

12. The City should require that vegetation clearing be limited to the minimum necessary to accommodate shoreline uses/development.

Environmental / Sensitive Areas Protection

13. The City should preserve, enhance, and/or protect critical areas in shoreline jurisdiction for their ecological functions and values, as well as their aesthetic, scenic, and educational qualities.

14. The City should continue to require that development provide a level of protection to critical areas within the shoreline that achieves no net loss of ecological functions, with project specific and cumulative impacts considered in assessing the potential for net loss of ecological functions.

15. The City's implementation of the SMP, including the integrated Sensitive Area Code, should ensure that shoreline ecological functions are maintained or improved in the long term.

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CHAPTER 6. FUNDING SOURCES AND IMPLEMENTATION STRATEGIES

Potential Funding Sources

Funding opportunities for restoration projects in the City of Duvall include local and state grants, and potentially federal funds that are administered through state or local programs. For potential projects in the City and surrounding area, the greatest likelihood of obtaining funding would result from continued partnerships with the King Conservation District, the Snoqualmie Watershed Forum, and non-profit organizations such as the Sound Salmon Solutions (formerly known as the Stilly Snohomish Fisheries Enhancement Task Force). Potential grant sources are described below.

Snoqualmie Watershed Forum / King Conservation District

KCD Opportunity Fund and Regular Round
Attn: Perry Falcone
KC DNRP WLRD
201 S. Jackson St., Ste. 600
Seattle, WA 98104
perry.falcone@kingcounty.gov

The King Conservation District in partnership with the Snoqualmie Watershed Forum provides two grant programs. A small grant program, called the "Opportunity Fund" provides small grants to private and public landowners of up to $30,000 for projects that improve habitat conditions in the tributaries and headwaters of the Snoqualmie Watershed. Examples of eligible projects include: removing fish barriers, planting native trees and shrubs along streams and in wetlands, and removing invasive weeds. Eligible recipients are private landowners, community groups, non-profit organizations, and government agencies. The larger "Regular Round" grant program provides grants that have reached up to $250,000 in the past for individual projects. Approximately $500,000 is available each year to non-profits and government agencies. The focus of this program is on undertaking larger salmon recovery projects throughout the Snoqualmie Watershed.

Washington State Department of Ecology
P.O. Box 47600
Olympia, Washington 98504-7600
360-407-6300
http://www.ecy.wa.gov/fap.html

Ecology's Water Quality Program administers four major funding programs that provide low-interest loans and grants for projects that protect and improve water quality in Washington State. Ecology acts in partnership with state agencies, local governments, and Native American nations by providing financial and administrative support for their water quality efforts. As much as possible, Ecology manages the four programs as one; there is one funding cycle, application form, and offer list. The four programs are: The Centennial Clean Water Program, The Water

Pollution Control Revolving Fund, The Clean Water Section 319 Program, and Stormwater Retrofit and Low Impact Development Grant Program. Local governments, Native American nations, conservation districts, and non-profit groups are eligible for funding. Grants and loans are available for point source and nonpoint source projects, for example, treatment facilities, stormwater control and treatment, stream restoration and protection, and on-site septic repair and replacement.

Environmental Protection Agency
Region 10: Pacific Northwest
Grants Administration Unit
Bob Phillips
phillips.bob@epa.gov
(206) 553-6367
http://www.epa.gov/epahome/grants.htm

The Environmental Protection Agency funds a variety of projects that aim to safeguard the natural environment and protect human health. Potential opportunities specific to watershed protection and restoration are listed below.

The Clean Water State Revolving Fund Program: Under this program, EPA provides grants or "seed money" to all 50 states plus Puerto Rico to capitalize state loan funds. The states, in turn, make loans to communities, individuals, and others for high-priority water-quality activities. Types of projects funded include protecting and restoring wetlands and riparian buffers.

Nonpoint Source Implementation Grant (319) Program: Clean Water Act Section 319(h) funds are provided only to designated state and tribal agencies to implement their approved nonpoint source management programs. State and tribal nonpoint source programs have a variety of components such as technical assistance, financial assistance, education, training, demonstration projects, and technology transfer. Each year, EPA awards Section 319(h) funds to states in accordance with an allocation formula that EPA has developed.

Wetland Protection, Restoration, and Stewardship Discretionary Funding: This program provides support for studies and activities related to implementation of Section 404 of the Clean Water Act for both wetlands and sediment management. Projects can support regulatory, planning, restoration or outreach issues. Typical grant awards range from $5,000 to $20,000.

Environmental Education Grants: This program funds a broad variety of environmental education, training, and outreach activities. Grant awards of up to $50,000 are provided to universities, state, local, and tribal education agencies, and nonprofit organizations.

National Fish and Wildlife Foundation
1120 Connecticut Avenue, NW, #900
Washington, DC 20036
Kathleen Pickering 202-857-0166
http://www.nfwf.org/AM/Template.cfm?Section=GrantPrograms

Non-profit organizations, local, state or federal government agencies are eligible to apply for funds for community-based projects that improve and restore native salmon habitat, remove

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barriers to fish passage, or for the acquisition of land/ conservation easements on private lands where the habitat is critical to salmon species. The National Fish and Wildlife Foundation's primary grant program, The Five-Star Restoration Program, provides modest financial assistance on a competitive basis to support community-based wetland, riparian and coastal habitat restoration projects that build diverse partnerships and foster local natural resource stewardship through education, outreach and training activities.

Trout Unlimited
Embrace-A-Stream
406-543-1192
http://www.tu.org/conservation/watershed-restoration-home-rivers-initiative/embrace-a-stream

Embrace-A-Stream (EAS) is the flagship grant program for funding Trout Unlimited's conservation efforts to conserve, protect, and restore coldwater fisheries and their watersheds. Trout Unlimited annually raises money from TU members, corporate and agency partners, and foundations to distribute as small grants to local TU projects. The goal of EAS is to conserve coldwater fisheries through innovative grassroots conservation projects. Successful projects are based on sound science, benefit the resource, strengthen the local TU chapter and council, and help build the constituency for protecting trout and salmon. TU volunteers are actively involved in project work and are expected to provide matching funds. An Embrace-A-Stream Committee comprised of TU volunteer representatives and scientific advisors evaluates all proposed projects.

Washington State Recreation and Conservation Office (RCO)
1111 Washington St. SE
PO Box 40917
Olympia, WA 98504
360-902-3000
http://www.rco.wa.gov/grants/index.shtml
info@rco.wa.gov

The RCO (formerly Interagency for Outdoor Recreation [IAC]) supports the work of several organizations such as the *Recreation and Conservation Funding Board* and the *Salmon Recovery Funding Board*.

The Recreation and Conservation Funding Board provides funds for the acquisition and development of recreation and conservation lands. The board distributes funds through eight grant programs, for instance:

Land and Water Conservation Fund: This program provides funding to preserve and develop outdoor recreation resources, such as parks, trails, and wildlife lands.

Washington Wildlife Recreation Program: The Washington Wildlife Recreation Program Account involves support for critical habitat, natural areas, urban wildlife, local parks, state parks, trails, and water access categories.

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Aquatic Lands Enhancement Account: This program funds acquisition, restoration, and public access projects that benefit wildlife habitat and aquatic conservation in waterfront areas.

The Recreation and Conservation Funding Board's grant process is open and competitive. Applications are submitted annually for some grant programs and every two years for others. The grant applications are reviewed by board staff and citizen committees. Letters of intent are usually due March 1. Applications are usually due May 1.

The Salmon Recovery Funding Board (SRFB) supports salmon recovery by funding habitat protection and restoration projects. It also supports related programs and activities that produce sustainable and measurable benefits for fish and their habitat. *Salmon Recovery Grants* can be used for buying salmon habitat, restoring areas along streams and other waterways, replacing barriers to fish passage, and creating fish habitat. The grants from SRFB range from $10,000 to nearly $900,000. They have been awarded to organizations in 28 counties for work ranging from planting trees along streams to cool the water for salmon, to replacing culverts that prevent salmon from migrating to spawning habitat, to restoring entire floodplains. SRFB, along with Puget Sound Acquistion and Restoration (PSAR), funds are typically distributed by watershed and in this case through the Snohomish Basin Salmon Recovery Forum (approximately $565,000 will be awarded in 2011).

Depending on the grant program, eligible applicants may include municipal subdivisions (cities, towns, counties, and special districts such as port, conservation, utility, park and recreation, and school), tribal governments, state agencies, nonprofit organizations, regional fisheries enhancement groups, and private landowners. To be considered for funding, acquisition projects must be operated and maintained in perpetuity for the purposes for which funding is sought. Restoration projects must be operated and maintained for ten years after construction is completed. All projects require lead entity approval and must address the goals and actions defined in the lead entity strategy or regional recovery plan.

Grants are awarded by the Salmon Recovery Funding Board based on a public, competitive process that weighs the merits of proposed projects against established program criteria.

Sources of Technical and Coordination Assistance

Snoqualmie Watershed Forum

The Snoqualmie Watershed Forum is a partnership between the Snoqualmie Tribe, King County, and the cities of Duvall, Carnation, North Bend and Snoqualmie. Duvall is an active participant in the forum.

According to the Forum webpage, the goal *is to protect and restore the health of the Snoqualmie Watershed in harmony with the cultural and community needs of the Valley*. The Forum implements this goal by providing leadership on key issues, including Snoqualmie restoration, by implementing projects that aid in salmon recovery, protect water quality and address flooding. The City should continue to rely on forum technical and coordinating resources to plan and implement restoration actions within the City. (http://www.govlink.org/watersheds/7/)

King Conservation District

In addition to offering a funding source for City and other Snoqualmie watershed restoration projects, the King Conservation District has several programs – including the Wetland Plant Cooperative and other technical assistance programs – that could provide technical assistance to the City and other groups implementing restoration projects. As well, the KCD provides direct landowner technical assistance like farm planning, riparian restoration, and education. (http://www.kingcd.org/pro_fis.htm)

Sound Salmon Solutions (formerly the Stilly Snohomish Fisheries Enhancement Task Force)

Sound Salmon Solutions worked with the City of Duvall to re-establish native riparian vegetation, provide education on public land, and lead community-based habitat restoration. This organization will also provide technical and project coordination assistance.

Wild Fish Conservancy – Northwest

Wild Fish Conservancy – Northwest is a nonprofit conservation group based in Duvall. Wild Fish Conservancy staff have been active both in the City and in other areas of the Snoqualmie watershed in implementing their mission – to conduct research on wild fish populations and habitats, to advocate for improved land use and fisheries management, and to develop restoration projects.

The City should continue to coordinate with the Wild Fish Conservancy during restoration planning and project implementation efforts. (http://wildfishconservancy.org/)

Cascade Land Conservancy

The Cascade Land Conservancy is a non-profit organization working to conserve land in Pierce, King, Mason, Kittitas, and Snohomish Counties. The Conservancy has led the conservation of more than 150,000 acres over the last decade including approximately 21 properties in Snohomish County. The Conservancy works with landowners using tools such as land purchase or donation, conservation easements, and stewardship endowments to preserve high-quality ecosystems. (http://www.cascadeland.org/)

Puget Sound Partnership

The Puget Sound Partnership is a coalition of citizens, governments, tribes, scientists and businesses working together to restore and protect Puget Sound. While the Partnership's focus is on the marine waters of the Sound, its web page compiles helpful information on topics such as low impact development, rain gardens, erosion control, etc. from both local and national sources. (http://www.psparchives.com/our_work/stormwater/stormwater_resources.htm)

Implementation Strategies

There are several opportunities and constraints to consider in the implementation of restoration projects. The City is fortunate to have a majority of the regulated shoreline area within public ownership, but community support of protecting and enhancing shoreline habitat will contribute

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to the long-term success of the projects. The overall strategy for implementation is to protect existing shoreline habitat, gain public support for policy updates that protect or enhance natural areas, and pursue funding for habitat restoration projects listed identified in

A general sequence of implementation for restoration projects is as follows:

1. Protect existing shoreline and riparian habitat through incentives, regulations, land acquisitions and easements.
2. Conduct public outreach via the NPDES Phase 2 permit to educate residents, businesses, industries, elected officials, policy makers, and planning staff with the aim of reducing or eliminating behaviors that cause or contribute to adverse stormwater impacts.
3. Enhance off-channel habitat in lower Thayer Creek and Coe-Clemens Creek.
4. Enhance shoreline and edge habitat conditions along the Snoqualmie River mainstem.
5. Enhance riparian areas (e.g. riparian plantings and invasive species removal).
6. Address water quality impacts and sources of the impacts in the upper tributary basins.

Some of the challenges to implementing restoration projects include securing funding, designing and permitting successful projects, and understanding the larger watershed influences on local shoreline conditions. These challenges are summarized as follows:

- Scarcity of funding: Designing, carrying out, and monitoring the success of restoration efforts can be an expensive undertaking, particularly at larger (e.g., watershed or reach) scales. In general, funding for restoration is limited and competition for funds extensive.

- Project permitting: Obtaining necessary permits from local, state, and federal regulatory agencies can require substantial time and effort. Although encouraged and allowed by the SMP, complicated restoration projects may take a year or more to permit.

- Scale of issues: Many of the shoreline management issues facing Duvall extend across the entire watershed and beyond the City's boundaries. To a certain extent, complete solutions to these issues are beyond the City's control. However, the Snoqualmie Watershed Forum provides a mechanism for working with other local governments. It will be necessary to engage the public throughout the watershed and in neighboring jurisdictions to address issues such as flooding.

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CHAPTER 7. TIMELINES, BENCHMARKS, AND MEASURING EFFECTIVENESS

In the context of the SMP update, restoration planning is a long-term effort. The SMP guidelines include the general goal that local master programs "include planning elements that, when implemented, serve to improve the overall condition of habitat and resources within the shoreline area" (WAC 173-26-201(c)). The guidelines for restoration planning state that local programs should "…appropriately review the effectiveness of the projects and programs in meeting the overall restoration goals" (WAC 173-26-201(2)(f)).

As a long-range policy plan, it is difficult to establish meaningful timelines and measurable benchmarks in the SMP by which to evaluate the effectiveness of restoration planning or actions. Nonetheless, the legislature has provided an overall timeframe for future amendments to the SMP. In 2003, Substitute Senate Bill 6012 amended the Shoreline Management Act (RCW 90.58.080) to establish an amendment schedule for all jurisdictions in the state. Once the City of Duvall updates its SMP, the City is required to review, and amend if necessary, its SMP once every seven years (RCW 90.58.080(4)). During this review period, the City could document progress toward achieving shoreline restoration goals. The review could include:

- Re-evaluating adopted restoration goals, objectives, and policies;
- Summarizing both planning efforts (including application for and securing grant funds) and on-the-ground actions undertaken in the interim to meet those goals; and
- Revising the SMP restoration planning element to reflect changes in priorities or objectives.

Another mechanism that may serve to establish timelines and benchmarks would be establishment of a shoreline restoration program organized like or integrated with the City's capital improvement program (CIP). Similar to an infrastructure CIP, a shoreline restoration CIP would be evaluated and updated regularly. The shoreline CIP would be focused on site-specific projects and could be funded through grants or a fee-in-lieu program developed as part of the shoreline permitting process. Further, other CIP projects, such as stormwater facility improvements, could be evaluated to determine if their design could advance shoreline restoration goals.

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City of Duvall Shoreline Master Program Update

Public Participation Plan

Prepared for:
City of Duvall

March 2010

Duvall SMP

Reconnecting with the Riverfront.

ESA Adolfson

INTRODUCTION

The City of Duvall is updating its Shoreline Master Program (SMP) to comply with the Washington State Shoreline Management Act (SMA) and adopted state shoreline management guidelines. State law requires all Washington jurisdictions having "shorelines of the state to prepare and implement a Shoreline Master Program". The Snoqualmie River is the only waterbody in the City of Duvall classified as a "shorelines of the state."

A SMP contains goals and policies, development regulations, and permitting procedures for managing shorelines. The SMP is intended to address environmental protection, appropriate shoreline use and development, and public access. The SMP Update is the beginning of a multi-year process to update the City's shoreline plan in a manner that reflects the community's vision of their shoreline.

This Public Participation Plan (PPP) will guide the City of Duvall's SMP project team through the various public involvement activities for the update of the SMP. The PPP is designed to solicit early and continuous feedback from stakeholder groups and community members. As such, the PPP is a dynamic document that may evolve depending on input obtained during the update process.

Updating the City's SMP will require varying levels of public participation and dissemination of project information at different stages in the process. Intensive outreach will coincide with major steps such as preparing the shoreline inventory, analysis and characterization; drafting policies, shoreline designations, and regulations; developing a restoration plan; assessing cumulative impacts; and completing the required SEPA environmental review process. At the conclusion of the update process, all of the draft documents prepared in the earlier steps will be assembled and refined into a Final SMP.

PUBLIC PARTICIPATION GOALS

Washington State's Shoreline Management Act requires local governments to inform the people of the state about the local planning process and invite and encourage participation by citizens and stakeholders who have interest or responsibility related to shorelines. The goal of the PPP is to provide a guide to proactively encourage public participation throughout the SMP Update process.

The City of Duvall recognizes that effective and thorough public participation are critical to a successful SMP that is easy to administer, fits within the framework of the City's goals and community vision, and has broad support. Duvall is committed to seeking input and cooperation from residents, local stakeholders, the City's Public Works Department, neighboring jurisdictions (including Carnation, North Bend, King County and Snohomish County), resource agencies and area Tribes. The City intends to seek and encourage public interest in the update process and this plan identifies effective opportunities for public participation. The City expects to obtain information from Duvall residents about their vision of the future use, preservation, and conservation of the shoreline area. This information will inform the development of SMP goals, policies, and regulations and will compliment, verify, and refine other City planning documents.

ROLES AND RESPONSIBILITIES

The City of Duvall is responsible for the update of the SMP in compliance with the state guidelines (WAC 173-26) as well as terms of the contract for receipt of grant funds from the Washington State Department of Ecology (Ecology; Grant # G100025). This includes conducting and documenting public involvement throughout the SMP Update process, (WAC 173-26-201 (3)(b)(i); WAC 173-26-090 and 100; WAC 173-26-251 (3)(a)),

including communication with state agencies and affected Indian Tribes (WAC 173-26-201 (3)(b)(ii) and (iii); WAC 173-26-100(3); WAC 173-26-251(3)(a)). The primary contact for the City of Duvall is:

Lara Thomas
Planning Manager
City of Duvall Planning Department
PO Box 1300
Duvall, WA 98019
lara.thomas@duvallwa.gov

Ecology must approve the City's updated SMP as required by the State SMA, and as such will provide guidance throughout the process. The primary contact for Ecology is:

Patricia Lambert
Washington State Department of Ecology, NW Regional Office
3190 160th Avenue SE
Bellevue, WA 98008
plam461@ECY.WA.GOV

KEY PARTIES

Building an SMP that addresses the City of Duvall's local conditions will require meaningful collaboration with the City's Public Works Department (since they are responsible for managing City parks and infrastructure in the shoreline area) and focused outreach to the local residents and interested stakeholder groups. Focused outreach for the SMP project will mean:

- Providing **access** to project news and information including, but not limited to: scopes of work, the project schedule, technical documents, and draft policies and regulations;
- **Listening** to stakeholder ideas and concerns and responding appropriately; and
- Giving stakeholders a voice in the process by creating **avenues for input** and forums for **two-way communication**.

Local community groups, elected officials, businesses, and residents care about shoreline policies, uses, and designations. Because issues such as fish and wildlife habitat, water quality, and public access to the shorelines are regional issues, interested parties outside of the City limits will also want to be involved. The following entities have been identified as key stakeholders:

Local Stakeholders

- Shoreline property owners
- Duvall residents
- Duvall Public Works Department
- Duvall Planning Commission
- Duvall City Council

Other Stakeholders Who May Express Interest

Local Jurisdictions

- King County
- Snohomish County
- City of Carnation
- City of North Bend
- City of Monroe
- City of Snoqualmie

Regional Partnerships / Organizations

- Snoqualmie Watershed Forum
- King Conservation District
- Duvall Historical Society

State Agencies

- Dept. of Ecology (DOE)
- Dept. of Fish & Wildlife (WDFW)
- Dept. of Natural Resources (DNR)
- Dept. of Transportation (WSDOT)
- Dept. of Archeology & Historic Preservation (DAHP)
- Dept. of Commerce (WDOC) (formerly CTED)

Indian Tribes

- Tulalip Tribes
- Muckleshoot Tribe
- Snoqualmie Tribe

Federal Agencies

- Army Corps of Engineers
- NOAA Fisheries
- US Fish and Wildlife Service (USFWS)
- FEMA

Environmental Groups

- Stilly-Snohomish Fisheries Enhancement Task Force
- Wild Fish Conservancy
- Audubon
- Futurewise

To be most effective, the level of outreach will vary depending on the phase of the project, the level of information available, and the type of input needed for development of proposed management provisions.

STRATEGIES TO INVOLVE THE PUBLIC

The City plans to use a variety of different tools to inform, engage and involve the public during the update process. Key public participation tools are listed in the table below.

DUVALL SMP UPDATE PUBLIC PARTICIPATION TOOLS

Tool	Description
Database	A mailing and email database will be created and updated throughout the project. The database will include key parties and contacts, and correspondence.
Project Identity	A consistent style and format will be developed for all printed materials and the website to increase the public's recognition of the project – the logo included on the cover of this Plan is a key component of developing a Project Identity, with an overall emphasis to create a positive image for the project and encourage citizen participation.
Advisory Committee Meetings	These meetings provide a forum for in-depth information exchange in an educational environment. This gives stakeholders a meaningful role in steering the project toward success and creates a sense of ownership where committee members feel committed to positive outcomes.
Website	A project website will be established. The website will be regularly updated with new project related materials, news releases, and meeting notices. The website can also be used for on-line surveys and collecting public comments, and will promote transparency because information is open and available to everyone. The City is considering creating a Facebook page to inform the public and solicit comments.
Community-wide forums	Forums enable broad, but personal, access to project staff for questions and answers. This provides opportunities for interactive involvement (e.g., visioning exercises, polling, etc.).
Outreach materials	Outreach materials such as fact sheets, press releases, graphics, and brochures will be developed to support briefings, public meetings, and other events.
Newsletters/ Mailings / Press Releases	Media items will keep the project in the public view and enable the City to convey key messages to a wide audience. Articles included in the community newspaper, or separate mailings, may be mailed prior to public meetings and at key project milestones. The information may also be developed to be used as an e-newsletter and the information will be posted on the project website.

The City will establish an Advisory Committee made up of shoreline residents and representatives from state agencies, Tribes, environmental group(s) active in the Duvall area, adjacent jurisdictions, the City Planning Commission, and the City Council to act as a sounding board during the update process. The Advisory Committee will work directly with City staff and the consultant team to vet technical information, inform policy development, and craft regulations.

SMP discussions will also occur in other community-wide forums. These forums will provide additional opportunities for information exchange and public input, and will occur as needed at key points during the process. Opportunities for community involvement (via open houses, surveys, hearings) will be advertised in the local newspaper and through other media (internet, radio, mailings, etc).

Schedule and Outreach Activities

Each phase of the SMP Update presents unique opportunities for information exchange with local residents and interested stakeholders. The information exchanges help to educate the public about the importance of sound shoreline management and help the project team gain local knowledge and appreciation for the public's values and concerns.

Figure 1 on the following page lays out a framework for the SMP Advisory Committee meetings, public open houses, and public hearings within the phases of the SMP Update. The specific location and format of the meetings will be determined during the update process.

The project team will engage Duvall's citizens and interested stakeholders continuously throughout the process using a variety of methods and tools. This will include hosting a visioning workshop or possibly designing an on-line survey (using SurveyMonkey, for example) to solicit opinions on how the shoreline areas should be managed. This would build on and not duplicate work done in 2003 as part of the citywide visioning exercise as well as the work that went into the City's 2008 Parks and Open Space Plan.

