US Army Corps of Engineers®
Portland District

Springfield Metropolitan Waterways Ecosystem Restoration Feasibility Study Integrated Environmental Assessment

January 2014

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EXECUTIVE SUMMARY

The scope of the feasibility phase is to investigate ecosystem restoration projects in the Cedar Creek watershed. The objective of the report is to recommend a cost effective restoration plan that maximizes ecosystem benefits to nationally significant resources with the least amount of environmental, cultural and socioeconomic impact. The non-Federal sponsors for this study are the City of Springfield and Lane County.

Cedar Creek, as defined by the watershed boundary, covers a total of 9,472 acres in the vicinity of Springfield, Oregon. The watershed includes north and south branches of Cedar Creek, Gray Creek, Gay Creek, Blue Water Ponds, 69th Street Channel, 72nd Street Channel, 75th Street Channel, and numerous headwater streams. In addition, a portion of the McKenzie River watershed is included within the study area. A total of three reaches of Cedar Creek ripe for restoration are located in the study area .

Historically, the study area supported a diverse biota that has degraded by the increasing pressures from development over the last 150 years. Following development and alterations of the natural environment, the quantity and quality of habitat has been largely degraded by a number of factors including draining wetlands, increased erosion, hardening of channel banks, and the introduction of non-native species followed by declines in native plant diversity and composition. Habitat availability has been reduced as the study area has become urbanized and increases in development have degraded water quality.

Cedar Creek is constrained by urban and agricultural settings, where the creek and associated tributaries are incised, eroding, disconnected from the historical floodplain and its varied habitats, and water quality is degraded. Restoring floodplain structure and function provides an opportunity to restore the natural formation of microhabitats and also provide important hydraulic connections to support associated aquatic habitats.

This study recommends an ecosystem restoration plan to restore degraded aquatic resources that are habitats for fish and wildlife in Cedar Creek. Resources anticipated to benefit from restoration include instream aquatic resources that produce fish, amphibian and invertebrate habitat and riparian resources that produce habitat for a variety of fish, wildlife, avian, amphibian and invertebrates.

Cedar Creek aquatic resources will benefit from a restored riparian buffer, channel meanders, bank stability and complexity features (i.e, large wood). Measures implemented at the confluence of Cedar Creek and the McKenzie River will provide fish passage to off channel rearing habitat and access to habitat in Cedar Creek during the summer months. The recommended plan will improve aquatic habitat connectivity, reduce invasive species coverage, and increase biodiversity.

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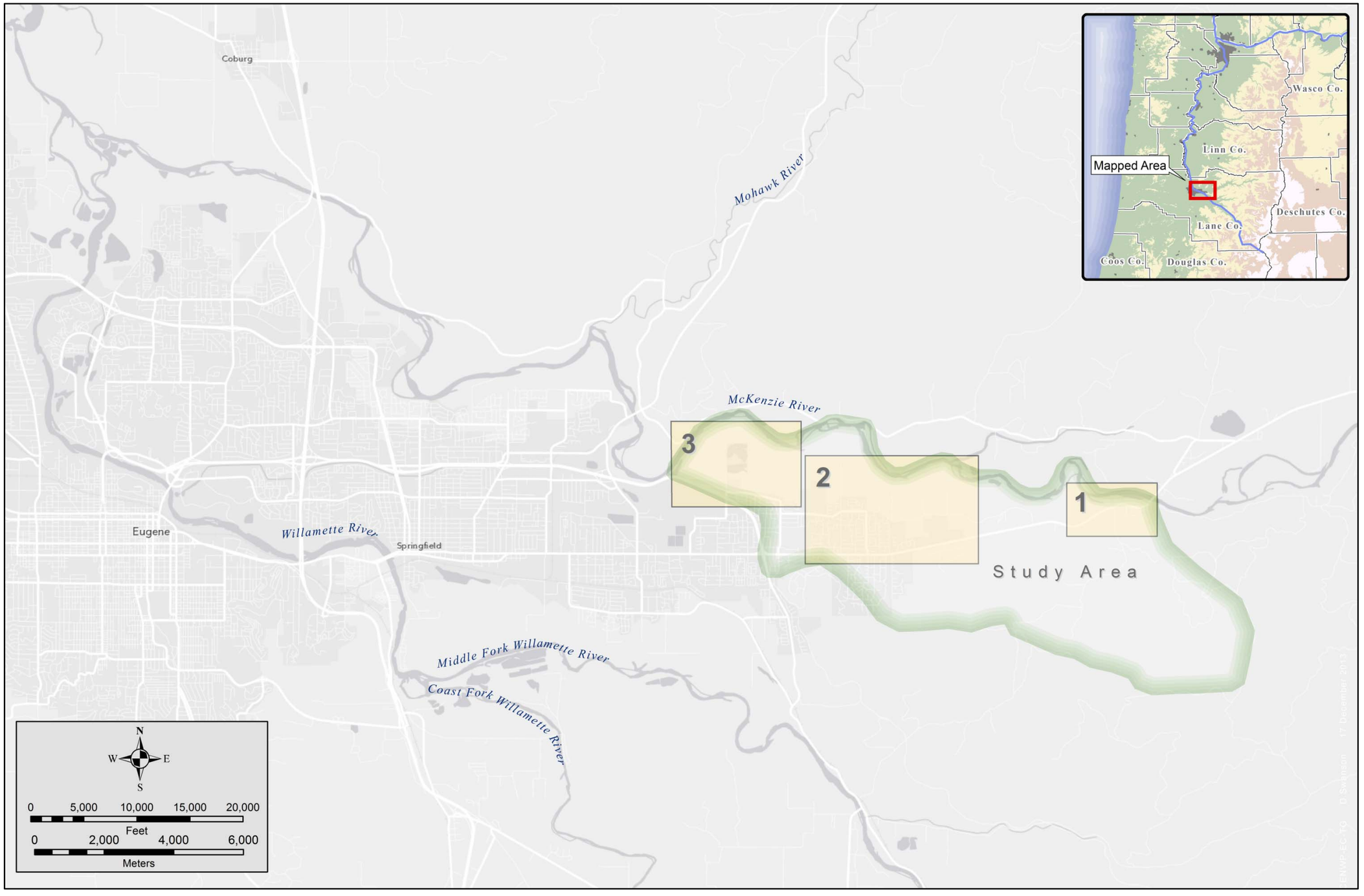
Coburg
Mohawk River
McKenzie River
Eugene
Willamette River
Springfield
Middle Fork Willamette River
Coast Fork Willamette River
3
2
1
Study Area
Mapped Area
Wasco Co.
Linn Co.
Deschutes Co.
Lane Co.
Coos Co.
Douglas Co.
N
W
E
S
0 5,000 10,000 15,000 20,000
Feet
0 2,000 4,000 6,000
Meters

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Study goals and objectives listed below directly address key problems outlined above.

Goal #1, *Restore natural habitats along waterways, including main and side channel in-stream and riparian habitats and their ecological functions.*

Objectives

A. increase riparian corridor widths and improve corridor quality by planting native species
    - *Measure of success:* Riparian corridors are no less than 50 feet on either side of the stream channel (where space is available) and the majority of vegetation in the corridor is native.

B. restore channel complexity of stream channels to remove channelization and increase structural diversity and complexity of instream habitat
    - *Measure of success:* All restored channels maintain banks with natural slopes and do not show signs of erosion, downcutting, toe cuts, bank sloughing, or rotational slumping during the monitoring period.

Goal #2, *Improve access to quality habitat, including removing barriers, improving connectivity, and increasing habitat quantity for fish and wildlife*

Objectives

A. improve fish and wildlife "friendly" connections from the McKenzie River to Cedar Creek and ensure availability of cooler water flows in Cedar Creek year-round
    - *Measure of success*: Improve at least one connection between the McKenzie River and Cedar Creek and ensure it is fish passable.

B. restore migratory corridors ensuring that restoration does not create "habitat islands"
    - *Measure of success:* All restored areas are directly connected to Cedar Creek and the McKenzie River and do not impede migration of fish and wildlife.

Goal #3, *Improve quality places for recreation by restoring Cedar Creek corridors, and providing trails.*

Objectives

A. increase miles of trails
    - *Measure of success:* Additional miles of trails accessible to the public.

The existing condition of unique habitat parameters was evaluated for Cedar Creek and its tributaries using an environmental evaluation tool call the Watershed Assessment Model (WAM). The WAM quantifies habitat parameters to estimate potential Habitat Benefit Units (HBUs) will be produced in the study area in the Future Without Project (FWOP) condition. These results formed the basis of the Project Development Team's (PDT) characterization of the overall habitat quality and relative level of degradation in the creek system. This analysis identified the three reaches that are ripe for restoration.

A Tool Box of Solutions was developed during a planning charette with stakeholders that included a comprehensive list of restoration measures that could be considered for application in the three degraded reaches under consideration. One or more restoration measures were combined into restoration options to address the key habitat degradation issues of each reach. Each reach option was formulated to address some or all of the study goals and objectives. Where multiple options were feasible, separate combinations of restoration measures were developed to achieve varying levels of environmental benefits or as different methods for addressing the objectives. Formulation of options in the reaches provided a gradation of restoration potential (i.e. low, medium, high).

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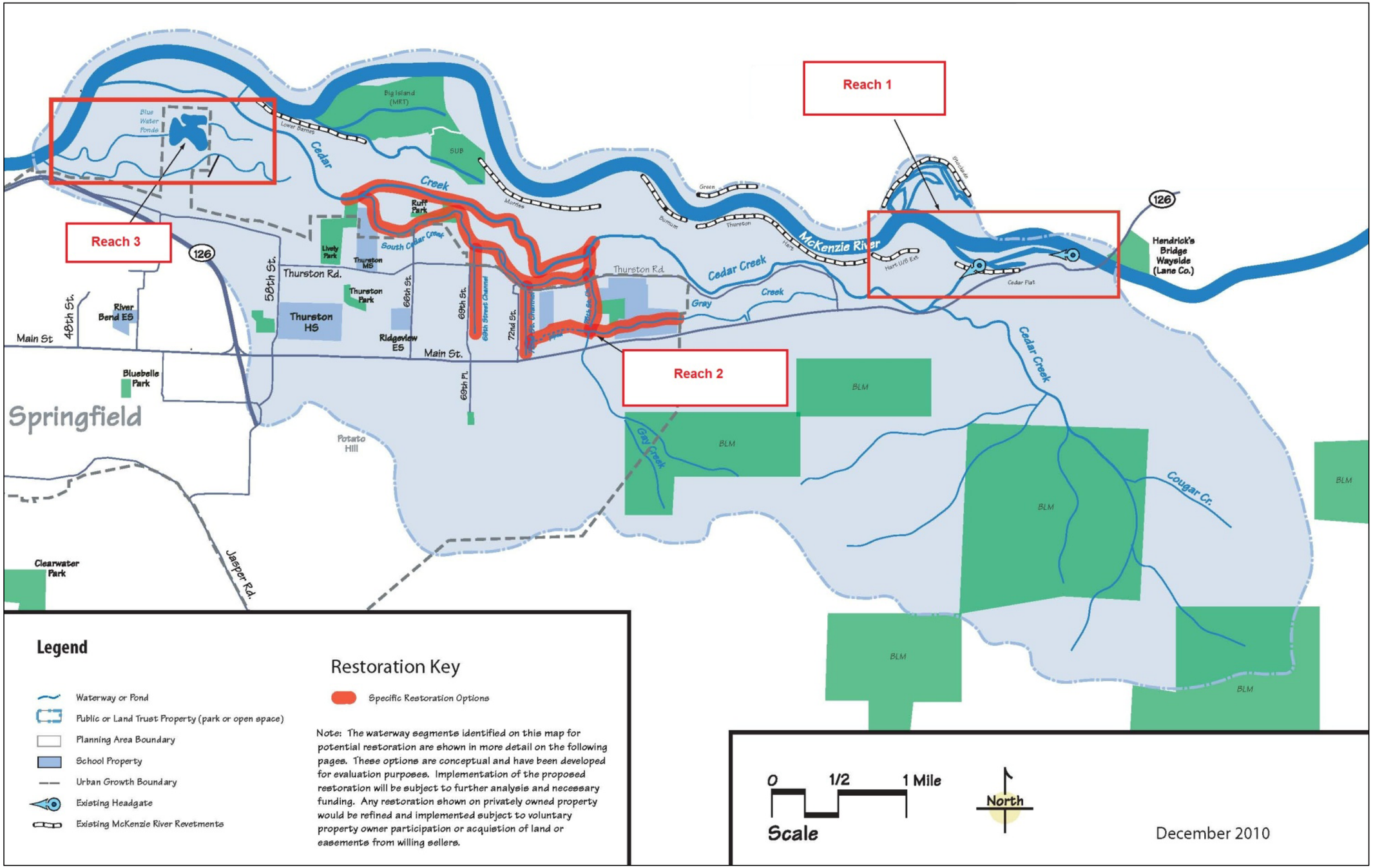
Reach 1
Reach 2
Reach 3
Blue Water Ponds
Big Island (MRT)
Lower Barnes
Cedar Creek
SUB
Ruff Park
Lively Park
Thurston MS
South Cedar Creek
Thurston Rd.
58th St.
66th St.
69th St.
72nd St.
69th Pl.
60th Street Channel
Thurston Park
Thurston HS
Ridgeview ES
Main St
48th St.
River Bend ES
Bluebelle Park
Springfield
Potato Hill
Clearwater Park
Jasper Rd.
126
Morress
Green
Burnum
Thurston
Hart
McKenzie River
Hart U/S Exit
Brookside
Cedar Flat
Hendrick's Bridge Wayside (Lane Co.)
Gray Creek
Cedar Creek
BLM
Guy Creek
Cougar Cr.
Legend
Waterway or Pond
Public or Land Trust Property (park or open space)
Planning Area Boundary
School Property
Urban Growth Boundary
Existing Headgate
Existing McKenzie River Revetments
Restoration Key
Specific Restoration Options
Note: The waterway segments identified on this map for potential restoration are shown in more detail on the following pages. These options are conceptual and have been developed for evaluation purposes. Implementation of the proposed restoration will be subject to further analysis and necessary funding. Any restoration shown on privately owned property would be refined and implemented subject to voluntary property owner participation or acquistion of land or easements from willing sellers.
0 1/2 1 Mile
Scale
North
December 2010

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The WAM was used to quantify the potential lift to ecosystem function in HBUs from implementing each reach option. Conceptual cost estimates were generated using the Micro-Computer Aided Cost Estimating System (MCASES) and include costs associated with engineering and design, construction and contingencies, and land acquisitions.

Cost Effectiveness and Incremental Cost Analysis (CE/ICA) was performed using Institute of Water Resources Plan (IWR-PLAN) Software Suite using potential HBU outputs generated by the WAM and estimated costs from MCASES. The analysis provides a framework for comparing the differences in output across alternative measures and the associated changes in cost. Fifteen plans were included in the Cost-Effective Set. Incremental Cost Analysis identified four "best buy" plans.

The recommended restoration plan will restore regionally and nationally significant aquatic resources that provide habitat for fish and wildlife in the Cedar Creek watershed. Habitat connectivity will be improved allowing for increases in biodiversity throughout the study area.

Reach 1

The recommended restoration plan in Reach 1 include utilizing an existing McKenzie River side channel to divert flow into Cedar Creek from a point along the river that is more geologically stable (approximately 1,400 feet upstream from the current intake) and to create a fish friendly open water connection between Cedar Creek and the McKenzie River. The design will support diversions of summertime flows of McKenzie River water into Cedar Creek to between 10.0 and 15.0 cfs. High wintertime flows are 40 cfs. Instead of installing a water control structure (as originally discussed), the side channel will be modified using a constructed riffle to divert flows from the McKenzie into Cedar Creek while still maintaining hyporheic flow. Similarly, vegetation and strategically placed boulders will be used to stabilize the areas around the side channel. The existing intake structures will be removed and replaced with open-entrance channels to facilitate movement of aquatic organisms and fish. A small rock-weir downstream of the existing structures will be reinforced to maintain oxbow habitat for Oregon chub while simultaneously ensuring sufficient head for water flow into Cedar Creek and preventing erosion and possible head-cutting.

The existing intake structures are not fish-friendly, are blocked by debris, and do not function year-round. Installation of restoration measures will divert flows from the McKenzie River into Cedar Creek downstream of Hendrick's Bridge to maintain flows year-round, while also being ecologically balanced to maintain hyporheic flow, facilitate fish ingress/egress, and promote natural stream functions. Year-round flows support the productivity of invertebrates, fish and wildlife during the low-flow summer season when water is withdrawn from the creek for irrigation. The cool waters of the McKenzie River would also improve overall water temperatures in the creek to support cold-water life histories of ESA-listed salmonids. The constructed riffle would maintain critical functions including geomorphic stability and diversity of water depth, substrate, and velocity, thereby increasing overall habitat complexity.

Reach 2

The recommended restoration plan in Reach 2 improves the waterway connections between South and North Cedar Creek to permanently maintain flow in South Cedar Creek and restore riparian vegetation along South Cedar Creek. Channel restoration in South Cedar Creek occurs adjacent to the middle school to improve in-stream habitat conditions. The 69th Street Channel is converted to a low flow channel to improve aquatic habitat. Riparian restoration is completed and a segment of concrete channel is removed on the 72nd Street Channel. Flow is diverted back into the 75th Street Channel and more riparian vegetation is improved. A portion of the Gray Creek channel that is currently flowing through underground pipes is day-lighted and channel restoration along Gray

Creek is completed to improve aquatic habitat. Recreational trails along many of the waterways are constructed to facilitate public access as part of the locally preferred option.

Much of the riparian zone throughout Reach 2 is dominated by reed canary grass (*Phalaris arundinaceae*), Himalayan blackberry (*Rubus armeniacus)*, and other invasive, non-native species. Control of non-natives will likely be accomplished via a combination physical removal and herbicide application to control regeneration. Native plant species will be selected as they best suit the landscape (riparian, aquatic, etc.) to benefit water quality and fish and wildlife habitat.

Improved waterway connections would divert water into desired channels and waterways to increase the spatial and temporal extent of aquatic and riparian habitat available to support fish, wildlife, and plants. Currently, South Cedar Creek periodically goes dry during the summer, low-flow season. In order to maintain year-round water to support aquatic and riparian habitats, a bottomless culvert/arch would be installed where Cedar Creek branches to divert water into South Cedar Creek in order to maintain year-round flows. Secondly, a second bottomless culvert/arch would be installed on Gray Creek to divert water into the remnant 75th Street Channel, which runs northwest to South Cedar Creek. Gay Creek currently empties into Gray Creek at the 75th Street Channel, historically ran north and fed directly into South Cedar Creek. Under the proposed actions, Gay Creek will continue to flow into the Gray Creek channel downstream of the new diversion structure.

Channel restoration is proposed for portions of Gray Creek adjacent to Thurston Elementary School and the downstream portion of South Cedar Creek. Upstream of the school property, the Gray Creek channel would be restored with added meanders and in-stream features (pools, LWD, basking structures, etc.) to mimic natural stream conditions. Similar restoration actions would occur at the downstream section of South Cedar Creek where it rejoins with North Cedar Creek. Downstream from Bob Artz Park, Gray Creek enters a pipe and a culvert before emptying into the 72nd Street Channel. The piped segment immediately south of the school property would be daylighted and the 72nd Street Channel box culvert would be removed to open the channel and restore natural aquatic habitat.

<u>Reach 3</u>

The recommended restoration plan in Reach 3 includes acquiring the Blue Water Ponds (and relocating the commercial/industrial interest currently operating). The banks of the ponds will be re-contoured to improve wetland/riparian habitat. Flow will be diverted from Cedar Creek to the ponds as a function of restoring backwater channels. Western Pond Turtle habitat will be restored, including installation of basking structures in and around the ponds. Riparian habitat is restored along 14,000 linear feet of waterways and some recreational access is constructed to facilitate public access and use of the ponds.

The recommended restoration plan is proposed for implementation at a Total Project Cost of $32,405,000 including all anticipated construction costs based on the Effective Price Level date of 1 October 2014, costs of Lands, Easements, Rights-of-way, Relocations, and Disposal (LERRDs), Interest During Construction (IDC), and monitoring costs. Total cost of LERRDs is estimated to be $14,542,000. Due to Corps policy limits LERRDs costs to 25% of the total project cost, $8,101,250 of the LEERDs cost qualifies to be applied toward the non-Federal sponsors cost share. The additional $6,440,750 in LEERDs costs will be the responsibility of the non-federal sponsor without cost share credit.

Corps cost share policy for ecosystem restoration states that the Corps will pay fifty percent of Pre-construction Engineering and Design (PED), 65 percent of restoration construction costs and fifty percent of recreation construction costs. The non-Federal sponsor is responsible for fifty percent of

PED costs, 35 percent of the restoration construction costs and fifty percent of recreation construction costs. Cost responsibilities are presented in the table below:

Activity	Activity Cost	Federal Cost	Non-Federal Cost
PED: 50/50 cost share	$3,591,000	$1,795,500	$1,795,500
LEERDs not eligible for cost share	$6,440,750	$0	$6,440,750
Restoration Construction (including eligible LERRDs): 65/35 cost share	$21,577,250	$14,025,213	$7,552,037
Recreation Construction: 50/50 cost share	$796,000	$398,000	$398,000
Total	$32,405,000	$16,218,713	$16,186,288

This Feasibility Report with Integrated Environmental Assessment has included an examination of all practicable alternatives for meeting the study purpose and need for the study area. The recommended restoration plan is an incrementally justified and cost-effective approach, which meets local sponsor objectives and demonstrates a federal interest.

The recommended restoration plan will increase the quantity aquatic habitat and increase access to Cedar Creek and its side channels. The plan provides positive ecosystem benefits in terms of aquatic habitat restoration, water resource protection, repair of degraded physical conditions, and provision of multiple social benefits.

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1. STUDY BACKGROUND

1.1. Study Overview

The purpose of the Springfield Metropolitan Waterways Feasibility Study (Study) is to identify feasible options to restore aquatic and riparian habitats throughout the Cedar Creek watershed near Springfield, Oregon. The study area encompasses the entire Cedar Creek watershed in western Oregon (Figure 1).

1.2. Study Authority

The Senate Committee on Public Works resolution for the Willamette River Basin Comprehensive Study was adopted on November 15, 1961 and authorized the U.S. Army Corps of Engineers (Corps) Chief of Engineers to determine:

> *" . . . whether any modification of the existing project is advisable at the present time, with particular reference to providing additional improvements for flood control, navigation, hydroelectric power development, and other purposes, coordinated with related land resources, on the Willamette River and Tributaries, Oregon."*

Furthermore, the House Committee on Public Works resolution for the Willamette Basin Review Study was adopted September 8, 1988 and authorized the Chief of Engineers to determine:

> *". . . whether modifications to the existing projects are warranted and determine the need for further improvements within the Willamette River Basin in the interest of water resources improvements."*

Subsequent to these resolutions, the US Army Corps of Engineers, Portland District (Corps) conducted a reconnaissance study and determined ecosystem restoration is warranted and there was additional need for improvements to water resources in Cedar Creek.

1.3. Planning Process

Ecosystem restoration is one of the primary missions of the Corps' Civil Works Programs. Contributions to national ecosystem restoration (NER) include increases in the net quantity and/or quality of nationally significant resources. Measurements of NER outputs are based on changes to quality and quantity of ecological resources measured by improvements to overall habitat quality and/or increasing the quantity or extent of habitats. These changes are expressed quantitatively in physical units or indexes (but not monetary units), and are measured in the study area for the overall benefit of the Nation.