Key Activities and Meetings

The SMP Update will occur in phases, consistent with Ecology guidance and the City's Ecology grant. Phase 1, which included preparation of this PPP, and Phase 2 are occurring currently, during the first *grant* year of the update. Under the Grant Agreement, the project will occur over three years, with the first year running through June 2010, the second year fro July 2010 to June 2011, and the third year starting in July 2011. Key outreach activities and meetings during the respective phases and grant years of the SMP Update are detailed below.

Phase 1 (Year 1) *COMPLETED*

- Project team meeting to identify the City's key objectives for the SMP Update and to discuss the public involvement strategy.

Phase 2 (Year 1)

- First Advisory Committee meeting: Intended to introduce the Advisory Committee to the SMP Update process, establish project team and Advisory Committee roles with regards to the committee, and provide review of the internal draft Inventory and Characterization Report. To occur in May 2010.
- Public meeting (open house): This will serve as the public 'kick-off' meeting for the project. It will provide an opportunity to present the draft Inventory and Characterization Report with key information conveyed and gathered as detailed in Figure 1 (next page). To occur after submittal of Task 2.3 deliverables to Ecology.

Phase 3 (Year 2)

- Second Advisory Committee meeting: Will be part of Task 3.1, and will be a key component of the visioning process. To occur in August 2010.
- Shoreline use, access, and restoration visioning efforts: The visioning effort will be the key component of Task 3.1. The project team will use targeted and City-wide strategies to gain public insight on shoreline goals. Anticipated approach is to use an online survey. To occur in August 2010.
- Third Advisory Committee meeting: Will be part of Task 3.5, during which Draft SMP goals, policies, and regulations will be reviewed. To occur after completion of the internal review Draft SMP.

Phases 4 and 5 (Year 3)

- Fourth Advisory Committee meeting: Will provide an opportunity for dialogue on restoration planning and revised goals, policies, and regulations, as detailed by Figure 1 below. This will occur during the Phase 4 effort.
- City Council / Public Hearing: These will occur as part of finalizing and adopting the SMP during the Phase 5 effort. Along with the 60-day comment period, this will provide an opportunity for formal comment on the Draft SMP before local adoption.

FIGURE 1. INFORMATION EXCHANGE AND ACTIVITIES DURING EACH PHASE OF THE SMP UPDATE.

Information Exchange		Outreach Activities
Jurisdiction, Public Participation Plan (PPP)		
	• Purpose of the update. • Scope of work. • City and State roles. • Schedule and next steps. • Ways to become involved. • Areas affected by the SMP and how they were determined.	• **Posted on website:** Notice of project initiation; Jurisdiction map and PPP. • **Newspaper article** introducing SMP Update project. • **Key stakeholders** contacted for initial input and information.
	• Who wants to be on mailing list?	
Inventory, Analysis and Characterization		
	• Current conditions and ecological values of the shoreline area. • Affects of human use and development. • Key management objectives (and affects on ecological values).	• **Posted on website:** Inventory report and maps. • **Advisory Committee meets** to plan and discuss inventory and begin policy formulation. • **Public attends open house** to hear inventory and characterization findings and provide comment. • **Key stakeholders** receive copy of inventory and characterization results.
	• Anecdotal information about shoreline areas. • Is the inventory information accurate and are conditions characterized appropriately? • Are inventory management priorities consistent with local goals? • Do we know enough about conditions to make policy decisions?	
Visioning, Designations, Goals, Policies, Regulations, Admin Provisions, & CIA		
	• Suggested goals and policies to achieve the City's visions for the shoreline. • Draft provisions for allowed uses and potentially restricted activities in the shoreline. • Strategies for preventing cumulative adverse impacts to the shoreline environment.	• **Shoreline visioning meeting or on-line survey:** public offers views on shoreline goals. • **Posted to website:** Draft goals, policies and regulations. • **Advisory Committee meets** to discuss key policy and regulatory provisions. • **Public attends open house** to hear draft policies and regulations and provide comment. • **Key stakeholders** receive copy of draft SMP provisions
	• What is the public's vision for the shoreline area? • Agreement on general purpose statement of the SMP? • What shoreline attributes do the citizens value and what do they want to improve or change? • Agreement on the allowed uses and general provisions for environmental protection. • How should the city handle redevelopment of shoreline properties? • What are the best strategies for preventing cumulative adverse effects?	
Restoration Plan, Revisit and Finalize SMP, Document No Net Loss		
	• Opportunities to improve shoreline conditions and enhance public access to the shoreline. • Full draft of the SMP policies and regulations and a summary of how they contribute to the No Net Loss requirement.	• **Posted to website:** Draft restoration plan and SMP. • **Advisory Committee meets** to revisit key SMP provisions (if needed). • **Public attends open house** to provide comments on revised SMP. • **Key stakeholders** receive copy of draft restoration plan and revised SMP.
	• How should No Net Loss be defined? • Are the restoration opportunities accurately described? • Are the public access opportunities adequate and consistent with City goals?	
SEPA Review, Local Approval		
	• SEPA determination. • Reason for local action. • Response to formal public comment.	• City initiates formal 60-day public review. • City issues SEPA determination. • **Public gives formal testimony** on draft and final SMP at PC and Council hearings. • **Key stakeholders** can submit formal public comments, testify at hearings and comment on SEPA determination.
	• Formal comments and testimony.	

Information to convey Information to gather

Documentation

Information generated from the consulting team, web based and citizen surveys, public comments and Advisory Committee meetings will be compiled and organized in a user-friendly format. This information will be used to define shoreline issues and proposals to resolve such issues and will be available on the City's web site and on file with the City Clerk.

Activities will be documented in the SMP checklist consistent with the grant agreement for the SMP Update. Submittal of the SMP checklist will occur at the end of each phase of the project and will demonstrate how public participation efforts comply with this plan and with Ecology guidelines.

Public Review

The public will be invited to share concerns and interests in written form as well as participate in public meetings. As draft documents are developed, they will be made available for public review and presented at public meetings and/or open houses. Prior to adoption of the SMP by the Department of Ecology, at least one public hearing will be held in accordance with RCW 90.58.120.

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memorandum

date October 2, 2009

to Lara Thomas

from Aaron Booy and Margaret Clancy

subject McCormick Park Reconnaissance / Opportunities and Constraints Assessment

ESA Adolfson (ESA) prepared this memorandum to assist the City of Duvall in evaluating mitigation and restoration opportunities and constraints at William F. McCormick Park. The City is interested in exploring restoration opportunities at the site to meet City resource protection and enhancement goals. The City is also considering the establishment of a mitigation 'receiving area' on city-owed lands to help offset impacts of future development.

This memo describes current and historic conditions, provides a preliminary inventory of conditions on the Snoqualmie River shoreline, and identifies potential mitigation and restoration focus areas. This information is intended to help the City evaluate potential future uses of the park area and can inform the City's comprehensive Shoreline Master Program update, which is currently underway.

Site Overview

The McCormick Park project area (project area) is approximately 80 acres in size, and borders approximately 1.1 miles of the Snoqualmie River to the west and State Route 203 (Main Street) to the east (Section 13, Township 26 North, Range 6 East; Figure 1). The Snoqualmie Valley Trail (valley trail), which follows an old railroad right-of-way, bisects the project area (Photo 1). King County owns and maintains the valley trail, which is elevated above the adjacent river valley on a fill berm. The limits of the project area extend outside of McCormick Park proper to several other contiguous City- and publically owned areas, including: the undeveloped portions of the valley trail corridor, areas of Depot Park (City-owned), and two other undeveloped City-owned open-space parcels (Figures 2 and 3).

The project area from the river to the valley trail corridor varies in width from about 330 feet at the narrowest point in the middle of the site to 1,500 feet at the southern end of the site. To the east of the valley trail corridor, two areas of City-owned property extend an additional 300 to 400 feet to the east toward Main Street.

The McCormick Park project area lies almost entirely within the alluvial valley of the Snoqualmie River (Photos 2 and 3; Figures 2 and 3). Limited portions of the eastern limits of the project area, within Depot Park and in the vicinity of the Police Station, are outside of the alluvial valley.

The majority of the City of Duvall, including Main Street, is located on the hillside above the site. This hillside drains generally to the west. Coe-Clemens Creek and Thayer Creek, along with unnamed tributary streams, flow from east to west down the hillside before reaching the project area (see Figure 1 and the City of Duvall

Environmentally Sensitive Areas maps, available:
http://www.duvallwa.gov/appsformspubs/planningappsformspubs.html).

Overall topography across the project area is flat, befitting its floodplain landscape position (Photos 2 and 3). There are subtle topographic features in some locations, including small swales, and a slight slope to the east (away from the river). Coe-Clemens Creek and Thayer Creek flow across the Snoqualmie River floodplain, in some cases within straight channels that suggest that they were channelized when the land was converted from forest to agriculture (see further discussion of streams and historical conditions below) (Photos 4 and 5). Several reaches of Coe-Clemens Creek, however, meander through the site (Photo 6; see *General Hydrology* and *Coe-Clemens Creek* descriptions for further detail).

The northwest portion of McCormick Park is partially developed including mowed fields, gravel trails and several picnic benches over approximately 4.75 acres (Photo 2; Figure 2). This area of the park includes an interpretive 'flood pole' documenting the elevations of past flood events. Access to the developed area of McCormick Park is provided by two trails linking to the Snoqualmie Valley Trail. The northern-most of the trails passes over the northern branch of Coe-Clemens Creek via a small bridge. The trail providing the most direct access from the valley trail to McCormick Park is located approximately 200 feet upstream. The stream flows through a culvert at this location. Depot Park, to the east of the developed portion of McCormick Park and the valley trail, includes a parking lot, a historic rail depot that now serves as a community building, and trails linking to the valley trail and McCormick Park. The parking lot at Depot Park also serves the adjacent police station. Throughout the remainder of the project area, there are gravel and dirt maintenance roads that provide access from the valley trail to the river shoreline and project area. These roadways are regularly used by City park, maintenance, and Wastewater Treatment Plant staff. During our field investigations, it was apparent that these unpaved roads are commonly used as trails by the public.

General Hydrology

Hydrology within the project area is generally influenced by direct precipitation, surface and shallow subsurface inflow from Coe-Clemens Creek, Thayer Creek, and other unnamed tributaries draining the hillslope to the east, and from the Snoqualmie River. The large majority of the project area is located within the 100-year floodplain of the Snoqualmie River (FEMA 1995 and Preliminary FEMA DFIRM Mapping - 2007). The mapped floodplain extends from the river's right-bank to east of the valley trail throughout project area.

Generally, surface and ground- waters from the eastern hillslide flow to the valley and valley trail berm via surface and shallow subsurface pathways. Flows from Coe-Clemens Creek, Thayer Creek, and the other small unnamed drainages co-mingle in the wetland system immediately east of the valley trail corridor, an area mapped with poorly drained soils[1]. The relative volume of surface flows through each of the three stream channels downstream (west) of the valley trail likely varies over time dependent on beaver activity and other channel variables (see stream mapping on Figure 2).

Snoqualmie River Shoreline Conditions

The project area is located along the right (east) bank of the lower mainstem of the Snoqualmie River between river miles 9.3 and 10.3[2]. The Snoqualmie River is a Shoreline of the State (and also a Shoreline of Statewide Significance) as it passes along the western edge of Duvall. As such, the river is managed under the requirements

[1] The United States Department of Agriculture Soil Conservation Service Soil Survey of Snoqualmie Pass Area, Washington (parts of King and Pierce Counties) mapped soils throughout the large majority of the project area as moderately well drained Nooksack silt loam (0 to 2 percent slopes). Other on-site mapped soils include poorly drained Puget silty clay loam (0 to 2 percent slopes), located in the vicinity of the ponded and wetland areas associated with Coe-Clemens Creek to the east of the Snoqualmie Valley Trail.

[2] The project area is located within the Snoqualmie River basin which drains an approximately 693 square mile area. The Snoqualmie River, along with the Stillaguamish River, is a main tributary to the Snohomish River. The Snohomish is designated as water resource inventory area (WRIA) 7.

of the Shoreline Management Act (SMA, RCW 90.58) and the City's Shoreline management regulations (DMC 14.78). Jurisdiction under the SMA extends 200 feet from the ordinary high water mark and includes any associated floodplains and wetlands. Within the project area, the approximate extent of SMA jurisdiction for the Snoqualmie River appears to be largely coincident with the limits of the 100-year floodplain (see Figures 2 and 3 for mapping of approximate SMA jurisdiction).

The reach of the Snoqualmie River through the project site, and along the entire western boundary of the City, is incised into the alluvial valley (Photo 8). During normal flows, the river is a low energy system characterized as a glide stream environment with a relatively slow flow rate and no pooling or riffle area. During significant flood events, however, the river engages much of the valley including the majority of the project area. During our reconnaissance there was substantial evidence throughout the project area of the most recent significant flood event, which occurred in January 2009 (Photos 3, 7 and 8). This flood inundated the majority of the site and included significant overbank flow that left the main channel approximately 5,000 feet south of the project. This flow continued north across the Snoqualmie River valley then spilled back into the main channel as flows receded, as evidenced by significant wrack deposition on the floodplain and on the floodplain (landward) side of riparian vegetation. Overbank flow onto the site is likely relatively common; according to the flood pole, it appears that flows have engaged the site in 50 percent of years.

The Snoqualmie River riparian corridor within the project area is characterized by a steep bank (due to the incised river) backed by a narrow deciduous forest corridor. The bank is vegetated with herbaceous trees and shrub species, with Himalayan blackberry as the dominant (invasive) shrub growing along the large majority of the bank. The forested community is generally only about 10 to 20 feet wide from the bank, but it is approximately 50 feet wide around the confluences with the tributary channels. The Stilly-Snoqualmie Task Force has recently installed native plants along portions of the Snoqualmie River riparian buffer, primarily in areas to the south of the Thayer Creek confluence with the river (Photo 7) and areas surrounding lower Co-Clemons Creek. Native riparian communities consisting of shrub and tree species were installed in wetland and stream buffer areas immediately west of the Snoqualmie Valley Trail corridor at the north end of the project area.

The riparian vegetation along the river slows surface flows from the tributary channels across portions of the floodplain and promotes infiltration, which improves water quality. However, channel incision within the lower end of the tributaries concentrates runoff, and increases fine sediment loading. Water quality is also affected by the presence of a large ponded area along the channel of Coe-Clemens Creek, directly east of the valley trail. The pond raises water temperatures, which affects outflows to the Snoqualmie River.

Historical Alterations: To assess the type and extent of historical alterations to the Snoqualmie River shoreline, and throughout the project area, we reviewed 1870s-era Government Land Office (GLO) maps (Figure 4) and 1936 aerial photography (Figure 5), both of which have been geo-referenced as part of the UW River History Project. Our investigation of historical mapping and photos specifically looked for changes in channel plan form, land cover, and other key site features.

Changes to the mainstem of the Snoqualmie River reach within the project area over the last 100 years have been focused on the northern and southern portions of the McCormick Park project site. Both areas include meander bends, while the majority of the site is in a straight reach. The straight reach through the central portion of the project area appears to have been relatively stable. In the southern portion of the project area, it appears that the channel has migrated to the south and east (see red, green, and blue lines on Figures 4 and 5 for comparative locations). The magnitude of this channel movement is less than one bankfull width, or approximately 175 feet. This change appears to be ongoing, with the formation of an in-channel bar on the river's left (west) bank, and continued erosion on the outside (east side) of the bend.

The most significant channel movement of the Snoqualmie River appears to have occurred at the northern end of the park (Figures 2, 4 and 5). Over this short reach the channel has been straightening itself, eroding the river's right bank, and building a new bar on the opposite shoreline. This movement appears to have been on the scale of one bank full width. This migration may have been influenced by bank protection measures (riprap) that have been installed along the river's left bank. This channel movement is evident currently, as the right (east) banks of the river along McCormick Park are systemically failing (Photo 8).

The GLO map shows three tributaries that flow through the site in the general location of the existing Coe-Clemens Creek channel, Thayer Creek channel, and unnamed creek channel to the south. This mapping suggests that the existing unnamed channel in the southern portion of the site (located entirely within the southern portion of the project area; see Figure 3 and stream section below) was at one time the mouth of the creek that drains through King County's Duvall Park (to the south of the City). Flows from the Duvall Park area are now conveyed through a ditch system that enters the river farther upstream. The tributary alignments shown on the GLO maps generally support our assumption that the tributaries were channelized when the property was claimed for agricultural use.

The 1936 air photo confirms that the majority of the site was used for agriculture. This land conversion likely resulted in some land leveling, including filling and modification of original channel alignments, potential installation of tile drains (not confirmed by site observations), vegetation removal, and potentially the installation of informal 'push-up' levees (no information reviewed, beyond field observations, suggesting the installation of informal levees).

Streams[3]

Coe-Clemens Creek: Flow from Coe-Clemens Creek enters the project area through a highly impounded culvert beneath Main Street. The channel meanders through the eastern portion of Wetland I (see below), and becomes braided, poorly defined, and intermittent within this wetland area. Flow from the creek disperses to the north, toward the ponded area immediately west of Depot Park, as well as to the south, where surface water eventually converges with Thayer Creek. The majority of flows from Coe-Clemens Creek spill over a beaver dam that has been augmented with an artificial inlet structure (HDPE pipes that flow through the beaver dam). The beaver dam and flow-through structure are located directly below a bridge along the valley trail corridor. There are additional beaver dams and inlet structures on the west side of the trail berm along the stream corridor.

From the ponded areas created by these impoundments, surface flow reaches the river via a northern channel that appears to be the mouth shown on the 1936 photo and the GLO maps (Figures 4 and 5), and to the west via a straightened channel that was likely created during the land conversion to agriculture. Both channels are influenced by beaver activity. The western channel flows through one of the larger wetland areas on the site (Wetland H); water levels in the wetland are likely dependent on flows from the upper pond, and elevation controls at beaver dams within the west channel (Photo 6). This wetland appears to have seasonal surface ponding, and likely dries out in most summers.

Thayer Creek: Thayer Creek enters the McCormick Park project area from the southeast, where it passes near the southern and eastern edges of the City's wastewater treatment facility. To the east of the valley trail berm, the creek channel is straight, and flows directly along the toe of the trail berm for approximately 200 feet. Thayer Creek flows under the valley trail berm via a culvert crossing before flowing directly west into the river. It appears that the creek was channelized into its current alignment, which moved the discharge point to the river approximately 500 feet upstream (south). The remnant mouth remains in a forested section of the Snoqualmie river riparian area, approximately 400 feet to the north of the area of the GLO-mapped mouth (Figures 2 and 4).

[3] Stream channels were identified based on inventory data available from the City's Stream Habitat Assessment – Existing Conditions Report (Herrera Environmental Consultants, Inc., April 2006) and in-field observations of defined bed and bank and evidence of surface water flows consistent with the City's Critical Areas Ordinance (DMC 14.42.310).

Unnamed Channel: An unnamed channel flows into the Snoqualmie River within the southern portion of the project area (Figure 3). This unnamed feature is a blind channel that extends for approximately 400 linear feet, but may have historically extended further to the south according to GLO mapping (Figure 4). The upper-most stretch of the channel is very narrow and appears to have been ditched. The channel becomes more incised as it approaches the Snoqualmie River, similar to the Thayer Creek and Coe-Clemens Creek confluences. There was no flow within the channel during our site visit.

Wetlands

Existing inventory information, including the City's wetland inventory map and the United States Fish and Wildlife Service (USFWS) *National Wetland Inventory* (NWI), were reviewed prior to our field reconnaissance. NWI mapping for the project area identifies the majority of the project area as freshwater emergent wetland (NWI Online Mapper, accessed April 2009, available: http://www.fws.gov/wetlands/Data/Mapper.html).

Wetlands and streams were identified by walking transects across the McCormick Park project area and analyzing aerial photos[4]. Fourteen wetlands occur on-site and three occur off-site. Figures 2 and 3 show the approximate locations of identified wetlands within the McCormick Park project area. Because the wetlands were not formally delineated during the site visit, wetland size was interpreted based upon points collected in the field using a hand held GPS, previous delineations, observations made in the field, and examination of aerial photography. Table 1 provides information describing all on-site and off-site wetlands.

Overall, wetlands within the project area are limited to areas that receive surface and shallow subsurface flow from the tributary channels. The small wetlands located on the slope above the Snoqualmie Valley, immediately west of Main Street, receive shallow groundwater from hill-side seeps. Much of the project area is dominated by relatively coarse soils that allow for rapid infiltration and percolation which prevents development of wetland conditions. Some areas to the south appear to have finer surface deposits, which result in perched water tables (south-end depressional wetlands – see Table 1).

The vegetation communities of the project area wetlands are similar. Wetlands A, C, and D are entirely herbaceous. Herbaceous wetland areas were dominated by common velvet grass (*Holcus lanatus*), cattail (*Typha latifolia*), and soft rush (*Juncus effusus*). Reed canarygrass (*Phalaris arundinacea*) is a dominant invasive species throughout all of the palustrine emergent (PEM) wetland areas.

All other wetlands have emergent (PEM) and scrub/shrub (PSS) communities. Dominant PEM vegetation within these areas is consistent with wetlands A, C, and D. PSS vegetation communities were dominated by salmon berry (*Rubus spectabilis*), vine maple (*Acer circinatum*), and willow species (*Salix spp.*). The understory of these areas included soft rush, trailing blackberry (*Rubus ursinus*), giant horsetail (*Equisetum telmateia*), skunk cabbage (*Lysichitum american*) and lady fern (*Athyrium filix-femina*). Himalayan blackberry (*Rubus armeniacus*) was the primary invasive species observed within shrub communities, although Japanese knotweed (*Polygonum cuspidatum*) was also observed in an upland area near the northern outlet of Coe-Clemens Creek. Small areas of tree canopy associated with Wetlands H and I include red alder (*Alnus rubra*) and black cottonwood (*Populus balsamifera*).

[4] Wetland determinations were made during our reconnaissance-level investigation using methods defined in the Washington State Wetlands Identification and Delineation Manual (Washington State Department of Ecology, 1997), a manual consistent with the Corps of Engineers Wetlands Delineation Manual ("1987 Manual") (Environmental Laboratory, 1987) and the City's Critical Areas Ordinance (DMC 14.42.200). The methods outlined in the manual are based upon three essential characteristics of wetlands: (1) hydrophytic vegetation; (2) hydric soils; and (3) wetland hydrology. Field indicators of these three characteristics must all be present in order to make a positive wetland determination. It is recommended that wetland boundaries be formally delineated by professional scientists and surveyed by a professional land surveyor prior to detailed site planning.

Standard protective buffer widths for wetlands are specified by DMC 14.42 and depend on category, as determined by Ecology's Western Washington Wetland Rating System (Hubry, 2004). Estimated wetland categories (including scores for water quality, hydrologic, and habitat function) and associated buffer widths are shown in Table 1. Preliminary wetland rating forms, prepared during field investigations and through interpretation of aerial photography, are attached to this memo.

Table 1. Wetlands in and adjacent to the McCormick Park project area.[5]

Wetland Name	Landscape position	Modifications / Impairments	Area (SF and/or acres)		Estimated Wetland Category and Buffer			On-site or off-site
South-end Depressional Wetlands (A, B, C, D, E, F, Q)	Within unnamed south-end drainage; no outlets – drain via shallow groundwater flow to Unnamed south-end channel and directly to Snoqualmie River. All areas except for sloped portion of Wetland B within Snoqualmie River floodplain.	Reed canarygrass is dominant in significant areas of all South-end Wetlands. Wetland B is a slope wetland to the east of the trail, extending across an off-site property; highly constricted by the trail berm, with hydrologic connection to depressional area of Wetland B through trail bridge. Wetland Q was likely historically connected with Wetland B before placement of the fill berm along the valley trail corridor.	A	30,000 SF / 0.68 acres	A	Cat. II (53 points overall, 20/20/13)	60 feet	Wetlands A, C, D, E, F are all entirely on-site. Wetland B is a slope wetland to the east of the Snoqualmie Valley Trail (off-site – delineation completed by others) and a depresional wetland to the west of the trail (on-site). Wetland Q is entirely off-site (Figure 3)
			B	4.7 acres total[6]	B	Cat. II (66 points overall, 24/20/22)	100 feet	
			C	250 SF	C	Cat. III (41 points overall, 20/8/13)	60 feet	
			D	150 SF	D	Cat. III (41 points overall, 20/8/13)	60 feet	
			E	12,000 SF / 0.3 acres	E	Cat. II (57 points overall, 20/20/17)	60 feet	
			F	500 SF	F	Cat. III (50 points overall, 20/14/16)	60 feet	
			Q	0.8 acres (likely extends further south)	Q	Wetland entirely outside of the project area – likely a Category II with a 80 to 100 foot buffer.		
G	Immediately west of trail berm and north of access road; no distinct outlet – potential hydrologic connections include Wetland E to south, Thayer Creek to east and north, and Snoqualmie River to west. Shallow groundwater flow into and out of the wetland. Entirely within Snoqualmie River floodplain.	Wetland area likely historically contiguous with Wetland areas G and N. Isolated by trail and maintenance road fill berms.	1 acre		Category II with58 points overall (20/20/18) 60 foot buffer			On-site (Figure 2)

[5] When wetlands and streams were located, ESA staff used a hand-held global positioning system (GPS) Trimble unit (rated at 1 meter accuracy) to identify the approximate boundaries of wetlands and stream features. Several wetlands adjacent to the McCormick Park site were delineated by others in the past as part of site development submittals provided to the City. For these areas, ESA staff made observation from the site to verify survey data provided by the City was accurate, and did not mark the boundaries with the GPS unit. Adjacent wetland areas are mapped on Figures 2 and 3 as off-site wetlands.

[6] 3.3 acres of Wetland B on-site to the west of the berm.

DRAFT

Wetland Name	Landscape position	Modifications / Impairments	Area (SF and/or acres)	Estimated Wetland Category and Buffer	On-site or off-site
H	Primary source of hydrology is overbank flow from Coe-Clemens Creek and the Snoqualmie River. Immediately west of trail berm within the primary Coe-Clemens Creek drainage. Contiguous with Wetland I via main Coe-Clemens outlet under trail, however hydrologically separated by beaver dam, except during river flood events. Entirely within Snoqualmie River floodplain.I	Wetland area historically contiguous with Wetland I; constrained by trail berm.	3.4 acres	Category II with approximately 69 points overall (28/16/25) 120 foot buffer	On-site (Figure 2)
I	Immediately east of trail berm within the primary Coe-Clemens Creek drainage. Extends east to Main Street fill slope / Coe-Clemens Creek impounded inflow culvert. Stream disperses into wetland area, with channels / intermittent channels fanning out to the north and south. Contiguous with Wetland H via main Coe-Clemens outlet under trail, however hydrologically separated by beaver dam, except during extreme river flood events. Southern portion of the wetland drains to south and combines with Thayer Creek immediately upstream of culvert under the Snoqualmie Valley Trail. Entirely within Snoqualmie River floodplain except for limited slope portions extending	Wetland area historically contiguous with Wetland H; constrained by trail berm. Large ponded area extends from northern tip of wetland to the main outlet under the trail; ponded area created by trail berm, and potentially other historic modifications.	11.7 acres total[7]	Category II with approximately 64 points overall (14/24/26) 140 foot buffer	Majority of wetland is on-site. Southern lobe of wetland, except for southern-most extent, is off-site – off-site area depicted on Figure 2 is approximate.

[7] Approximately 7 acres of Wetland I are on City owned park lands; privately owned area of Wetland I is located on undeveloped portion of commercial/industrial parcel extending from Main Street to Snoqualmie Valley Trail.

Wetland Name	Landscape position	Modifications / Impairments	Area (SF and/or acres)		Estimated Wetland Category and Buffer	On-site or off-site
	upslope near Wetland J and K.					
J and K	Wetlands J and K are slope wetlands immediately west of Main Street. Wetland hydrology is from shallow groundwater seeps. Wetlands have no distinct outlet – defuse into upland shrub and herbaceous areas to the west.	Both wetlands are dominated by Himalayan blackberry. In addition, past filling and grading and channelization on the off-site property has modified the hydrology of these wetlands and limited their habitat function.	J	4,200 SF (small area extending onto City park land)	Category IV with approximately 28 points overall (6/6/16) 50 foot buffer	Majority of these wetlands are off-site – western most portions extend onto City park lands (Figure 2).
			K	3,200 SF (small area extending onto City park land)		
L, M, and N	Wetlands L and M are located in small depressions immediately upslope of the Thayer Creek channel. Hydrology to wetlands from shallow groundwater seeps (from hillside to east) and stormwater discharge. Wetland N is located in a small depression, and is bisected by a gravel maintenance road.	Wetlands are dominated by reed canarygrass and Himalayan blackberry. In addition, past filling and grading and channelization in these areas has modified the hydrology of these wetlands and limited their habitat function. Wetland N is bisected by an unpaved maintenance roads.	L	1,250 SF	Category III with 32 – 34 points overall (16/8/8-10) 60 foot buffer	All three wetlands are on-site (Figure 2/3).
			M	300 SF		
			N	2,800 SF		
O, P, and Q	Wetlands O and P are slope wetlands immediately west of Main Street. Wetland hydrology is from shallow groundwater seeps. Wetlands have no distinct outlet – defuse into upland shrub and herbaceous areas to the west.	Wetlands are dominated by reed canarygrass and Himalayan blackberry. Modified and degraded by past land modifications and land use activities within and immediately adjacent.	O	4,300 SF	Off-site with no near access from publically owned areas – no wetland rating forms completed	Both wetlands are off-site (Figure 3).
			P	0.25 acres		

Potential Restoration Opportunities

In the near term, and considering the City's potential use of this area to provide off-site mitigation for development impacts throughout the City, we have developed some generalized treatment options for the site. The intent is to capture restoration options that span different levels-of-effort, and could be installed either all at once, or using a phased approach. To facilitate discussion of the area, potential restoration opportunities are presented in six focus areas:

1. Coe-Clemens and Thayer Creek channels.
2. Coe-Clemens pond.
3. Southern (Wetland B) swale and depressional wetlands.
4. Snoqualmie River bank stabilization.
5. Non-native plant control
6. Mainstem off-channel habitat.

The general locations of each focus area, except for non-native plant control which is applicable throughout the project area, are identified on Figures 2 and 3.

Focus 1: Coe-Clemens and Thayer Creek Channels
Significant portions of both Coe-Clemens and Thayer Creeks flow through straightened, degrading channels from Main Street to their confluence with the Snoqualmie River. In their current degraded conditions, the streams limit the hydrologic, water quality, and habitat functions of the site wetlands and buffer areas. As documented by the City's 2002 Stream Restoration Plan (Herrera Environmental Consulting, Inc., 2002), the straightened and degrading streams limit water contact time with floodplain vegetation and soils, and are a source of fine sediment to the river. The existing streams limit upstream migration available to adult salmonids and habitat availability for juvenile salmonids, and provide a toe hold for non-native invasive weeds. By creating new stream corridors with greater sinuosity and re-routing at least portions of the tributary channels through the site to the west of the trail corridor, the City could achieve the following goals:

- Increase channel length;
- Potentially increase wetland area;
- Increase channel stability; and
- Restore native riparian forest.

Our initial assessment indicates that restoration of the Thayer Creek channel would be, in general, easier than restoration of the Coe-Clemens Creek channel. Coe-Clemens is more challenging as it is constrained by the existing developed portion of the park to the north, and its flow through and proximity to the most significant wetland area in the project area (Wetland H/I complex).

The primary design challenge for re-routing the tributary channels will be the design of the transition from the tributary to the river. The overall drop from the berm to most river levels is on the order of 15 to 20 feet. Holding the elevation of the tributary high through the majority of the project area will result in the greatest potential for increasing wetland area, but would increase the need for engineered structures (log or otherwise) to prevent headcutting at the mouths of the tributaries. Further, the drop at the end of the channel could preclude fish movement from the main channel into the tributary channels. The overall grade of these channels is influenced by beavers, so it is likely that stepping the channel down gradually would be better solution for this issue.

Costs associated for this option would be dependent on the amount of excavation necessary. The significant depth at the mouth would likely necessitate a fair amount of material removal.

Focus 2: Co-Clemens Pond
It is likely that the large pond to the east of the trail corridor and west of Depot Park elevates Coe-Clemens Creek water temperatures during the summer. The Snoqualmie River is listed on the 303(d) list for fecal coliform (with TMDL implemented), so reducing summer temperatures should be an overall goal. Installing trees around the pond, and placing shallow mounds of fill in the pond to allow shrubs and trees to grow could help reduce water temperatures. The pond is also currently at least a partial migration barrier for fish (Herrera, 2002 and 2006).

It may be beneficial to install some temperature loggers through spring and summer of 2010 to determine the magnitude of the temperature issue. This would be a relatively inexpensive way to determine how important this focus could be.

Focus 3: Southern (Wetland B) Swale and Depressional Wetlands
Hydrology from the Wetland B tributary area supports the depressional wetland complex along the Snoqualmie Valley Trail berm. Hydrologically, this area appears to function at a high level. Water is detained on the surface, and is infiltrated, becoming shallow subsurface flow to the river. Therefore, we recommend that any modifications in this area intended to create additional wetland area be carefully planned and designed to avoid degrading existing functioning.

If increasing wetland area in the southern area is determined to be an objective, earthwork would need to be very subtle. Grading of shallow swales could occur to potentially expand wetland area further to the west. However, the amount of water flowing to this area is limited, so it does not appear that significant wetland area could be created here. Enhancement of Wetland B and other south-end depressional wetlands, buffers, and upland riparian areas with installation of native vegetation and habitat features may be a more successful approach.

Focus 4: Snoqualmie River Bank Stabilization
As noted in the alterations section of this memorandum, there are long stretches of bank (approximately 500 feet) in the northern portion of the project area that are actively failing (Photo 8). This appears to be part of a longer-term process where the river is migrating east in this location. The river migration process will likely continue. A successful strategy to stabilize the shoreline along this reach could include grading back the banks and planting the banks and riparian area with native vegetation. Shoreline stabilization in the northern portion of the project area would provide an additional buffer between the developed park and the river, reduce fine sediment loading from the failing banks, and improve riparian cover.

Focus 5: Non Native Plant Control
There are significant areas of non-native invasive plant species within the project area, most notably Himalayan blackberry and reed canarygrass. Managing these infestations will be key in the long term success of native plantings. There are many options for treatment, including intensive techniques such as removal of the top 18 inches of soil material and/or herbicides. Less intensive techniques include mulching, dense native plantings, etc. Weed control will be a key element of any of the actions within the project area, and will need to be a significant part of restoration planning.

A successful option for control of reed canarygrass could be through establishing areas of dense native tree and shrub vegetation as 'islands' in areas dominated by the invasive weed. This less intensive technique would not eradicate canarygrass, but would shade the plant and provide an opportunity for native vegetation to become established and successfully compete in the project area. This strategy is additionally recommended due to the large canarygrass seed sources from adjacent properties which would limit the effectiveness of eradication.

An additional option for controlling reed canarygrass is to strip the top 18 to 24 inches of soil, roots and seedbank material. This is a very invasive technique and as such application within the project area may be limited. However, it does have the advantage of quickly removing the rootmat that is the most significant challenge in dealing with canarygrass. In this instance, this removal of material could have the added advantage of lowering

the average elevation of the restoration areas, which would increase floodplain storage, and could potentially be done in a way that could restore and enhance existing wetlands. The disadvantages to this approach would be the cost for removing and disposing of the material, significant permit effort (federal, state, and local), and the significant disturbance to the project area. If large areas of topsoil were removed, it would be necessary to employ significant, pro-active and adaptively managed sediment and erosion control measures. Aggressive removal of reed canarygrass should be considered where grading is proposed as a component of project area restoration.

Focus 6: Off Channel Habitat
In general terms, the amount and quality of off-channel habitat all along this stretch has been reduced. Our initial assessment suggests there appear to be three ways that off-channel habitat could be created or enhanced on the McCormick Park project area:

- Enhance riparian vegetation throughout;
- Focus off-channel habitat at tributary confluences; and/or
- Excavation new off-channel features (e.g., oxbows).

The first option is by far the easiest, and should be implemented under any approach. This effort has started, evidenced by new plantings in areas of the Snoqualmie River riparian corridor (Photo 7).

The second option could relatively easily be incorporated into the design of the tributary channel re-alignment discussed in Focus 1. Further, the existing mouths could be left as off-channel habitat, rather than filling the entire existing channels. The primary challenges here are: 1) the significant volume of material that would have to be removed to have off-channel habitats actively engaged with water during most river flows and 2) providing some type of grade control in these channels in order to prevent river headcutting into the site, and to allow the channels to withstand overbank flows re-entering the main channel on this site.

Excavating an entirely new off-channel feature, such as a secondary channel or an oxbow, would require the most design and construction effort. Based on our observations of deposition patterns from the January 2009 event, most overbank flow appears to leave the main channel well south of the McCormick Park project area. Therefore, any feature that would be excavated into the project area may only function as intended in a limited range of flows, before being overwhelmed by overbank flow from the south. Additional feasibility-level design would be necessary and would need to assess river gauge data to determine elevation ranges where this effort may be effective, and investigate reference standards to determine what parameters should be the design focus.

Ideally, over the long term, McCormick Park would be restored to a mature, native, riparian forest community resembling pre-development conditions. Achieving this goal would create a functional floodplain that, despite land use and hydrologic changes in the surrounding contributing basin, would be highly resilient to ecological stressors, and provide high levels of hydrologic, water quality, and habitat ecosystem function.

Developing a Mitigation Receiving Area

Throughout the City of Duvall, development density has increased substantially within the last decade, with rural lands being converted to commercial uses and moderate density residential neighborhoods. Development pressures are anticipated to continue in the coming years, putting additional stress on the City's wetland and stream systems. Consistent with the City's plans to focus critical areas mitigation within McCormick Park and

contiguous publically owned areas, this section presents an overview of some of the legal, logistical, and administrative challenges associated with developing a mitigation receiving area[8].

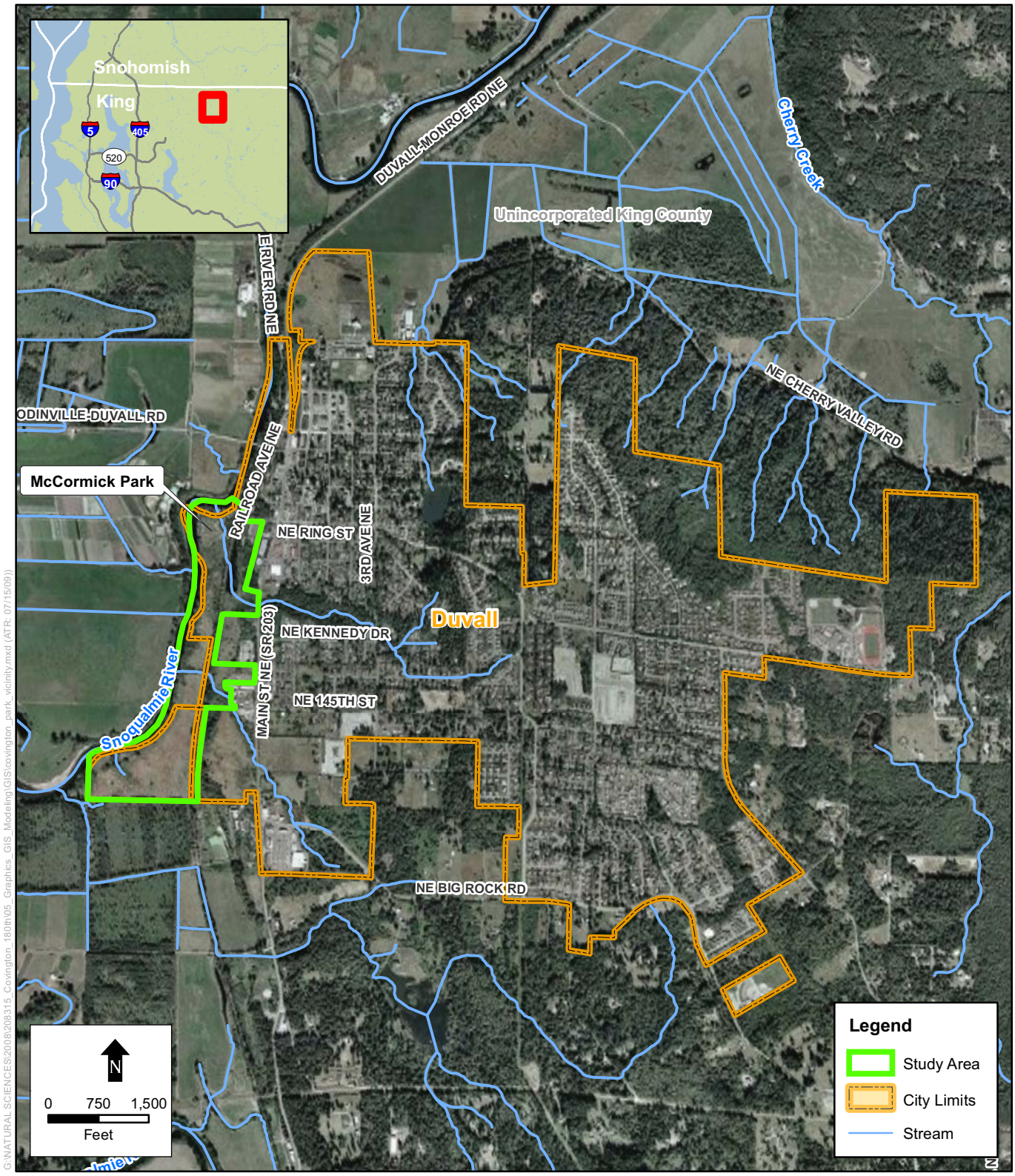
Creating a mitigation receiving area would likely require some changes to the Duvall Municipal Code in order to establish a preference for mitigating impacts within McCormack Park. The City would need to determine which types of impacts would be eligible for off-site compensation and establish parameters for how on-site versus off-site mitigation decisions would be made. This effort might also entail determining which types of impacts could be mitigated out-of-basin at a mitigation bank, for example. Critical Areas Regulations currently allow for off-site mitigation as long as specific sub-basin and watershed location requirements are met and the City determines that the off-site location will "provide the greatest ecological benefit and have the greatest likelihood of success." The City makes this determination on a case-by-case basis based on the available information, not on specific criteria. The City's upcoming comprehensive SMP update process could provide an opportunity to develop more specific policies and regulations consistent with and supportive of the restoration priorities and receiving area envisioned for the McCormick Park area.

The City would also need to determine how the McCormack Park mitigation would be implemented. One option is for the City to implement all of the mitigation and collect funds from developers (to offset the costs) at the time permits are issued. Fees would be commensurate with the estimated cost of mitigation for the impact that is occurring. This type of in-lieu fee (ILF) approach would likely require formal review and approval by the U.S. Army Corps of Engineers, the Department of Ecology, and possibly other agencies if the program is to be compliant with federal and state wetland regulations. An in-lieu fee system would allow the City to maintain consistent implementation and management of the receiving area. This consistency would allow for uniform maintenance and adaptive management, and generally enhance the likelihood of overall mitigation area success.

Alternatively, the City could require the applicant to prepare a plan and construct the mitigation according to City specifications. Under this scenario, the restoration focus areas identified in this letter, as well as other potential restoration objectives, would be used to create a framework for project implementation. The framework would be used to design individual restoration projects. The scale and extent of the mitigation efforts occurring in the McCormick Park would be commensurate with the scale of the development impact.

A key challenge with either approach will be assuring ongoing maintenance and monitoring of the mitigation area. Under either of these two potentially workable systems (or a combination of both), local regulatory and planning programs would need to be tailored and/or updated to encourage use of the receiving area.

[8] For purposes of this letter, a mitigation receiving area refers to the implementation of required critical areas mitigation from areas with low ecological potential (those areas being developed – the *mitigation sending areas*) to areas with high ecological potential (those areas that the City is targeting for preservation and restoration – the *mitigation receiving areas*).

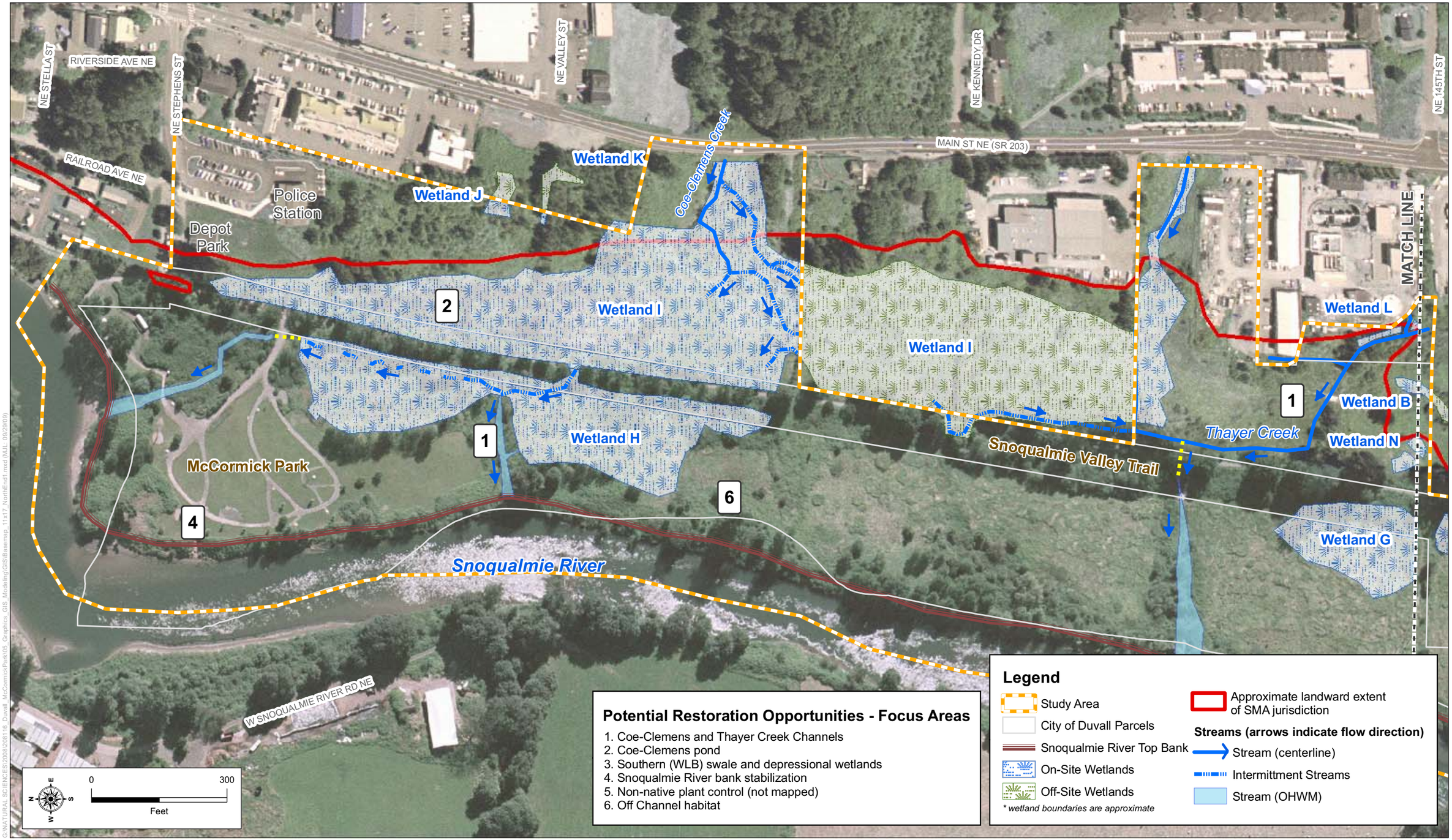


SOURCE: AEX, 2007 (Aerial); City of Duvall, 2008; King County, 2009.