The Corps' Civil Works planning process follows a six-step structured approach to problem solving, through which the process provides a rational framework for sound decision-making. The six-step process is used for all planning studies conducted by the Corps. The six steps are:

Step 1 - Identifying Problems and Opportunities
Step 2 - Inventorying and Forecasting Conditions
Step 3 - Formulating Alternative Plans
Step 4 - Evaluating Alternative Plans
Step 5 - Comparing Alternative Plans
Step 6 - Selecting a Plan

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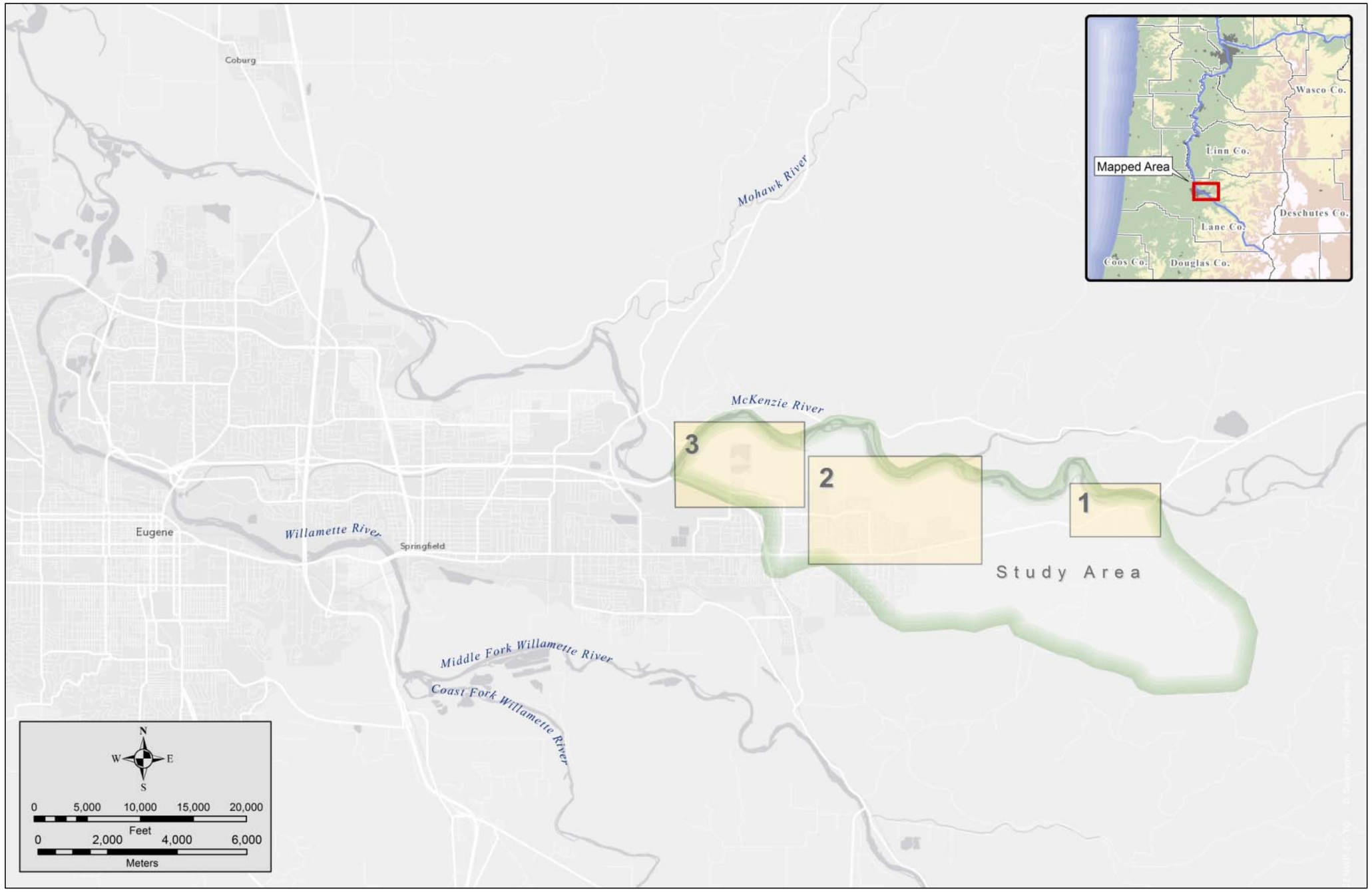
Figure 1 Study Area Location



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1.4. Reconnaissance Study

The Corps' Eugene-Springfield Metro Waterways Project Section 905(b) Analysis (Reconnaissance Study) was completed in October 2002. The purpose of the Reconnaissance Study was to determine if there is a Federal interest to conduct studies under the Corps' ecosystem restoration, flood risk reduction, and recreation mission areas.

The results of the Reconnaissance Study were:

> *"A feasibility study to develop comprehensive watershed analysis and develop multiple-objective improvements throughout the Eugene-Springfield metropolitan waterways is determined to be consistent with the federal interest. This determination is based upon the presence and impact of previous Corps water development projects within in the study area; the relationship of the study purpose to other Corps activities within the Willamette basin; the Corps interest in aquatic restoration, ESA recovery, …and other issues; the history of Corps involvement in the metro area and other local cooperation factors; and several other findings."*

1.5. Feasibility Study Report Scope and Objective

The scope of the feasibility phase is to identify ecosystem restoration plans in the Cedar Creek watershed. The goal of this report is to recommend a cost effective restoration plan that maximizes ecosystem benefits to nationally significant resources in a cost effective manner with the least amount of environmental, cultural and socioeconomic impact. This study is prepared under the terms defined in the Feasibility Cost Share Agreement with the non-federal sponsors signed in 2003 and amended in 2013. The non-federal sponsors are the City of Springfield, Oregon (City) and Lane County (County). Per the agreement, costs for conducting the study and preparing the report are shared 50/50 between the Corps and the sponsors[1]. A portion of the sponsor's cost share requirement has been met through work-in-kind and the remainder with cash contributions.

The study uses a 50-year period of analysis, or planning horizon. This period of analysis begins when the first construction season is completed.

1.6. Study Purpose and Need*

1.6.1. Study Purpose Statement*

The purpose of this study is to identify degraded habitat conditions in Cedar Creek and recommend an ecosystem restoration plan (proposed action) to address these conditions and restore habitats for fish and wildlife. The goals and objectives of the project were identified to address the degraded habitat conditions identified during the study. These objectives include improving the ecological structure and function of aquatic and riparian habitats by improving hydraulic connectivity between Cedar Creek and the McKenzie River, minimizing the establishment and extent of non-native species and ensuring the system is accessible to native fish and wildlife throughout the year and that channels are fish passable throughout.

A recommended restoration plan in Cedar Creek will serve to improve and restore the quality of in-stream and riparian habitats, increase connectivity of the floodplain, reduce invasive species coverage, and increase biodiversity throughout the study area. As a result, the recommended restoration plan will increase the overall quality and quantity of habitats and natural resources in the study area.

[1] Any costs associated with the project that exceed the Corps' permissible 50% contribution will be covered in-full by the sponsors.

1.6.2. Study Need Statement*

Historically, the study area supported a diverse biota that has degraded over time from the increasing pressures of development over the last 150 years. The quantity and quality of habitats have been reduced by a number of anthropogenic factors including the loss of wetlands and their associated riparian areas due to draining and filling, disconnection of the floodplain, increased erosion, hardening of channel banks, and the introduction of non-native species followed by declines in native plant diversity and composition. Habitat availability has been reduced and disconnected as the study area has become urbanized and increases in development have degraded water quality.

Riparian corridors have been minimized throughout the study area, if not removed entirely, in favor of maximizing agricultural, commercial, and residential development. Much of the riparian corridor is comprised largely of non-native species which out-compete native species and provide reduced functioning shelter, foraging, or breeding habitat to the area's wildlife. Where the riparian buffer has been minimized, sediments and stormwater wash directly into the creek without filtering through natural media. The widespread lack of trees and shrubs along the creek channel further degrades habitat quality in the creek, where temperatures increase beyond the lethal limit for many cold-water fishes as a result of no shade over the stream channel.

Much of Cedar Creek is incised, eroding, or conversely filling in from eroding material upstream. Cedar Creek has been substantially disconnected from the historical floodplain. The creek has been channelized and water control structures were installed in the early and mid-1900's to facilitate irrigation and control wintertime and freshet high flows on the McKenzie River. As a consequence of disconnecting the creek from the floodplain, fish and wildlife access to valuable off-channel habitats has been reduced. Because some of the structures are not maintained regularly, they are blocked with debris. The existing configuration of the intakes precludes fish passage. Much of the creek channel has been straightened and channelized, with hard armoring along some banks and in-stream habitat features (large woody debris, boulders, etc.) have been removed in favor of increasing channel conveyance.

Restoring the connectivity, structure, and function to aquatic and riparian habitats provides the best opportunity to restore and maintain ecosystem processes which support fish and wildlife resources. Because these issues are recognized by both the Corps and local governments as providing the most important opportunities to restore habitats in the study area, there is a need to implement restoration actions to support these nationally significant resources.

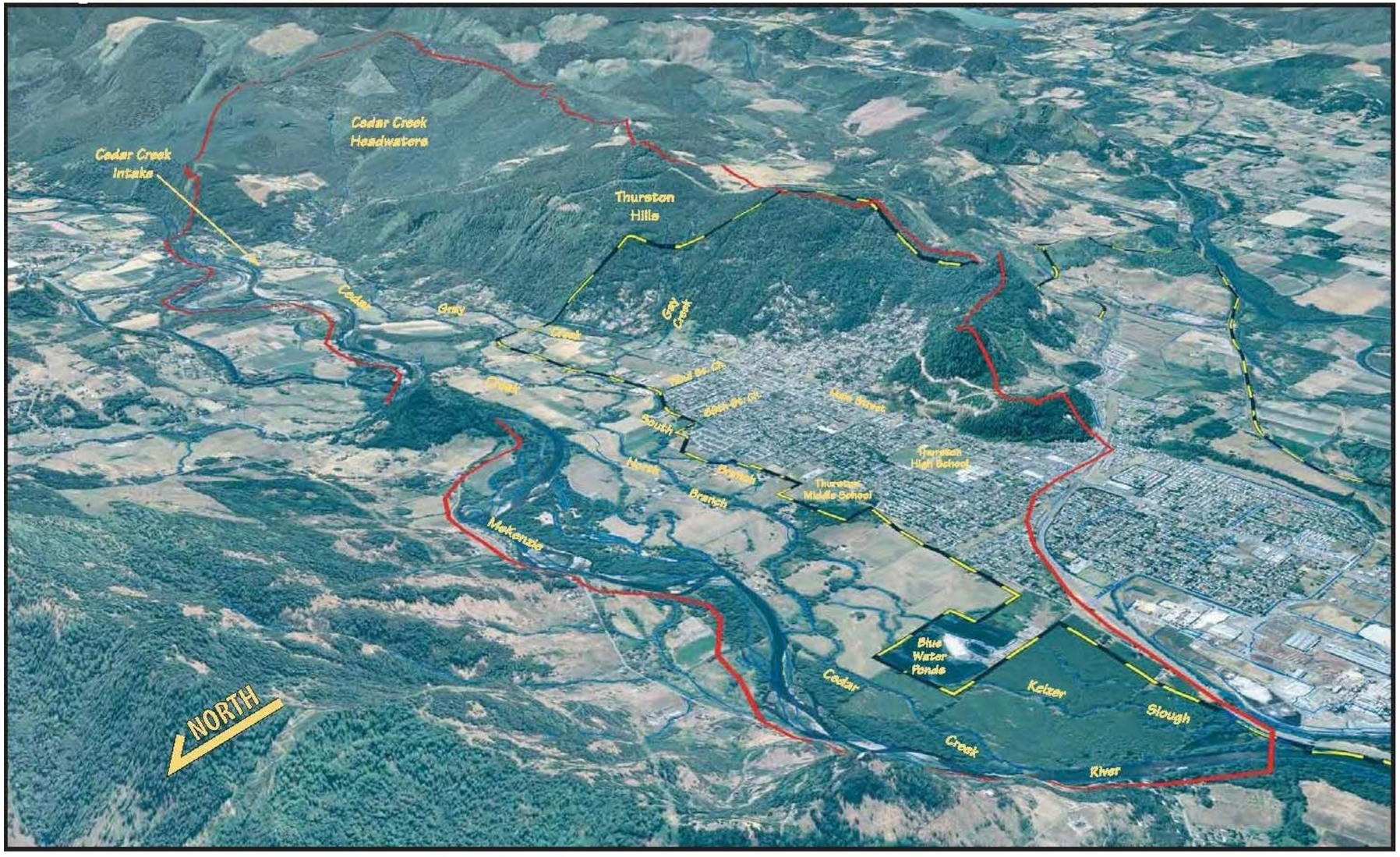
1.7. Study Area

Cedar Creek (Figure 2), as defined by the watershed boundary, covers a total of 9,472 acres including the north and south branches of Cedar Creek, Gray Creek, Gay Creek, Blue Water Ponds, 69th Street Channel, 72nd Street Channel, 75th Street Channel, and numerous headwater streams. In addition, a portion of the McKenzie River watershed is included in the study area in proximity to where the McKenzie River and Cedar Creek floodplains merge. Three reaches if Cedar Creek are ripe for restoration and are identified in Figure 1.

1.8. Resources of National Significance

The significant of resources in the study area are recognized in terms of institutional, public, and technical importance.

Figure 2 Study Area Birdseye View



Aerial Photo Base: Summer 2005

Produced by LCOG, December 2007

Legend:

- Urban Growth Boundary
- Major Water Resources
- Study Area Boundary

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1.8.1. Institutional Significance

Institutional recognition is based on the significance of resources acknowledged in laws, adopted plans and policy statements by agencies both public and private. These habitats have been documented in the scientific community as valuable, diverse, and rare. Water resources and riparian areas have garnered federal protection through federal laws, such as the Clean Water Act that regulates impacts to waters of the US. Fish and wildlife species that rely on these water and riparian resources are protected under the Migratory Bird Treaty Act, Endangered Species Act, and Magnuson–Stevens Fishery Conservation and Management Act.

The formal recognition of the McKenzie River, of which Cedar Creek is a major tributary, by multiple agencies illustrates the significance of the resources in the study area. The plans and programs listed in Section 2 demonstrate the significance of the resources to multiple agencies. Of particular importance is the *Upper Willamette River Conservation and Recovery Plan for Chinook Salmon and Steelhead* that lays out strategies for the recovery of listed Upper Willamette River Chinook salmon and steelhead trout, in indicator of significance to the State of Oregon (ODFW 2011). Reconnection of floodplain habitats is one of the primary methods outlined in this plan.

A recommended plan for Cedar Creek will contribute towards meeting key objectives of the Willamette Subbasin Plan which acknowledges that juvenile fish rearing habitat in the lower McKenzie River basin is confined to lower portions of streams, such as Cedar Creek (NPCC 2004). Key aquatic habitat strategies of the subbasin plan that this study will address include: 1) increase interaction of rivers and floodplains; 2) increase supply and recruitment of large wood by improving riparian composition and extent, and providing for flows to capture wood; and 3) control the most damaging terrestrial and aquatic invasive species (NPCC 2004a).

This recommended plan will support restoration of State of Oregon Goal 5 natural resources as required by state planning laws and regulations. These water and riparian resources are also given significance in the Eugene-Springfield Metropolitan General Plan as designated significant resources.

1.8.2. Public Significance

Public recognition means that some segment of the public either individually or as a group recognizes the importance of an environmental resource. Collaboration with the public through the watershed councils and other public outreach plans, such as Rivers to Ridges, has shed light on the importance of the study area and its resources to the public. This study is supported by many local organizations and their members.

1.9. Report Contents and Description of Documents

This report contains a summary of the feasibility study from plan formulation through selection of a recommended restoration plan. Also included in this report are preliminary designs and cost estimates, and a description of the existing baseline conditions. This document integrates the feasibility study results with an Environmental Assessment (EA) to comply with National Environmental Policy Act (NEPA) requirements. The feasibility report has been prepared with an appropriate level of analysis to develop the project schedule and baseline cost estimate to facilitate a decision on whether to move forward with preconstruction engineering and design (PED).

Chapter 1 includes the general description of the study authorization, purpose and scope, sponsorship, and the purpose and need statement. Chapter 2 identifies other Federal, state and local programs and projects operating within the study area. The problems and restoration opportunities in the study area are described in Chapter 3 and Chapter 4 provides a narrative

describing the existing and likely Future Without Project (FWOP) conditions within the study area. Chapter 5 describes the plan formulation process and Chapter 6 describes the recommended restoration plan. Chapter 7 describes the potential effects of the recommended restoration plan on the environment. Chapter 8 describes public involvement efforts conducted to date. Chapter 9 describes the status of environmental compliance. Chapter 10 describes the proposed monitoring plan. Chapter 11 describes the recommended monitoring and adaptive management plan and Chapter 12 provides the conclusions and recommendations from the study.

2. EXISTING PROJECTS AND RELATED STUDIES/PROGRAMS

2.1. US Army Corps of Engineers

The Corps has a lengthy history of involvement in the development and management of water resources in the upper Willamette basin, beginning with navigation projects in the 1870s. Recent Corps efforts in the Southern Willamette Valley include:

- Springfield Mill Race, Section 206. Construction of the project, beginning in 2009, included restoration of the aquatic ecosystem by improving habitat, and flow management. Construction activities concluded in 2011 and 2012. Overall, the project secured a year-round water source, thus enabling restoration of downstream fish habitat and improved fish passage. Aside from the restoration activities, the Mill Race promotes a suite of recreational uses and historic preservation potential in the downtown Springfield area. The City of Springfield was the local sponsor.

- Willamette River Floodplain Restoration Study – Coast Fork and Middle Fork Sub-Basins. The purpose of this Feasibility Study, completed in 2013, was to evaluate opportunities to restore floodplain function along the lower Coast Fork and Middle Fork of the Willamette River. The study and recommended restoration plan was approved by the Chief of Engineers in the winter of 2013 and will move into the PED phase in 2014.

2.2. Other Federal Agency Studies/Actions

- Recovery Plan for the Oregon Chub (1998): The U.S. Fish and Wildlife Service (USFWS), in partnership with the Oregon Department of Fish and Wildlife (ODFW), developed a recovery plan for the threatened Oregon Chub. The plan was developed with the ultimate objective of delisting the species, but also established criteria for downlisting the species, as well.

- 2008 Willamette Project Biological Opinion (2008): This Biological Opinion (BiOp) was prepared by the National Marine Fisheries Service (NMFS) and stipulates the need for restoration actions to address fish populations, specifically salmonids, under Section 7(b) of the Endangered Species Act (ESA).

  NMFS completed a consultation with the Corps, Bonneville Power Administration, and the Bureau of Reclamation (together, the Action Agencies) on July 11, 2008, on the impact of the Willamette River Basin Project on relevant species listed for protection under the ESA (salmonids). The Willamette Project consultation began in 1999. During the course of the consultation, the Action Agencies also consulted with USFWS on ESA-listed species within their jurisdiction (bull trout and Oregon chub).

- Upper Willamette River Conservation and Recovery Plan for Chinook Salmon and Steelhead (2011): The Upper Willamette stakeholder team, together with ODFW and NMFS, developed a recovery plan for threatened and endangered salmon (and steelhead) populations in the Willamette River and its tributaries.

2.3. Related Local and Regional Plans and Studies

Numerous local and regional planning efforts provide relevant guidance to the Study and support implementation of the proposed restoration actions. Some key efforts, listed by date, include:

- Eugene-Springfield Metropolitan General Plan (1987): The *Metro Plan* provides oversight for land use and transportation in the area. The Plan identifies a minimum level of key urban services related to waterways resources: wastewater, water service, parks and recreation services, and land use controls. Water resource-related plan elements set forth objectives to maintain benefits associated with these resources, including maintaining livability through wise management and planning, retention of multiple values, minimizing impacts, and protection of certain resources.

- Aquatic and Riparian Habitat Assessment for the Eugene-Springfield Area (2002): A report was prepared at the request of the Metropolitan ESA Coordinating Team (MECT) and was funded in part by a grant from the Oregon Watershed Enhancement Board. The purpose of the report was to determine current conditions, identify data gaps, and provide preliminary site-specific recommendations for waterways in the Metro area. The report identified Cedar Creek as being a key opportunity area for habitat protection and riparian restoration.

- Rivers to Ridges – Metropolitan Parks and Open Space Study (June 2003): The vision was developed by the Lane Council of Governments (LCOG) in collaboration with Lane County, the City of Eugene, the City of Springfield, and Willamalane Parks and Recreation District. The vision is a conceptual framework for future park and open space protection in the region and has been endorsed by the elected officials of the four local partners. In this vision, Cedar Creek was specifically called out as *blueways*. By the *Rivers to Ridges* definition, a *blueway* is a key water based connection where targeted acquisition, restoration, and recreation will occur.

- Willamalane Parks and Recreation Comprehensive Plan (2004): This Plan provides general guidance for future park and open space acquisitions and restorations for the Springfield area. The Plan recommends exploring the feasibility of trail connections along the Thurston Hills ridge in conjunction with the planned natural area park acquisitions in the Cedar Creek basin.

- Willamette Basin Restoration Priorities Watershed Summaries (2005): The Oregon Watershed Enhancement Board restoration priorities include provisions for improving Chinook salmon habitat in the upper Willamette River system with goals specifying enhanced connectivity, channel complexity, and restoration of riparian area function.

- The Governor's Blueprint for Restoring and Enjoying a Healthy Willamette Basin (2005): Released in May 2005, the Governor’s Blueprint identifies three priority areas of focus (Repair, Restore, Recreate) for the Willamette Basin, as well as actions that cut across all three priority areas.

- Oregon Conservation Strategy (2006): The Conservation Strategy is an effort to use the best available science to create a broad vision and conceptual framework for long-term conservation of Oregon’s native fish and wildlife, as well as various invertebrates and native plants. As a guide to conserving the species and habitats that have defined the nature of Oregon, this strategy can help ensure that Oregon’s natural treasures are passed on to future generations. The Conservation Strategy emphasizes proactively conserving declining species and habitats to reduce the possibility of future federal or state listings. It is not a regulatory document, but

instead presents issues and opportunities, and recommends voluntary actions that will improve the efficiency and effectiveness of conservation in Oregon.

- Willamette Basin Total Maximum Daily Load (2006): The Willamette Basin Total Maximum Daily Load (TMDL) document was released in September 2006 and identifies needed improvements in the upper Willamette Basin to pollutant loads for mercury, bacteria, and temperature to ensure waterways are able to provide for "beneficial uses" such as fish rearing, water contact recreation, and fish consumption.

- City of Springfield Stormwater Facilities Master Plan (2008): The purpose of this plan is to provide a guiding document in order to plan for more comprehensive, efficient, and multi-objective management of the City of Springfield's stormwater resources. In addition to providing proposed capital improvement projects (CIP) for flood control and water quality, a review of existing stormwater standards/codes was conducted to recommend changes that will support the implementation of Springfield's goals and policies related to stormwater.

- Ridgeline Area Open Space Vision and Action Plan (2008): The Ridgeline Area Open Space Vision was developed to serve as the framework for future open space and recreation efforts for Eugene's Ridgeline area. In addition to the Vision, a detailed Action Plan was developed to help direct the implementation of the Ridgeline Area Open Space Vision. The Action Plan includes goals, recommended actions, and strategies organized under the following six categories: Habitat Conservation and Management; Recreation; Tourism; Water Resources; Views and Viewsheds; and Urban-Rural Transition.

- Willamette River Open Space Vision and Action Plan (2010): The Willamette River open space planning effort was initiated in June 2009. Lane Council of Governments (LCOG) facilitated this visioning process, working closely with fifteen partner organizations. Public outreach included two workshops, an online survey (completed by nearly 500 participants), and extensive outreach to a variety of interest groups. The open space vision is intended to serve as a conceptual framework to guide future open space and recreation planning and acquisition efforts for the Willamette River corridor in the coming years and decades, and is non-regulatory in nature. Implementation will be achieved through the combined efforts of the partnership, property owners, and the public and will rely on voluntary land owner participation.