Duvall McCormick Park . 208116

Figure 1

McCormick Park Reconniasance and Assessment - Vicinity Map
Duvall, Washington

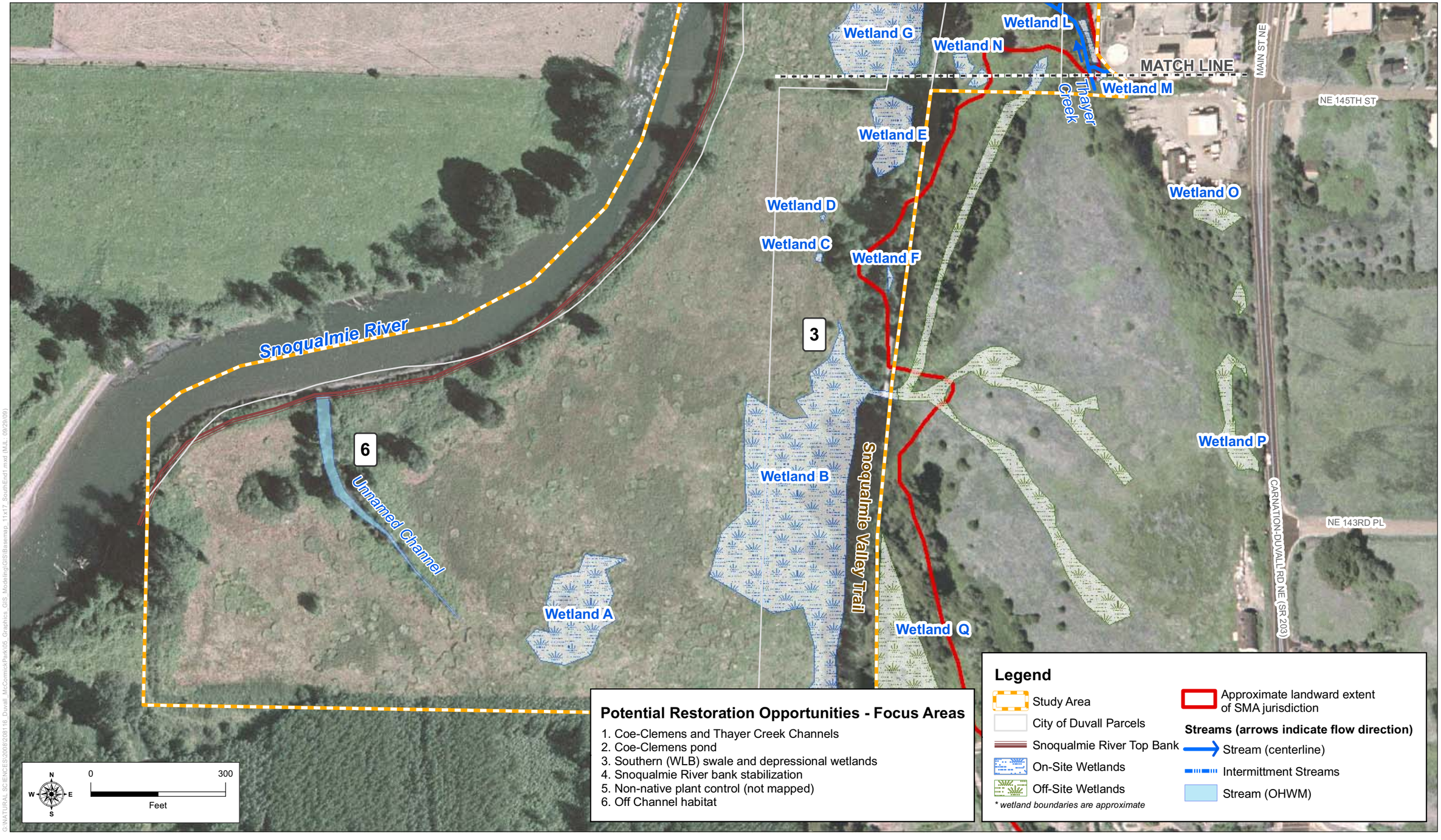


SOURCE: Barghausen, 2006; ESA Adolfson, 2009; King County, (2005) 2009

Duvall McCormick Park . 208116

Figure 2

McCormick Park Reconniasance and Assessment - North End
Duvall, Washington



Potential Restoration Opportunities - Focus Areas

1. Coe-Clemens and Thayer Creek Channels
2. Coe-Clemens pond
3. Southern (WLB) swale and depressional wetlands
4. Snoqualmie River bank stabilization
5. Non-native plant control (not mapped)
6. Off Channel habitat

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SOURCE: Barghausen, 2006; ESA Adolfson, 2009; King County, (2005) 2009

Duvall McCormick Park . 208116

Figure 3

McCormick Park Reconniasance and Assessment - South End
Duvall, Washington

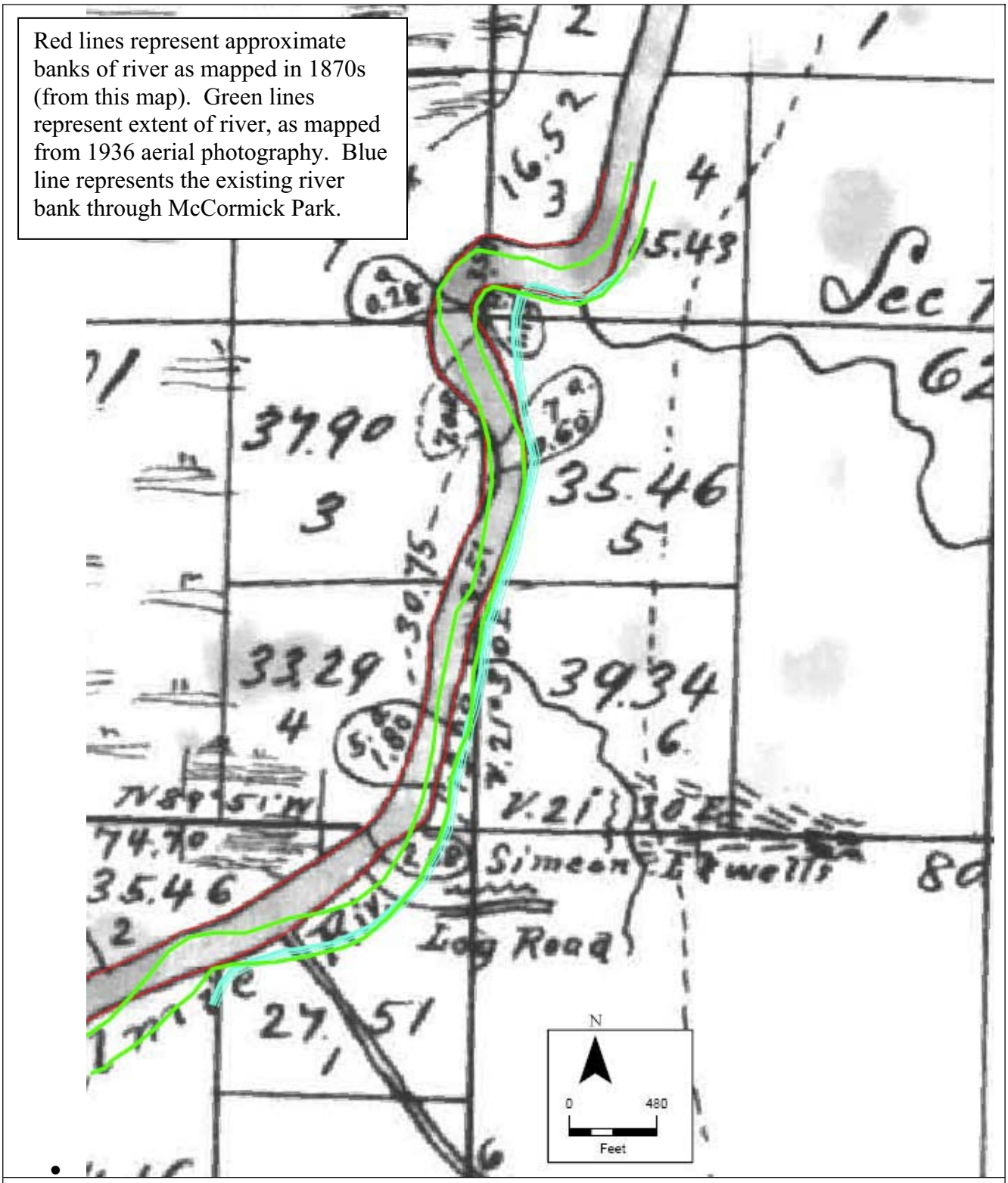

Figure 4. Digital image of 1870s era General Land Office (GLO) map for the McCormick Park Reconnaissance and Assessment project vicinity. Map made available by the University of Washington River History Project.

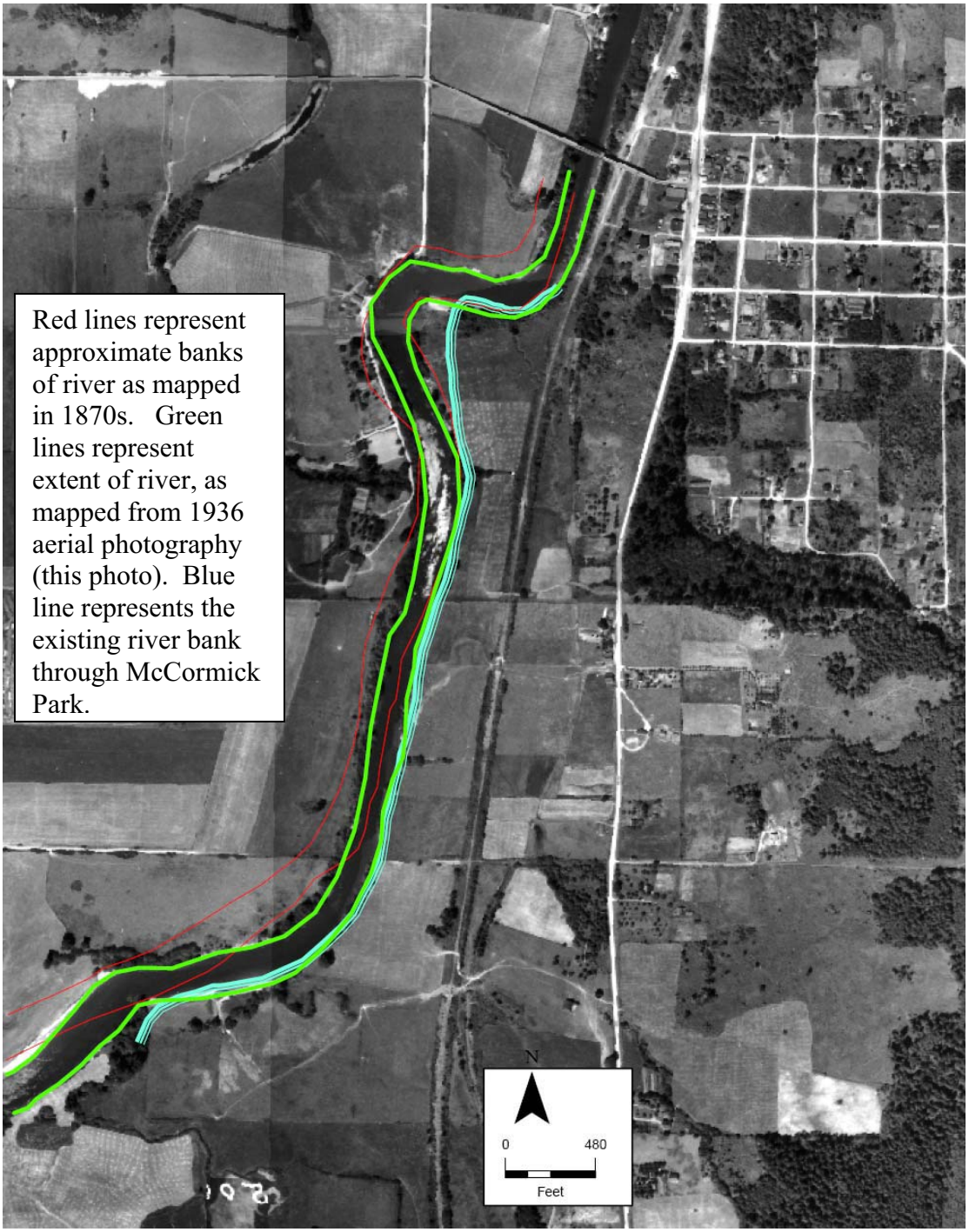

Figure 5. 1936 aerial photography for the McCormick Park Reconnaissance and Assessment project vicinity. Photo made available by the University of Washington River History Project.

Photo 1. View of Snoqualmie Valley Trail foot bridge, taken from edge of Wetland B. Bridge height show the approximate elevation change between the valley bottom and the trail (April 2000).

Photo 2. View across northern portion of McCormick Park, facing south. The northern portion of McCormick Park is the only area to the west of the Snoqualmie Valley Trail that has been improved for recreational use (April 2009).

Photo 3. View of wetlands and undeveloped area to the west of the trail corridor, facing south from the vicinity of the central Coe-Clemens Creek outlet (April 2009).

Photo 4. Coe-Clemens Creek channel and incised banks immediately upstream of confluence with the Snoqualmie River (photo looking east, April 2009).

Photo 5. Thayer Creek channel immediately west of the City of Duvall Wastewater Treatment Plant facility (April 2009).

Photo 6. View across Wetland H and meandering Coe-Clemens channel within wetland, to the west of the trail corridor. Note significant amounts of racked flood debris behind alders at the edge of the wetland (April 2009).

Photo 7. View of southern portion of the McCormick Park study area, taken from the bank of Snoqualmie River. Note installed native vegetation throughout the upland meadow area, much of which held flood debris from the previous significant flood event (April 2009).

Photo 8. Snoqualmie River facing south from the northern portion of McCormick Park. Note banks failures along the near bank of the river (April 2009).

Landscape Analysis for Critical Areas Ordinance Update

Prepared for

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ACRONYMS

BAS	Best Available Science
CAO	critical areas ordinance
City	City of Duvall
CMZ	channel migration zone
CPSWSF	Central Puget Sound Water Suppliers Forum
DO	dissolved oxygen
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
GIS	geographic information system
GMA	Growth Management Act
KCDNRP	King County Department of Natural Resources and Parks
msl	mean sea level
NMFS	National Marine Fisheries Service
RM	river mile
ROS	rain-on-snow
SCS	Soil Conservation Service
SBSRF	Snohomish Basin Salmon Recovery Forum
WDFW	Washington Department of Fish and Wildlife
WRCC	Western Regional Climatic Center

1. INTRODUCTION

The City of Duvall is in the process of updating its critical areas ordinance (CAO) (Chapter 14.42 of the Duvall Municipal Code) to incorporate new information and comply with Growth Management Act (GMA) mandates for critical area protection. The City hired Parametrix to develop scientific recommendations for the update based on a landscape-scale assessment of ecosystem process and their relationship to critical area functions, and Best Available Science. This analysis is primarily focused on streams and wetlands, however other GMA-designated[1] critical areas (frequently flooded areas, critical aquifer recharge areas, and geologically hazardous areas) are also considered as these areas are interconnected and interdependent.

1.1 REPORT PURPOSE

The purposes of this report are to characterize ecosystem-wide processes; assess the condition and function of these processes within the City of Duvall (City); and develop recommendations for protecting and restoring critical areas through the CAO update process. The characterization includes a coarse analysis of the broad area that influences the City's critical areas and a more detailed assessment of the critical area conditions within the City limits. This report expands on the Best Available Science review work previously prepared for the Snoqualmie Watershed Near-Term Action Agenda Implementation Project (Adolfson Associates 2004) and the Model Code for Critical Areas prepared for the cities of Duvall, Carnation, Snoqualmie, and North Bend (Snoqualmie Watershed Forum 2004) by identifying areas of importance for maintaining hydrologic and biologic processes that shape and influence Duvall's critical areas. This work is intended to facilitate development of science-based approaches for meeting the GMA goal of no net loss of ecological function by focusing protection and restoration efforts on key areas within the City (Figure 1-1).

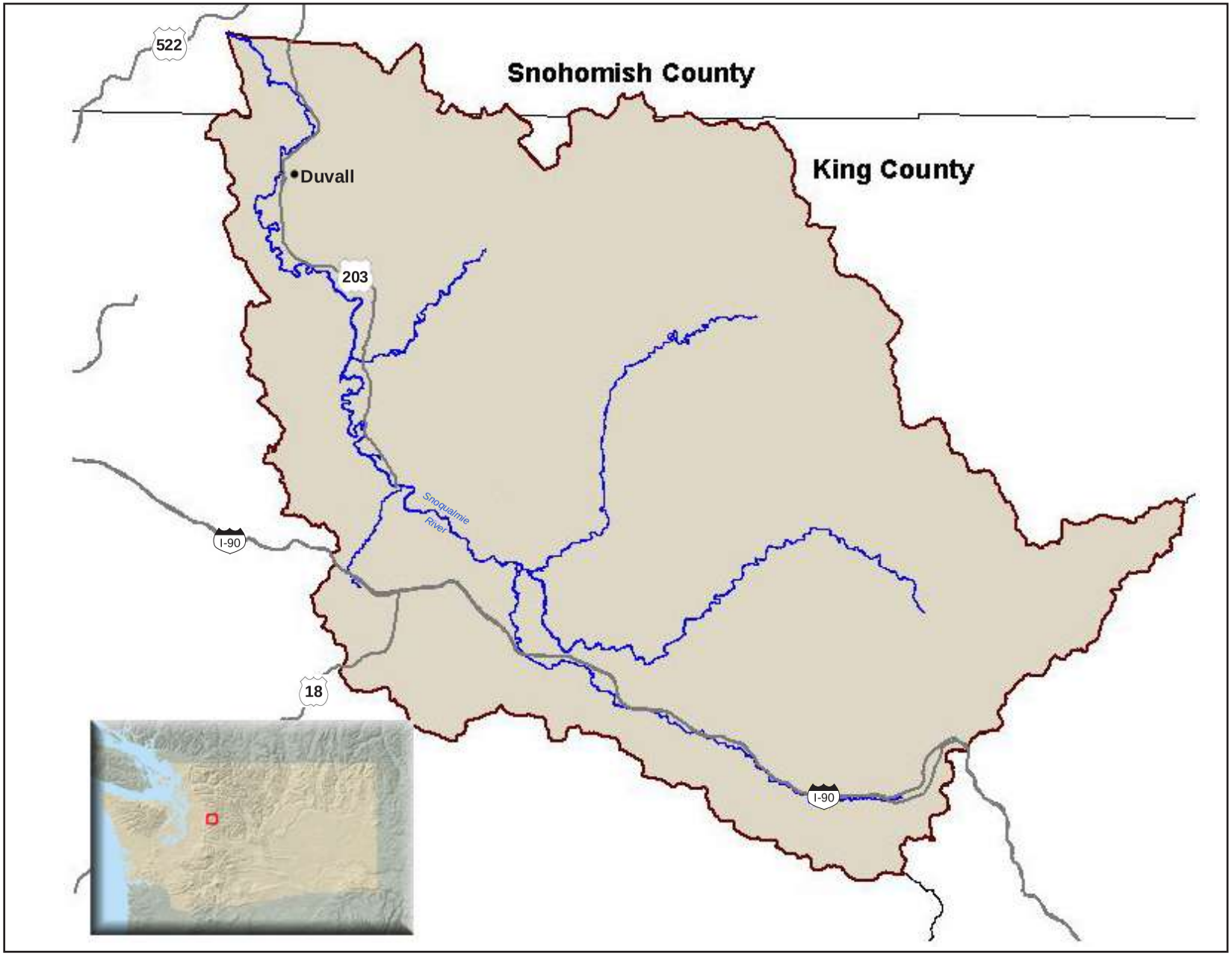
1.2 REGULATORY OVERVIEW

The GMA requires all cities and counties in Washington State to adopt development regulations to protect the functions and values critical areas. Local governments can tailor their policies and regulations to fit local circumstances but must demonstrate that they have:

- included the best available scientific information, and
- given special consideration to measures that preserve and enhance anadromous fisheries.

The GMA requirement to include Best Available Science was adopted by the state legislature in 1995 (RCW § 36.70A.172.1). In 2000, the state's Office of Community Trade and Economic Development (CTED) adopted procedural criteria to implement these changes and provided guidance for identifying Best Available Science. The rule makers concluded that identifying and describing critical areas functions and values and estimating the types and likely magnitudes of adverse impacts were scientific activities. Thus, RCW 36.70A.172(1) and the implementing regulations require the substantive inclusion of Best Available Science in developing critical area policies and regulations.

[1] RCW 36.70A.050



Parametrix City of Duvall 553-3240-006/01(02) 5/05 (B)

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Figure 1-1
Vicinity Map

The State legislature and the Growth Management Hearings Boards have defined critical area "protection" to mean preservation of critical area "structure, function, and value." Local governments are not required to protect all functions and values of all critical areas, but are required to achieve "no net loss" of critical area functions and values within their jurisdiction. Local governments are also required to develop regulations that reduce hazards associated with some types of critical areas including geologically hazardous areas and frequently flooded areas. The standard of protection is to prevent adverse impacts to critical areas, to mitigate adverse impacts, and/or reduce risks associated with hazard areas.

The information contained within this report was prepared by qualified scientists acting as consultants for City staff. It is intended to be a scientific basis for recommended changes and additions to the Duvall critical areas ordinance.[2] The information presented is pertinent to Duvall, applicable to the types of critical areas present, and is consistent with the Best Available Science criteria contained in WAC 365-195-900 through 925.

[2] In some instances, the BAS review supports existing provisions of the City code and no changes are recommended.

2. METHODS

Major components of the analysis are: (1) review existing scientific information, (2) assess landscape-scale processes using available literature and geographic information system (GIS) data, 3) map resources and areas of interest, and (4) recommend measures for critical areas protection and restoration.

2.1 REVIEW OF EXISTING INFORMATION

Parametrix reviewed existing reports describing the current and historic conditions of natural resources within the Snoqualmie Watershed and the City limits. Existing data sources that were reviewed for this study included, but were not limited to:

- Draft Snohomish River Basin Salmon Conservation Plan (Snohomish Basin Salmon Recovery Forum 2004)
- Snoqualmie Watershed Aquatic Habitat Conditions Report: Summary of 1999-2001 Data (Solomon and Boles 2002)
- Snoqualmie Watershed Stream Habitat Reconnaissance Report (Solomon and Boles 2004).
- Snoqualmie Near-Term Action Agenda Implementation Project: Best Available Science Issue Paper (Adolfson Associates, Inc. 2004)
- Mapping Historical Conditions in the Snoqualmie River Valley (RM 0 - RM 40) (Collins and Sheikh 2002)
- Stream Habitat Assessment for the City of Duvall, Washington: Existing Conditions Report (Herrera Environmental Consultants, Inc 2002)
- A Comparison of the City of Duvall and the Western Washington State Wetland Rating Programs, an Assessment of Best Available Science–Draft (Cooke Scientific, Inc. 2004).

GIS data were used to characterize current conditions within the Snoqualmie Watershed and Duvall. The City provided most of the GIS data layers used for the analysis, but King County provided data for areas outside the city limits.

2.2 LANDSCAPE–SCALE ANALYSIS

The landscape-scale analysis provided in this report is based generally on the approach developed by the Washington State Department of Ecology (Ecology) Shorelands and Environmental Assistance Program (Stanley et al. unpublished) and reported in Ecology's Wetlands in Washington State, Volume 2 (Hruby et al. 2004). The approach addresses two main questions:

- Which geographic areas are important for key landscape processes?
- Have human activities in the important areas altered the key processes?

Ecology has identified the following steps for addressing these questions:

(1) Identify and map existing aquatic resources using available data;

(2) Define and describe the contributing area using available data;

(3) Identify key processes necessary for maintaining ecosystem integrity;

(4) Assess important areas and areas where processes have been altered; and

(5) Develop restoration and protection recommendations.

This coarse-grained analysis allows local governments to integrate ecosystem processes into critical areas assessment and planning (Hruby et al. 2004). The need to consider processes and functions at multiple scales when developing plans for protecting or restoring critical areas is well-established (Gove et al. 2001; Poiani et al. 2000; Dale et al. 2000). Researchers including NMFS (1996) and Hruby et al. (2000) have developed different methods for evaluating site-specific functions or indicators of function but few methods provide rapid and effective approaches for characterizing processes at the watershed or landscape scale.

2.2.1 Identifying Aquatic Resources

Available digital information from the City and the King County GIS Center (2005) was used in identifying and mapping aquatic resources in Duvall. We did not field verify critical areas for this review.

2.2.2 Contributing Area

The contributing area is that portion of the landscape contributing water (surface and groundwater) and water-borne materials to the aquatic resources within the analysis area, and where key processes influence aquatic functions (Stanley et al. 2004). For this study, we defined the contributing area for the Snoqualmie Watershed as the topographic basin boundary. Although the contributing areas for surface water and groundwater sometimes differ they appear to be consistent for this study area. Groundwater movement in the Snoqualmie Watershed downstream of approximately North Bend (river mile [RM] 44), corresponds to topography, flowing downslope along the Snoqualmie River (Turney et al. 1995).

For this analysis of aquatic resources in Duvall, the contributing area for surface water and groundwater is assumed to be equivalent and is defined by the sub-basin boundaries. Because the streams above the Snoqualmie River floodplain in Duvall are all first-order (headwater) streams, the contributing area differs for each. Sub-basins are described in more detail in Section 3.2 below.

2.2.3 Key Processes

Ecosystem processes and functions are complex, interrelated, and work on multiple temporal and spatial scales. Key process important for maintaining aquatic resources such as streams, lakes, and wetlands are (Beechie et al. 2003):

- Hydrology (surface and ground water)
- Sediment supply
- Water quality (e.g., nutrients, pathogens, and toxins/metals)
- Organic matter
- Heat/Light.

These processes are all related to the transport of materials and energy across the landscape. All of these processes affect aquatic resources, but some processes have a greater effect on a particular resource type than others (Table 2-1) (Hruby et al. 2004).

Table 2-1. Landscape Processes that Maintain Aquatic Resources in the Puget Sound Lowlands

Aquatic Resource	Key Landscape Processes[1]
Rivers/ Riverine Wetlands	**Surface water runoff (peak flow)** **Groundwater movement** **Sediment supply** **Water quality (nutrients, pathogens, toxins/metals)**, contaminant cycling **Large Woody Debris (LWD) delivery**
Lakes/ Lacustrine Wetlands	Surface water runoff **Surface water storage** Groundwater movement Sediment supply **Water quality (nitrogen and phosphorous cycling)**, contaminant cycling
Depressional Wetlands	Surface water runoff **Groundwater movement** **Sediment supply** **Water quality (nitrogen and phosphorous cycling)**, contaminant cycling LWD delivery
Slope Wetlands	**Groundwater movement**

1 Processes in bold are most important for maintaining the integrity of the aquatic resource.

2.2.3.1 Process Controls

The key processes noted above operate in a framework established by process controls, including geology, climate, vegetation, and land use. Geology and climate are ultimate controls that are generally not manageable by humans and are relatively free from human influence.[3] Vegetation and land use are proximate controls that are more manageable and susceptible to human activity.

Geology

Geology imposes a suite of conditions on landscape processes. To that affect, (1) It influences topography, landform stability, and substrate permeability and reactivity. (2) Geology determines the route and type of water transport pathways (overland flow, streams, and subsurface flow) over and through the landscape. (3) It also influences water quality through residence time (infiltration rate), substrate chemistry and pH, sediment availability, and to some extent toxin availability (heavy metals) (Turney et al. 1995).

Climate

Climate interacts with geology to determine watershed conditions. Glaciation resulting from climate change was the predominant process that shaped much of the surficial geology in the

[3] Human activities can affect climate (global warming) however climate change is not manageable at the local scale.

Puget Sound region. While geology can determine where and how materials move through a system, climate is directly responsible for the amount, form, and timing of water inputs.

Vegetation

The plant cover over a landscape, or on a site, influences the interaction of water and surficial geology. Plants perform a number of important functions that control the distribution of water including: intercepting precipitation, which decreases water's available energy for sediment transport; recirculating water through transpiration, which may, in turn, influence local climatic conditions; providing shade, which moderates temperatures and humidity near the ground's surface; stabilizing soil structure with their roots; and providing organic input, nutrient enrichment, and habitat structure. Thus, vegetation is extremely important for protecting and restoring aquatic resources. The ability of vegetation to perform these functions varies with vegetation type (forest, meadow, shrub wetland).

Unlike geology and climate, human activities can easily alter vegetation. The type and extent of vegetation on a site, or within a region, can vary dramatically over a short time-interval as a result of human actions (i.e., burning, clearing, irrigation). Thus, it is a proximate control that can be managed.

Land Use

Land use activities related to agriculture, forestry, and residential/commercial development, can alter vegetation and, to a lesser extent, surficial geology, which can affect landscape processes. Land use acts as a stressor on natural processes disrupting the interception and uptake of precipitation and nutrients; microclimate; the type and amount of nutrient and pollutant inputs; infiltration and recharge; and the proportion of water distributed via surface and subsurface flows.

2.2.4 Important Areas and Process Alterations

Each landscape process works via a suite of mechanisms through which the process influences ecological functions and by which it may be impaired. For example, erosion and mass wasting mechanisms determine sediment inputs to aquatic systems, while other mechanisms act to store or transport the delivered sediment through the system. These mechanisms are associated with specific areas (referred to as important areas) on the landscape that exhibit certain characteristics (geology, vegetation, and land use). The relationship between processes, mechanisms, and important areas is summarized in Table 2-2.

Table 2-2. Mechanisms and Important Areas for Landscape Processes

Process	Mechanism	Important Areas
Hydrology	Infiltration/recharge	Permeable soils, riparian areas, floodplains
	Surface water storage	Depressional wetlands, lakes, floodplains,
	Peak flows	Impervious surfaces, rain-on-snow (ROS) zone, forest cover
	Groundwater movement (baseflow)	Permeable deposits, fissured bedrock
Sediment Supply	Erosion	Erodible soils, especially on steep slopes, Channel Migration Zones (CMZs)
	Mass wasting	Slopes prone to landslides
Water Quality	Physical properties (temperature, turbidity)	Forest cover, riparian zones
	Chemical properties (pH, nutrient levels)	Depressional wetlands, wetlands with organic soils, riparian zones, hyporheic zones, floodplains
	Contaminants (toxins, pathogens)	Depressional wetlands, riparian zones, hyporheic zones, floodplains
Organic Inputs/LWD	Riparian vegetation	Riparian zones, forested CMZs
	LWD recruitment	Riparian zones, forested CMZs, landslide hazard areas

2.2.4.1 Hydrology

Hydrology is the study of the movement of water through the landscape. For purposes of this report, hydrologic mechanisms include infiltration and recharge, surface water storage, peak flows, and groundwater flow. Interception and evapotranspiration, two other important hydrologic mechanisms, are not considered in this landscape analysis, but their alteration is inferred from changes in land cover.

Well-drained soils, floodplains, rain-on-snow (ROS) zones, depressional wetlands, and lakes are all areas of importance for the distribution of water over the landscape. As water, typically in the form of precipitation, contacts the ground surface, infiltration is the first mechanism that determines the movement of water through the landscape. Infiltration is important as the source of water (recharge) for lateral subsurface movement (interflow) or baseflow (groundwater), which in turn are important for aquifer recharge and stream discharge. Depressional wetlands, floodplains, and lakes/ponds all have the potential to store

water, particularly during peak flow events (Sheldon et al. 2003; Hruby et al. 2000). This surface water storage desynchronizes runoff, attenuating the duration of storm events and reduces peak flows. Runoff is the discharge of surface water through a watershed. Sources of runoff include direct precipitation onto surface waters, overland flow, interflow, and groundwater discharge. The rate, distance, and volume of water movement across the landscape vary for each of these water sources, and this variability desynchronizes flows.

Water's distributive pathway across the landscape affects the volume, location, and timing of water availability. Hydrologic connectivity affects stream base flows and wetland hydrology, particularly during low-flow periods, and is an important issue for fisheries management. Flow volume and water depth to a large degree determine habitat suitability for fish in streams and off-channel waters. Stream channelization (the straightening and armoring of channels) increases flow velocities and simplifies instream habitat. Culverts, while maintaining hydrologic connectivity, may be barriers to fish passage by altering flow velocities or channel morphology (Solomon and Boles 2002, 2004; SBSRF 2004; Stockard and Harris 2005).

Groundwater flow paths occur at regional, intermediate and shallow scales corresponding to shorter flow paths and residence time, respectively. Regional groundwater is maintained along deep flow paths in pre-Quaternary bedrock and is defined by large-scale topographic features such as Puget Sound and the Cascade Mountains. Local groundwater occurs in upper Quaternary deposits and is governed largely by local topography. Recharge occurs mainly in glacial drift plains and is discharged as surface water via springs and seeps. Shallow groundwater boundaries typically follow surface watersheds. The location, flow path depth, and scale of movement of intermediate groundwater falls somewhere between regional and shallow groundwater. Groundwater serves as a source of stream baseflow during summer and can be an important source of drinking water. In Puget Sound, groundwater is the primary source of drinking water for rural areas and is increasingly being used for urban consumption (Ebbert et al. 2000).

2.2.4.2 Sediment Supply

Water is the medium and gravity the energy that move sediment from hillslopes to aquatic systems. Hillslope sediment transport is accomplished primarily through surface erosion, mass wasting, and slope creep; therefore areas of erodible soil and landslide-pone hillslopes are important areas for sediment supply processes. Clearing vegetation, exposing erodible soils, or increasing the amount of impermeable surface may affect the pattern and timing of water distribution, which may, in turn, accelerate erosion and slope failures.

Over time, streams move laterally, or migrate, across their floodplains. Channel migration may be gradual as a stream erodes its banks or may occur as a sudden event when a stream shapes a new channel, avulsing a portion of the floodplain and abandoning the previous channel. The area of active channel migration is called the channel migration zone (CMZ) and it can be an important area for sediment supply (KCDNRP 2004).

Surface erosion occurs as the result of physical soil entrainment by water. Conversely, mass wasting transports soil down hillslopes discontinuously, at high rates over very brief periods of time, and can transport soils at greater depths than creep. This landscape analysis is limited to surface erosion and mass wasting because they are the dominant natural sources of increased sediment inputs due to land use (Nelson 1999; Slaymaker 2000). Erosion above natural background levels may degrade stream habitat by increasing the proportion of fines in the substrate and if elevated sufficiently, aggrade the streambed. Streambed aggradation may lead to channel braiding (the development of multiple shallow channels) and can limit or

block fish passage and further degrade habitat suitability (Dunne and Leopold 1978; Herrera Environmental Consultants, Inc. 2002).

2.2.4.3 Water Quality

Important areas for water quality processes are depressional wetlands, floodplains, and hyporheic zones. These areas affect the rate at which water moves over and through the landscape. Slower transport times allow sediments, chemicals, and nutrients to settle out of water (Minton 2002). Water quality is affected by parameters that include the physical properties (temperature, clarity) and chemical composition of water. Degraded water quality results when these parameters exceed normal baseline levels, often from the input of additional sediment, nutrients (phosphorous or nitrogen), or the introduction of toxins (e.g., pathogens, heavy metals, or pesticides). Water quality can also be impaired by a decrease in specific parameters, such as dissolved oxygen (DO) or pH. Toxins, such as mercury and fecal coliform, may present a health risk to humans (WAC §173-201A).

Alterations in heat and light reaching a water body can alter water quality. Heat inputs may occur within a given water body or stream reach, or in upstream tributary waters. Light inputs are a function of the amount of shade at a given site, but elevated water temperatures may by transported to receiving waters. Changes in the amount of light may affect the density and composition of the water plants within a water body, which may in turn, determine habitat suitability for aquatic animals. In this study, alterations in heat will be discussed under water quality and alterations in light (shading) will be discussed under organic inputs.

When water quality is degraded beyond the normal range the endemic aquatic community is adapted to, species may be lost from the community (Naiman et al. 1992). Impaired water quality may lead to algal blooms or the proliferation of non-native species, further compromising water quality. Salmonids are sensitive to changes in dissolved oxygen, turbidity, temperature, and pH and alterations in these parameters, have been identified as limiting factors for salmonid reproduction and survival (NMFS 1996; WAC §173-201A; SBSRF 2004; Solomon and Boles 2004).

Land use and the proportion of the built environment within a watershed can directly impact water quality in a given basin, including groundwater. Generally, the more developed a basin, the greater the proportion of impervious surface and potential for increased input of sediment, pollutants such as hydrocarbons, and nutrients to a water body.[4] The primary mechanism of contaminant transport from urban and rural lands to the surrounding watershed is runoff. Impervious surfaces (i.e., roads, sidewalks, pavement, and rooftops) are key in the transport of stormwater runoff and associated contaminants (Minton 2002). Irrigation and storm events can enhance the movement of pesticides and metals bound to loose organic matter (Minton 2002), and increased sediment loads created by erosion can accumulate adsorbtive pollutants (EPA 2001). Elevated nutrient, pesticide, and fecal coliform levels in water have been found in agricultural areas (Solomon and Boles 2002; Onwumere and Batts 2004).

[4] Increased impervious surface area is also associated with higher peak flows and lower base flows in small streams (Paul and Meyer 2001; Adolfson Associates, Inc. 2004; Glasoe and Christy 2004).

2.2.4.4 Organic Matter and LWD Inputs

Organic matter, often in the form of leaf litter and other plant detritus, is the basis of the food web and largely determines productivity in aquatic and terrestrial systems. Riparian areas are important areas for organic and heat/light processes. Organic inputs provide nutrients and structure to the substrate and are an important food source for microbes, invertebrates, vertebrates, and plants (Knutson and Naef 1997; Kauffman et al. 2001; Sheldon et al. 2003). If abundant enough, organic matter may be the principal component of organic soils (peat, muck). Originating as plant and animal matter, organics may be imported to an aquatic site by surface waters or may originate *in-situ*.

LWD (greater than 4-inches diameter and 6-feet length) provides nutrients, structure, and essential fish and wildlife habitat to streams and wetlands (Knutson and Naef 1997; Kauffman et al. 2001; Solomon and Boles 2002; Sheldon et al. 2003). By altering stream hydraulics, LWD contributes to the creation of scour pools and eddies and also provides cover (shade and refugia), all of which are important habitat features for salmonids and other aquatic species (Kauffman et al. 2001; Solomon and Boles 2002; SBSRF 2004). Delivery of LWD to streams results from landslides along steep slopes or bank failures via active channel migration in CMZs (Collins and Sheikh 2002; KCDNRP 2004).

2.3 RESOURCE MAPPING

The analysis area for resource mapping includes the municipal boundary and designated urban growth area (UGA) for the City of Duvall. Base layers for resource mapping and analysis were provided by the City. The digital municipal and UGA boundaries were merged to create the analysis area boundary. Digital stream, basin, and two-foot contour layers were used to define Sub-basins within the analysis area. Sub-basin boundaries were delineated based on topography and streams.

Land cover within the City was mapped from true color digital orthophotographs (2002) . The coordinate system for the analysis was Washington State Plane North, North American Datum 1983, feet. Five general land cover categories were defined prior to mapping:

- **Developed –** main arterial roads and highways, paved surfaces, and building or structure footprints and the associated landscaping (less than 1 acre in size);
- **Grass –** meadows, pastures, and landscaped areas (greater than 1 acre in size) dominated by herbaceous vegetation;
- **Tree/shrub –** discontinuous mature tree cover, usually deciduous species, continuous sapling tree cover, or shrub cover;
- **Forest –** continuous mature tree cover, usually conifers; and
- **Water –** open water in Rasmussen Lake and the Snoqualmie River.

Land cover polygons, down to approximately 1-acre in size, were delineated onscreen using ArcVIEW GIS®, Version 3.2 and attributed with the appropriate cover category. Polygon delineation and attribution were based on an ocular estimate of the dominant cover type within the polygon.

To assess the condition of aquatic resources within the City, digital layers provided by the City (wetlands, streams, soils, topography) were overlaid on the land cover layer produced by Parametrix. Distances from aquatic resource areas to other features and the radius of potential resource buffers were calculated by ArcVIEW GIS®.

2.4 ASSUMPTIONS AND DATA GAPS

The landscape analysis approach uses readily available information to assess conditions. This approach assumes that adequate data are available; that available site-specific studies are applicable to the watershed; and that conditions within the analysis area have not changed appreciably since the available studies were done. Where data are not available, or current, surrogates for a given parameter may be appropriate (existing forest conditions as a surrogate for LWD in streams).

3. RESULTS

This section provides a broad overview of the Snoqualmie Watershed and the landscape processes influencing the functions of aquatic resources. Processes are assessed in regard to their historic conditions and the subsequent impairments that have occurred as a result of human activity. Landscape processes and ecological functions are discussed at the watershed and the sub-basin scales to provide the context for management decisions for the protection and restoration of critical areas within the City of Duvall.

3.1 Overview of Snoqualmie Watershed and Duvall

The following sections describe the characteristics of the contributing areas and outline the framework within which landscape processes function in the watershed and in the Duvall analysis area.

3.1.1 Aquatic Resources

Aquatic resources within the watershed include the Snoqualmie River and tributary streams; floodplain, depressional, and slope wetlands; lakes; and groundwater. Historically, these aquatic resources provided important functions such as peak flow storage, groundwater recharge, water quality maintenance, and fish and wildlife habitat. The Snoqualmie Watershed is composed of 16 basins, ranging in size from 4 to 170 square miles in area. The larger basins are generally found in the eastern portion of the watershed, where the topography steepens appreciably above approximately 1,500 feet elevation. Approximately 2,243 miles of streams have been mapped throughout the watershed, ranging in size from small unnamed tributaries to the mainstem Snoqualmie River (King County GIS 2005). Major tributaries to the Snoqualmie River include Cherry Creek (right bank, RM 7), the Tolt River (right bank, RM 24), the Raging River (left bank, RM 35), and Tokul Creek (right bank, RM 38). The gradient of the Snoqualmie River is steepest above Snoqualmie Falls and is gradual below the falls (Solomon and Boles 2002).

Historically, wetlands within the watershed would have been most abundant within the Snoqualmie River floodplain. Lakes are found throughout the watershed. Porous and alluvial soils, conducive to groundwater recharge are found primarily along the mainstem Snoqualmie River.

The Snoqualmie River provided migratory, spawning, and rearing habitat for all salmonids native to Western Washington, except for sockeye salmon (*Oncorhynchus nerka*) (Wydoski and Whitney 2003). Riparian and instream habitat would have supported a number of species that today are listed or classified as special status species, including Chinook salmon (*O. tshawytscha*), coho salmon (*O. kisutch*), bull trout (*Salvelinus confluentus*), and bald eagles (Haliaeetus leucocephalus),. Tributary streams, including Duvall area streams, would have likely provided spawning and rearing habitat for coho salmon, steelhead and rainbow trout (*O. mykiss*), and cutthroat trout (*O. clarki*).

In the Duvall area, important aquatic resources include approximately 2 miles of the mainstem Snoqualmie River, Thayer and Coe-Clemmons Creeks, Cherry Creek tributaries, and a number of palustrine wetlands (Figure 3-1). The area of Duvall west of State Route 203 is within the Snoqualmie River floodplain and the boundary between the Snoqualmie and Cherry Creek basins bisects Duvall, running in a northwesterly to southeasterly direction (King County GIS 2005). For this study, eleven sub-basins were identified within the analysis area (Table 3–1).

Table 3-1. Sub-basins Within Duvall Analysis Area.

Basin	Sub-basin	Area (acres)	Percent Analysis Area
Snoqualmie	Snoqualmie North	213	11
	Coe-Clemmons Creek	374	18
	Snoqualmie River	29	1
	Thayer Creek	269	13
	Snoqualmie South	324	16
Cherry Creek	Cherry Creek A	223	11
	Cherry Creek B	91	4
	Cherry Creek C	174	9
	Cherry Creek D	195	10
	Snoqualmie East	77	4
	Snoqualmie Southeast	54	3

3.1.2 Geology

Encompassing approximately 692 square miles, the Snoqualmie Watershed extends from the crest of the Cascade Mountains in the east to the confluence of the Snoqualmie and Skykomish Rivers in southwestern Snohomish County. Elevation within the watershed varies from approximately 15 feet (mean sea level [msl]) at the confluence of the Snoqualmie and Skykomish Rivers to approximately 6,700 feet msl along the Cascade crest. The Snoqualmie Watershed is located within the 1,856-square-mile Snohomish Basin (Water Resource Inventory Area 7), the second largest basin on Puget Sound (SBSRF 2004).

The topography steepens in the eastern portion of the watershed and bedrock is relatively common in the mountains. A large bedrock outcrop, at approximately RM 40 on the mainstem Snoqualmie River, forms Snoqualmie Falls and separates the upper Snoqualmie Valley from the lower valley. The landforms within the Snoqualmie Watershed have been shaped by glaciation. The foothills of the Cascades and surrounding the Snoqualmie Valley are generally overlain with glacially derived soils such as till and outwash. Alluvium, varying in size from boulders and cobble to silt, is found along the floor of the Snoqualmie Valley and major tributaries. Snoqualmie Falls blocks the downstream transport of coarse sediment; tributary streams below the falls supply coarse sediment to the lower valley (Solomon and Boles 2002).

The City of Duvall is located on the east slope of the lower Snoqualmie Valley, between approximately RMs 9 and 11 (Solomon and Boles 2004). The analysis area for this study (city limits and UGA) encompasses approximately 2,023 acres. Duvall is situated along the western slope of a knoll that is contiguous with hilly topography on the western edge of the Cascade foothills. Topography along the northeastern portion of the analysis area is quite steep and King County has mapped this area as prone to landslides (King County GIS 2005). The Snoqualmie River forms the western city limits of Duvall and approximately 7 percent of the city (138 acres) lies within the Snoqualmie floodplain.