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3. PROBLEMS AND OPPORTUNITIES

3.1. Problems

Increased development in the watershed has reduced habitat availability and degraded overall water quality. Below is a summary of problems and issues present in Cedar Creek:

- Native fish refugia in side channels and tributaries to the McKenzie River are restricted due to levee construction, installation of water control structures, and hydraulic modification of the river.
- Riparian habitat has been significantly impacted along Cedar Creek and the urban "Street Channels" (i.e. 69th, 72nd, 75th Streets) due to past urban stormwater practices, urbanization, and development of agricultural areas.
- Tributary channels to Cedar Creek experience channel instability from increased erosion, downcutting, toe cuts, bank sloughing, rotational slumping, and channelization for urban development causing:
  - increased sediment deposition in the water column degrades water quality
  - reduced bank stability impairs growth of mature bank vegetation, further degrading habitat

3.2. Opportunities

There is opportunity to improve hydrologic connection between the McKenzie River and off-channel habitats to increase native fish access to rearing habitat and refugia. There is also opportunity to restore riparian habitats along Cedar Creek and its tributaries adjacent to the stream channel by widening the riparian buffer to increase the quantity and quality of this buffer habitat, as well as increase the composition and distribution of native vegetation. Opportunities exist to stabilize stream banks to improve overall instream habitat quality, as well as reduce erosion and bank failure through vegetative plantings and channel re-alignment (meanders).

Public interest in increasing recreation opportunities in the study area is well supported. Regional and city planning documents recommend exploring the feasibility of trail connections along the Thurston Hills ridge to the McKenzie River. Public schools border the stream corridors and provide great potential for educational programs relating to water resources and natural habitats to increase public understanding of regionally and nationally significant resources found in the study area.

3.4. National Planning Objectives

As stated above, ecosystem restoration is one of the primary missions of the Corps Civil Works program. Guidance document ER 1165-2-501 states:

> *"The purpose of the Civil Works ecosystem restoration activities is to restore significant ecosystem function, structure, and dynamic processes that have been degraded…The intent of restoration is to partially or fully reestablish the attributes of a naturalistic, functioning, and self-regulating system."*

The Federal objectives for the ecosystem restoration mission differ slightly from other missions. Evaluation and comparison of ecosystem restoration alternatives necessitates both monetary and nonmonetary metrics. As such, the guidance ER 1165-2-501 states:

> *"Consistent with the analytical framework established by the P&G, plans to address ecosystem restoration should be formulated and recommended, based on their monetary and non-monetary benefits. These measures do not need to exhibit net national economic development (NED) benefits and should be viewed on the basis of non-monetary outputs compatible with the P&G (Planning and Guidance) selection criteria."*

The aquatic and riparian restoration evaluated in the study is consistent with the Corps ecosystem restoration mission, as well as the ecosystem Federal objective.

3.5. Restoration Plan Goals and Objectives

Pursuant to the Corps' regulation ER 1165-2-501, the intent of restoration is to partially or fully reestablish the attributes of a naturalistic, functioning and self-sustaining system. The planning goals and objectives described below directly address key problems identified in the Cedar Creek watershed outlined above.

This study investigates the restoration actions necessary to restore and support essential habitat types, as well as the restoration actions necessary to prevent further declines in abundance of regionally and nationally significant resources.

Goal #1, *Restore natural habitats along waterways, including main and side channel in-stream and riparian habitats and their ecological functions.*

Objectives

- increase riparian corridor widths and improve corridor quality by planting native species
    - *Measure of success:* Increase riparian corridors to 100 feet wide on either side of the stream channel (where space is available) with a highly diverse composition of native vegetation.
- restore channel complexity to remove channelization and increase structural diversity of instream habitat
    - *Measure of success:* All restored channels maintain banks with natural slopes and do not show signs of erosion, downcutting, toe cuts, bank sloughing, or rotational slumping during the monitoring period. In addition, meanders are created in the stream channel (where space allows) and low-flow and high-flow channels are maintained.

Goal #2, *Improve access to quality habitat, including removing barriers, improving connectivity, and increasing habitat quantity for all species.*

Objectives

- provide fish and wildlife "friendly" connections from the McKenzie River to Cedar Creek and ensure availability of cold water flows in Cedar Creek year-round
    - *Measure of success*: Improve waterway connections with Cedar Creek and between the McKenzie River and Cedar Creek, and ensure connections are fish passable.
- restore migratory corridors ensuring that restoration does not create "habitat islands"
    - *Measure of success:* All restored areas are directly connected to Cedar Creek and the McKenzie River and do not impede migration of fish and wildlife.

Goal #3, *Improve quality places for recreation by restoring Cedar Creek corridors, and providing trails.*

Objectives

A. increase miles of recreational trails
    - *Measure of success:* Additional miles of trails accessible to the public.

3.6. Constraints and Assumptions

Constraints were identified that encompass physical, biological, and socio-political limitations for restoration potential in the study area, including policy and planning constraints.

Urbanization and agricultural practices will continue to put pressure on aquatic habitats in Cedar Creek for the foreseeable future. The existing urbanized sections of Cedar Creek are constrained by residential development, where width and length of riparian zones are fragmented by multi-use trails and roadways. The continued presence of non-native plant and animal species will also be a source of stress for native species. While tenacity of non-native species will present a challenge to restoring fully functional aquatic and riparian ecosystems, the restoration goals aim to reduce the extent of non-native species and allow for the establishment of a native species.

Cedar Creek is within the 100-year designated floodplain for the McKenzie River. Improvements in the regulatory floodway require a zero rise (no net rise) in flood elevations. National Floodplain Insurance Program (NFIP) regulations and the applicable community floodplain ordinance must be adhered to during project-specific design and development. In addition, per the Federal Emergency Management Agency (FEMA) regulations, a Conditional Letter of Map Revision (CLOMAR) or a Letter of Map Revision (LOMAR) process may be required for adjustments to the floodplain resulting from project impacts. Like land ownership, these policy and planning issues present management challenges for implementing restoration actions in the study area.

The study assumes a risk based planning approach with analytical resources utilized to resolve high-risk issues that may impact the decision-making process. These risks may also have extreme impacts to cost, project effectiveness, or sustainability after construction. This study, though it remains at the preliminary design level, provides sufficient detail and analysis to allow decision-makers to thoroughly assess the risks involved and ensure that the planning purpose, needs and goals are met through project implementation. In addition, there is enough detail in the preliminary design plans to provide an adequate level of confidence that the most appropriate, cost effective alternatives are selected.

Some sources of additional information utilized in this risk based assessment are found in the following sources:

- City of Springfield Storm Water Facilities Master Plan.
- Existing FEMA Flood Insurance Studies and mapping.
- Corps and US Geological Survey (USGS) flow and stage information.
- Biological surveys from the City of Springfield.
- Existing Natural Resources Conservation Service (NRCS) and other soils data.
- Existing well logs.
- Corps levee and revetment program information.

Information from these and other sources was used as input for hydraulic calculations and modeling to inform flooding concerns, and as data and input for environmental modeling. For the

recommended restoration plan cost estimate, calculations were used to size conveyance features, primarily channels and other hydraulic structures.

This approach is supported by Corps engineering regulation in ER 1110-2-1150 which provides guidance with regard to this issue stating “for the purpose of this regulation, non-life safety critical structures are those small features whose failure would not result in loss of life, or significant economic loss or liability. ”

Engineering Construction Bulletin, ECB 2012-18 was also used to define the engineering level of effort for this feasibility study. It requires increased use engineering judgment in the analysis and cost estimates supporting plan formulation and selection for both alternative level as well as final recommendation. It directs that the Project Development Team (PDT) make a risk informed decision to defer some details or analysis to the PED phase, provided that proper plan formulation and life safety requirements are met.

4. EXISTING AND FUTURE WITHOUT PLAN CONDITIONS*

4.1. Existing (Baseline) Conditions*

The existing (baseline) conditions described below are intended to provide detailed information on existing and projected conditions for the study area. The generalized topics covered include physical conditions (topography, and geology and soils); water resources (hydraulics and hydrology, and water quality); land use and population (socio-economics, environmental justice communities, cultural and historic resources, land use, recreation); biological resources (habitat types, fish and wildlife resources, threatened and endangered species); and pollutant concerns (air quality, noise, and hazardous waste). Some information is presented at the regional scale to help define the context within the study area.

The information provided below was used to inform and direct the decision making process as issues and opportunities were assessed and potential plan alternatives were identified. The baseline data provided below was used to assess and evaluate the function and effectiveness of the proposed restoration alternative.

4.1.1. Watershed Assessment Model

The Corps' Civil Work program stipulates that feasibility studies must capture and quantify the environmental benefits of each proposed restoration alternative to evaluate the relationship of costs of an alternative to the benefits achieved. Calculating environmental benefits can be partially accomplished by the use of habitat models which describe habitat quality in terms of specific fish and wildlife species, communities or functional groups.

A *Watershed Assessment Model* (WAM) was developed by the Cities of Eugene and Springfield, with contribution from LCOG and the Corps, to evaluate habitat quality for the study area. Using field data collected in 2006 and 2007, the condition of unique habitat parameters was evaluated for the waterways and individual reaches of Cedar Creek. The WAM characterized four broad habitat categories: 1) physical conditions, 2) water quality, 3) natural resources and habitat, and 4) recreational opportunity. It should be noted the recreational values from the WAM were not used in the plan formulation process to evaluate environmental benefits from the plan alternatives. To meet the Corps' policies and guidance for habitat models, the WAM was reviewed by the Corps' Planning Center of Expertise for Ecosystem Restoration (ECO-PCX) and Corps Headquarters and the model was approved on November 28, 2012 for application in this study.

The WAM assessment was developed as an adaptation of several federal and state methodologies, and was customized for local conditions and the needs for the study area. The U.S. Department of Agriculture's (USDA) *Stream Visual Assessment Protocol* was used as a model to provide a concise and accurate watershed scale assessment of stream health (USDA 1998). In addition, the *Rapid Stream Assessment Technique* modified by the City of Hillsboro, Oregon from an U.S. Environmental Protection Agency (USEPA) synthesis of bioassessment protocols and survey techniques was further used to model stream health in the Cedar Creek system (Clean Water Services 2000).

Specific categories for each of the four WAM habitat categories were rated qualitatively and quantitatively (where data was provided) to determine the overall health and functionality of each study segment. The *physical conditions* qualitatively evaluated bank stability, bed stability of the creek channel, sediment size, and the physical alignment (i.e. channelized or meandering) of the

stream. The assessment of water quality did not rely on data or evaluate pollutant loads, but rather evaluated the absorption and filtration potential of the riparian zone to filter pollutant and sediment loads. *Water quality* also evaluated the presence or absence of the tree canopy adjacent to the stream channel, where an intact canopy contributes to thermal loading of the stream channel, thereby reflecting temperature. Similarly, the presence or absence of stream features which influenced aeration of the water were used as a reflection of dissolved oxygen levels. The integrity of the bank and whether the stream channel was hardened or armored was indicative of erosion potential, which contributes to turbidity and water quality.

Natural resources for Cedar Creek were assessed in the WAM using a suite of parameters. The width of the riparian zone was measured, and then ranked such that wider riparian zones provided more habitat value. Invasive species were evaluated for presence or absence, and percent cover, whereby increased covered decreased habitat value. The diversity of habitat types (wetland, forest, grassland, etc.) was assumed to support a diverse array of fish and wildlife, wherein reaches with multiple habitat types provided more natural resource value than areas with fewer habitat types. Evaluating the structural components of aquatic habitats was used to qualify the in-stream habitat structure and served as a measure of habitat quality and potential diversity. And finally, the width and degree of physical barriers, and the degree and type of vegetation along the bank was evaluated for migratory potential, where the stream channel could be used as a migratory corridor. The *recreational opportunities* for Cedar Creek were assessed by evaluating the accessibility of the different reaches, and whether existing public-use facilities were present.

The results of the WAM evaluation allowed the PDT to model and characterize the overall habitat quality and relative level of degradation in the creek system under existing conditions, per individual reach segment. In addition, the model was applied to the conceptual design alternatives to measure the potential changes in environmental outputs to evaluate which alternative provided the most ecosystem benefit to habitat elements (physical conditions, water quality, natural resources) per unit of cost.

Table 1 Watershed Assessment Model Results for the Study Area

Waterway Segment		Channel Assessment Score				Total Score	% of Possible	Overall Waterway Rating		
		Physical	Natural Resource	Water Resource	Recreation			Good (> 53)	Fair (41-52)	Poor (< 40)
McKenzie Floodplain Control Gates		16	17	22	*5*	60	38%			X
Cedar Creek	Mainstem	25	29	30	*9*	93	58%	X		
	North Fork – *upstream*	30	17	24	*10*	81	51%		X	
	North Fork – *downstream*	26	24	24	*7*	81	51%		X	
	South Fork	24	19	27	*10*	80	50%		X	
Headwater Streams	Cedar Creek	25	29	30	*9*	93	58%	X		
	Gay Creek	15	21	26	*7*	69	43%		X	
Stormwater Channels and Ponds	69th Street	14	11	11	*15*	51	32%			X
	72nd Street	19	17	12	*17*	65	41%		X	
	75th Street	16	15	15	*7*	53	33%			X
	Gray Creek – UGB	19	18	21	*11*	69	43%		X	
	Gray Creek – Rural	15	15	22	*3*	55	34%			X
	Blue Water Ponds	17	19	22	*3*	61	38%			X

It was determined that reaches rated as “good” did not require habitat improvements, as they were already functioning and provided quality habitat for fish and wildlife in the study area. Of the twelve reaches evaluated in the WAM, two were rated overall as “good” and thus dropped from further consideration and planning: the headwaters and mainstem of Cedar Creek. Conversely, reaches that were rated as “fair” or “poor” were determined not to provide high quality habitat and these areas were therefore in need of habitat restoration. Those reaches which scored lower in habitat quality include the segment of Cedar Creek where it diverges from the McKenzie River floodplain control gates near Hendrick’s Bridge, the north and south forks of Cedar Creek, Gay Creek, all of the stormwater channels, the Blue Water Ponds, and Keizer Slough. It should also be reiterated that the recreational values were not included in the Overall Waterway Rating, as these values do not contribute to, or detract from, habitat value.

A complete description of the WAM and model outputs can be found in *Appendix A*. The overall quality of existing habitats, as measured by the WAM, was used to identify restoration potential in Cedar Creek (Figure 3). Those reaches characterized as poor to fair were included for restoration consideration in the study. Figure 4 identifies the reaches considered for restoration in this study.

4.1.2. Topography

The study area is located in the southern Willamette River valley, and includes a portion of the McKenzie River watershed. The study area is characterized by four primary landforms: contiguous hills and slopes, the main valley floor, river and major creek systems, and a number of solitary buttes.

A system of contiguous forested hills is located north and south of the City of Springfield. The hills are relatively steep and are characterized by a dendritic drainage pattern. The Cedar Creek area is very flat with occasional wetlands and small, gently sloped, interspersed hills. It includes a number of slow moving tributary creeks, excavated drainage channels, and smaller farm-related drainage channels.

Additionally, there are a number of solitary buttes which rise above Cedar Creek. These buttes range in relative height from several hundred feet to over a thousand feet from their surrounding landforms. Major examples include Potato Hill, Quarry Butte, and Kelly Butte.

4.1.3. Geology and Soils

Landforms in the study area were created over millions to thousands of years ago by a combination of influences including ice ages, volcanism, and cataclysmic hydrologic events. The area is comprised of three major geologic formations: *basalt geology*, which is believed to be from andesitic basaltic or pyroclastic bedrock formed 10-25 million years ago; the *Missoula flood deposits*, which consists of the valley floor buried with silts from a series of epoch floods (most recently 12,000 to 15,000 years ago); and *river alluvium*, which is characterized by coarse sediments and gravel deposits by rivers originating in the Cascade Mountains.

The upper portion of the study area lies in an area mapped as Holocene alluvium consisting of unconsolidated gravel, sand, silt, and clay deposited in active stream channels and on adjoining flood plans (USGS map I-2569, 2000; and interpolated from McClaughry et al., 2010). Much of the subject channel lies in a channel bar area, likely consisting of interbedded sands and gravels. It is anticipated that soils in the project area will consist of one to five feet of silty and sandy topsoil, underlain by interbedded sands and gravel; this needs to be verified through site exploration.

The central portion of the study area lies in an area mapped as Holocene alluvium consisting of unconsolidated gravel, sand, silt, and clay deposited in active stream channels and on adjoining

flood plans (McClaughry, et al., 2010). The central part of the site has been mapped as Holocene to upper Pleistocene older alluvium consisting of unconsolidated gravel, sand, silty and clay that formed on low terraces, on high river benches or abandoned stream channels. The southernmost part of the site generally consists of Quaternary terrace and fan deposits, of deeply dissected, unconsolidated to semi-consolidated, gravel, sand, silty and clay that form along upper alluvial terraces. Based on a preliminary review of water well logs, the site appears to be underlain by three to fourteen feet of clayey to silty soils, underlain by clayey gravel to sandy gravel. It is not clear how still the upper clayey to silty soils are, or if they contain organic matter.

The lower portion of the study area lies in an area mapped as Holocene alluvium consisting of unconsolidated gravel, sand, silt, and clay deposited in active stream channels and on adjoining flood plans (McClaughry, et al., 2010). Based on a preliminary review of water well logs, the site appears to be underlain by six to eight feet of clayey to silty soils, underlain by sandy gravel with some boulders. It is not clear how still the upper clayey to silty soils are, or if they contain organic matter.

4.1.1. Cedar Creek Hydrology

The study area is bordered to the north by the McKenzie River and its adjacent floodplain with typical features characteristic of an active geomorphology. The McKenzie River adjacent to the Cedar Creek reach includes gravel bars and islands, off channel channels and backwater and remnant oxbows.

Average annual flow in Cedar Creek is estimated at 32 cubic feet per second (cfs). Cedar Creek flows in the summer months (July through September) are approximately fourteen cfs. Average winter flows (October through February) are approximately forty cfs. During the high-flow months, runoff comes naturally from the headwater streams in the Thurston Hills area and the McKenzie River floodplain area. The 100-year Cedar Creek River flow ranges from 980 cfs at Hwy 126 to 1,895 cfs at the confluence with the McKenzie River, RM 16 (Reach 3). Flows are derived from a flood insurance study for Lane County and Incorporated Areas. Cedar Creek flows are summarized and described in Appendix C.

During the summer months, sources of runoff from the headwater streams all but dry-up and flows are augmented by diverting water from the McKenzie River to restore fish and wildlife habitat, mitigate the effects of groundwater extraction for drinking water supply, and support irrigation of agricultural lands. A private property owner currently manipulates the channel at this point on a yearly basis to ensure the south branch receives some flow, but there is no permanent water control structure (and no assurance that this practice will continue). Without a permanent connection, South Cedar Creek is at risk of going dry during the summer months. North Cedar Creek is a natural channel with year-round flow due to an irrigation diversion. South Cedar Creek tends to have sporadic flows during summer months depending on the condition of the diversion and seasonal water flows.

In 2009, an ODFW application for flow augmentation under the Salmon and Trout Enhancement Program (STEP) was approved for Cedar Creek. This program allows for fish and wildlife flows on an interim basis, providing a minimum of ten cfs of water to be diverted from the McKenzie River from May through October to maintain habitat for fish and aquatic life. The approval also allows for up to forty cfs of water to be diverted between November and April to provide flushing flows and critical off-channel winter rearing habitat for native McKenzie River fish populations. The diversion allowed under the STEP program has no end date, but is reviewed periodically to ensure habitat benefits are being achieved. These flows were understood to be the desired future inflows from the McKenzie River into Cedar Creek Reach.

Figure 3 Baseline Condition in Each Reach (WAM Results)

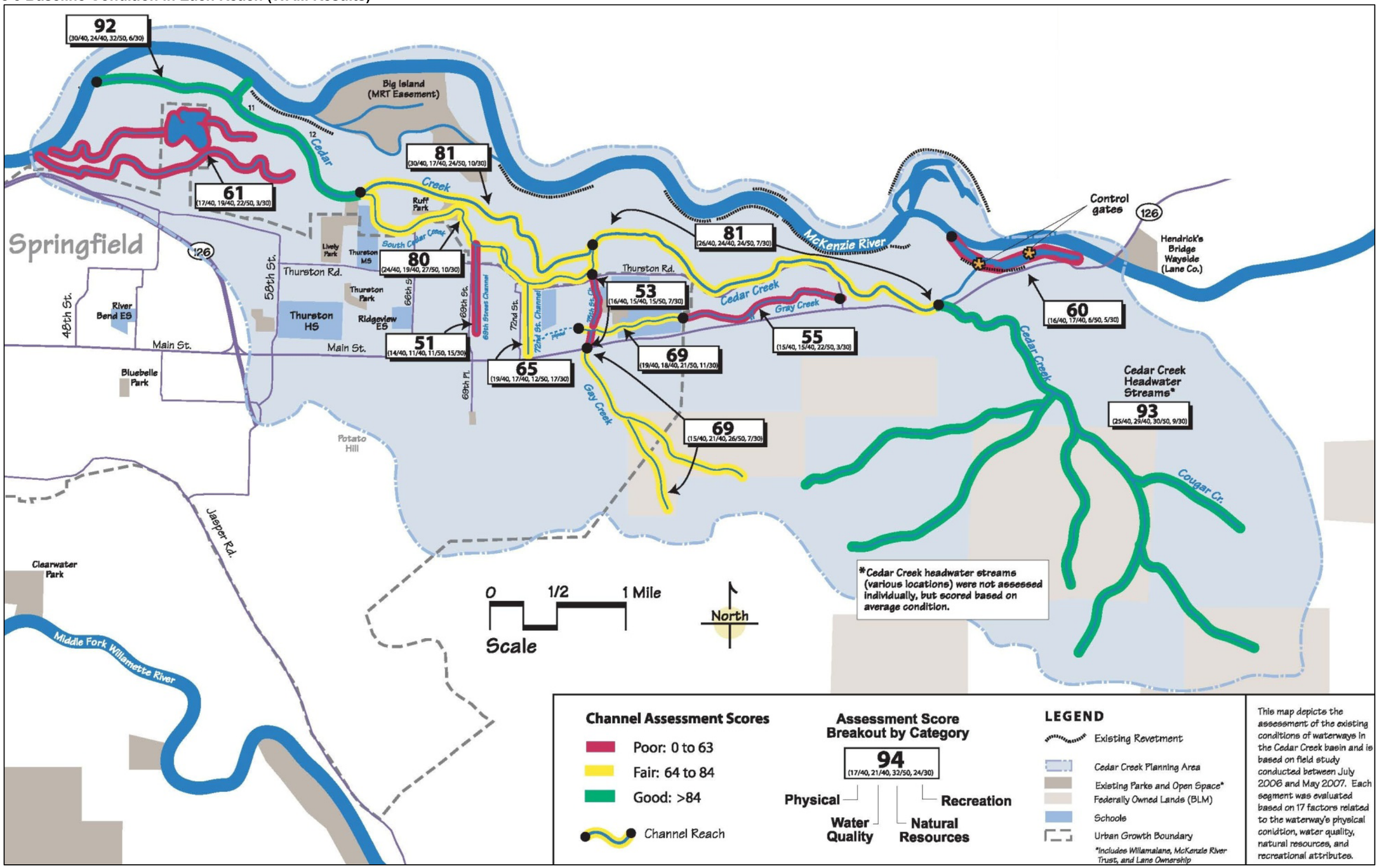

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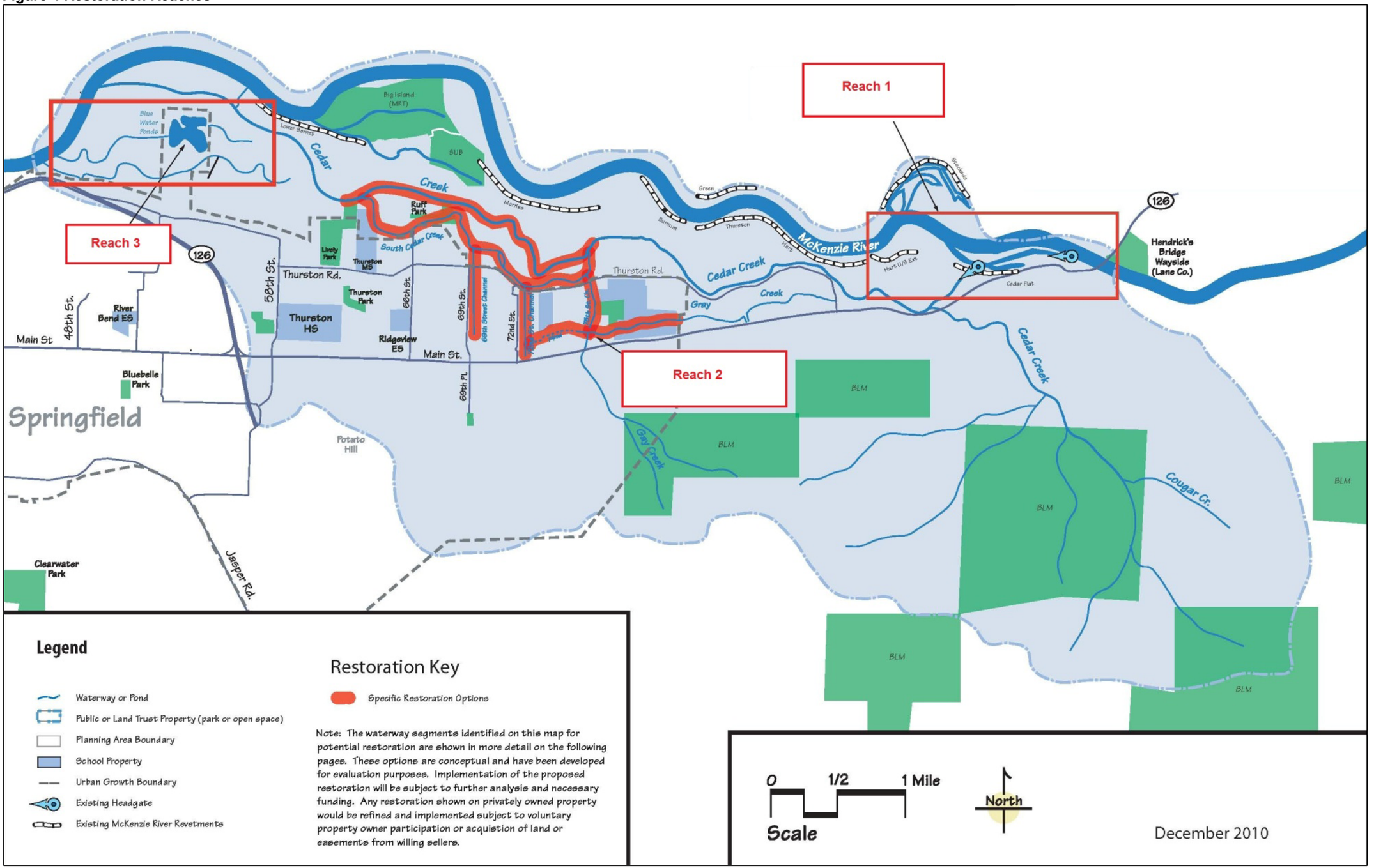
Figure 4 Restoration Reaches



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4.1.2. Cedar Creek Surface Waters

The surrounding hills are dissected by numerous smaller headwater creeks and minor streams that combine to create tributaries such as Gray and Gay Creeks which eventually flatten and slow down as they reach the valley floors, taking on a more meandering alignment. These creeks eventually combine with Cedar Creek, which ultimately combines with the McKenzie River at the downstream end of Reach 3. The study area includes over 39 miles of open waterways, and provides drainage for 9,472 acres of urban and rural lands. The flow regime is a complex system with managed and unmanaged flows, uncontrolled agricultural and forestry stormwater runoff, controlled inflow from the McKenzie River, and tributaries from urban developments. Source waters include near-pristine mountain foothill streams and rivulets, agriculturally-impacted rural farm and forestry drainages, urban pipes and waterways, ditches, and channels the drain highways, roads, residential, commercial, and some industrial areas.

The McKenzie's natural flows have been altered by dam regulation, diversions, water withdrawals, and development. Changes to the river include the development of Corps storage reservoirs on two of its tributaries, Cougar Lake and Blue River Lake. Other local dam projects, diversions into canals for electricity production, riprap and bank armoring, and channelization are additional alterations to the McKenzie River. The river's water quality is excellent and the McKenzie River provides the best remaining salmon and trout habitat in the Willamette Valley system.

Cedar Creek is a tributary to the McKenzie River and drains approximately eleven square miles of rural and urbanized areas east and north of Springfield. It originates in the Cedar Flat area and flows through the Thurston area of east Springfield before branching into two forks, North and South Cedar Creeks. These forks join again near the Willamalane Lively Park Swim Center, before entering the McKenzie River through several braided channels. The main channel is approximately eight miles in length and lies entirely within the 100-year floodplain for the McKenzie River.

The Cedar Creek reaches considered for restoration begin just downstream of Highway 126 crossing, Hendrick's Bridge. Cedar Creek an unexcavated channel and is likely a historic meander of the nearby McKenzie River. The creek bed appears to consist of silts, which is characteristic of a stream in a floodplain. In this area, the flows from McKenzie River enter the adjacent side connection channel and enter the creek itself via an gated intake structure. The structure consists of a 30-inch pipe with a manually actuated water control slide gate built in 1964. As Cedar Creek flows onto the valley floor in the vicinity of Hwy 126 it changes character and flows slowly at a low gradient. Flows then pass to an existing 4-30-inch pipe culvert intake structure into Cedar Creek. The existing intake structure was built in 1914 and has gated intakes which are manually controlled to restrict wintertime flows. Flows are conveyed past the 4-30-inch intake structure to Reach 2 and the existing water control structure which currently keep most low and high flows in the north branch of Cedar Creek.

Main channel flows are split between the South and North branches of Cedar Creek near Bob Artz Park. There is an existing water control structure that currently keeps most flows in the North Fork of Cedar Creek. In the South Fork, Gray and Gay Creeks along with the storm water outfalls flows conveyed along 72nd and 69th Streets discharge directly into creek.

The 69th Street Channel a half mile long channel, originates south of D Street and east of 69th Street, and is generally trapezoidal in form with very steep sided banks. It flows directly north to Thurston Road where it then flows into a 60-inch, 103-foot long culvert. The culvert is a fish passage barrier, and empties into South Cedar Creek on the north side of Thurston Road. The channel is fed by runoff and groundwater, and drains an area approximately 450 acres in size. Access to this outfall is difficult due to its location on private property and the fact that it is overrun by blackberry. This

channel is maintained by the City of Springfield. These channels existed as historic drainages but were excavated for conveyance function and are comprised of earthen soil materials with occasional rip-rap to address stability concerns. The channels are relatively young in geomorphic terms, showing relatively little signs of down-cutting or streambank failure. As upstream areas convert to urban development, it is anticipated that these channels will respond to hydrologic changes, exhibiting more down-cutting and erosion, with increased sediment loads downstream.

The 72nd Street Channel is another half mile long channel and originates at the north side of Main Street where it flows northward starting as a narrow concrete lined channel, followed by a drop structure, then as an open trapezoidal shaped channel. At Thurston Road it flows into a 66-inch culvert for 110 feet before entering South Cedar Creek. This outfall culvert is also barrier to fish passage. The channel provides drainage for about 157 acres and is maintained by the City of Springfield.

75th Street Channel (Gay Creek) is a two mile long channel and is a tributary to Gray Creek and originates in the forested hills to the south of Main Street and flows north where it flows onto the flat valley floor and outfalls into Gray Creek. It has a drainage area of 534 acres. Historically this channel had continued north for another 1,200 feet where it flowed directly into South Cedar Creek. However, this flow is now entirely captured by Gray Creek and the 75th Street Channel to the north is dry throughout most of the year. The 75th Street Channel (also known locally as Gay Creek), is fed mainly by runoff and groundwater seeps from the hills south of Main Street, but also receives some urban runoff in its lower reach.

Gray Creek is a two and one half mile secondary tributary that enters the 72nd Street Channel flowing east to west. The creek runs parallel to Main Street for approximately 5,500 feet, where it then enters a 54-inch storm pipe south of the Thurston Elementary School for 1,500 feet before flowing into the 72nd Street Channel. It receives flow from runoff and groundwater and also receives all of the flow from Gay Creek.

The Cedar Creek branches recombine downstream adjacent to Thurston Middle School, in the vicinity of the Willamalane Lively Park Swim Center and flows parallel to the McKenzie River through several braided channels before eventually discharging into the McKenzie River.

Reach 3 is composed of Keizer Slough and the Blue water ponds are not currently connected to the Cedar Creek. Blue Water Ponds and Associated Waterways. The Blue Water Ponds are located at the western edge of the study area, north of the intersection of 52nd Street and High Banks Road. There are two distinct ponds of varying size located on private property. Based on field observations, the lakes appear to be hydrologically connected. It is thought that at one time Keizer Slough may have run through this area, but agriculture practices and quarrying activities have modified former surface water connections. The ponds are currently fed by groundwater and are the result of gravel mining activities in the 1960s. Eugene Sand and Gravel is in the process of filling the south pond. The northern and central ponds are relatively steep banked and have little native cover.

4.1.3. Water Quality

The Cedar Creek system is designated as a fish-bearing stream from the confluence with the McKenzie River upstream to the headwater streams. As described above, the WAM qualitatively assessed water quality conditions in the study area, evaluating filtration, aeration, erosion control, temperature, and pollutant uptake as a function of characterizing water quality standards.

The headwater streams show little evidence of bank failure, incision and/or erosion, which is likely attributed to the undeveloped condition of these areas and the presence of contiguous canopy

cover. These characteristics are indicative of a properly functioning ecosystem, including water quality conditions. It should be noted however, that these headwater streams have not been monitoring for compliance with state water quality standards and the Blue Water Ponds or Keizer Slough assessed for water quality conditions via application of the WAM.

The main stem of Cedar Creek and results rated that water quality in the main stem of Cedar Creek was good, but that it could be improved through riparian management practices, including management of non-native species and increasing the extent of tree canopy and understory vegetation. As Cedar Creek flows west and branches into the North and South Cedar Creek, water quality is further impaired by runoff from urban stormwater and unstable banks. The WAM results for South Creek were rated as poor, noting the overall rating could be improved by improving bank stability, improving riparian condition, removing invasive species, and increasing overstory canopy and understory vegetation. Gray Creek and the 69th, 72nd, and 75th Street Channels were also rated as having poor water quality for reasons similar to South Cedar Creek. Similarly, these channels could be improved by enhancing bank stability, increasing tree and canopy cover, restoring the riparian corridor, removing non-native, invasive species and replanting with a diverse assemblage of native species.

Water Quality – 303(d) Listed Waterways

The Oregon Department of Environmental Quality (DEQ) has the responsibility for developing water quality standards that protect beneficial sues of the state's water resources. Beneficial uses include *Aesthetic Quality, Boating, Commercial Navigation & Transportation, Fish & Aquatic Life, Hydropower, Water Contact Recreation, and Water Supply: Drinking, Industrial, Irrigation*. The state also develops standards and monitors water quality to determine whether beneficial uses are protected. Waterways within the study are being monitored by DEQ for compliance with Clean Water Act (CWA) water quality standards.

Section 303(d) of the federal Clean Water Act (CWA) requires that the state develop a list of waterbodies that do not meet water quality standards and submit this list to the USEPA every two years. This list serves as a means of identifying and prioritizing water quality problems, and serves as a guide for establishing pollution reduction programs in targeted watersheds with the objective of reestablishing compliance with state water-quality standards and protection of beneficial uses. To date, the McKenzie River is the only monitored waterway in the study area that does not meet water quality standards for temperature. The beneficial uses impacted by these waters are *anadromous fish passage* and *salmonid fish rearing*. Temperature was determined to be below standards based on the requirements of anadromous fishes, whose needs for cold water (for spawning, rearing, and migration) are not consistently met. However, water quality in the McKenzie River near the study area is generally quite high in spite of the development that has occurred upstream of the study area.

A TMDL was developed in 2009 for the Willamette River sub-basin: Upper Willamette Basin Total Maximum Daily Load, which includes the McKenzie River. These TMDL requirements are being implemented for *bacteria*, *mercury*, and *temperature* standards along most of the waterways in the study area. The City of Springfield, Lane County, and the City of Eugene are the designated management agencies responsible to comply with this TMDL. The TMDL Implementation Plan prescribes the following activities to meet temperature standards for the McKenzie River (City of Springfield 2009):

- Inventory existing and potential shade and enhancement areas – Develop a priority project list for shading, and work to develop public/private partnerships for demonstration projects.

- Riparian area, parking lot, and streetscape shade enhancement – Code review, evaluation and enhancement for parking lot, streetscape shade and riparian vegetation management, setbacks and buffers and retrofit practices if appropriate, and outreach and education to groups, citizens, and businesses and industry.
- Manage industrial warm water discharges – Work with industrial sources and Oregon DEQ to address warm water discharges for point sources through National Pollutant Discharge Elimination System (NPDES) permit program.
- Public Outreach and Education – Develop and distribute outreach and education materials to the public.

The City's 2012-2013 TMDL annual plan states "Goals and tasks for temperature reduction as outlined in the TMDL Implementation Plan have all been completed with deadlines being met" (City of Springfield 2013).

Lane County also is actively attempting to meet water quality standards for temperature on the McKenzie River. The 2008 Lane County Willamette Basin Total Maximum Daily Load Implementation Plan prescribes the following activities to meet the temperature standard for the McKenzie River (Lane County 2008):

- Maintain existing shading vegetation within riparian areas – Continue compliance with setback requirements, and replant equivalent riparian areas impacted by County public improvement projects with native trees and scrubs and monitor survival.
- Strengthen relationships with watershed councils to participate in riparian tree plantings and other projects that benefit stormwater – Strengthen working relationships between County staff, regional watershed councils and restoration practitioners, maintain procedure of including watershed councils on public notice and agency referral lists for development projects within the County, and partnership with watershed councils on waterway improvement projects.
- Determine the feasibility of retaining or creating easements for County-owned critical riparian area proposed for sale as tax foreclosed properties – Establish framework to identify County-owned critical riparian area.

The County's 2013 TMDL Monitoring Report indicated that work on these activities is ongoing and continues to focus on reduction or elimination of the removal or disturbance of streamside vegetation (Lane County 2013).

Water Quality- Local Ambient Water Quality Monitoring

Water quality monitoring data have been collected within the study area by the City of Springfield, as required by its NPDES permit, and by the Eugene Water and Electric Board (EWEB). These monitoring effects have resulted in an extensive collection of baseline data for flow and water quality pollutants in the study area. Detailed results can be view on the EWEB's website (www.mckenziewaterquality.org), and the data generally servces as an indicator of general water quality of surface waters in the Cedar Creek system. Waterways in the study area that do not meet water quality standards for temperature include Cedar Creek, Gray Creek, and the 72nd and 75th Street Channels. In addition, the 69th and 72nd Street Channels do not meet bacteria standards and the 69th Street Channel also does not meet dissolved oxygen standards. Because of the Upper Willamette Basin TMDL, the City is required to manage pollutant loads associated with bacteria and temperature, which include waste from livestock, pets, birds, and wildlife; sediments; illegal dumping of human waste; landfills; wood, pulp, and paper processing; loss of riparian vegetation; discharges from electrical power plants; and increased runoff from impervious surfaces.

4.1.4. Socioeconomic Conditions

Approximately 2,170,000 people currently reside in the Willamette Valley, which accounts for nearly 70 percent of the state of Oregon's total population. Based on the 2000 U.S. Census, 53,000 reside in the City of Springfield.

The Willamette Valley accounts for the majority of Oregon's economic activity, where agriculture and timber resources accounted for the two principle industries throughout the basin. There was a large reduction in timber harvest in the 1990's, primarily in response to ESA and other environmental concerns. As a result, the basin is shifting from a natural-resource based economy toward a more diverse economy to include manufacturing of non-lumber goods (transportation, recreational vehicles), tourism, and service-sector employment (health services, business and professional services, and social services).

An examination of the socioeconomic conditions finds:

- Seventy-five percent of the total study area is outside of the existing City of Springfield UGB.
- The study has a higher level of owner occupied households (76.6 percent) than either Lane County or the State.
- Of the thirteen census block groups contained in the study area, eight had a median household income that exceeded both the Lane County and State median incomes.
- More households were occupied by families (75 percent) in the study area than either Lane County or the State.

4.1.5. Environmental Justice

An evaluation was conducted to determine the presence of Environmental Justice/Title IV Populations within the study area. The 2000 U.S. Census information was used for this evaluation and the results indicate these populations are distributed throughout the study area. The area of potential effects was assumed to be a ¼ mile radius from the main waterway of Cedar Creek and the Blue Water Ponds. This area of potential effect was used to determine the possible environmental effects of implementing the proposed restoration action.

According to the results, there are between 5,001 and 10,000 persons per square mile in the urban growth boundary (UGB) of the City of Springfield while the rural portions outside of the UGB average between 1 and 1,000 persons per square mile. The majority of the study area falls outside of the UGB, where population density averages between 311 and 950 persons per square mile. Of this population, between 35 and 88 are adults classified as seniors, aged 65 years or older, and these individuals are distributed equally across all census block groups. The population density of seniors living within the UGB averages between 418 and 785 persons per square mile.

The presence of minority populations within the UGB averages between five and six percent, while minority populations outside of the UGB average between five and six percent in the lower portion of the waterway near the Blue Water Ponds, and between seven and nine percent in the central and upper portions of the Cedar Creek watershed. The percent of the block groups categorized as disabled average thirteen and fourteen percent and twenty and 23 percent within the UGB, while all census blocks outside of the UGB average fifteen to nineteen percent disabled persons. The percent of households falling below the federal poverty guidelines average between four and eleven percent in the headwaters of Cedar Creek. In the central portion of the study area, where Cedar Creek flattens out into agricultural and pasture lands, the average percent of households in poverty averages between zero and three percent. The highest level of poverty is found in the lower portion of Cedar Creek, near the Blue Water Ponds and in a portion of the UGB, where the percent of

households falling below the poverty line is between twelve and twenty percent; the remaining census block within the UGB averages four to seven percent of households below the poverty line.

These results demonstrate that the study area has while the area is not especially densely populated, multiple environmental justice communities throughout the Cedar Creek watershed. Seniors and disabled persons, in addition to households living below the federal poverty line are present in all reaches under consideration for restoration. Additional environmental justice information is provided in *Appendix A.*

4.1.6. Cultural Resources

In the City of Springfield there are six individual historic sites and one historic district listed on the National Register of Historic Places (NRHP), all of which are near downtown and more than a mile from the Planning Area. Their locations are outside of the area of potential effect (APE). The Washburne Historic District lies in the heart of Springfield's original downtown area with historic houses built in the late Nineteenth and early Twentieth Centuries. Dorris Ranch is listed in the National Register of Historic Places and is Oregon's oldest working filbert farm, established in 1892. It is managed by the City of Springfield's park and recreation district as a 258-acre public park and living history farm. Both of these are more than three miles from the study area and outside of the APE. However, the NRHP database only includes historic sites and structures that have already been determined eligible and listed; it does not make reference to any unevaluated, potentially eligible or other unlisted properties. Such locations could exist within the APE (in undeveloped, developed and urban areas) where cultural resource assessments have not been conducted.

The following historical resources are listed in the *Working Paper: Historical Resources Lane County Comprehensive Plan Revision* as being structures, sites, objects, and areas that have "local, regional, statewide or national historical significance" based on the definition in Oregon's Statewide Planning Goal 5. The Thurston Grange Hall is close to the cluster of public schools in the Thurston area, which is on the eastern edge of Springfield. The Springfield Memorial Cemetery is in the Washburne Historic District, west of the project area. The Hebert Gray Century Farm is more than ten miles east of the study area.

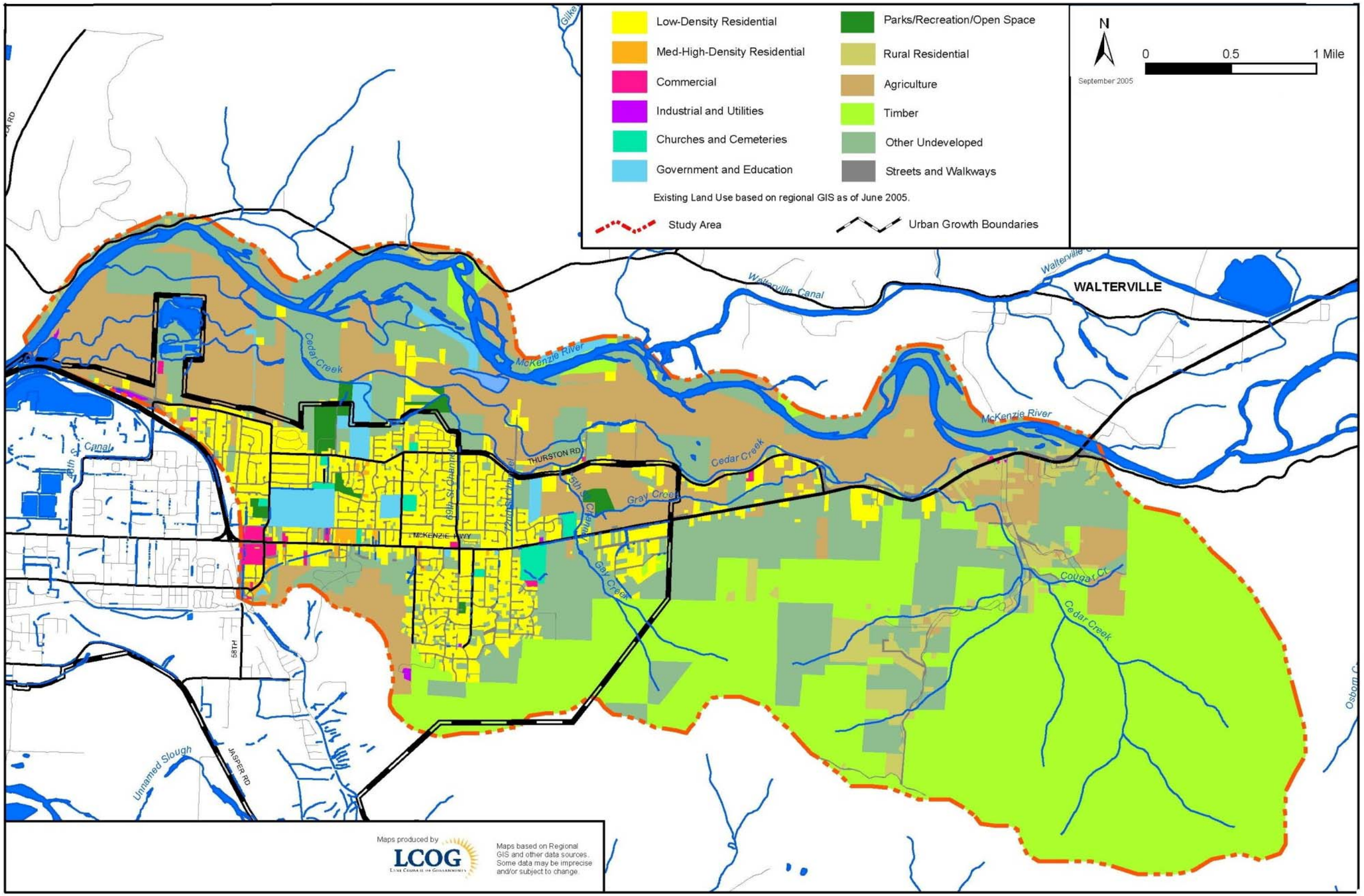
The SHPO database was examined for archaeological survey coverage and cultural resources recorded within the project APE. Less than ten percent of the project area has had any form of survey coverage, and, given the isolated nature of the locations examined, the previous work contributes little to what is known about the APE's cultural past. The adequacy of these earlier surveys is hard to assess as these often do not have adequate descriptions of field methods, or, may not meet the modern survey standards accepted by SHPO. Modern survey work for road corridors and utilities is the source for most of the coverage available; unfortunately, survey work conducted along the mentioned road and utility corridors contributes little or nothing to the assessment needs required within the APE.