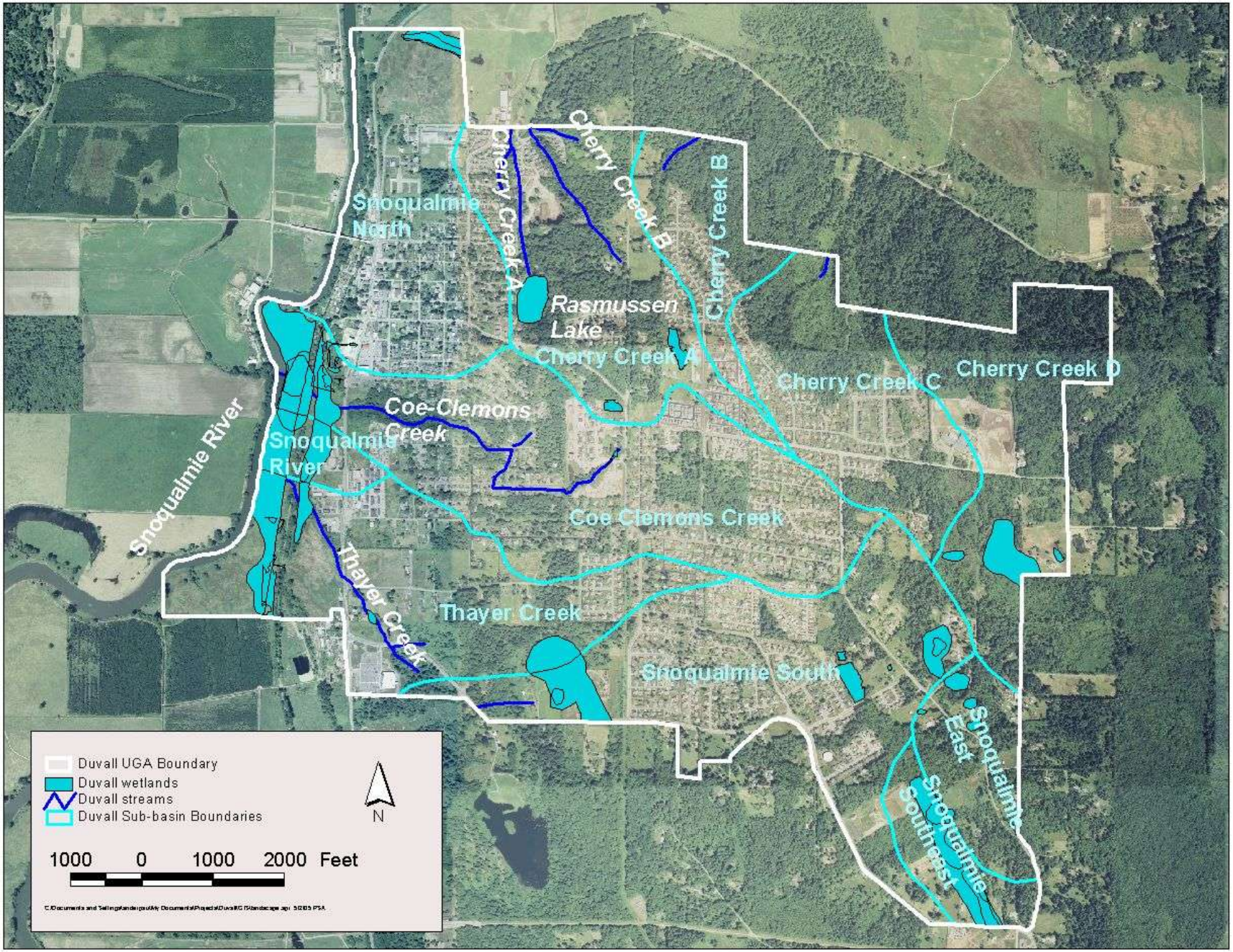

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Figure 3-1
Sub-basins and Important Aquatic Resources, City of Duvall

Relatively impermeable till (Alderwood gravely sandy loam) is the principal soil type (1,837 acres; 91 percent) found in the analysis area; the remainder being outwash (48 acres; 2 percent) and alluvium (138 acres; 7 percent). The outwash is Alderwood and Kitsap soils on very steep slopes (25 to 70 percent slope), which have rapid runoff, a severe to very severe erosion hazard rating, and a severe potential for slippage (SCS 1973). Outwash soil is found primarily along the northeastern city limits, roughly corresponding to the landslide hazard area mapped by King County (King County GIS 2005), and is also found along Coe-Clemmons Creek between State Route 203 and 3rd Avenue Northeast. Alluvial soils in the analysis area (Briscot silt loam, Nooksack silt loam, and Puget silty clay loam) are fine grained, having slow to moderate permeability, slow runoff, and a slight erosion hazard (SCS 1973). Two of these alluvial soils (Briscot silt loam and Puget silty clay loam) are classified as hydric soils (SCS 1991), which typically develop in low-energy (floodplains, wetlands, and off-channel areas), saturated conditions and may be a wetland indicator (Sheldon et al. 2003).

3.1.3 Climate

Climate is directly responsible for the gross patterns of thermal inputs and the magnitude, type, and timing of water inputs to a region. Climate also indirectly influences the movement of other materials. Western Washington has a maritime climate characterized by cool summer and mild winter temperatures. Prevailing southwesterly winds from the Pacific Ocean deliver an annual average of up to 48 inches of precipitation, primarily as rainfall, to the Puget Trough lowlands. Most precipitation falls between October and March and summers are typically dry. At lower elevations, winter temperatures below freezing and snow may occur but are usually of short duration (Franklin and Dyrness 1987).

Weather patterns can be regionally generalized in the Snoqualmie Watershed. Due to orographic effects, the Cascade Mountains receive the bulk of precipitation in the watershed, with Snoqualmie Pass (elevation 3,020 feet msl) receiving up to 105 inches of precipitation annually (period of record 1931 to 1972) (WRCC 2005). Much of this precipitation occurs in the form of snow; the mean average snow depth for the period of record was 34 inches at Snoqualmie Pass (WRCC 2005). Precipitation and the snowfall:rain ratio decrease with elevation and to the west towards the shoreline of Puget Sound. In contrast to Snoqualmie Pass, average annual precipitation at Snoqualmie Falls (elevation 440 feet msl) and Everett (elevation 60 feet msl) is 61 inches and 37 inches, respectively, while average annual snow depth for both is 0 inches (WRCC 2005).

Runoff processes are a function of the timing and type of rainfall. The Snoqualmie River headwater streams receive a large proportion of total annual runoff from snowmelt originating in the Cascade Mountains. At mid to high elevations within the watershed (between 1,500 and 4,500 feet elevation msl), ROS events play an important role in runoff. Below approximately 1,500 feet elevation, rainfall is the principal source of precipitation to the Snoqualmie River and smaller drainages within the watershed (Brunengo et al. 1992; Solomon and Boles 2002; Ketcheson et al. 2003).

3.1.4 Vegetation

Historically, Western Washington and the Snoqualmie Watershed were mostly forested (Franklin and Dyrness 1987; Collins and Sheikh 2002). Upland areas were dominated by coniferous forest. Hardwoods and shrub communities were found along valley bottoms and within floodplains. However, conifers accounted for the majority of biomass in valley bottoms and over the landscape.

The majority of the Snoqualmie Watershed lies within the *Tsuga heterophylla* (western hemlock) forest zone; that portion of the watershed above approximately 2,000 feet elevation lies within the *Abies amabilis* (Pacific sliver fir) zone (Franklin and Dyrness 1987). Historically, forests were the dominant plant communities in the Snoqualmie Watershed. Upland areas were dominated by coniferous forest, composed primarily of western hemlock, Douglas-fir (*Pseudotsuga menziesii*), and western redcedar (*Thuja plicata*), with Pacific sliver fir predominant at higher elevations. Hardwoods, such as red alder (*Alnus rubra*), black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), and willows (*Salix* spp.), were more abundant than conifers in valleys and floodplains, but conifers increased in frequency with distance from active stream channels (Franklin and Dyrness 1987; Collins and Sheikh 2002).

In a reconstruction of Snoqualmie Valley habitat conditions in approximately 1870, prior to settlement by Anglo-Americans, Collins and Sheikh (2002) identified a large shrub-dominated wetland complex between RM 4 and RM 11 (which includes the Duvall vicinity). This wetland complex occupied the full breadth of the valley, contained remnant channels and depressions that appeared to be at lower elevations than the Snoqualmie River banks, and included extensive areas of emergent marsh (Collins and Sheikh 2002).

Conifer forests are still the dominant plant community over much of the watershed, particularly in the foothills of the Cascades. Riparian forests along the mainstem Snoqualmie River have, to a large extent, been cleared and converted to agricultural or developed lands (Collins and Sheikh 2002; Solomon and Boles 2004).

Emergent and shrub communities are found in wetlands and riparian zones throughout the watershed. Shrub communities dominated by Sitka alder (*Alnus sinuata*) and blueberries (*Vaccinium*) are common on high elevation slopes and avalanche chutes. Dominant species in the lowland shrub communities include red alder, willow, red-osier dogwood (*Cornus sericea*), and hardhack (*Spiraea douglasii*), while common emergent wetland species include sedges *(Carex* spp.), rushes (*Juncus* spp.), cattails (*Typha latifolia*), and skunk cabbage (*Lysichiton americanum*).

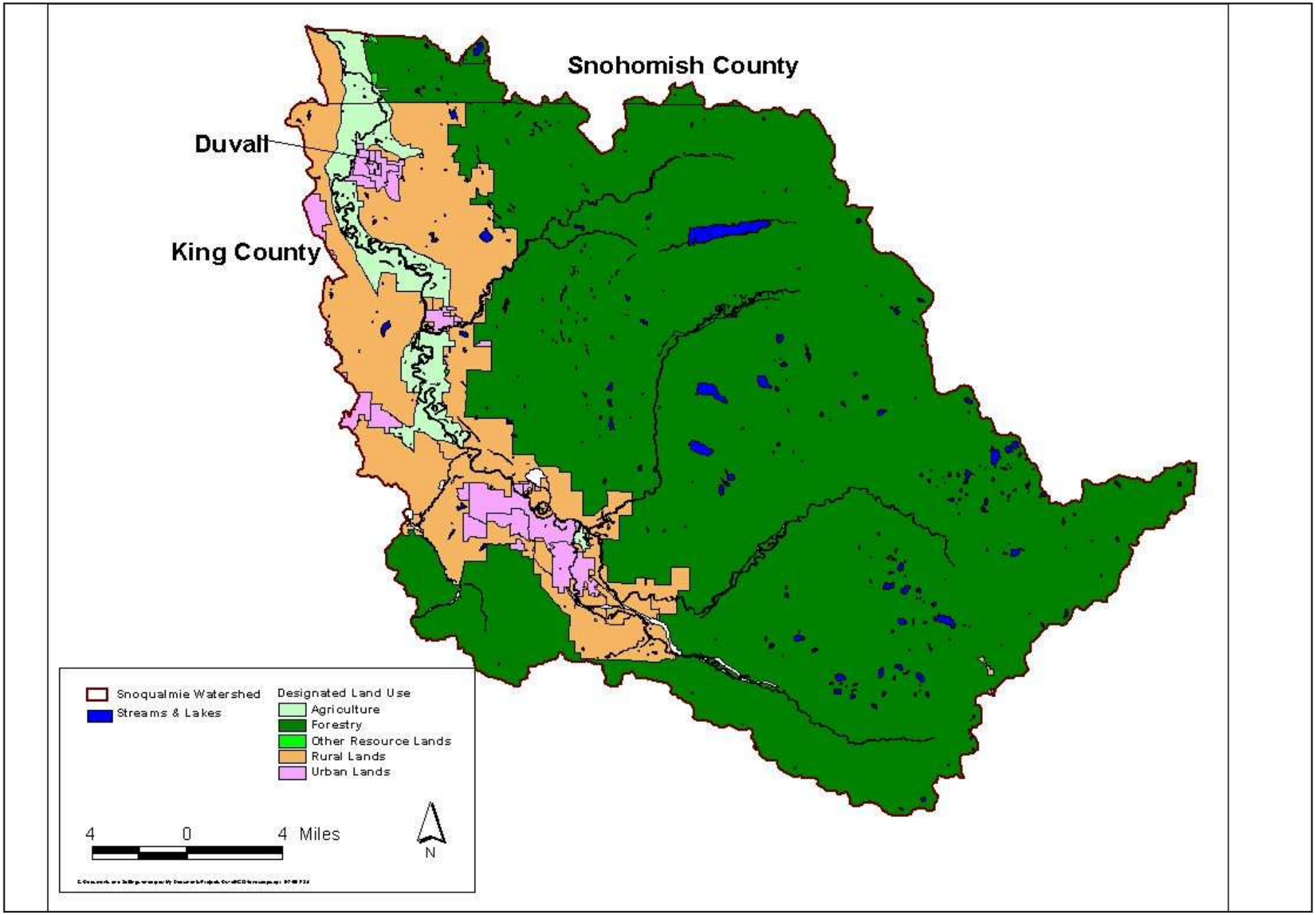
Prior to settlement, it is likely that nearly all of Duvall was forested. Non-forested areas would have primarily been wetlands, open water, and active landslides (Franklin and Dyrness 1987).

3.1.5 Land Use

Approximately 97 percent (664 square miles) of the watershed are within King County, and the northerly 3 percent (21 square miles) are within Snohomish County (Figure 3-2). Today, over 76 percent of the Snoqualmie Watershed is classified as forest land (525 square miles) (Solomon and Boles 2002; King County GIS 2005; Snohomish County GIS 2005). The Mount Baker-Snoqualmie National Forest, commercial timberlands, and the City of Seattle's South Fork Tolt Watershed are found in the eastern two-thirds of the Snoqualmie Watershed. Timber harvest on the publicly owned forestlands has declined dramatically since the early 1990s due to concern over threatened fish species and water quality (Seattle Public Utilities 2003).

Agricultural lands within the watershed, primarily in dairy production, are concentrated within the Snoqualmie River floodplain downstream from the City of Snoqualmie (RM 34).

Designated agricultural lands cover approximately 4 percent (26 square miles) within the Snoqualmie Watershed (King County GIS 2005; Snohomish County GIS 2005).



Parametrix City of Duvall 553-3240-006/01(02) 5/05 (B)

Figure 3-2
Land Use, Snoqualmie Watershed

Urban lands within the watershed account for approximately 3 percent (19 square miles) of the lands. Four incorporated cities are found within the Snoqualmie Valley (Duvall, Carnation, Snoqualmie, and North Bend) and portions of the urban growth areas for the cities of Redmond and Sammamish are located on the western edge of the watershed (King County GIS 2005; Snohomish County GIS 2005). In 2000, the Snoqualmie Valley human population was of 40,000 and is expected to reach 70,000 by the year 2020 (Solomon and Boles 2002).

The remainder of land use within the watershed (117 square miles; 17 percent) is designated as rural residential (King County GIS 2005; Snohomish County GIS 2005). Table 3–1 summarizes the designated land use categories within the Snoqualmie Watershed and Duvall.

Land use within Duvall is primarily urban, including a number of residential designations, commercial, employment, and public facilities. Designated open space within Duvall includes parks, open space, and vacant lands (see Table 3–2, Figure 3–3).

Table 3-2. Land Use within the Snoqualmie Watershed and Duvall.

Snoqualmie Watershed	Land Use Category	Acres	Percent of Area
	Agriculture	16,673	4
	Forestry	335,906	76
	Other Resource Lands[1]	477	<1
	Rural Lands[2]	74,571	17
	Urban Lands[3]	11,870	3
Total		43,9497	100
Duvall[4]	Land Use Category	Acres	Percent of Area
	Urban[5]	896	70
	Open Space[6]	388	30
Total		**1,284**	**100**

1 Includes Mineral, Open Space, and Rural Conservation lands
2 Includes Rural-5 acre, Rural Neighborhood, Rural Residential, Rural Town, and Rural City Urban Growth Area lands
3 Includes Urban Growth Area, Urban Planned Development, and Urban Residential lands
4 Acreage within city limits from Duvall Comprehensive Plan (2004)
5 Includes Commercial, Employment, Mixed Use, Public Facilities, and Residential land use
6 Includes Parks Open Space and Vacant land use
Source: King County GIS (2005); Snohomish County GIS (2005); City of Duvall (2004)

3.2 Landscape Process Inventory

This section describes important areas for key processes based on historic conditions.

3.2.1 Hydrology

Important areas for hydrologic mechanisms are found throughout the Snoqualmie Watershed. High precipitation and ROS areas are found at the higher elevations in the eastern watershed; well-drained soils, important for infiltration, are found along the valley bottoms and lower side slopes; floodplains and depressional wetlands are found along the mainstem Snoqualmie and major tributaries; and lakes are scattered across the landscape from the lowlands to the higher elevations. Figure 3-4 highlights the important areas for hydrologic mechanisms in the Snoqualmie Watershed.

3.2.1.1 Infiltration and Recharge

Two geologic formations in the Snoqualmie Watershed are important to infiltration and are associated with surficial recharge: porous, coarse-grained soils (outwash) above relatively impermeable subsurface strata; and alluvium along major streams. Deep recharge is found in areas with fissured bedrock (Turney et al. 1995; Adolfson Associates, Inc. 2004). These areas occur within and adjacent to the Snoqualmie River and tributary floodplains (King County Groundwater Protection Program 2004). King County mapped a large, contiguous area of coarse-grained soils along the Snoqualmie River floodplain in King County from approximately RM 50 (east of North Bend) downstream to approximately RM 6 on the Snohomish County line (King County Groundwater Protection Program 2004) (see Figure 3–4). Tributary basins also contain smaller areas of high infiltration capacity contiguous with the Snoqualmie floodplain. Mapped groundwater movement within the East King County Groundwater Management Area areas is downslope towards the Snoqualmie River and downstream within the Snoqualmie Valley. Groundwater elevations (above msl) vary from approximately 800 feet in the Snoqualmie-North Bend area to 40 feet within the Snoqualmie floodplain near Duvall (King County Groundwater Protection Program 2004).

Precipitation rates within the watershed are higher in the Cascade Mountains and foothills than to the west, and areas with high infiltration and recharge capacity typically occur in the upper Snoqualmie Valley. Mapped annual recharge rates along the Snoqualmie River vary from approximately 10 inches at Duvall up to approximately 60 inches at North Bend (Turney et al. 1995).

Two large aquifers are found beneath the Snoqualmie River, the larger of the two is the Snoqualmie Aquifer, in the vicinity of North Bend (East King County Ground Water Advisory Committee 1998). This aquifer is of sufficient size to have been identified as potential source of municipal water and low-flow augmentation for the river (Seattle Public Utilities 2001; Adolfson Associates, Inc. 2004).

The East King County Groundwater Management Plan has identified the Snoqualmie Aquifer as a high priority for protection (East King County Ground Water Advisory Committee 1998) and the county has established a groundwater protection committee for eastern King County (King County Ordinance 14214). The relatively high infiltration rate through the substrate overlying the Snoqualmie Aquifer is correlated with a high risk of aquifer contamination, and Ecology monitors groundwater quality in this region (Onwumere and Batts 2004) (see Water Quality below).

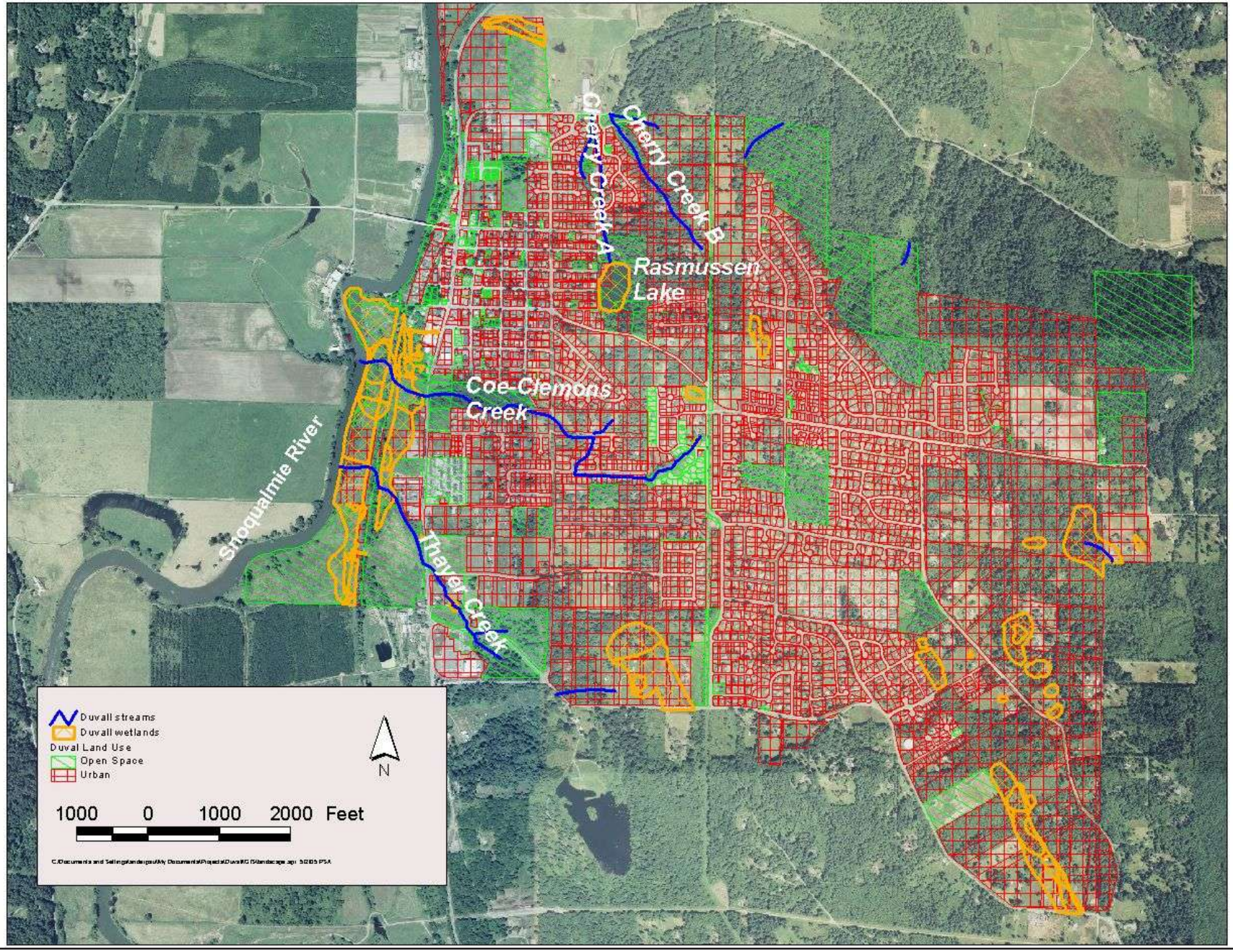


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Figure 3-3
Land Use Designations
City of Duvall

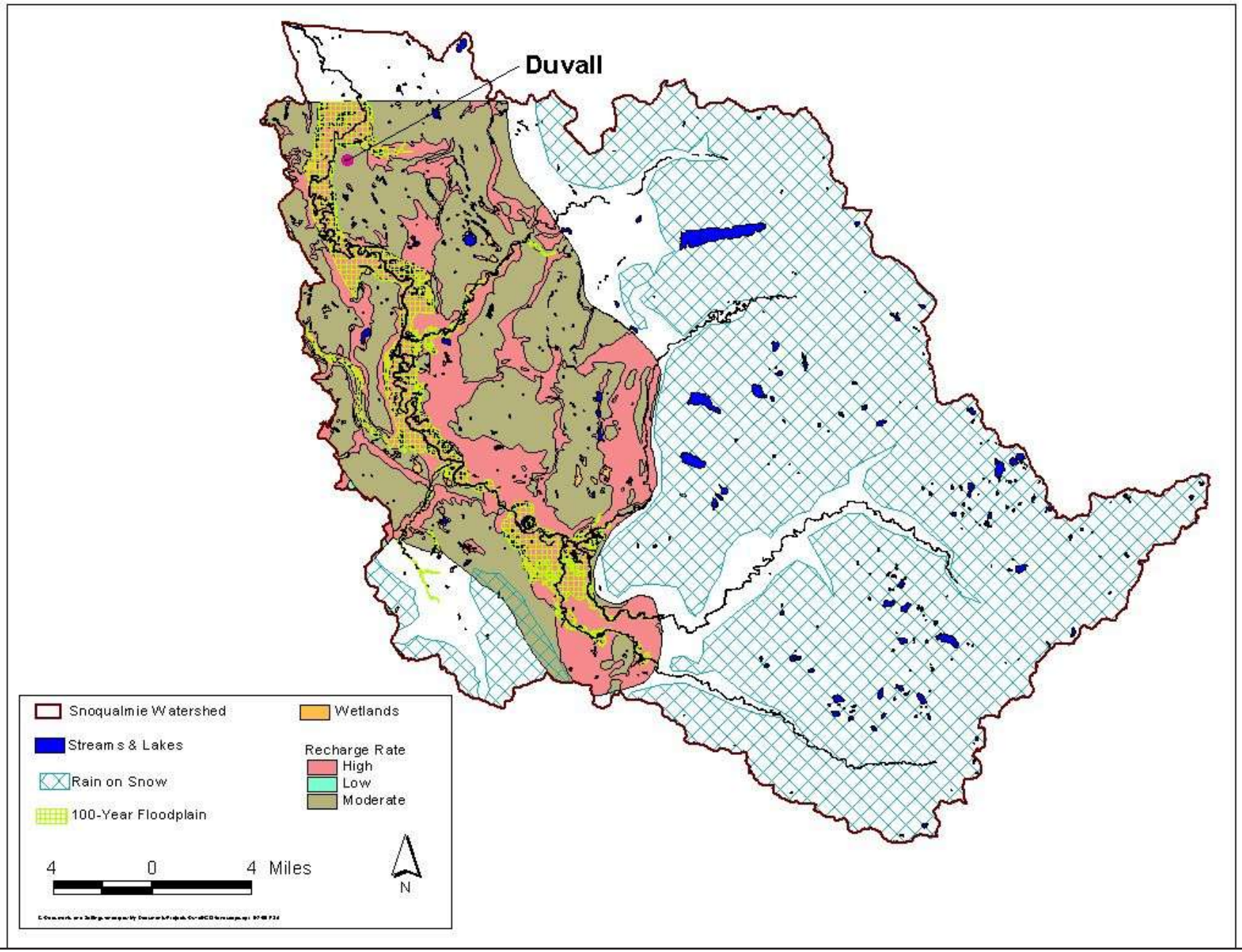

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Figure 3-4
Hydrologic Mechanisms and Important Areas, Snoqualmie Watershed

Due to the steep slopes and relatively impermeable till soils that underlie much of Duvall, infiltration and groundwater recharge within Duvall is limited. The estimated annual recharge of 10 to 20 inches for most of the Duvall area is a relatively low rate of recharge (Turney et al. 1995). Porous soils in northeastern Duvall have been mapped by King County as an important area for recharge (Figure 3-5) (King County GIS 2005).