4.1.7. Land Use

Most of the land in the Willamette Valley floor is privately owned. Agriculture is the predominant land use, and is also where the majority of Oregon's crop production occurs. The region's fertile soil and temperature climate are well suited to the production of high valued crops such as grass seed, Christmas trees, fruits, berries, nuts, and vegetable.

The study area can be separated into three distinctive areas based on predominant land uses as depicted in Figure 5 and Table 2:

Figure 5 Current Land Use



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- The first area is the largely undeveloped headwaters of Cedar Creek and its tributaries. This area lies mostly outside of the current Springfield UGB, contains steep slopes, and is predominantly used for timber production on a mix of U.S. Bureau of Land Management (BLM) and privately owned lands. Also included in this area is a scattering of low density rural residential uses.
- The second general area includes the highly urbanized portion of the basin contained within the Springfield UGB. This area is dominated by low density residential uses, with smaller quantities of commercial, industrial, school, and park uses. The area also contains a significant quantity of undeveloped land along the southern edge of the UGB at the higher elevations. Approximately 2,349 acres, or 25 percent of the total study area, is situated within the existing UGB.
- The third distinctive area is the expanse of relatively flat agricultural lands to the north and east of the UGB through which the main channel of Cedar Creek flows.

Table 2 Existing Land Use in Study Area

Existing Land Use	Inside UGB (acres)	Outside UGB (acres)	Total (acres)
Agriculture	269	1,419	1,688
Churches and cemeteries	43	0	43
Commercial	29	2	31
Government and Education	98	67	166
Industrial and Utilities	6	6	12
Rural Residential	0	300	300
Low-density Residential	758	147	905
Med/High-density Residential	21	0	21
Parks, Recreation, Open-space	48	17	65
Roads and Walkways	291	97	388
Sand and Gravel	0	0	0
Timber (forest)	314	3,060	3,374
Undeveloped	472	2,007	2,479
Total	**2,349**	**7,123**	**9.472**

Source: Existing land use information is based on GIS parcel information compiled by LCOG in June 2005; extracted from Without-project Conditions Report, December 2005.

Prime and Unique Farmlands

Within the study area there are approximately 1,800 acres of soils that fit one of five federal NRCS definitions of prime farmland, with approximately fifty percent, or 900 acres classified as “all areas are prime farmland.” Almost 42 percent, or 755 acres, are classified as prime farmland if irrigated. Of the remaining three categories the largest acreage is classified as prime farmland if drained, 110 acres, with twenty acres as prime farmland if drained and either protected from flooding or not frequently flooded during the growing season. Approximately fifteen acres are prime farmland if protected from flooding or not frequently flooded during the growing season.

4.1.8. Recreation

The Cedar Creek study area encompasses approximately 575 acres of public or land trust ownership that can be considered permanent parks or open spaces. This land includes six Willamalane Park and Recreation District parks totaling 67 acres. The BLM owns 400 acres of forested lands, and a 108 acre parcel of land, called Big Island, owned by the McKenzie River Trust on the south side of the McKenzie River and managed as habitat for juvenile salmonids, red-legged

frogs, Oregon chub, and Western pond turtles. While the BLM lands and Big Island are public trust lands, neither has formal public access currently available.

Recreational facilities currently found in the study area include swimming pools, sports fields, ball courts, and playgrounds associated with neighborhood parks and nearby schools. Soft surface trails total approximately 0.5 miles, but there are no multi-use paths or trails present in the study area.

4.1.9. Vegetation and Habitat Types

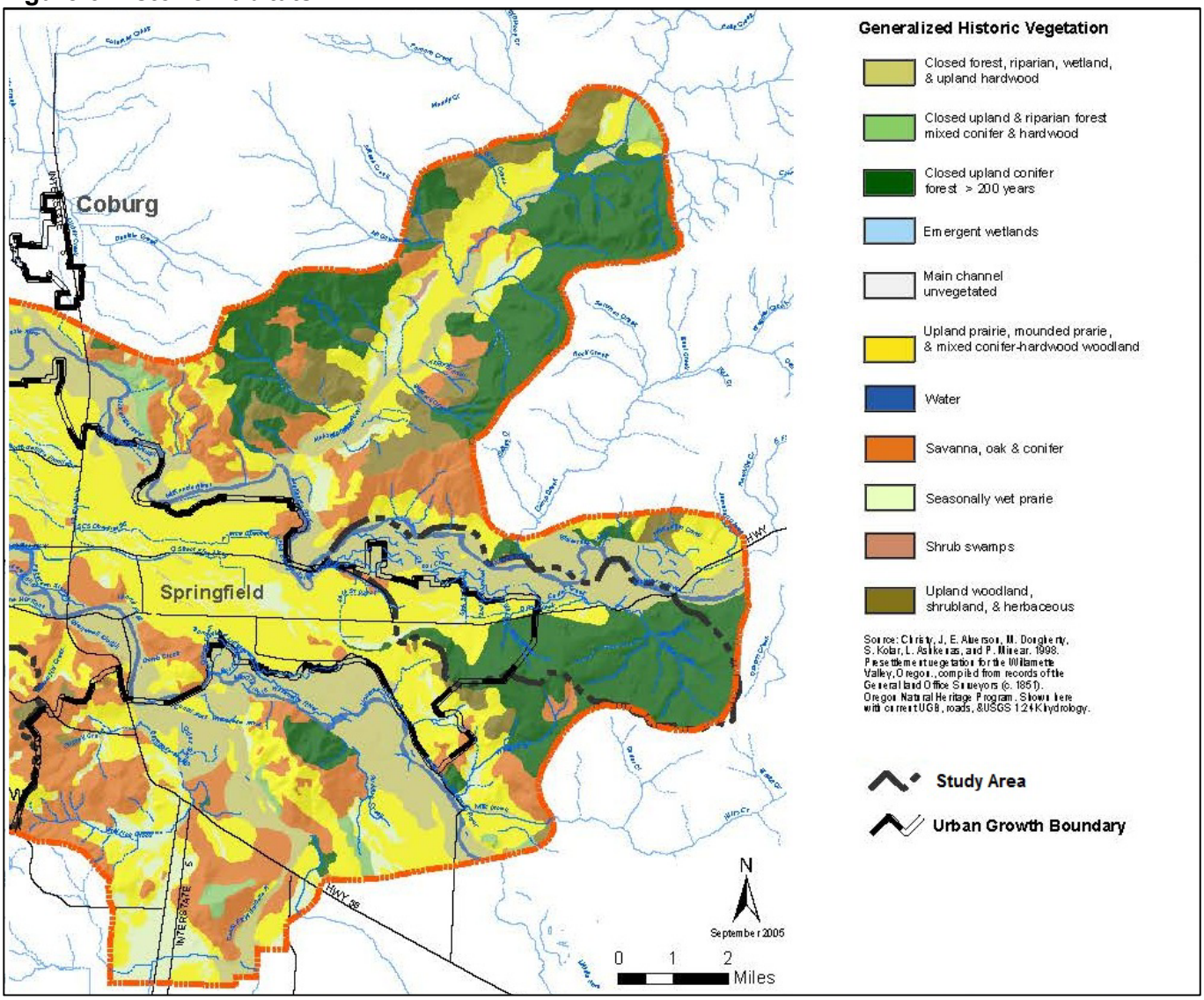
Historic Conditions

Vegetation communities throughout the study area have changed significantly since European settlement (c. 1840s). Earliest pioneer writings on the Springfield area indicate that the McKenzie River was a series of meandering channels, swales, and floodways that braided across the alluvial fan formed at the confluence of the McKenzie and Willamette rivers. These conditions created a multitude of seasonal wetlands, which flooded in winter and experienced reduced flows in summer. These floodplain-associated wetlands dominated the Willamette River and upstream in the McKenzie River basin to where the topography naturally confined the channel, near Walterville. Figure 6 depicts historic habitats for the study area.

Native Americans engaged in seasonal practices of regularly burning the valley floor and hillsides for hunting and gathering purposes. This action effectively suppressed the composition of native woody vegetation and small trees, while also stimulating the growth of camas, tarweed, oaks, and other species. This low-intensity burning maintained habitat types, which included large areas of prairie and savanna. As a result, the conifer-dominated landscape common on the valley floor today was not present at that time, except in patches where conifers were protected from fire or were old enough to be unaffected by the burning.

Marshes and wet prairie communities were extensive and nourished by the regularity of major Willamette River flooding. Many of the wetlands were season wet prairies, and others included ash swales and willow swamps. Beaver likely played a large role in creating and maintaining wetland habitats.

Figure 6 Historic Habitats



Existing Conditions

Important modifiers to dynamic ecosystem processes include flooding, drought, wildlife, volcanic activity, and human/anthropogenic activities (dams, culverts, revetments, pollutants, roads, etc.). Over the past 150 years, the majority of historical plant communities in the Willamette Valley have been lost, reduced, or greatly degraded due to a multitude of factors, including the widespread loss or restriction of these natural processes. Agricultural practices, flood control projects, forestry and timber harvest, and urban development have all contributed to major changes in plant communities and in the faunal communities that they support. Table 3 shows the estimated change in the extent of habitat types from historic conditions and Figures 7 and 8 depict the existing habitat types in the study area. Remaining communities are significantly degraded due to fragmentation, invasion by exotic species, and alterations to historic abiotic factors, such as flooding and fire. Flood control projects upstream of the study area have reduced the frequency, duration, and timing of floods. Flooding plays an important role in shaping and maintaining plant communities and nutrient distribution and availability.

Table 3 Estimated Change in Habitat Types Throughout Study Area

Habitat Type	Historic Habitat Types (acres)	Existing Habitat Types (acres)
Urban and Rural Development	0	1,595
Agriculture, Pasture and Turfgrass	0	1,244
Permanent lentic water	278	267
Closed forest, riparian, wetland, and upland hardwood	2,592	1,049
Mixed conifer-hardwood woodland, upland and mounded prairie	1,531	223
Upland woodland, shrubland, and herbaceous	5	1,846
Savanna, oak, and conifer	85	63
Closed upland conifer forest, greater than 200 years	4,807	181
Closed or semi-closed mixed conifer forest, less than 200 years	0	2,927
Seasonal wet prairie	104	7
Total	**9,402**	**9,402**

Habitats in the basin are strongly influenced by their proximity to the Springfield urban area, as well as the hydrology and topography of the area. To the north and east of Springfield, the urban forest gives way to rural farm and ranch lands. Although there are large groves of both coniferous and hardwood trees remaining in these areas, the predominant vegetation regime is that of pasture, meadow, agricultural fields and wetlands. Human-caused impacts to forest and wetland habitat types increase as population density increases in proximity to the area's urban center. Geography/topography also influences plant communities, as the floodplain and foothills affect the accessibility and usability of the land, and consequently, the intensity of those associated land uses. In addition, the major rivers are generally bordered by riparian gallery forests of varying width and complexity. These forests are often dominated by large black cottonwoods and other native deciduous trees with a relatively intact native understory. However, many of these gallery forests are being taken over by coniferous species or are slowly dying out as the native plants fail to reproduce due to changes in the natural hydrology of the rivers.

Urban and rural residential development has had substantial economic, cultural, and ecological impacts. Areas that were previously converted to farmlands are not being converted into housing developments, with increased impervious surfaces. These developments accelerate the transport of surface waters to streams by preventing water from permeating into the soil and replenishing groundwater, which further degrades wetland and riparian habitats dependent on groundwater. Furthermore, increasing the impervious surfaces and associated stormwater conveyance has resulted in increased runoff volumes, further incising channels, hardening substrates, and has contributed to the loss of functional pool habitats.

In the southwest portion of the study area in the Springfield UGB, land uses are largely residential and plant communities are a relatively homogeneous mix of lawns, exotic trees, shrubs, grasses, and some native plants. Human activities such as mowing, brush removal, pesticide use, and channel maintenance sustains this vegetation, creates disturbance, and introduces exotic species. Ornamental plants themselves have become weedy in open spaces and parks near residential areas including various species of ivy, cotoneasters, privet, blackberries, hollies, exotic grasses, and numerous other species. Rural residential and agricultural use predominate the lower portions of Cedar Creek and McKenzie River. Habitat issues in these areas and land uses include the composition and introduction of non-native species, the influx of pollutants, and intensive management to maintain highly modified conditions.

Figure 7 Existing Habitats

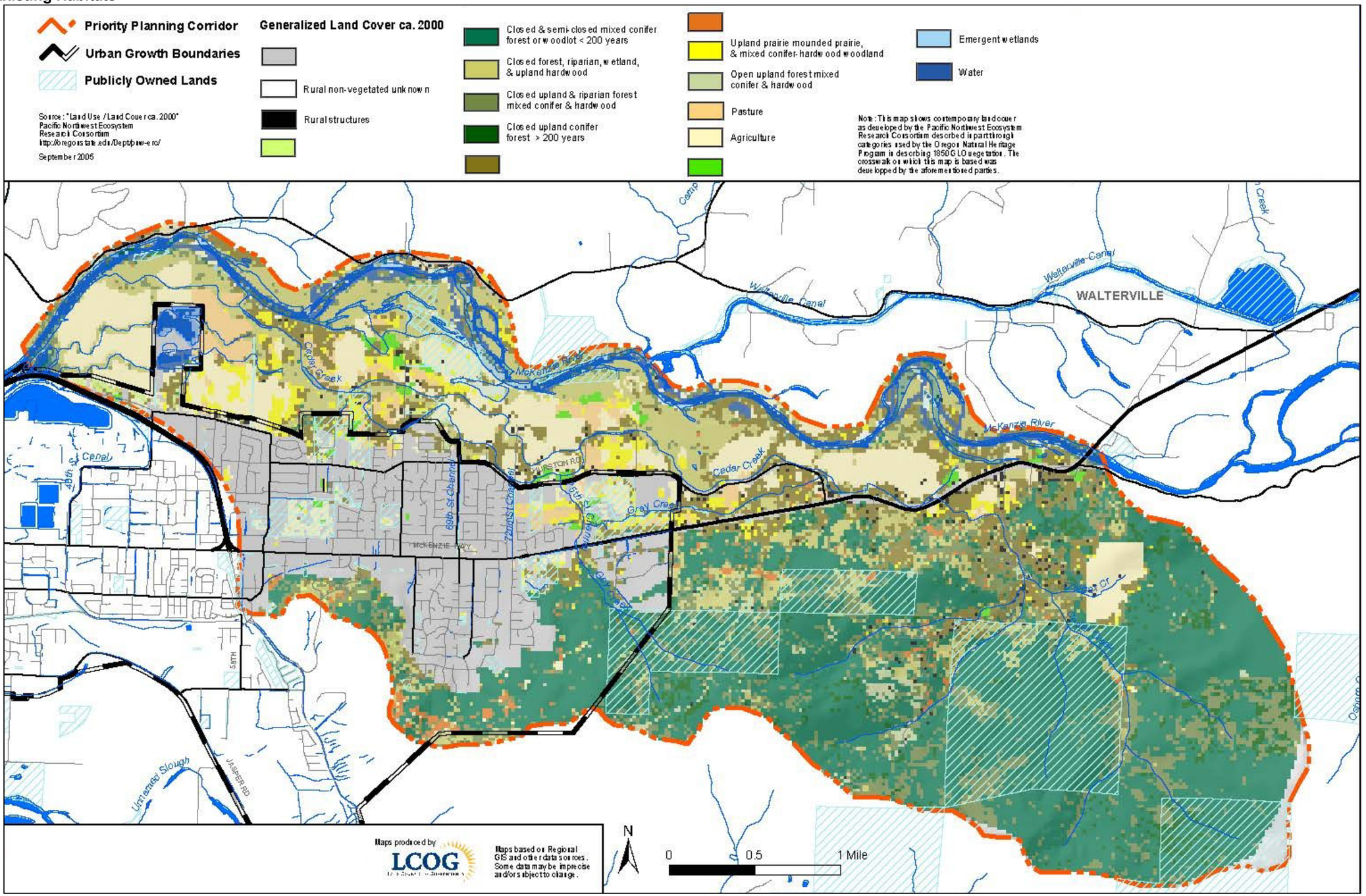


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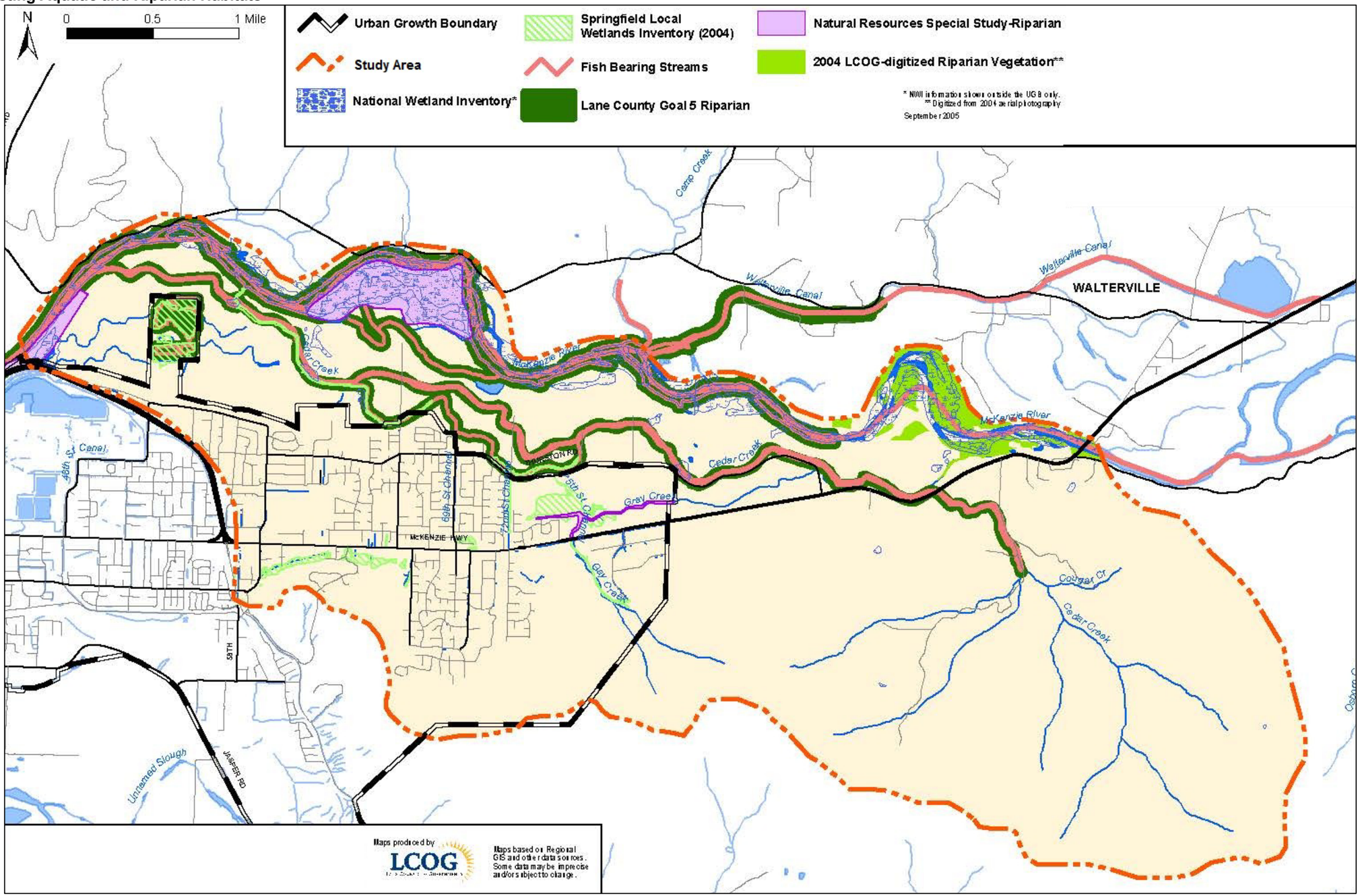
Figure 8 Existing Aquatic and Riparian Habitats



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Although greatly reduced compared to historic distribution, riparian forest currently lines much of Cedar Creek and the McKenzie River at the lower elevations of the study area. In these areas, native plant, fish, and wildlife populations are generally present. The intact portions of the riparian zone serve as a wildlife corridor between the remaining larger habitat areas. The channels in the area are extremely impacted with very minimal riparian habitat, although there is potential for improvement in some of these areas. In headwater areas of Cedar Creek, riparian habitat has been significantly impacted by timber harvest and the quality and width of these riparian zones is greatly diminished as a result. Exotic vegetation makes up a large percentage of the understory in much of the riparian forest.

Similarly, many in-stream habitat features have been altered by the loss of riparian forests and the removal of large woody debris from the stream channel. For example, over 5,500 driftwood trees were pulled from a 55-mile reach of the upper Willamette River over a ten-year period beginning in the 1890's. These trees ranged from five to nine feet in diameter and from 90 to 120 feet in length (Maser and Sedell 1994). Contributions of large wood into the stream channels provide important structural habitat elements for the development of riffles and pools and increasing overall structural complexity, diversity, and productivity of micro-habitats in the aquatic ecosystems. Where these habitat components have been removed, micro-habitats have been lost or functionally degraded.

Wetlands occur in both urban and rural habitats within the study area. The City of Springfield has completed a wetland inventory for areas inside the city limits and National Wetlands Inventory (NWI) coverage exists for the remainder of the study area. Wetland habitats are present as an integral part of Cedar Creek and its tributaries and in isolated patches of lowland or remnant river channels and sloughs. Additional areas in the study area have historically been wetlands, but are now developed. It is likely that many of these areas would eventually revert to wetland conditions if allowed to naturalize under required hydrologic conditions.

4.1.15. Fish and Wildlife

Wildlife populations are common in both the urbanized and rural parts of the study area, though these have changed significantly since Euro-American settlement.

Within the study area, mammal populations have changed over time. Larger mammal populations such as black bear, elk, and mountain lion that were present historically have been greatly reduced, but are still present in small numbers. Other large mammals such as gray wolf and grizzly bear were extirpated in the late 19th or early 20th century. Feral and domestic cats are quite common and impact songbird populations. Fox, bobcat, coyote, raccoon, opossum, and a variety of rodent species are common throughout the area. In aquatic communities, beaver, river otter, mink and muskrat are uncommon; non-native nutria are common in local streams and creeks. Black-tailed deer are common throughout the watershed.

Bird populations in the study area have likely changed, along with changes to the vegetation community. Losses of large tracts of wetland prairie and older conifer/hardwood forest habitat have affected ground nesting birds, as has the introduction of additional non-native predators like domestic and feral cats and opossum. Cavity nesting birds have been affected by a significant reduction in riparian forest habitat and standing dead trees, as well as aggressive, non-native cavity nesters. In urban areas, dead standing trees are often removed for aesthetic or safety reasons further reducing cavity nesting opportunities.

Habitat still exists for migratory waterfowl, though it is reduced and fragmented by development and adversely impacted by modifications to surface waters and wetlands. Most remaining waterfowl habitat in the study area exists within the creek river corridors, in backwater channels, islands, and

sloughs. Some adjunct benefits are derived from agricultural development, as practices associated with certain crops and ground covers provide a food source for migrating waterfowl, geese and cranes.

Reptile and amphibian species are particularly vulnerable to population disruption because of their specific needs for aquatic and terrestrial habitat features, needing various vegetation structures to complete their life-cycles. Further, they have proven susceptible to the introduction of non-native predators, including humans, and appear to be especially sensitive to toxic materials and poor water quality in their environment. Western pond turtle populations have declined significantly over the past century. Loss of nesting habitat (open, grassy areas near their aquatic rearing habitats) in the study area resulting from development, agriculture, and grazing, and an increase in native and non-native predators, such as bass and bullfrogs, have continued to repress populations of this species. Non-native bullfrogs have altered other amphibian and fish populations through predation and competition for food and nesting resources. Native red-legged frog populations have also diminished locally due to habitat loss and predators. Wetlands, rivers, and streams in the Cedar Creek drainage, including the McKenzie River and its side channels serve as the most important refugia for remaining reptile and amphibian populations within the study area.

The McKenzie River, as the dominant river in the study area, and is a rich resource of aquatic life. The McKenzie River watershed supports both anadromous and resident fish species including spring Chinook, bull trout, native rainbow trout, and steelhead (resident, non-historically native). Historically, the McKenzie River produced an estimated forty percent of the spring Chinook run in the Willamette River above Willamette Falls. The watershed contains the last major refuge for bull trout in the Oregon Cascades and is likely the most important remaining area for spring Chinook production in the upper Willamette River. The watershed supports continuous blocks of quality fish and wildlife habitat, with much of the upper basin in federal ownership.

Fish and aquatic organisms in other streams and creeks in the study area, particularly the urban streams and channels, have been impacted by structural, chemical and hydrologic changes. The *Aquatic and Riparian Habitat Assessment for the Eugene-Springfield Area* (Andrus and Walsh, 2002) offers a fairly complete discussion of fish and aquatic organism populations in the area. In this assessment, Andrus and Walsh found that habitat quality in streams within the study area had been more affected by land use practices than the area's rivers. Stormwater inputs, channelization and lack of overstream-shade limits the widespread use of side-channel habitats to warm-water tolerant species, and blockages due to piping limit the distribution of fish and macroinvertebrates in some areas. The macroinvertebrates found in Cedar Creek tended to contain more diverse and less pollutant tolerant communities than populations in the McKenzie and Willamette mainstems, which may be indicative of moderately healthy macroinvertebrate communities and less-healthy side-channel habitats.

A wide range of invertebrates are present within the study area. These animals, and their habitats, form a critical link in a healthy ecosystem, breaking down biomass and cycling nutrients, providing necessary links in the food web between primary producers and consumers. In general, earlier studies indicate that the McKenzie River and adjacent riparian areas currently include a mix of invertebrate habitats ranging from excellent to very poor. And, while little data exists on very early species, conclusions can be drawn from the known historical conditions versus those existing today, where findings show a general decline in species abundance and diversity. Andrus and Walsh found that macroinvertebrates in Cedar Creek tended to contain more diverse and less pollutant tolerant communities than populations in the McKenzie and Willamette mainstems, which may be indicative of moderately healthy macroinvertebrate communities and less-healthy side-channel habitats (2002).

As land use, hydrology, and host plant species' distributions have changed, so have these populations. Invertebrates in the study area occupy both terrestrial and aquatic habitats, and many of which require both habitats to thrive. Cedar Creek and the McKenzie River are hosts for various flying insects which require water as part of their life cycle, such as dragonflies, stoneflies, and mayflies, which in turn, become part of the food chain, along with strictly aquatic species such as daphnia, snails, and water gliders.

4.1.16. Threatened, Endangered, Candidate and Special Status Species

Federally listed species or habitats that may occur in the vicinity of the study area are listed in Table 4, and include: northern spotted owl (*Strix occidentalis caurina*), Chinook salmon (*Oncorhynchus tshawytscha*), bull trout (*Salvelinus confluentus*), Oregon chub (*Oregonichthys crameri*), Fender's blue butterfly (*Icaricia icarioides fenderi*), Golden Indian paintbrush (*Castilleja levisecta*), Willamette daisy (*Erigeron decumbens* var*. decumbens)*, Howellia (*Howellia aquatilis*), Bradshaw's lomatium (*Lomatium bradshawii*), and Kincaid's lupine (*Lupinus sulphureus* var*. kincaidii*). Currently, the only candidate species in Lane County is the yellow-billed cuckoo (*Coccyzus americanus occidentalis*).

For information about federally listed threatened (T), endangered (E), proposed, candidate species, and species of concern which may occur in Lane County see http:www.fws.gov/species/.

Table 4 Threatened, Endangered and Candidate Species, Sensitive Species, and Rare Species of the Cedar Creek Planning Area*

COMMON NAME	SCIENTIFIC NAME	FED	OR	HABITAT NOTES
AMPHIBIANS/REPTILES				
Northern Pacific pond turtle (Western)	*Actinemys marmorata marmorata (Clemmys marmorata)*	SOC	SC	Marshes, streams, rivers, lakes with logs for basking and nearby sparsely vegetated ground for nest digging
BIRDS				
Acorn woodpecker	*Melanerpes formicivorus*	SOC		Uses cavaties in large oaks; oak woodlands with soft snags, open understories
Band-tailed pigeon	*Patagioenas fasciata*	SOC	SC	Uses mixed structure conifer forest, needs mineral sites
Common Nighthawk	*Chordeiles minor*		SC	Nests in short grassy areas or gravel bars
Little willow flycatcher	*Empidonax traillii brewsteri*		SV	Willow & other shrub thickets, near water
Northern spotted owl	*Strix occidentalis caurina*	LT		Recent sightings in forested habitat within ½ mile east of planning area boundary and 1 mile south
Olive-sided flycatcher	*Contopus cooperi*	SOC	SV	During migration in forested uplands
Yellow-billed cuckoo	*Coccyzus americanus occidentalis*	PT		Uses gallery forests and intact riparian corridors along rivers and streams.
Pileated woodpecker	*Dryocopus pileatus*		SV	Forages in mixed forest
Western bluebird	*Sialia Mexicana*		SV	Primary habitat is oak savanna
Western meadowlark	*Stumella neglecta*		SC	Open prairie habitat for nesting
Yellow-breasted chat	*Icteria virens*	SOC	SC	Dense shrubby habitats, usually near water
FISH				
Bull trout	*Salvelinus confluentus*	LT		DCH--McKenzie River, the northern border of Planning Area
Chinook Salmon UWR Spring	*Oncorhynchus tshawytscha*	LT		DCH includes Cedar Creek, McKenzie River, mainstem Willamette River
Oregon Chub	*Oregonichthys crameri*	LT	SC	Downlisted from LE to LT 4/23/10. Historical observation in Willamette River within ½ mile of Planning Area
INVERTEBRATES				
MAMMALS				
Long-eared myotis	*Myotis evotis*	SOC	SU	Associated with conifer forests, uses snags, buildings, other structures
Pallid bat	*Antrozous pallidus*	SOC		
Silver-haired bat	*Lasionycteris noctivagans*	SOC	SU	Prefers large tree cavities for maternity and other roosting.
Western gray squirrel	*Sciurus griseus*		SU	Oak woodlands & savanna
White-footed vole	*Arborimus albipes*	SOC	SU	Riparian-associated
PLANTS				
Bradshaw's lomatium	*Lomatium bradshawii*	LE	LE	Wet prairie; population with fair viability east of planning area within 1 mile
Howell's montia	*Montia howellii*	LT		Wet prairies, moist, gravelly spots, vernal wet areas with sparse vegetation
Tall bugbane	*Cimicifuga elata*		C	Slightly moist north slopes in conifer forests with bigleaf maple, in small gaps; several populations in forested headwaters within planning area, and just south
Wayside aster	*Eucephalus vialis* (*Aster vialis*)	SOC	LT	Oak savanna, mixed forest gaps and edges; in forested headwaters within planning area, and just south

COMMON NAME	SCIENTIFIC NAME	FED	OR	HABITAT NOTES
AMPHIBIANS/REPTILES				

Fed = Federal Status
LE=Listed Endangered
LT=Listed Threatened
SOC=Species of Concern
C=Candidate for listing with enough information available for listing

OR = State Status
SC or C=Sensitive-Critical
SV=Sensitive-Vulnerable
SP=Sensitive-Peripheral
SU=Sensitive-Undetermined Status

*This list includes species found within or near the Cedar Creek Planning Area, or for which habitat within the Planning Area could be suitable.

The State of Oregon also has a state Oregon Threatened and Endangered Species Act which is much more limited in scope than the federal ESA. The Oregon ESA applies to actions of state agencies on state-owned or leased lands. The federal and state lists are similar but do differ. In addition, the State of Oregon has a sensitive species classification system that was created to help prevent species from being listed as threatened or endangered. To see the ODFW Sensitive Species list see: http://www.dfw.state.or.us/wildlife/diversity/.

Cedar Creek is a tributary of the McKenzie River that flows through Cougar Dam. Two Willamette Valley BiOps were issued in 2008 by the USFWS and NMFS to address issues of continued operation of the Willamette Valley dams owned and operated by the Portland District Corps. The BiOps address the impacts to listed species, including: Oregon chub, bull trout, and Upper Willamette River (UWR) Chinook salmon. The existence of these BiOps increases the institutional significance of actions within Cedar Creek where the following species are present:

- UWR Chinook salmon (*Oncorynchus tshawytscha*), endangered - with DCH
- Bull trout (*Salvelinus confluentus*), endangered - with DCH
- Oregon chub (*Oregonichthys crameri*), threatened - without DCH in the planning area

Implementation of an ecosystem restoration plan will contribute to the recovery of the listed species known to occur (or with the potential to occur) in the study area.

A conservation recovery plan has been developed for spring Chinook in the Willamette Valley (ODFW 2011). The USFWS has developed a recovery plan for Oregon chub, and separately a draft recovery plan for bull trout (USFWS 1998 and 2002, respectively).

The following species are known to occur in the study area and may be affected by the recommended restoration plan:

Chinook Salmon – Upper Willamette River, Threatened

The Evolutionary Significant Unit (ESU) for Upper Willamette River Chinook salmon (*Oncorhynchus tshawytscha*) was listed as *threatened* on March 24, 1999 (64 FR 14308) and the status was reaffirmed on June 28, 2005 (70 FR 37160). The five-year status review completed on August 15, 2011 (76 FR 50448) confirmed Chinook should remain listed as *threatened*. Critical habitat was designated on September 2, 2005 (70 FR 52630) and includes the McKenzie River (downstream from Cougar Dam) and Cedar Creek.

Salmonids require clean, oxygenated cool water and clean gravel for spawning, and Chinook prefer to spawn in the mainstem of large tributaries (Healey 1991). Females deposit eggs in gravel substrate, in areas of relatively swift water of mainstem rivers or large tributaries (Healey 1991). Larvae remain in the gravel for two to four weeks until the yolk is absorbed, and fry emerge four to eight weeks later (Moyle 1976). Ideal temperatures for embryonic growth and development range between 41°F and 57°F. Optimum rearing habitat for juveniles consists of pools and wetland areas with woody debris and overhanging vegetation that promote prey availability while also provide escape cover from predators. Chinook salmon feed on terrestrial and aquatic insects, amphipods,

and other crustaceans while young, and primarily on other fish as older juveniles and sub-adults. Mortality of Chinook salmon in the early life stages is usually high due to natural predation and human induced changes in habitat, such as siltation, high water temperatures, low oxygen conditions, loss of stream cover and reductions in river flow.

Spring Chinook salmon are native to the McKenzie and historically, spring Chinook spawning and rearing areas were distributed along the mainstem McKenzie up to Tamolitch Falls, Gate Creek, Horse Creek, Lost Creek, the South Fork McKenzie, Blue River, and the Mohawk (LCOG 1996). The McKenzie provides spawning habitat for the largest population of spring Chinook in the Willamette Valley. Although heavily influenced by hatchery fish from the McKenzie Hatchery, the wild population of spring Chinook in the McKenzie River is the most productive in the Willamette gene conservation group. They utilize Cedar Creek as part of the complex of freshwater streams and side channels providing important rearing habitat. Chinook are present in the Planning Area from May through November as adults and year-round as juveniles. Typically, yearlings migrate downstream in the spring, and outmigrate to the ocean between March and May, spending two to four years in the ocean before returning as adults to spawn.

Updated population trends for spring Chinook in the McKenzie River subbasin are pending additional data analysis. Figure 9 below shows the ten-year spawning abundance of spring Chinook in the McKenzie River from 1999-2008. The black portion designates natural origin fish, and the white portion delineates all fish – natural and hatchery origin. Data is only available through 2005, and as a result the overall population trend for this time period is not available. However, generalities can be made based on the available data. While the overall population has increased, recent years have shown a slight downward trend in spawning abundance; until additional data is available, the current status is undetermined. According to Ford, the McKenzie River population is currently characterized as at a “low” risk of extinction (2011). The causes for the recent downward trend are unknown, but could be a result of upstream fish passage barriers, poor ocean conditions, and decreased juvenile survival in the Columbia River estuary as a result of increased predation.

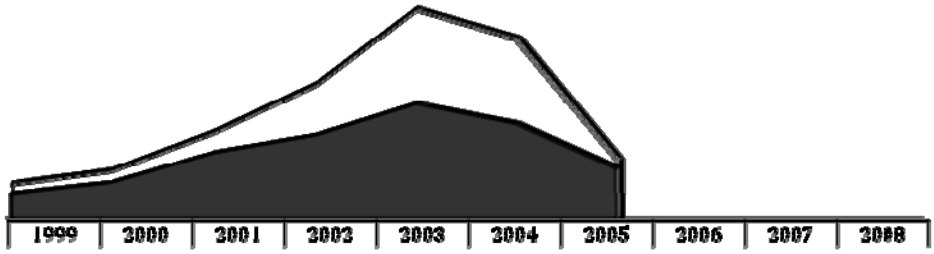


Figure 9: 10-year Population trend for spring Chinook in McKenzie River

The McKenzie River population of spring Chinook currently has one the best risk ratings for abundance, productivity, spatial structure, and diversity. Key limiting factors include the lack of access to historic spawning areas, high pre-spawning mortality of adults, altered water temperatures and degraded freshwater habitat quality, lack of gravel and large woody debris recruitment downstream of the dams, hatchery-related effects, the introduction of non-native, invasive species, and the loss of channel complexity and habitat formation due to reduced peak flows (NMFS 2008). Given the passage restrictions in Reach 1 and 2, juveniles are currently only able to utilize the Cedar Creek side channel habitat when they are washed into the creek system via overland flows during high water on the McKenzie. Natural egress occurs where the creek reconnects to the McKenzie in Reach 3 north of the ponds.

Bull Trout - Threatened

The Klamath River and Columbia River segments of the bull trout population were listed as a *threatened* species on June 10, 1998 (63 FR 31647) and the entire co-terminus U.S. population of bull trout was confirmed as *threatened* on November 1, 1999 (64 FR 58910). Critical habitat was designated on October 6, 2004 (69 FR 59996) and revised on October 18, 2010 (75 FR 63898). Historically, bull trout ranged throughout the Columbia River Basin, east to western Montana, south to the Jarbidge River in Nevada, the Klamath Basin in Oregon, and the McCloud River in California, and north to Alberta, British Columbia and possibly southeastern Alaska. The main populations existing in the lower 48 states today are in Montana, Idaho, Oregon, and Washington. There are three populations in the McKenzie River subbasin, all of which are considered essential to the recovery of the species (USFWS 2010).

Critical habitat for the Coastal Recovery Unit includes the Upper Willamette River critical habitat unit. This unit includes numerous waterbodies: all reaches and side channels of the McKenzie River upstream from its confluence with the Willamette River to (and inclusive of) the Trail Bridge Dam and reservoir; Smith River up to the Smith River Dam; Sweetwater Creek; the South Fork and East Fork of the South Fork of the McKenzie River from its confluence with the McKenzie River below (and inclusive of) Cougar Dam upstream to the Roaring River; Blue River upstream to Blue River Dam; Horse Creek and side channels to Separation Creek; Lost Creek to White Branch Creek; Deer Creek; Olallie Creek; and Anderson Creek. Cedar Creek, downstream from Leaburg Dam is not designated as critical habitat, but is part of the complex off-channel habitat tied to the mainstem of the McKenzie River (which is designated as critical habitat).

Bull trout have the most specific habitat requirements of salmonids, and require clean, cold water with complex, connected habitats. Factors limiting the number of bull trout in the McKenzie River include habitat degradation and fragmentation, in addition to the blockage of migratory corridors, poor water quality, the effects of climate change and past fisheries management practices (including the introduction of non-native species). Bull trout prefer colder streams and, in Oregon, are rarely found in streams above 15°C. Stream temperatures influence spawning and hatching, and spawning has been triggered in Oregon rivers when temperatures fall below 48°F (9°C) (Riehle 1993). In British Columbia, 80-95% of eggs hatched if water was between 2-4°C (McPhail and Murray 1979). Groundwater and cold water springs maintain cool temperatures in the McKenzie River yearround, ranging from 39 to 53°F. Eggs incubate four to five months, hatching in late winter or early spring and fry may remain in streambed for up to three weeks. Substrate and stream bottom conditions have been correlated to abundance of juvenile bull trout and spawning site selection by adults (Rieman and McIntyre 1993; McPhail and Murray 1979). As juveniles, bull trout prey primarily on terrestrial and aquatic insects, but become piscivorous as they grow larger and prey on whitefish, sculpins, and other salmon and trout.

Given the paucity of historical information about the distribution of bull trout, it is difficult to quantify the amount of historical habitat currently occupied. Bull trout (commonly called Dolly Varden) are the native char in the McKenzie River and are the only char native to the state of Oregon. Oregon is at the southern edge of the bull trout range and the McKenzie population is the only population of note remaining west of the Oregon Cascades. It is thought that the McKenzie River population(s) functioned as a single unit and it wasn't until Cougar Dam and Trail Bridge Dam were constructed in the 1960s that the population was fragmented into three discrete spawning populations: above Trail Bridge Dam; downstream of Trail Bridge Dam to the mouth of the McKenzie; and in the South Fork of the McKenzie (ODFW 2005). Currently, there is limited spawning distribution in the headwaters of the McKenzie because individuals are isolated above Trail Bridge and Cougar Dams. Adults that move downstream past the dams are not able to return to their natal streams to spawn, influencing abundance and productivity in the upstream populations.

Fluvial adults have been observed in the McKenzie population, downstream of Leaburg Dam, approximately twenty miles east of the study area. Although movement of the McKenzie population is blocked by dams and spawning is limited to a total of 5km in Anderson and Olallie creeks, the McKenzie population is the most abundant and largely concentrated upstream of Leaburg Dam (upstream of the Planning Area); no spawning occurs in the study area. Based on redds counts, the number of adults in the McKenzie population (mouth of the McKenzie to Trail Bridge Dam at RM X) is estimated to be 150-200 individuals and trending towards stable (ODFW 2005).

Fry from the McKenzie population are transported to the Middle Fork of the Willamette River in an effort to restore trout populations in that system. Bull trout are expected to be present in the McKenzie River throughout the year, either as adults or juveniles. Individuals overwinter in large pools, distributed throughout the mainstem as far downstream as Hendricks Bridge (the upstream extent of the Planning Area). In spring, upstream migration to spawning tributaries begins and continues through summer.

Oregon Chub, Threatened

The Oregon chub was listed as *endangered* in 1993 (58 FR 53800). A recovery plan was published in 1998 and critical habitat was designated on March 10, 2010 (75 FR 11010). The species' status has recently improved, and on April 23, 2010, the USFWS downlisted the classification of the Oregon chub from endangered to *threatened* (75 FR 21179). When the species was listed in 1993, there were eight known populations. In 2012, there were 36 known populations with over 500 individuals, of which 20 had stable or increasing population trends, meeting the de-listing critiera (ODFW 2012) [3]. While the overall status of the species has improved in recent years, many individual populations are still at risk from habitat loss, increased predation, interspecific competition with non-native species, increased sediment accretion, and poor water quality.

Oregon chub are year-round residents of off-channel habitats with minimal water flow, including beaver ponds, oxbows, side channels, backwater sloughs, low gradient tributaries, and flooded marshes (USFWS 1998). Oregon chub are typically found in waters that exceed 16°C in the summer and have an average depth greater than 6.6 feet (2 m). Adult chub have been found to live from seven to ten years, with females living longer on average than males (Scheerer and McDonald 2003). Dense, aquatic vegetation is also characteristic of Oregon chub habitat, which is used for spawning habitat and predator avoidance. Spawning takes place between mid-May and August, peaking in July when temperature are >15°C, and occurs in areas with dense aquatic cover (USFWS 1998, Scheerer and McDonald 2003). Oregon chub prey on invertebrates suspended in the water column or on the substrate, primarily small crustaceans.

Historically, Oregon chub were found in off-channel habitats throughout the Willamette River valley, as far downstream as Oregon City and as far upstream as Oakridge (USFWS 1998). Critical habitat has been designated for 25 units representing 132 acres of habitat within the mainstem Santiam, North Santiam, South Santiam, McKenzie, mainstem Willamette, and Middle Fork Willamette Rivers subbasins. There is no DCH in Cedar Creek; however, there is DCH in the McKenzie River near the project area. During routine fish surveys in 2001, ODFW discovered a genetically viable population of chub in the McKenzie River downstream from Hendrick's Bridge, between RM 18 and 19 (Maben 2001). Subsequent surveys estimate that over 300 individuals inhabit an area locally referred to as "Big Island", a decrease from the initial 900+ that were surveyed in 2002.

[3] ODFW has drafted a de-listing monitoring plan; it is anticipated that chub will be delisted sometime in 2014.

In addition, ODFW discovered a naturally occurring population in 2012 in the slough immediately downstream of the original intake structure on Cedar Creek, estimated to include approximately 200 individuals. Additional populations are found in off-channel sloughs and oxbows of the McKenzie River upstream and downstream of the Cedar Creek drainage. Future monitoring of these populations will document population trends and stability and what (if any) migration occurs between locations. Oregon chub are likely to occur throughout the year in the project area.

4.1.17. Air Quality

The area within the Springfield UGB is designated by the EPA and Oregon DEQ regulations as a non-attainment area for Particulate Matter 10 and is classified as moderate for air quality. Air quality in the area is within federal air quality standards found on the DEQ website at http://www.deq.state.or.us/aqi/index.aspx. Project level hot spot analyses must be done for any project within the Eugene/Springfield UGB.

In addition, there is local air protection agency, the Lane Regional Air Protection Agency (LRAPA) which monitors air quality for Lane County using standards developed by the EPA.

4.1.18. Noise

Sources of noise in the project area are traffic along major arterials and collectors and are not considered impactful. Sensitive sites for noise and air quality are schools and hospitals in the study area.

4.1.19. Hazardous and Toxic Materials

The study area is in areas of historic low density development; most sites are in open field and stream environments with minimal historic human activity, other than agricultural activities. For these low density areas, the risk of encountering contaminated soils or groundwater is low.

Relevant database searches, historic aerial photograph review, and historic topographic map review indicate there is little potential for the presence of hazardous and toxic materials. The results of these searches can be found in *Appendix A*. Additional information regarding four orphan sites listed indicates that they are of no risk to the project. No remediation is anticipated for the Blue Water Ponds area.