3.2.2 Surface Water Storage

Within the Snoqualmie Watershed, surface water storage at high elevation is found primarily in tarns and the Tolt Reservoir; and at lower elevations within lakes, alluvial channels and floodplains, and depressional wetlands. The mapped Snoqualmie 100-year floodplain encompasses approximately 34 square miles (King County GIS 2005).

Within the Duvall analysis area, approximately 200 acres are available for surface water storage in the Snoqualmie River floodplain, wetlands outside of the floodplain and Rasmussen Lake. The 100-year floodplain within Duvall (133 acres) accounts for approximately 0.6 percent of the mapped Snoqualmie 100-year floodplain storage capacity.

The principal streams arising in Duvall (Thayer Creek, Coe-Clemmons Creek, and Cherry Creek tributaries) generally have limited surface water storage capacity due to the relatively steep stream gradients, impermeable soils, and limited off-channel wetlands above the Snoqualmie Valley. One exception to the limited storage capacity in Duvall is the westerly tributary to Cherry Creek, identified as Cherry Creek Tributary A by Herrera Environmental Consultants, Inc. (2002), which passes through Rasmussen Lake, the largest water body in the city. Rasmussen Lake, approximately 5.3 acres, is identified on the National Wetlands Inventory map as a palustrine unconsolidated bottom permanently flooded wetland.

3.2.2.1 Peak Flows

Peak flows in the Snoqualmie River and principal tributaries typically occur November through January because of ROS and May and June as a result of snowmelt (Solomon and Boles 2002). Historically, overbank flooding by the Snoqualmie River in the lower valley was likely a regular occurrence. A number of tributary streams (Tolt River, Raging River, Cherry Creek, and Tuck Creek) in the lower valley would have also been subject to overbank flooding during the winter (Solomon and Boles 2002, 2004).

Although overbank flooding is a regular occurrence along the mainstem Snoqualmie River, prolonged inundation of the floodplain periphery was likely an infrequent occurrence historically (Collins and Sheikh 2002). Forest cover within the Snoqualmie floodplain, circa 1870, appeared to be stratified by species tolerance to inundation. Trees relatively tolerant of saturated soils, predominantly hardwoods, were found closest to the river, while the incidence of conifers increased with distance away from the mainstem Snoqualmie (Collins and Sheikh 2002).

Warm, moisture-laden tropical weather systems in winter usually produce the heaviest rains and stream flows, particularly in the ROS zone (Dunne and Leopold 1978; Solomon and Boles 2002). The ROS zone occurs in middle elevations where temperatures alternate from freezing to non-freezing conditions. In Puget Sound, these conditions usually occur in elevations ranging from 1,500 to 4,500 feet (Brunengo et al. 1992). Approximately 370 square miles of the Snoqualmie Watershed (54 percent) are within the ROS zone (see Figure 3-4).

The highest elevation in Duvall is less than 500 feet, well below the ROS zone. However, the Duvall portion of the Snoqualmie floodplain may be inundated as a result of rapid snowmelt in upstream, higher elevation basins. Because all of the streams within Duvall, except for the

Snoqualmie River, are headwater streams with relatively small contributing basins, extensive overbank flooding from these streams was likely not a regular occurrence historically. The reaches of these streams within the Snoqualmie floodplain would have been subject to flooding from the Snoqualmie River.

3.2.2.2 Groundwater Flow

Intermediate and shallow are the appropriate scales for discussing groundwater within the Snoqualmie Watershed and Duvall analysis areas. At these scales, groundwater is largely controlled by topography, confining geologic features, and patterns of recharge and discharge (Vaccaro et al. 1998). Principal groundwater areas within the Snoqualmie Watershed include the Snoqualmie Valley and major tributary valleys (Appendix A).

The primary historic conditions influencing groundwater flow in Duvall are the City's topographic location and the predominant, relatively impermeable soils, which do not allow significant infiltration or augmentation of groundwater flow. Duvall's position on a hilltop limits groundwater flow to Duvall from the surrounding landscape. Groundwater in Duvall was mapped below approximately 200 ft elevation (above sea level) in coarse-grained deposits and between 200 and 300 feet elevation in Vashon outwash till by Turney et al. (1995). The flow path for groundwater in the coarse-grained deposits followed the topography (Turney et al. 1995) (Appendix A).

3.2.3 Sediment Supply

Mass wasting is a common phenomenon in the eastern portion of the watershed, where relief is extreme. Areas important for surface erosion are also located in hilly areas containing outwash and other coarse-grained soils. Puget Sound Lowlands typically have only isolated areas in which erosion naturally occurs at high rates, such as transitions from plateaus to terraces, alluvial fans, and upland canyons formed by streams. Areas susceptible to erosion have been mapped throughout the western portion of the watershed. Mapped landslide hazard areas have been mapped along the sidewalls of the Snoqualmie Valley and major tributary valleys, including Cherry Creek (King County GIS 2005).

Channel migration contributes to sediment supply by eroding stream banks (KCDNRP 2004). In an examination of channel migration in the lower Snoqualmie Valley, Collins and Sheikh (2002) concluded that the Snoqualmie River CMZ below RM 12 has been relatively narrow and stable since glacial retreat. The CMZ between RM 12 and RM 23 is up to 0.6-mile wide, except where narrowed by tributary deltas, and channel migration within this reach has been active. Upstream of RM 23 the Snoqualmie River CMZ is more confined due to steepening gradient and till or bedrock geology (Collins and Sheikh 2002).

In Duvall, the Alderwood and Kitsap soil series found in the northeastern portion of the city and along Coe-Clemmons Creek are prone to mass wasting. The King County soil survey rates the erosion hazard for this soil as severe to very severe and the slippage potential as severe (SCS 1973). The landslide hazard area in the northeastern part of the City corresponds with the Alderwood and Kitsap soil series (SCS 1973; King County GIS 2005). The Alderwood series are rated as moderate for erosion hazard and slippage potential. The Alderwood series also contain gravels that may be of suitable size for salmonid spawning, whereas the grain size in the Alderwood and Kitsap soils is finer and channel substrate derived from this soil series may not be suitable for salmonid spawning (SCS 1973; Herrera Environmental Consultants, Inc. 2002).

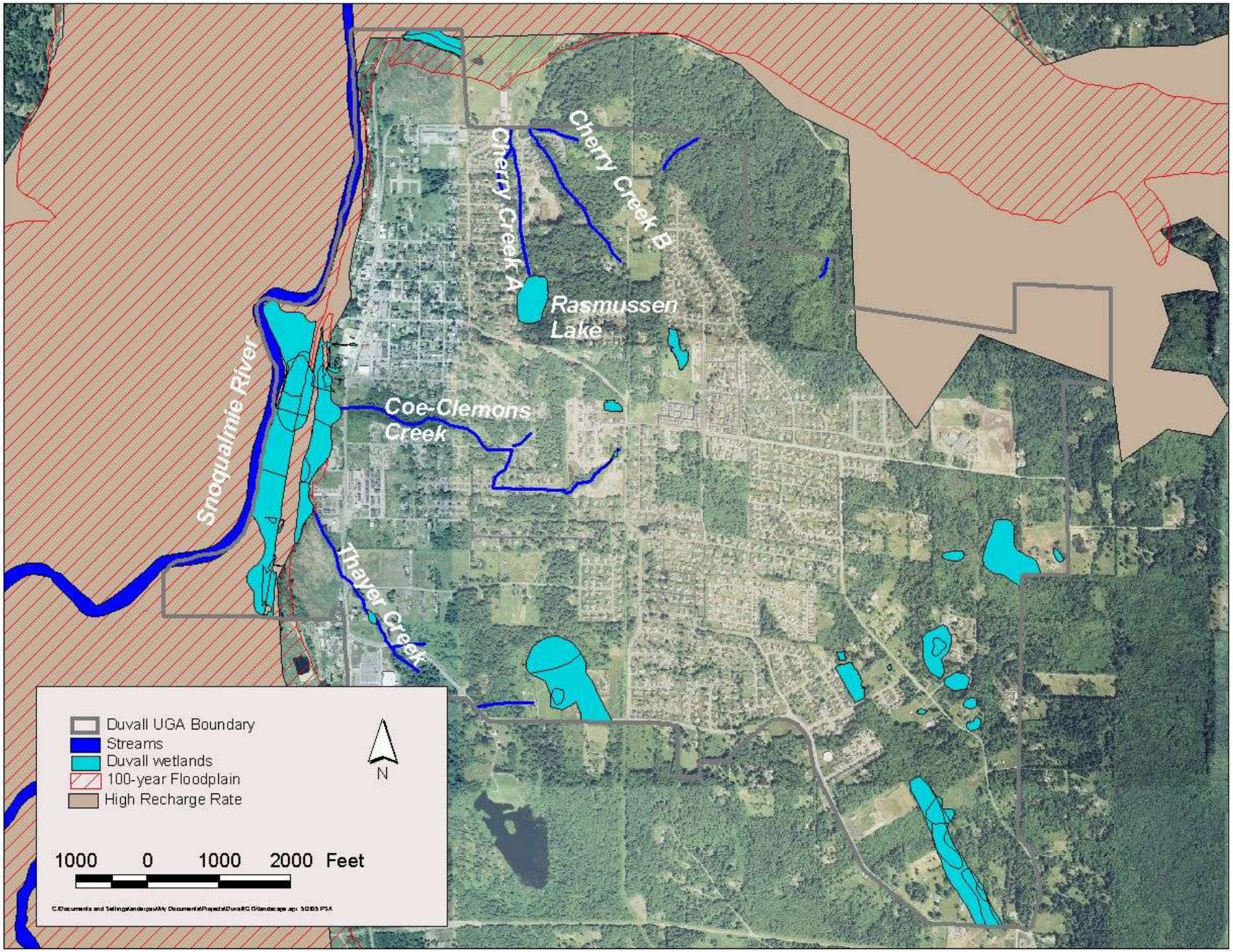

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Figure 3-5
Hydrologic Mechanisms and Important Areas, City of Duvall

3.2.4 Water Quality

Important areas for water quality in the Snoqualmie Watershed historically would have been found in wetlands, hyporheic zones, and vegetated riparian areas and upland forests. Many of these areas would have been found along the mainstem Snoqualmie River, its floodplain, and major tributaries. Riparian communities in the upper watershed would have been forested and in the lower valley were shrub dominated (Collins and Sheikh 2002). These intact riparian communities would have contributed to water quality by limiting erosion and providing shade.

Important areas in Duvall for water quality would have included wetlands, Rasmussen Lake, riparian zones along Thayer, Coe-Clemmons and Cherry Creeks, the porous outwash soils found in northeastern Duvall, and the forested uplands.

3.2.5 Organic Matter and Heat/Light Inputs

Riparian vegetation within and along streams and wetlands is a major source of organic input to aquatic ecosystems. Riparian vegetation historically was well developed along most streams in Western Washington. Conifers were the predominant forest species throughout the Snoqualmie Watershed prior to Anglo-American settlement, and were likely the dominant overstory along streams lacking active floodplains. Hardwoods were the dominant overstory within active floodplains and valley bottoms (Franklin and Dyrness 1987; Collins and Sheikh 2002). Organic matter is delivered to streams via leaf litter, bank failure, landslides, and mass wasting.

The majority of low-order headwater streams occur in the eastern Snoqualmie Watershed, and landslide processes are important for LWD recruitment to these streams. Where headwater streams are present in the lowlands, hillslope processes are less important sources of LWD. Streams along valley floors are more dependent on riparian zones for LWD inputs, although isolated areas of bank failures and landslides are present, particularly where the landform changes from hills and plateaus to the Snoqualmie Valley.

Channel migration is an important source of LWD for alluvial streams as a result of bank erosion. The CMZ has not been determined for most alluvial streams in the Snoqualmie Watershed, but it has been mapped for the mainstem Snoqualmie River (King County GIS 2005).

In the Duvall reach of the Snoqualmie River, Collins and Sheikh (2002) reported a dense scrub-shrub wetland complex near RM 11 and this wetland would not have been an important source of LWD. Records from the 1800s on the amount of LWD in the Snoqualmie River are not available, but Collins and Sheikh (2002) speculate that historically, LWD in the Snoqualmie was comparable to the amounts documented for other area rivers. Pre-settlement riparian zones above the Snoqualmie floodplain in Duvall were likely not extensive due to the small size of streams and wetlands, low-permeability soils, and the steepness of the topography. Occasional isolated bank failures along streams would have delivered LWD to streams.

3.3 Landscape Process Alterations

Landscape processes in the Snoqualmie Watershed have been altered to some degree since the late 1800s (Collins and Sheikh 2002). The primary alterations within the watershed have been vegetation clearing, through timber harvest and/or conversion to agricultural or developed land uses, and stream channelization. Since the early 1900s there has been a continual increase in the proportion of the watershed covered by impervious surfaces.

Streams and wetlands have been altered or eliminated to accommodate agriculture and other development. Groundwater flow has been interrupted and aquifers have been accessed for groundwater withdrawals to supply drinking water and irrigate agricultural lands. These alterations have occurred primarily within the Snoqualmie Valley. Table 3-3 summarizes indicators of alteration applicable to this analysis.

Table 3-3. Indicators of Landscape Process Alteration within the Snoqualmie Watershed

Process	Mechanism	Indicators of Alteration
Hydrology	Infiltration and recharge	Impervious land cover, wetland loss
	Surface water storage	Impervious land cover, decreased floodplain capacity, increased flooding, channelization, wetland loss
	Peak flows	Impervious land cover, decreased floodplain capacity, duration and frequency of peak flows, loss of forest cover in ROS zones, stream channelization[1], wetland loss, incised channels, increased erosion,
	Groundwater movement	Impervious land cover - especially roads and associated utility infrastructure, groundwater contamination, decreased baseflow to streams and wetlands
Sediment Supply	Erosion	Developing areas, roads within 200 ft of waters, till agriculture, increase in braided channels over historic conditions, excessive fines in stream substrate
	Mass wasting	Roads and development in landslide hazard areas, changes in channel morphology (alluvial fans, braided channel), excessive fines in stream substrate
Water Quality	**Physical properties (temperature, turbidity)**	Disturbed riparian zones, channelization, impervious land cover, wetland loss, 303(d) exceedance listing
	Chemical properties (pH, nutrient levels)	Residential development, agricultural lands, disturbed riparian zone, channelization, wetland loss, decreased DO, algal blooms, 303(d) exceedance listing
	Contaminants (toxins, pathogens)	Urban and rural residential land use, road density within 200 ft of waters, livestock, channelization, wetland loss, 303(d) water quality exceedance listing
Organic Inputs/LWD	Riparian vegetation	Urban, rural residential, agricultural land use in riparian zone (loss of forest cover), livestock, wetland loss, dominance of non-native riparian vegetation
	LWD recruitment	Urban, rural residential, agricultural land use in riparian zone (loss of forest cover), livestock, channelization, dominance of non-native riparian vegetation

1 Includes channel straightening and/or bank hardening, resulting in floodplain disconnection.

Source: Turney et al. (1995); Collins and Sheikh (2002); Herrera Environmental Consultants, Inc. (2002); Solomon and Boles (2002, 2004).

Within Duvall, the primary alterations to landscape processes include vegetation clearing (hydrology, water quality, organic input), increased impervious surface (hydrology, sediment supply, water quality), and floodplain disconnection of streams within the Snoqualmie floodplain (hydrology, sediment supply, water quality, organic input).

Based on the analysis of the 2002 orthophotographs, the estimated amount of developed land cover in Duvall is 40 percent (Table 3-4, Figure 3-6). The Coe-Clemmons Sub-basin had the highest estimated developed area (62 percent) and the Snoqualmie Southeast Sub-basin had the lowest (3 percent). Urban development within Duvall is concentrated in western (Snoqualmie North, Coe-Clemmons Creek, Snoqualmie River, and Thayer Creek Sub-basins) and central portions of the City (Cherry Creek A, Cherry Creek B, Cherry Creek C, Coe-Clemmons Creek, and Snoqualmie South Sub-basins). Development in western Duvall includes commercial, retail, public facilities, and residential land use, while the development in central Duvall is residential.

Table 3-4. Land Cover by Sub-basin within Duvall Analysis Area

Sub-basin	Cover Type	Area (acres)	Percent Analysis Area
Cherry Creek A	Forest	70	31
	Tree/Shrub	33	15
	Grass	27	12
	Developed	88	39
Cherry Creek B	Forest	46	50
	Tree/Shrub	0	0
	Grass	8	9
	Developed	37	41
Cherry Creek C	Forest	88	51
	Tree/Shrub	2	1
	Grass	6	4
	Developed	78	44
Cherry Creek D	Forest	159	82
	Tree/Shrub	4	2
	Grass	16	8
	Developed	16	8
Coe-Clemons Creek	Forest	16	4
	Tree/Shrub	89	24
	Grass	31	8
	Developed	230	62
Snoqualmie East	Forest	54	70
	Grass	17	22
	Tree/Shrub	0	0
	Developed	7	8

Table 3-4. Land Cover by Sub-basin within Duvall Analysis Area (continued)

Sub-basin	Cover Type	Area (acres)	Percent Analysis Area
Snoqualmie North	Forest	0	0
	Tree/Shrub	25	12
	Grass	56	26
	Developed	124	58
Snoqualmie River	Forest	0	0
	Tree/Shrub	2	8
	Grass	17	57
	Developed	9	32
Snoqualmie SE	Forest	31	58
	Tree/Shrub	<1	<1
	Grass	21	38
	Developed	2	3
Snoqualmie South	Forest	52	16
	Tree/Shrub	36	11
	Grass	80	25
	Developed	156	48
Thayer Creek	Forest	0	0
	Grass	153	57
	Tree/Shrub	59	22
	Developed	54	20
Total	**Forest**	**517**	**26**
	Tree/shrub	**251**	**12**
	Grass	**433**	**21**
	Developed	**799**	**40**

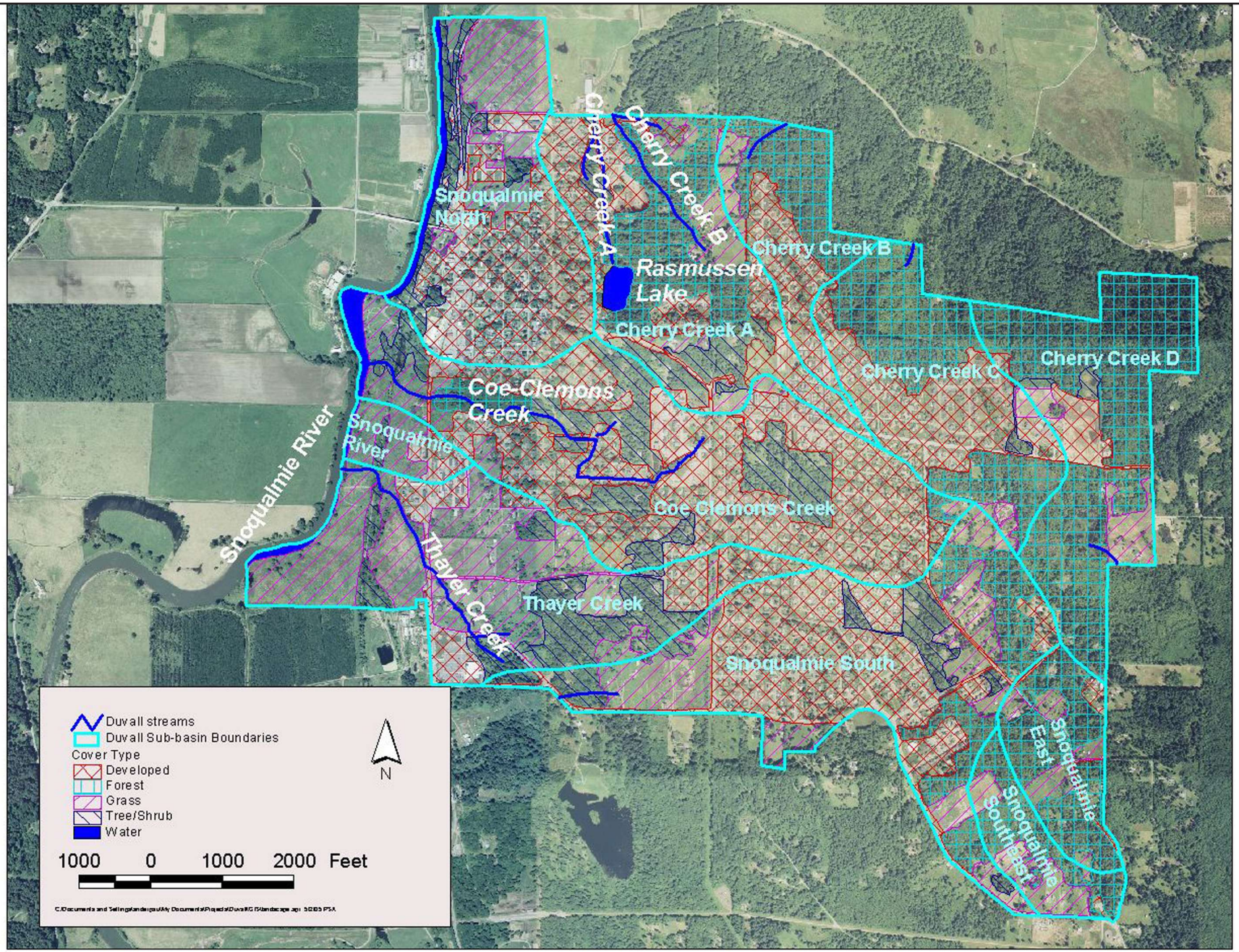

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Figure 3-6
2002 Land Cover and Sub-basins within Duvall

3.3.1 Hydrology

Alterations to hydrologic mechanisms in the Snoqualmie Watershed include decreased infiltration/recharge because of increases in impervious surface, channelization, and disconnection of streams from their floodplains; decreased storage capacity due to bank armoring, channelization, and wetland loss; increased peak flows resulting from vegetation clearing and an increase in impervious surface; and groundwater withdrawals and groundwater contamination.