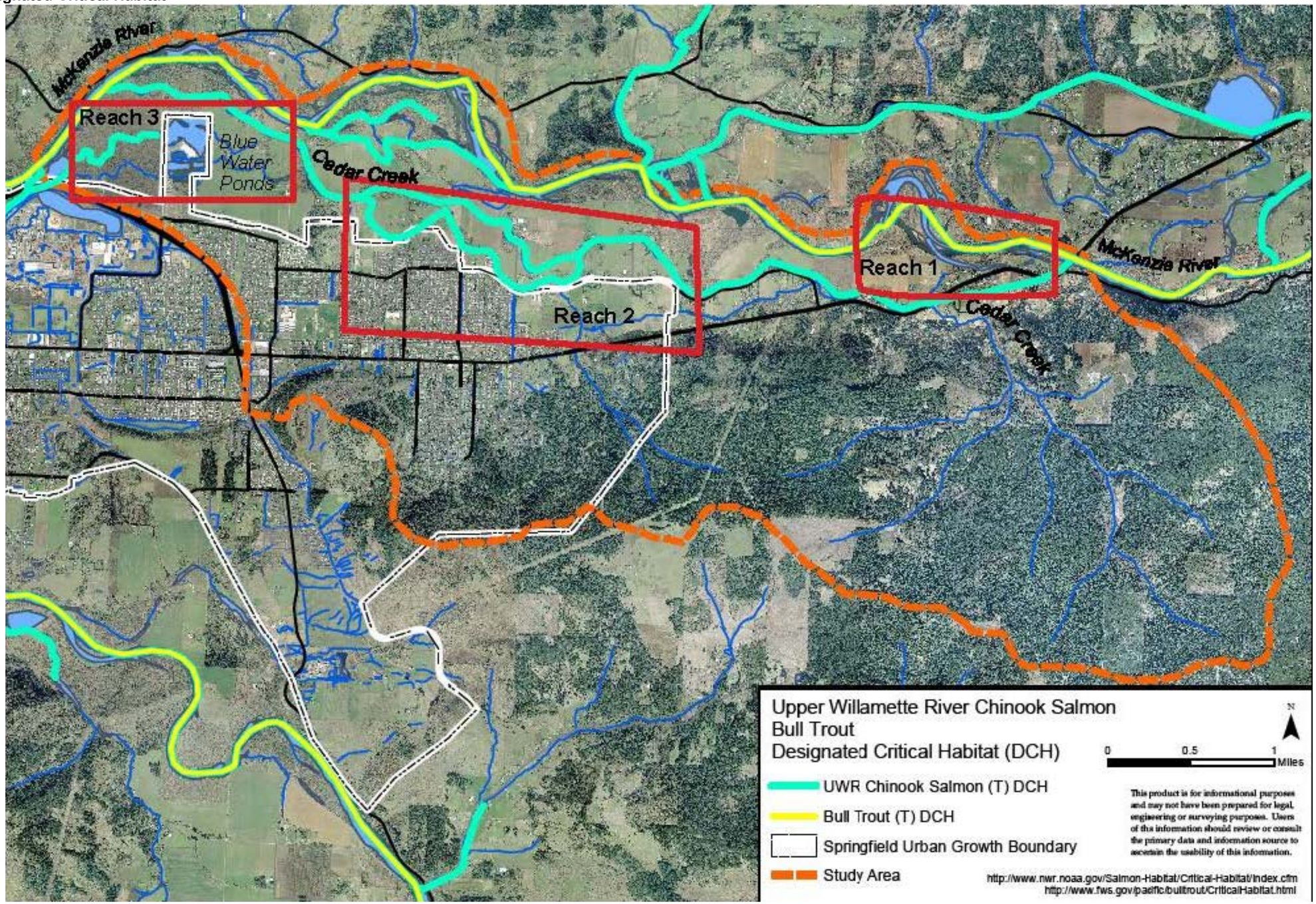
4.2. Future Without Plan Condition (No-Action Alternative)*

Under the FWOP condition (No-Action Alternative), conditions of the affected environment are projected to remain the same over the 50-year planning horizon beginning in 2019.

The FWOP condition is not anticipated to worsen due to aggressive land management and strict land use regulations in the study area. In addition, the CWA regulates modifications of “waters of the U.S.” by preventing fill of streams and wetlands. All modifications to a regulated water must be permitted prior to modification. The permitting process requires analysis to determine environmental impacts under NEPA as well as additional analysis including but not limited to potential effects to ESA listed species.

The State of Oregon regulates protection of natural resources and conservation of scenic and historic areas and open spaces under Oregon’s Statewide Planning Goals and Guidelines Goal 5:

Figure 10 Designated Critical Habitat



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Natural Resources, Scenic and Historic Areas, and Open Spaces. This includes a required inventory of natural resources that was completed by Lane County, and the Cities of Eugene and Springfield. Goal 5 outlines a series of implementation requirements to protect these resources during the development of local Comprehensive Plans. In addition, state law requires removal or fill in "waters of the State" to obtain permits. This permitting process is similarly stringent to that of the CWA with regard to environmental impact analysis.

To protect riparian resources, The Eugene-Springfield Metropolitan Area General Plan identifies channels within the study area as resources to be protected under Goal 5. As a result, Lane County regulates riparian vegetation through ordinances that designate the following:

- Along all streams with average annual stream flow greater than 1,000 cfs, as designated for riparian vegetation protections by the Eugene-Springfield Metropolitan Area General Plan, the riparian corridor boundary shall be 75 feet upland from the top of each bank.
- Along all lakes, and fish bearing streams with average annual stream flow less than 1,000 cfs, as designated for riparian vegetation protections by the Eugene-Springfield Metropolitan Area General Plan, the riparian corridor boundary shall be 50 feet from the top of bank.

It is not anticipated that existing regulations will become less stringent during the planning horizon. Substantial modification of waters of the U.S. or of the State are thoroughly analyzed to prevent negative impacts. If negative impacts do occur, on-site mitigation or mitigation at a site near the impact can be expected.

Though it can be anticipated that the local sponsor will attempt to execute restoration projects, these projects are likely to be on a much smaller scale and are anticipated to only keep pace with potential degradation (i.e. invasive species).

4.2.1. Waterway Assessment Model Results

The WAM was applied to the existing conditions to provide an anticipated quantified condition. As mentioned above, it is anticipated that the FWOP will remain similar to the existing conditions due to regulations and local sponsor projects that keep pace with potential degradation. Table 5 details the results of the FWOP condition WAM results.

Table 5 Future Without Plan Condition Waterway Assessment Model Results

Alternative	WAM Physical Conditions Score	WAM Water Resources Score	WAM Natural Resources Score	WAM Score Divided By The Total Possible Score
Reach 1 FWOP/No-Action	16.0	17.0	22.0	0.42
Reach 2 FWOP/No-Action	18.4	16.0	17.2	0.40
Reach 3 FWOP/No-Action	17.0	19.0	22.0	0.45

4.2.2. Topography

Topography within the study area is anticipated to remain generally the same as the existing condition under the FWOP condition. However, the diversion channel entrance from the McKenzie River, immediately downstream of Hendricks Bridge, will likely continue to experience change as the result of the natural evolution of the downstream gravel bar and sediment accretion. The channel

entrance could close over the 50-year planning horizon forming a continuous terrace from the existing bar to the mainland, cutting Cedar Creek off from the McKenzie River at its upstream diversion.

4.2.3. Geology and Soils

Geological characteristics are anticipated to remain the same as the existing conditions under the FWOP condition. Upland and terrace soil characteristics are also anticipated to remain the same as the existing condition under the FWOP condition. Some channel areas within the Cedar Creek system will likely experience continued sedimentation and result in shallower water conditions. If the channel entrance at McKenzie River eventually becomes blocked as the result of gravel bar migration, terrestrial soils horizons will likely develop in the newly formed land.

4.2.4. Hydrology and Hydraulics

Geomorphic change to the McKenzie River channel bed in the vicinity of the study area (McKenzie River RM 16 to 24) is likely under the FWOP condition. This reach is subject to flooding and channel migration within the confines of the geomorphic floodplain (river valley). It is likely that channel migration will continue to occur in the future when extreme channel forming floods occur.

The existing regulatory floodplains could change under the FWOP condition. However, it is not considered likely that the changes would be impactful (e.g. expansion of the floodplain or re-designation of flood hazard areas). Urban development is light and within the confines of the existing regulatory limits. Floodplain ordinances will likely prevent adverse expansion into the floodplain. Likely changes to the floodplain under the FWOP condition would likely be due to natural drivers such as extreme channel altering flood events causing channel migration or expansion of the head cut causing a change to the hydraulic profile in the area.

4.2.5. Water Quality

Water quality is expected to improve in the study area. The non-Federal sponsors have adopted and implemented stormwater development standards for new developments that require pollutants to be treated prior to runoff into natural waterways. These requirements will help to reduce future pollutant loads. The comprehensive, on-going water quality monitoring programs will be instrumental in keeping abreast of non-point source runoff issues and could help guide future management measures if and when conditions change and diminish.

The Cedar Creek basin has a number of water quality issues that threaten the long-term health and the many uses of this waterway. Cedar Creek provides a number of critical functions in this area, including: fish and wildlife habitat; mitigating the effects of stormwater runoff; providing irrigation to agricultural fields; and providing drinking water via groundwater-surface interconnections. There are a variety of efforts underway to protect and improve water resources and to minimize future impacts to these critical functions. Regulatory provisions occur at both the state and local levels. Un-regulated efforts such as best management practices are implemented by the agricultural community and various agencies, programs, and volunteer efforts have all had positive effects on groundwater resources and the quality of surface waters.

4.2.6. Socioeconomic Conditions

Socio-economic conditions are anticipated to remain consistent in the FWOP condition. Local projects will be constructed but if Federal funds are used to finance these projects, impacts to socioeconomic conditions are required to be analyzed and minimized.

Community and Regional Growth
Based on past trends, the City will likely experience continued growth pressures in the decades to come. Potential UGB expansion in the Cedar Creek study area may occur to the south and west of the current UGB, in the headwater area of Gay Creek.

Community Cohesion
There will be no foreseeable impacts to community cohesion resulting from the FWOP condition. Changes to the population of any community, segment, or separate parts of the communities or neighborhoods, and changes in income distribution and relocation of residents may occur to some extent as population growth occurs, but this is likely to occur with or without the proposed plan.

4.2.7. Environmental Justice
As the population ages within the study area, it can be expected that elderly portions of the environmental justice populations in the planning area may increase. Economic development programs in the City of Springfield may reduce overall poverty. Additionally, ethnic diversity within the United States as a whole is increasing; this can be expected to occur in the study area as well.

4.2.8. Cultural Resources
Although there are no documented historic structures, buildings, districts or properties currently identified in the APE, over the 50-year planning horizon historic resources or properties will likely be designated. In the FWOP condition, historic resources in the study area could be affected by small scale restoration projects implemented by the local sponsor.

4.2.9. Land Use
Figure 10 illustrates projected land uses in the planning area based on review of existing comprehensive planning documents.

Projections under the FWOP condition assume build-out of all vacant and undeveloped lands under the current zoning designations as regulated by the City and the County planning codes, as described in the *Eugene-Springfield Metro Area General Plan*. Approximately 26 percent of the land cover within the UGB is currently classified as impervious surface, while impervious surfaces cover only about six percent of the area outside of the UGB. It is assumed that approximately 436 acres of lands outside of the UGB will be converted to impervious surfaces, increasing the total impervious surface of the study are to twelve percent. It is further projected over the 50-year planning horizon at least 1,400 acres, or fifteen percent, of the total study area will be converted from undeveloped land to developed, urban-use (industrial, residential, road and rights-of-way) at the projected build-out. It is also assumed that developed lands will remain in the current land use regardless of future plan designation by the City or County.

The City of Springfield will continue to maintain public facilities along the waterways in the study area in the future under the FWOP condition. However, the coordinated watershed level of improvements to public recreation facilities and other infrastructure will not occur.

Prime Farmlands
Prime farmlands will not be affected by the FWOP condition unless projects outside of the UGB are constructed on prime or unique farmlands by Lane County. As lands are converted to impervious surfaces, some prime farmlands may be affected, but this is unknown at this time due to the unpredictability of future growth and expansion.

4.2.1. Recreation

The FWOP condition will include additional small scale recreational opportunities implemented by the City of Springfield as funds become available. These expansions include four new parks, including two natural areas and two neighborhood scale parks. The City is also considering constructing a recreational corridor that may connect these parks. These opportunities are identified in the City's comprehensive plan and would be implemented through their Capital Improvement Program.

4.2.2. Vegetation and Habitat Types

Figure 11 illustrates the projected habitat distribution in the study area under the FWOP condition and Table 6 shows the change in acreage and percent decreases of specific habitat types.

Table 6: Projected change in habitat types under the Without-Project Condition

Land Use / Habitat Type	Existing Conditions (acres)	Projected Conditions (acres)	Change	
			(acres)	(percent)
Urban and Rural Development	1,595	2,812	1,217	76%
Agriculture, Pasture and Turfgrass	1,244	1,009	-235	-19%
Permanent lentic water	267	267	0	0
Closed forest, riparian, wetland, and upland hardwood	1,049	919	-130	-12%
Mixed conifer-hardwood woodland, upland and mounded prairie	223	165	-58	-26%
Upland woodland, shrubland, and herbaceous	1,846	1,531	-315	-17%
Savanna, oak, and conifer	63	32	-31	-49%
Closed upland conifer forest, greater than 200 years	181	177	-8	-4%
Closed or semi-closed mixed conifer forest, less than 200 years	2,927	2,552	-375	-13%
Seasonal wet prairie	7	5	-2	-29%
Total Change	**9,402**	**9,469***		

*Projected acres assumed vacant habitat areas are developed according to the Metro Plan Land Use Designation and acres outside the UGB are developed according to the existing land use designations.

Existing acres of open water, riparian, and wetland habitats outside the UGB are projected to decrease from 2,269 acres to 2,038 acres in the study area over the 50-year planning horizon. Under the FWOP condition, the potential for improving habitat connectivity between and among the relatively few existing higher quality sites will be reduced, especially for the headwater streams and the downstream sections of Cedar Creek, Gray Creek, 75th Street Channel, and the McKenzie River.

Figure 11 Future Land Use

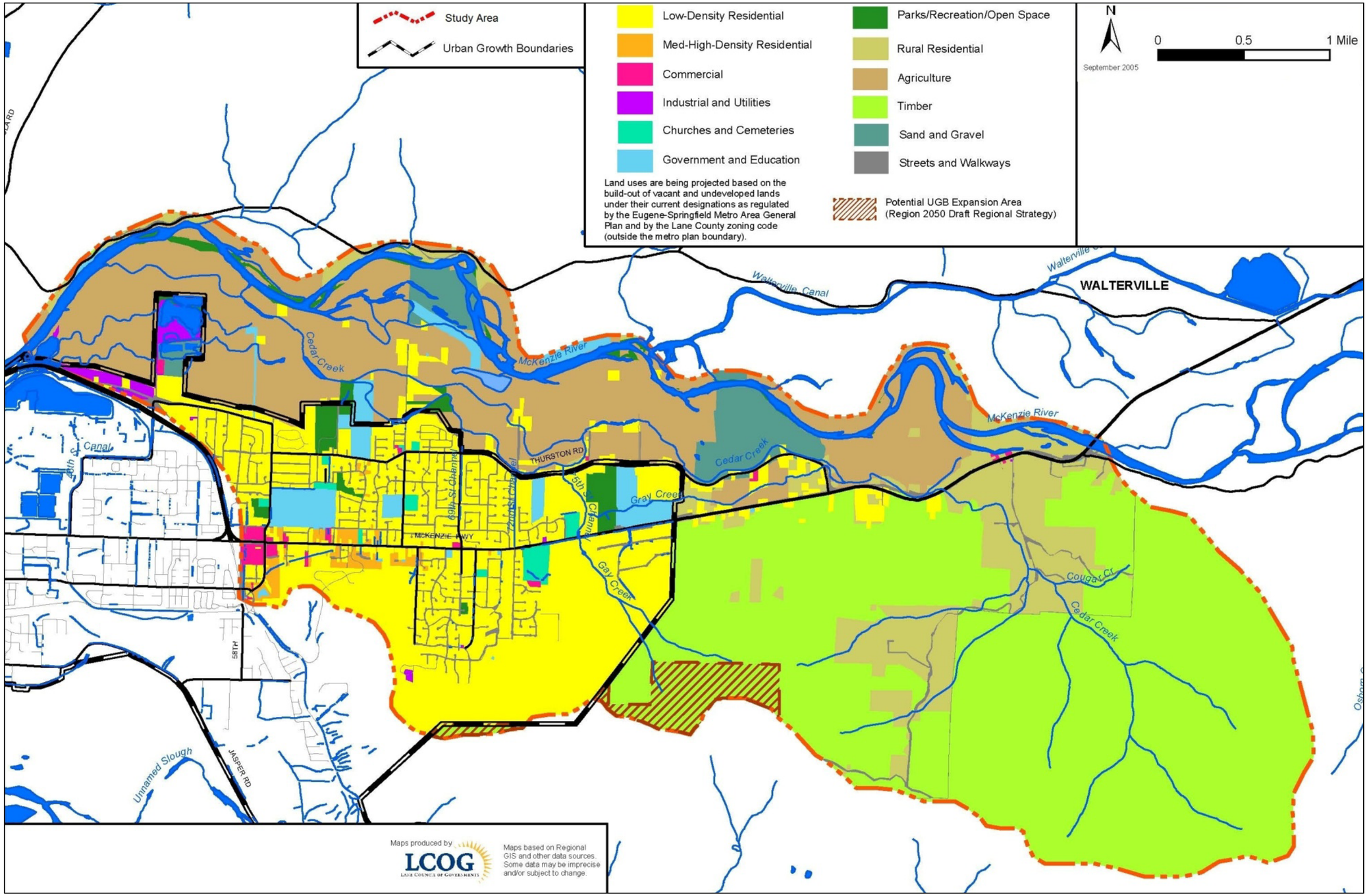

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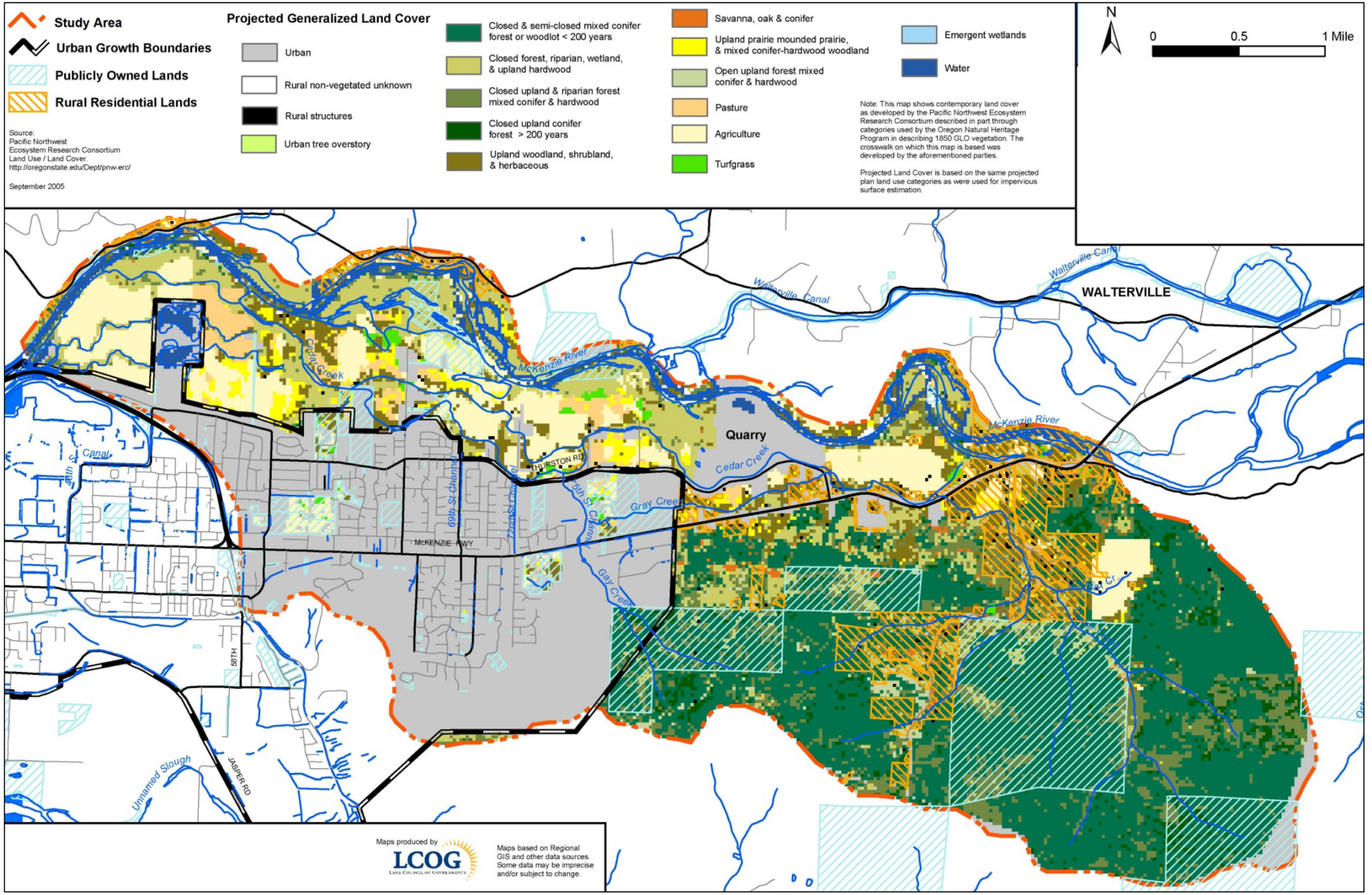
Figure 12 Future Habitat



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4.2.1. Fish and Wildlife

Under the FWOP condition, existing environmental conditions will not improve drastically over time due to loss of habitat, encroachment of invasive species and urban development. Limited or reduced habitat restoration will occur and connectivity between areas of habitat will remain as it is today due to regulations protecting environmental resources.

4.2.1. Threatened, Endangered, Candidate and Special Status Species

Opportunities for restoring habitat and supporting recovery efforts for threatened, endangered, candidate and special species will decrease under the FWOP condition. The FWOP condition will mean the effects from new development without concurrent repairs and improvement efforts could further impact species already listed as threatened or endangered under the ESA.

4.2.2. Air Quality

The FWOP condition will have no effect on air quality. Current trends are expected continue, as much of the project area is an urban environment where the primary air quality concerns are the result of everyday practices and processes commonplace in metropolitan areas

The Lane Regional Air Protection Agency (LRAPA) and Air Quality Index (AQI) data shows that air quality has generally increased over the past twenty years. The 2010 data shows low levels of particulates, ozone and carbon monoxide levels, and decreases in overall motor vehicle exhaust (LRAPA 2010). As a result, air quality for Lane County is (on average) good and is considered satisfactory with little or no risk to human health.

Current living practices, as they influence air quality, are not expected to change in the future, and it is expected that future trends will mimic regional conditions. While there may be some days where air pollution is moderately elevated (but still acceptable), it is expected that these times will be temporary and of short-term duration, resulting only in moderate health concerns for persons who are unusually sensitive to air pollution.

4.2.3. Noise

The FWOP condition will have no effect on noise pollution. Noise pollution in the Springfield area is largely the result of traffic patterns, none of which are considered impactful with respect to noise. It is assumed that traffic patterns and volumes along major arterials will remain the same under the FWOP condition, resulting in no changes to noise patterns in these areas. It is also reasonable to assume that no changes to noise or air quality around schools or hospitals will occur, as this would require prohibitively expensive rerouting of existing roads and highways, for which there is no recognizable need.