The amount and rate of infiltration lessens as the transit time of surface water through a watershed decreases. Several reaches of the river below Snoqualmie Falls have armored banks or flap gates, disconnecting the channel from its floodplain. In an assessment of habitat conditions along the Snoqualmie River and tributary streams, Solomon and Boles (2002, 2004) documented bank hardening and channel straightening, as well as loss of wetlands and channel complexity for a number of streams including the Snoqualmie River.

Collins and Sheikh (2002) documented an 81 percent decrease in Snoqualmie floodplain riparian wetlands between 1870 and 2000 and also concluded that the mainstem Snoqualmie River has been disconnected from its floodplain. Most of the historic wetland area has been converted to agricultural lands. Figure 3-7 shows historic and current Snoqualmie floodplain wetlands.

The historic extent of wetlands above the Snoqualmie floodplain in Duvall is not known, although given the steepness of the topography and relative impermeability of the predominant soils, it is assumed the loss of water storage capacity has not been significant. Solomon and Boles (2002) identified bank armoring at 2 sites and water diversion structures (flap gates, pumps) at two sites along the right-bank of the mainstem Snoqualmie in the Duvall area. They also found three large pools (pool length equal to or greater than channel width) within this section of the river (Solomon and Boles 2002).

Overbank flows from the reaches of Thayer, Coe-Clemmons, and Cherry Creeks within Duvall above the Snoqualmie floodplain has not been significant. The lower reaches of these streams are within the Snoqualmie floodplain and are subject to flooding from the Snoqualmie River. Sandbagging, apparently to limit overbank flows, was reported along a reach of Coe-Clemmons Creek within the Snoqualmie floodplain (Herrera Environmental Consultants, Inc. 2002).

Developed land use in the Coe-Clemmons and Cherry Creek tributary sub-basins exceeds 35 percent of land cover and is 20 percent of the Thayer Creek sub-basin (see Table 3-4). Forest cover is less than 50 percent in all of these sub-basins and is less than 20 percent (0 percent for Thayer Creek) of the mapped cover within 200 feet of these streams. Decreasing proportions of forest cover and increasing development (impervious surfaces) are associated with higher peak flows (see Table 3-3). Although overbank flows are not a major issue for these low-order streams, increased peak flow frequency and duration have affected their channel morphology. Herrera Environmental Consultants, Inc. (2002) assessed stream habitat in Thayer, Coe-Clemmons, and two Cherry Creek tributaries within the city limits and identified reaches within all of these streams with deeply incised channels and bank failures caused by altered runoff patterns. Excessive sedimentation was also seen in reaches of Thayer Creek and Cherry Creek Tributary B.

As well as altering hydrology, floodplain disconnection and decreased storage capacity can impair stream habitat suitability for fish. Infiltration and recharge can be important sources of stream baseflow during summers and side channels and backwaters offer fish rearing habitat.

In addition to floodplain disconnection and loss of storage capacity, road crossings and culvert placement have also affected a number of potential fish-bearing streams in the watershed and Duvall (Herrera Environmental Consultants, Inc. 2002; Solomon and Boles 2002, 2004; SBSRF 2004). Culverts are potential barriers to fish passage because of associated changes to stream flows and channel morphology (Solomon and Boles 2002, 2004; SBSRF 2004; Stockard and Harris 2005). has been identified as a management issue in the Snoqualmie Watershed (Solomon and Boles 2002, 2004; Adolfson and Associates, Inc. 2004; SBSRF 2004). Restoring floodplain hydrologic connectivity and removing or modifying man-made barriers to fish passage, specifically culverts, have been identified as important for restoration of salmonid habitat within the Snoqualmie Watershed (Solomon and Boles 2002, 2004; Adolfson and Associates, Inc. 2004; SBSRF 2004) and also Duvall (Herrera Environmental Consultants, Inc. 2002; Solomon and Boles 2002, 2004).

Groundwater flow in the watershed has been impacted by development in urban areas and by groundwater withdrawals in rural and agricultural areas. Development can impact the hydrology of sites downslope by altering the amount and delivery path of surface water and shallow groundwater. Groundwater extraction in the Snoqualmie Watershed occurs in lowland areas where population and agriculture predominate. Proposed water withdrawals of 20 to 40 million gallons per day have been proposed for the Snoqualmie Aquifer, although the water would be pumped into the Snoqualmie River during the summer, with a predicted flow augmentation of up to 8 percent (CPSWSF 2001).

3.3.2 Sediment Supply

Alterations to sediment supply in the Snoqualmie Watershed include elevated sedimentation rates and deposition in the Snoqualmie River and tributary streams. The Snohomish Basin Salmonid Recovery Technical Committee (2000, as reported in Solomon and Boles 2002) examined Chinook salmon habitat conditions in 25 Snoqualmie Watershed sub-watersheds (basins) and reported that sediment regimes are impaired or at risk of impairment in 24 of the basins.

Increased impervious surface (decreased infiltration and surface water storage) within a contributing area is associated with higher volumes of runoff. Increased runoff can produce higher peak flows and may cause scouring and bank failures, accelerating erosion and sediment loads. Solomon and Boles (2002) identified bank armoring and erosion at three sites along the right-bank mainstem Snoqualmie in the Duvall area. The sediment supply to reaches of Thayer, Coe-Clemmons, and two Cherry Creek (within Duvall) has been altered, apparently from increased peak flows. Reaches of all these streams were found with deeply incised channels and failing banks; reaches of Coe-Clemmons Creek (see Appendix B for figures showing stream segments) (Segments 1 and 3) and Cherry Creek Tributary B (Segment 2) were braided (Herrera Environmental Consultants, Inc. 2002). Excessive sedimentation, particularly fines, was seen in reaches of Thayer Creek, from a wetland upslope of the creek, Coe-Clemmons Creek, and Cherry Creek tributary B. The sediment in Cherry Creek Tributary B had partially filled a culvert under NE Rupard Road, limiting salmonid access to upstream reaches of the stream (Herrera Environmental Consultants, Inc. 2002).

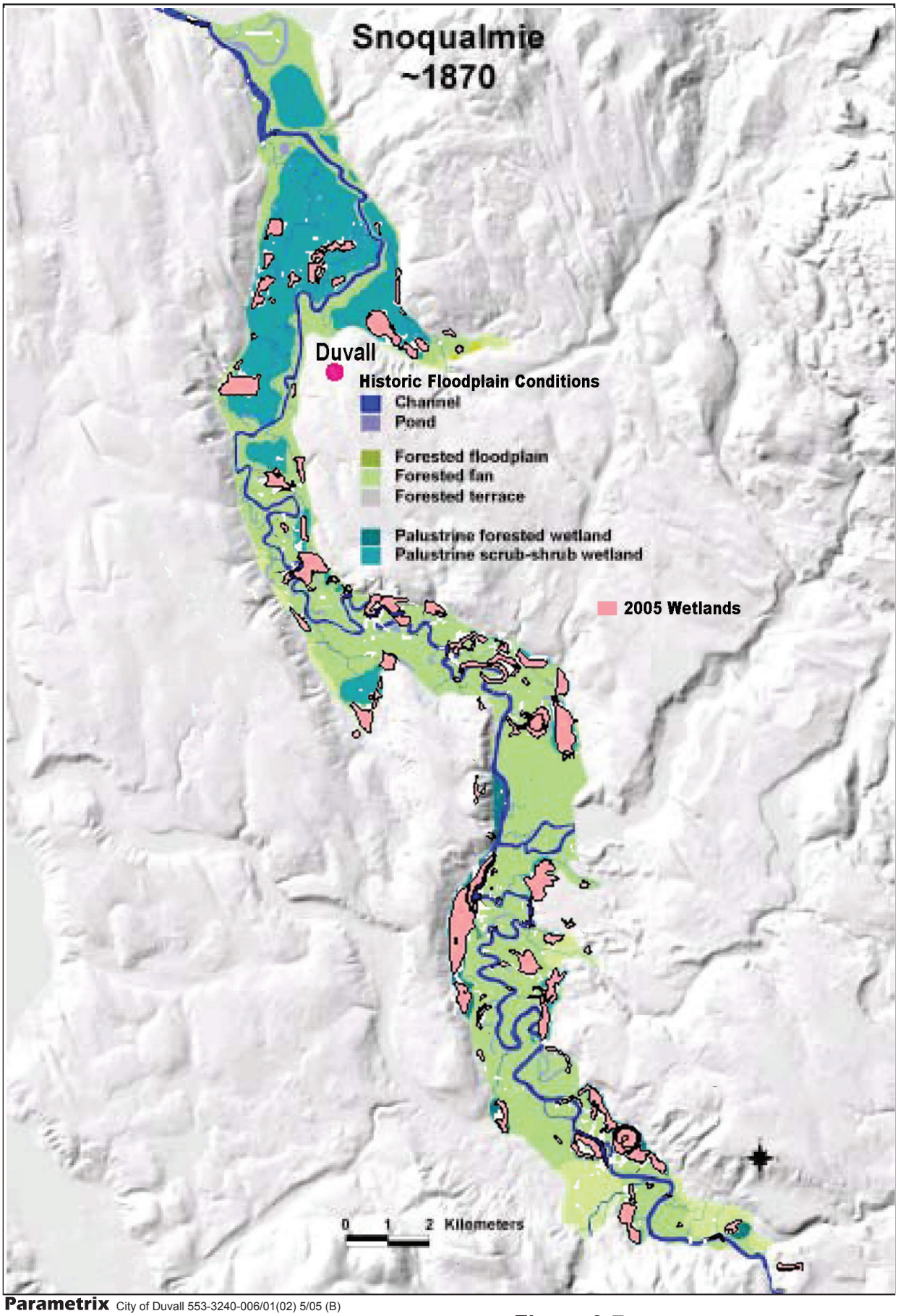

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Figure 3-7
Snoqualmie Floodplain Wetlands circa 1870 (Collins and Sheikh 2002) and 2005

3.3.3 Water Quality

Land use alterations and loss of forest cover, wetlands, floodplains, and hyporheic zones can cause changes in nutrients (nitrogen and phosphorous), oxygen, pH, temperature, turbidity, and introduce pathogens and toxins (metals, hydrocarbons, pesticides). Changes in land use and forest cover may decrease infiltration and increase the volume and rate stormwater runoff. Alteration of wetlands and floodplains decreases storage capacity and shortens the transit time of water across the landscape. Increased stormwater volumes and shortened transit times are associated with increased contaminant loads (Minton 2002). Land use changes from native plant communities to agricultural or urban land use is also associated with elevated nutrient and contaminant loads.

Water quality issues identified within the Snoqualmie River and tributaries include temperature, pH, turbidity, dissolved oxygen, nutrients, and fecal coliform contamination (Solomon and Boles 2002, 2004; Adolfson and Associates, Inc. 2004; Onwumere and Batts 2004; SBSRF 2004). Elevated nitrate levels (greater than 2.0 mg/L) were found in groundwater throughout the lower Snoqualmie Valley, particularly in the Falls City area, by Turney et al. (1995).

Documented water quality concerns in the Duvall area include temperature, pH, dissolved oxygen, nutrients, and fecal coliform contamination in the mainstem Snoqualmie River and temperature and fecal coliform contamination in Cherry Creek (beyond the Duvall city limits) (Solomon and Boles 2002, 2004; Onwumere and Batts 2004).

Lack of riparian vegetation is associated with increased water temperatures as a result of greater insolation; access to streams by livestock with elevated turbidity and fecal coliform, and reduced dissolved oxygen. Three sites where cattle had direct access to the Snoqualmie River in the Duvall reach were documented by Solomon and Boles (2002). The Ecology 1998 list of 303(d) impaired waters (2000) included an exceedance for fecal coliform in the Duvall reach of the Snoqualmie River. Solomon and Boles (2002) recorded a 7-day moving average water temperature of 20.5 degrees Celsius. They cite Berman (1998) who found that water temperatures above 18 degrees Celsius were harmful to salmonids (Solomon and Boles 2002).

Water quality parameters were not studied in the Duvall stream assessment (Herrera Environmental Consultants, Inc. 2002), but water quality problems in urban streams are well documented (Minton 2002; EPA 2003). Beschta (1978) found a significant increase in sedimentation in streams and wetlands within 200 feet of roads following logging in Oregon. In Duvall, road density within 200 feet of streams is highest along Coe-Clemmons Creek (approximately 2,000 linear feet) and Thayer Creek (approximately 1,200 linear feet). These streams as well as Thayer Creek include a number of road crossings, which may be an additional source of runoff and contaminants (Herrera Environmental Consultants, Inc. 2002). Rasmussen Lake was the wetland with the highest road density nearby. A residential neighborhood is located immediately to the west of the wetland. Elevated levels of nitrogen and phosphorous, from lawn and garden fertilizer, have been found in runoff from residential areas (Minton 2002).

Stream reaches with relatively low road density (no paved roads) within 200 feet included Thayer Creek and Coe-Clemmons Creek within the Snoqualmie floodplain. There were no paved roads within 200 feet of wetlands within the Snoqualmie floodplain and in the southeastern portion of Duvall (Snoqualmie SE and Cherry Creek D sub-basins).

Turney et al. (1995) found elevated arsenic levels (greater than 20 mcg/L) in two Duvall area groundwater wells (Well 13D03 and 24D01), nitrate (0.6 to 1.0 mg/L) in Well 13J01, and pesticides in Well 13D03. The water level in Well 13D03 was approximately 250 feet deep

and Turney et al. (1995) thought it was unlikely that the source of the pesticide contamination was local. There were no groundwater wells monitored by Turney et al. (1995) in the porous soils found in northeastern Duvall that have been mapped as a high recharge area by King County (King County GIS 2005). As a high recharge area, these soils may be a potential source of groundwater contamination from pollutant-laden (nutrients, contaminants) surface waters.

3.3.4 Organic Inputs

Alterations to organic inputs include conversion of native plant communities to agricultural or developed land use and changes in the density or species composition (i.e., forest to scrub-shrub or native shrub to non-native shrub) of riparian vegetation. Organic inputs have been altered throughout the lower Snoqualmie Valley. Overall, riparian habitat quality in the Snoqualmie Watershed is relatively intact (dense native, woody vegetation within the riparian zone) because a large proportion of the watershed is forested. Above Snoqualmie Falls the SBSRF (2004) report 73 percent of the watershed is mature forest. Within this portion of the watershed, as well as uplands in the remainder of the watershed, the potential for LWD recruitment remains relatively high. However, recruitment potential along valley bottoms is mixed in the watershed and is low along the Snoqualmie River and tributaries below Snoqualmie Falls. Downstream of North Bend, conditions generally worsen as land use intensity increases moving down the drainage (Solomon and Boles 2002).

Solomon and Boles (2004) assessed habitat conditions along 14 Snoqualmie tributaries and rated habitat quality as poor in the lower reaches of seven of these tributaries (Raging and Tolt Rivers; Canyon, Patterson, Langlois, Ames Lake, and Cherry Creeks) due to lack of riparian vegetation and LWD. Poor quality riparian habitat and lack of instream LWD have been identified as two of the most important issues for salmon habitat restoration in the Snoqualmie Watershed (Adolfson and Associates, Inc.; SBSNFR 2004; Solomon and Boles 2004).

In the Duvall reach of the Snoqualmie River (RM 9 to 11), Solomon and Boles (2002) found that right bank riparian habitat was in relatively good condition. Deciduous trees were found throughout the reach and dense native shrubs were dominant along more than half of the reach. The mainstem Snoqualmie was wide enough in this reach that trees were not able to shade the full width of the channel. They also found low amounts of instream LWD and few mature riparian trees available for future LWD recruitment (Solomon and Boles 2002).

Organic inputs, and thus land cover, is relevant to aquatic resources only in the riparian zone and slide areas that may contribute organic matter via debris flows. Intact riparian vegetation (herbs, shrubs, immature trees) was seen along Thayer, Coe-Clemmons, and Cherry Creek within the city limits but there was a lack of mature trees and large coniferous LWD in all of these streams (Herrera Environmental Consultants, Inc. 2002). The widest riparian zone with woody vegetation on Thayer Creek, approximately 400 feet wide, was found in Segment 6 (see Appendix B for figures showing stream segments). During the cover classification for this study, this area was mapped as tree/shrub cover. Along Coe-Clemmons Creek, Segment 4 had the widest forested riparian zone (approximately 400 feet wide). A forested riparian zone, up to 1,300 feet in width, covered most of the area between Cherry Creek Tributaries A and B directly north of Rasmussen Lake (Segment 3 for both streams). However, this riparian zone was approximately 50 feet wide to the west of Tributary A and 80 feet wide to the east of Tributary B. Emergent vegetation and non-native shrubs were dominant in the riparian zones along Segments 1, 2, 4, and 5 of Thayer Creek; Segments 1, 3, and 6 of Coe-Clemmons Creek; Segments 1 through 5 of Cherry Creek Tributary A; and Segments 1 and 2 of Cherry Creek Tributary B. Although, for all of the streams, immature and mature deciduous forest

were the predominant riparian community reported (Herrera Environmental Consultants, Inc. 2002).

Thayer and Coe-Clemmons Creeks, and the Cherry Creek tributaries within Duvall do not provide suitable Chinook salmon spawning habitat. Adult coho salmon were observed spawning in Thayer and Coe-Clemmons Creek in 2001. No coho salmon were seen in the Cherry Creek tributaries surveyed. Fish passage barriers have been documented downstream of the city limits in Cherry Creek (Herrera Environmental Consultants, Inc. 2002). Washington Department of Fish and Wildlife (WDFW) priority habitats identified in Duvall include four wetlands (also identified in King County and NWI data) and one riparian zone along the Snoqualmie River in southern Duvall. There were no data points for terrestrial priority species within Duvall (WDFW 2005).

Table 3-5 summarizes the functional responses of aquatic resources within the Duvall analysis area.

3.3.5 Summary

In summary, aquatic resources and landscape processes within the Snoqualmie Watershed are generally in good condition. A large proportion of the watershed remains forested and impervious surfaces represent a very small percentage of the total watershed area. Groundwater infiltration, flow, and water quality are largely intact. High peak flows and flooding have been altered for the Snoqualmie River and major tributaries in the lower valley. Sediment supply in the upper watershed has not been appreciably altered from historic conditions, although channel aggradation has been documented for the lower Tolt and Raging Rivers. Alterations to landscape processes and aquatic resources have been concentrated in the lower valley and along the mainstem Snoqualmie River. In the lower valley the principal alterations include: a significant loss of wetlands (storage capacity), instream LWD, and riparian vegetation (organic input, shading) within the Snoqualmie floodplain; bank armoring along the mainstem Snoqualmie and channelization of tributary streams; and placement of fish passage barriers (culverts) throughout the lower watershed (Herrera Environmental Consultants, Inc. 2002; Solomon and Boles 2002, 2004; Adolfson Associates, Inc. 2004; SBSRF 2004).

Aquatic resources and processes in Duvall have been altered but are, for the most part, intact. Riparian vegetation along the Duvall reach of the mainstem Snoqualmie is in better condition than reaches upstream and downstream of Duvall (Solomon and Boles 2002). The primary alterations to landscape processes in Duvall parallel those of the Snoqualmie Watershed. In the Snoqualmie floodplain, Duvall area streams have been disconnected from their CMZs, and there has been a loss of wetlands and riparian vegetation. Above the Snoqualmie floodplain, elevated peak flows and sediment loads as well as fish passage barriers have been identified as important management concerns (Herrera Environmental Consultants, Inc. 2002; Solomon and Boles 2002, 2004). In Duvall, management of aquatic resources should address the following alterations:

- Maintain existing riparian forests and trees along the Snoqualmie River, Coe-Clemmons, and Cherry Creeks to maintain and improve water quality (temperature and turbidity), sediment supply, and provide organic and LWD input;
- Restore riparian forests along reaches of the Snoqualmie River, Coe-Clemmons (Segments 1, 3, and 6) and Thayer (Segments 1 to 6) Creeks, and Cherry Creek tributaries A (Segments 1 to 5) and B (Segments 1 and 2) that are currently not forested to improve water quality (temperature and turbidity), sediment supply and provide organic and LWD input;

- Maintain and restore surface water storage (wetlands and off-channel habitat) along Coe-Clemmons, Thayer, and Cherry Creeks to reduce peak flows and improve sediment supply and water quality in these first-order streams. Restoration of, or increasing surface water storage capacity should be emphasized in sub-basins with over 35 percent developed land use (Cherry Creek A, Cherry Creek B, Cherry Creek C, Snoqualmie South, Snoqualmie North, and Coe Clemons Creek Sub-basins). Maintenance and restoration of surface water storage capacity should be emphasized in sub-basins with less than 35 percent developed land use (Snoqualmie SE, Cherry Creek D, Snoqualmie East, Thayer Creek, and Snoqualmie River Sub-basins);
- Reconnect Coe-Clemmons, Thayer, and Cherry Creeks to their floodplains and off-channel habitat to restore surface water storage and channel migration (sediment supply and organic input); and
- Remove or modify fish passage barriers on Coe-Clemmons and Thayer Creeks and Cherry Creek tributaries to allow fish access to upstream reaches (see Herrera Environmental Consultants, Inc. 2002 for specific restoration priorities) in support of organic inputs and habitat improvement; and
- Limit development and protect existing forest cover on high recharge areas (porous soils) in northeastern Duvall to protect infiltration/recharge, sediment supply and water quality. These high recharge areas have also been mapped by King County as a high landslide hazard area (King County GIS 2005).

Table 3-5. Functional Reponses of Aquatic Resources to Process Alterations in the City of Duvall

Process	Mechanism	Snoqualmie River	Streams	Wetlands
Hydrology	Infiltration/Recharge	No information	No information; high recharge area mapped on porous soils in northeastern Duvall	No information
	Surface Water Storage	Overbank flows; loss of wetlands and off-channel habitat within floodplain	Loss of wetlands and off-channel habitat in Snoqualmie floodplain	Loss of wetlands within Snoqualmie floodplain; no specific information on wetland loss above floodplain within Duvall
	Peak Flows	Overbank flows, bank armoring along mainstem	Incised channels and failing banks in Segments 1, 3, 5, and 6 of Thayer Ck; Segments 1, 3, 4, 5, and 6 of Coe-Clemmons Ck; Segments 1, 2, and 3, of Cherry Ck Trib A; Segments 1, and 3, of Cherry Ck Trib B	Excessive sedimentation in Thayer Creek from upstream mitigation wetland
	Groundwater Flow	Groundwater wells throughout lower Snoqualmie Valley and tributaries	No information	No information
Sediment Supply	Substrate Condition	Not properly functioning or at risk for Chinook salmon spawning habitat in mainstem, excessive sedimentation in many tributaries	Fines comprise 74, 24, 40, 100% of dominant substrate in Thayer, Coe-Clemmons, and Cherry Ck Trib A & B, respectively. Braided channel in Segments 3 and 4 of Coe-Clemmons Ck and Segment 2 of Cherry Ck Trib B	N/A
Water Quality	Temperature/pH/DO	Temperature and pH 303(d) exceedance in mainstem Snoqualmie River	No information, likely degraded due to proportion of urban land use and road density within contributing area	No information
	Nutrients	Groundwater arsenic and nitrate contamination upstream of Duvall (Fall City)	No information	Groundwater arsenic contamination
	Contaminants	Pesticides in Duvall groundwater Well 13D03	No information, likely degraded due to proportion of urban land use and road density within contributing area	No information, likely degraded due to proportion of urban land use and road density within contributing area
Organic Inputs	Riparian Vegetation/LWD	Degraded due to agricultural and urban land use, moderate tree and shrub cover in Duvall reach; low instream LWD, recruitment	Degraded along Thayer Ck due to low percentage of mature trees in riparian zone, degraded reaches but generally intact for Coe-Clemmons Creek and Cherry Creek tributaries	Variable, site-specific

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APPENDIX A

Groundwater Figures

APPENDIX B

Duvall Stream Segment Figures