4.2.4. Hazardous and Toxic Materials

Under the FWOP condition, there will be no effect on hazardous and toxic materials.

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5. PLAN FORMULATION, EVALUATION, COMPARISON, AND SELECTION

The Federal planning process has six distinct steps that are iterative in nature and lead to the formulation, evaluation, and selection of a recommended restoration plan. This chapter will summarize Step 3 (Formulation of Alternative Plans), Step 4 (Evaluation of Alternative Plans), Step 5 (Comparison of Alternative Plans), and Step 6 (Selecting a Plan).

5.1. Potential Restoration Measures

Step 3 began with identification of potential restoration measures. A Tool Box of Solutions was developed during a planning charette with stakeholders and resource agencies (USFWS, NMFS, ODFW) that included a comprehensive list of restoration measures that could be applied in degraded reaches remaining under consideration. Involvement by the stakeholders and resource agencies was vital to the development and screening of restoration measures and provided early input in the design process. Measures included in the Tool Box are illustrated in *Appendix B*. It should be noted that coordination and consultation with the resource agencies has been on-going throughout the planning process and will continue during PED.

Each measure included in the Tool Box was considered for its ability to meet study objectives and compliance with Corps policy. Measures were qualitatively evaluated based on the following decision criteria:

- The benefits each measure was expected to produce (physical, water quality, natural resource, social)
- Potential cost
- Typical scale of the measure (region, watershed, corridor, segment, or point specific)
- Life span (long, medium, short)
- Proven effectiveness based upon the history of a measure, previous research, and case studies
- Ongoing operational and maintenance commitments and constraints from non-Federal sponsors.
- Permits needed to implement the tool (local, state, and federal)
- Any special considerations of each tool, such as general advantages/disadvantages, access requirements, and other relevant information

Specific screening criteria were not developed; however, of the 36 measures included in the Tool Box of Solutions, the following measures were removed from further consideration based on general Corps authority:

- Riparian protection ordinance
- NPDES permit and TMDL Stormwater programming requirements
- Animal waste management
- Education/Clean-up/stream adoption/waste collection programs
- Secure water rights
- Interpretive displays, outdoor classrooms

The primary justification for removing these alternatives from further consideration is that the Corps is not authorized to cost share in many of these activities. The PDT discussed the option of the

Locally Preferred Alternative to incorporate these measures; however the sponsor was not interested in pursuing that option. These actions may be implemented by the sponsors through other programs and may contribute to the success of implementation of this plan.

At the conclusion of the charrette process, the charette participants made final recommendations on which strategies adequately addressed study objectives and should proceed for further evaluation and refinement. The charrette process was a critical step in the study because it allowed regional experts to evaluate a variety of restoration alternatives and only carry forward those that adequately met the project purpose and need, and sufficiently addressed the identified problems and opportunities.

Based on the results of the charrette process, scientists and staff from the Study Management Team (SMT) and PDT, including the Corps, LCOG, and the City of Springfield, refined the generalized concepts into a series of restoration measures. Those measures remaining under consideration after the measures screening process are described in Table 7.

Table 7 Measures Remaining for Alternative Formulation

Measure	Description	Goal and Objective Addressed
Remove invasive species	Physically or chemically remove invasive vegetation	*Goal #1 – Objective A*
Plant native species	Plant species native to the Upper Willamette Valley	*Goal #1 – Objective A*
Repair existing revetments	Repair existing revetments to prevent McKenzie River migration into Cedar Creek	*Goal #1 – Objective B*
Install diversion pump	Pump water from McKenzie River into Cedar Creek during the summer	*Goal #1 – Objective B*
Install pipe from McKenzie River to Cedar Creek	Install a pipe to transport flows from new intake below Hendrick's Bridge to Cedar Creek	*Goal #2 – Objective B*
Construct open water channel from McKenzie River to Cedar Creek	Construct a new open water channel from the new intake below Hendrick's Bridge to Cedar Creek	*Goal #2 – Objective B*
Divert and pipe water from EWEB Power Canal to Cedar Creek	Install a pipe from the EWEB Power Canal to Cedar Creek Canal with a route to be determined	*Goal #2 – Objective B*
Improve connectivity at fork of North and South Cedar Creeks	Install open bottom arch/culvert on South Cedar Creek	Goal #2 – Objective B
Widen channel	Increase the width of the channel	*Goal #1 – Objective B*
Construct diversion from Grey Creek to 75th Street Channel	Construct structure or channel to divert close from Grey Creek to the 75th Street Channel	Goal #2 – Objective B
Daylight piped waterway segment	Remove section of pipe and replace with a naturally contoured channel.	*Goal #2 – Objective B*
Remove concrete box channel	Remove concrete channel and re-create a natural channel	*Goal #2 – Objective B*
Construct trails	Connect various parks with trails	*Goal #3 – Objective A*

Measure	Description	Goal and Objective Addressed
Construct diversion structure from Cedar Creek to ponds	Install open bottom arch/culvert to divert a portion of flow from Cedar Creek to ponds	Goal #2 – Objective B
Acquire ponds	Acquire ponds near Cedar Creek	Goal #2 – Objective B
Pond restoration	Re-contour pond edges, restore riparian vegetation	Goal #1 – Objective A, B Goal #2 – Objective B

5.2. Combinability and Dependency of Management Measures

The PDT evaluated the measures remaining under consideration to determine if any measures are incompatible with one another. For the study area, the following measures were determined to be incompatible:

- Measures that modify the connection from the McKenzie River to Cedar Creek or that provide cool water flows into Cedar Creek from the EWEB power canal are not combinable. The justification for this determination is that each of these measures are intended to serve a function of providing cool water flows to Cedar Creek and application of these measures in the same alternative would be duplicative.

It should be noted that not all measures can be applied in all reaches. Reach options were developed to apply those management measure to the intended reach (i.e. water connections from the McKenzie River to Cedar Creek are only applicable to Reach 1; pond restoration only applies to Reach 3). However, actions implemented in Reaches 2 and 3 are dependent upon implementation of actions in Reach 1 to restore a natural hydrologic regime and year-round flows into Cedar Creek. While some actions in Reaches 2 and 3 could be implemented without those features in Reach 1 (restoration of the riparian zones), the benefits would not be fully realized, nor would the goals and objectives of the Study be met without implementing features in Reach 1 to restore the connectivity of Cedar Creek to the McKenzie River.

5.3. Development of Conceptual Reach Options

Within each of the reaches identified above, one or more restoration measures may be appropriately combined into reach restoration options (Table 3) to address the key habitat degradation issues of each reach. Each measure was considered for application to a reach if 1) it is geographically, technically, and engineering appropriate, and 2) it achieves a study objective for that reach or geographic area of the reach. Not all measures are appropriate for all reaches. Alternatively, more than one measure may be necessary to achieve an objective for a given reach.

The sensitivity of the WAM was also a consideration in formulation of reach options. In general, for a study area of this size, it may have been necessary to apply more than one measure to measurably see a change in the WAM score. In particular, scores for natural resources metrics, such as wildlife corridor function and habitat diversity may require more than one measure to be applied in several different locations in order to register a measureable change in the WAM score. Each reach identified a basic reach option that would register minimally achieve study objectives and register changes in habitat units. For Reach 1, several engineering possibilities to provide cold water flows and connect the McKenzie River were included in the reach options. For Reaches 2 and 3, reach options 2A and 3A were determined the minimum restoration requirements to achieve study objectives and register measurable changes in WAM scores.

Appendix B includes conceptual schematics of each reach option. Where multiple options were feasible, separate combinations of restoration measures were developed to achieve varying levels

of environmental benefits as well as different methods for addressing the objectives. Formulation of options in the reaches provided gradation of restoration opportunity (i.e. low, medium, high).

Conceptual engineering was completed when formulating the reach options and were based on the Sponsor's application of these measures on past local projects. Reach options were developed using two methodologies:

- Reach 1 options were developed based on application of measures that would resolve the issue of connection between the McKenzie River and Cedar Creek. Those measures were mutually exclusive, thus placed into separate reach options.
- For Reaches 2 and 3, reach options were developed that provided different scales or "building blocks" of restoration (i.e. low, medium and high). Each option applied several of the same measures, but the amount of measure applied was scaled. For example, Reach Option 2A focuses primarily on riparian restoration, where as Option 2B introduces meanders and daylighting piped sections of channels. Option 2C added additional features along the 69th Street Channel and removed additional box culverts. The same method was applied with Reach 3 with channel restoration in Reach 3A that adds pond restoration in Reach 3B.

Table 8 provides a description of each reach option to accomplish the study objectives. Detailed descriptions of the reach options can be found in *Appendix B.*

Table 8 Array of Conceptual Reach Options

Reach Option ID	Measures Applied	General Reach Option Description	Planning Goals and Objectives Addressed
1A	Install diversion pump, repair existing revetments	Installs a pump to ensure cold water from the McKenzie River is present in Cedar Creek year round	Goal #2, Improve access to quality habitat, including removing barriers, improving connectivity, and increasing habitat quantity for all species. • Objective A, provide fish and wildlife "friendly" connections from the McKenzie River to Cedar Creek and ensure availability of cold water flows in Cedar Creek year-round. o Partially met though this is not a "fish friendly option.

Reach Option ID	Measures Applied	General Reach Option Description	Planning Goals and Objectives Addressed
1B	Install pipe from McKenzie River to Cedar Creek, repair existing revetments	Installs a pipe to ensure cold water from the McKenzie River is present in Cedar Creek year round	Goal #2, Improve access to quality habitat, including removing barriers, improving connectivity, and increasing habitat quantity for all species. • Objective A, provide fish and wildlife "friendly" connections from the McKenzie River to Cedar Creek and ensure availability of cold water flows in Cedar Creek year-round. o Partially met though this is not a "fish friendly option.
1C	Construct open water channel from McKenzie River to Cedar Creek, plant native species, repair existing revetments	Construct a new waterway to ensure cold water from the McKenzie River is present in Cedar Creek year round	Goal #2, Improve access to quality habitat, including removing barriers, improving connectivity, and increasing habitat quantity for all species. • Objective A, provide fish and wildlife "friendly" connections from the McKenzie River to Cedar Creek and ensure availability of cold water flows in Cedar Creek year-round.
1D	Divert and pipe water from EWEB Power Canal to Cedar Creek, repair existing revetments	Installs a pipe to transport water from EWEB power canal ensure is cold water is present in Cedar Creek year round	Goal #2, Improve access to quality habitat, including removing barriers, improving connectivity, and increasing habitat quantity for all species. • Objective A, provide fish and wildlife "friendly" connections from the McKenzie River to Cedar Creek and ensure availability of cold water flows in Cedar Creek year-round. o Partially met though this is not a "fish friendly option.

Reach Option ID	Measures Applied	General Reach Option Description	Planning Goals and Objectives Addressed
1E	Improve connectivity at fork of North and South Cedar Creeks, plant native species, repair existing revetments	Uses the existing side channel and installs an instream grade control structure to ensure connection of the side channel and cold water from the McKenzie River is present in Cedar Creek year round	Goal #2, Improve access to quality habitat, including removing barriers, improving connectivity, and increasing habitat quantity for all species. • Objective A, provide fish and wildlife "friendly" connections from the McKenzie River to Cedar Creek and ensure availability of cold water flows in Cedar Creek year-round.
2A	Remove invasive species, plant native species	Restore aquatic and riparian habitat within existing channel limits	Goal #1, Restore natural habitats along waterways, including main and side channel in-stream and riparian habitats and their ecological functions. • Objective A, increase riparian corridor widths and improve corridor quality by planting native species.
2B	Remove invasive species. plant native species, widen channel, construct diversion from Grey Creek to 75th Street Channel, daylight piped waterway segment, remove concrete box channel	Restore aquatic and riparian habitat within existing channels and restore flow to the abandoned 75th Street Channel, daylight an existing storm pipe and restore aquatic habitat functions, and widen and meander a portion of South Cedar Creek	Goal #1, Restore natural habitats along waterways, including main and side channel in-stream and riparian habitats and their ecological functions. • Objective A, increase riparian corridor widths and improve corridor quality by planting native species. • Objective B, restore channel complexity to remove channelization and increase structural diversity of instream habitat. Goal #2, Improve access to quality habitat, including removing barriers, improving connectivity, and increasing habitat quantity for all species. • Objective B, restore migratory corridors ensuring that restoration does not create "habitat islands."

Reach Option ID	Measures Applied	General Reach Option Description	Planning Goals and Objectives Addressed
2C	Remove invasive species, plant native species, widen channel, construct diversion from Grey Creek to 75th Street Channel, daylight piped waterway segment, remove concrete box channel	Restore aquatic and riparian habitat within existing channels and restore flow to the abandoned 75th Street Channel, daylight an existing storm pipe and restore aquatic habitat functions, and widen and meander a portion of South Cedar Creek, additional widening at 69th Street Channel.	Goal #1, Restore natural habitats along waterways, including main and side channel in-stream and riparian habitats and their ecological functions. • Objective A, increase riparian corridor widths and improve corridor quality by planting native species. • Objective B, restore channel complexity to remove channelization and increase structural diversity of instream habitat. Goal #2, Improve access to quality habitat, including removing barriers, improving connectivity, and increasing habitat quantity for all species. • Objective B, restore migratory corridors ensuring that restoration does not create "habitat islands."
3A	Remove invasive species, plant native species, construct diversion structure from Cedar Creek to ponds, pond restoration	Improves flows during the summer from Cedar Creek into the intake and outflow waterways of Blue Water Ponds and would restore habitats, restore aquatic and riparian habitat within the existing channel limits	Goal #1, Restore natural habitats along waterways, including main and side channel in-stream and riparian habitats and their ecological functions. • Objective A, increase riparian corridor widths and improve corridor quality by planting native species.

Reach Option ID	Measures Applied	General Reach Option Description	Planning Goals and Objectives Addressed
3B	Remove invasive species, plant native species, widen channel, construct diversion structure from Cedar Creek to ponds, pond restoration, acquire ponds	Improves flows during the summer from Cedar Creek into the intake and outflow waterways of Blue Water Ponds and would restore habitat and includes purchase of Blue Water Ponds. restore aquatic and riparian habitat within the existing channel limits	Goal #1, Restore natural habitats along waterways, including main and side channel in-stream and riparian habitats and their ecological functions. • Objective A, increase riparian corridor widths and improve corridor quality by planting native species. • Objective B, restore channel complexity to remove channelization and increase structural diversity of instream habitat. Goal #2, Improve access to quality habitat, including removing barriers, improving connectivity, and increasing habitat quantity for all species. • Objective B, restore migratory corridors ensuring that restoration does not create "habitat islands."

5.3.1. Combinability and Dependency of Reach Options

Access to the study area by resident and anadromous fish is an important consideration in restoration activities. As such, success of restoration in Cedar Creek is measured by the increased presence of fish year-round and depends on sufficient cool water summer flows and increased access at the upper reaches of the planning area. Creation of contiguous restored reaches is also important for dispersal of fish throughout the study area. This creates a dependency that an action in Reach 1 be included in the selected restoration plan.

5.3.2. Incremental Benefits of Reach Options for Reaches 2 and 3

Reach options for Reaches 2 and 3 were developed to provide different scales or "building blocks" of restoration.

5.4. Evaluation of Alternatives

To properly evaluate the relative effectiveness and efficiency of alternative restoration measures at addressing environmental objectives of the project, a cost-effectiveness and incremental cost analysis (CE/ICA) was performed that compared the cost of an alternative to its habitat benefit. This required the development of preliminary costs for each of the restoration alternatives.

5.4.1. Waterways Assessment Model Inputs

In order to evaluate potential restoration alternatives for this study, the WAM was applied to reach options to measure the benefits expected from the restoration alternatives identified above in Table 8. Corps regulations (EC 1105-2-412) require that the environmental benefits for each alternative are evaluated using a Corps-certified model. Because the WAM was not a pre-certified model, a HEP/HSI model was developed (which is certified) to assess the reliability of the WAM and validate its output scores in order to approve it as a single-use model for this Study. The PDT worked closely with the Corps' ECO-PCX to develop the HSI and compare the results of both models.

The WAM was used to quantify existing conditions in the study area and also to each of the reach options to estimate differences in environmental output between reach options. This assumed that restoration options would be fully implemented as proposed. The scores that resulted from applying the WAM to the proposed restoration alternatives are shown in Table 9. Habitat Benefit Units (HBUs) are a standardized metric that score unique parameters in order to differentiate between the beneficial uplift (net increase in HBUs) provided by an alternative when compared to the FWOP condition (No Action Alternative). WAM score calculations and information used to evaluate the reaches can be found in *Appendix A.*

In general, each reach option was assumed to require five years to complete PED and acquire LERRDs. Additionally, each option was assumed to have a two year construction cycle. As such, the period of analysis begins in 2019 and ends in 2069.

Table 9 Waterway Assessment Model Results and Habitat Scores for Reach Options

Alternative	Project Acres	WAM Physical Conditions Score	WAM Water Resources Score	WAM Natural Resources Score	WAM Score Divided By The Total Possible Score	HBUs	HBU Increments*
Reach 1 FWOP/No-Action	20	16.0	17.0	22.0	0.42	8.4	
Reach 1A	20	23.0	22.0	22.0	0.52	10.4	2.0
Reach 1B	20	23.0	22.0	22.0	0.52	10.4	2.0
Reach 1C	20	33.0	30.0	32.0	0.74	14.8	6.4
Reach 1D	20	23.0	21.0	22.0	0.51	10.2	1.8
Reach 1E	20	37.0	30.0	37.0	0.81	16.2	7.6
Reach 2 FWOP/No-Action	85	18.4	16.0	17.2	0.42	35.7	
Reach 2A	85	19.2	22.6	26.6	0.53	45.0	9.3
Reach 2B	85	25.2	23.8	33.8	0.67	57.0	12
Reach 2C	85	25.2	23.8	33.8	0.67	57.0	0
Reach 3 FWOP/No-Action	114	17.0	19.0	22.0	0.45	51.3	
Reach 3A	114	26.0	27.0	36.0	0.68	77.5	26.2
Reach 3B	114	31.0	29.0	47.0	0.82	93.4	15.9

* Increments for Reach 1 are based on the change compared to the FWOP. For Reaches 2 and 3, increments are based on change between reach options as these reach options were developed to achieve low, medium or high levels of restoration.

It should be reiterated that the recreational component of the WAM was not included when evaluating the *habitat* outputs for the restoration measures to prevent biased results when recreational scores were higher or lower than other options. The overall calculation used to describe the HBUs generated by each reach option is:

$$\frac{\text{(WAM Physical Characteristic Score + WAM Water Resources Score + WAM Natural Resources Score)}}{\text{Total Possible WAM Score}} \times \text{Acres} = \text{HBU}$$

HBUs can also be used to compare and differentiate between project costs for individual reach options and incremental combination of measures.

5.4.2. Reach Option Cost Input

Conceptual cost estimates were generated by Corps cost engineers in 2007 using the Corps' Micro-Computer Aided Cost Estimating System (MCASES) and are based on the restoration options developed for each reach and include engineering and design, construction, and land acquisitions. A summary of these costs are provided in Table 10. Unit prices were obtained from the local sponsor from the unit cost quotes of material suppliers in the Springfield area, *Means Site Work Cost Guide for* 2006, or from MCACES (2007 price indices).

In 2012, the PDT conducted a sensitivity analysis to determine what change would be seen by updating the costs in 2012 price indices. In general, costs of all reach options escalated by six percent. No one reach option showed a higher cost increase. As such, the PDT concluded that updating the price indices would not impact the CE/ICA and elected to continue use of the 2007 prices.

Table 10 Conceptual Cost Estimates of Reach Options (2007 Price Indices)

Reach	Location	Option	Non-Recreation Costs						Interest During Construction	Monitoring Costs	Total Estimated Project Cost	Average Annual O&M Costs
					Real Estate							
			Construction	Engineering and Design	Acquisition of Lands, Easments, Rights-of-way, Relocations, and Disposal (LERRDs)	Administrative Costs	Subtotal	Total				
1	McKenzie River/Cedar Creek	A	$ 5,100,851	$ 1,275,213	$ 64,110	$ 12,000	$ 76,110	$ 6,452,174	$ 54,630	$ 10,000	$ 6,516,804	$ 1,600
		B	$ 9,796,837	$ 2,449,209	$ 121,600	$ 32,000	$ 153,600	$ 12,399,646	$ 631,821	$ 10,000	$ 13,041,467	$ 6,000
		C	$ 4,992,185	$ 1,248,046	$ 376,250	$ 44,000	$ 420,250	$ 6,660,481	$ 339,383	$ 10,000	$ 7,009,864	$ 9,750
		D	$ 7,474,262	$ 1,868,566	$ 187,970	$ 56,000	$ 243,970	$ 9,586,798	$ 488,493	$ 10,000	$ 10,085,291	$ 6,000
		E	$ 5,011,772	$ 1,252,943	$ 164,150	$ 16,000	$ 180,150	$ 6,444,865	$ 328,397	$ 10,000	$ 6,783,262	$ 9,000
2	Urban Areas	A	$ 231,287	$ 57,822	$ 651,020	$ 132,000	$ 783,020	$ 1,072,129	$ 328,769	$ 50,000	$ 1,450,898	$ 13,875
		B	$ 3,196,517	$ 799,129	$ 1,752,630	$ 152,000	$ 1,904,630	$ 5,900,276	$ 300,647	$ 50,000	$ 6,250,923	$ 17,700
		C	$ 4,144,775	$ 1,036,194	$ 1,868,630	$ 152,000	$ 2,020,630	$ 7,201,599	$ 366,956	$ 50,000	$ 7,618,555	$ 38,060
3	Blue Water Ponds, Keizer Slough	A	$ 506,507	$ 126,627	$ 2,513,730	$ 40,000	$ 2,553,730	$ 3,186,864	$ 162,386	$ 30,000	$ 3,379,250	$ 1,800
		B	$ 1,027,225	$ 256,806	$ 8,307,740	$ 206,500	$ 8,514,240	$ 9,798,271	$ 499,269	$ 30,000	$ 10,327,540	$ 2,100

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5.4.3. Cost-Effectiveness and Incremental Cost Analysis

CE/ICA was performed using IWR-PLAN Software Suite. The analysis provides a framework for comparing the differences in output across alternative measures and the associated changes in cost. The analysis was conducted in the following steps:

- Tabulate average annual cost and average annual environmental outputs (benefits achieved from the time construction was complete consistent with the proposed construction schedule) of each reach option
- Identify all potential combinations of reach options
- Calculate cost and output estimates for each alternative
- Identify any measures providing the same output at greater cost than other combinations
- Identify any measures providing less output at the same or greater cost as other combinations
- Evaluate changes in incremental costs for remaining combinations
- Identify most efficient set of remaining combinations ("best-buys")
- Display changes in incremental cost for best-buy combinations

The IWR CE/ICA analysis was carried-out using non-recreation and average annual O&M cost estimates, and habitat units. Habitat units were provided from the Waterways Assessment Model (see Table 9).

Costs were converted to average annual costs before they were entered into the IWR CE/ICA program. This was done with a spreadsheet using the payment (PMT) formula with an interest rate of 3.5% and duration of 50 years and includes O&M costs for during that 50-year duration. Converting costs into average annual costs and benefits provides the PDT a "true cost" comparison that includes the implementation schedule for the project. A longer implementation schedule will increase the average annual cost and delay the achievement of benefits. Inclusion of O&M costs also provides a holistic understanding of the real costs to achieve the HBUs over the 50-year planning horizon. These average annual non-recreation costs were added together and used as the input variable in the IWR program.

<u>Cost-Effectiveness Analysis</u>

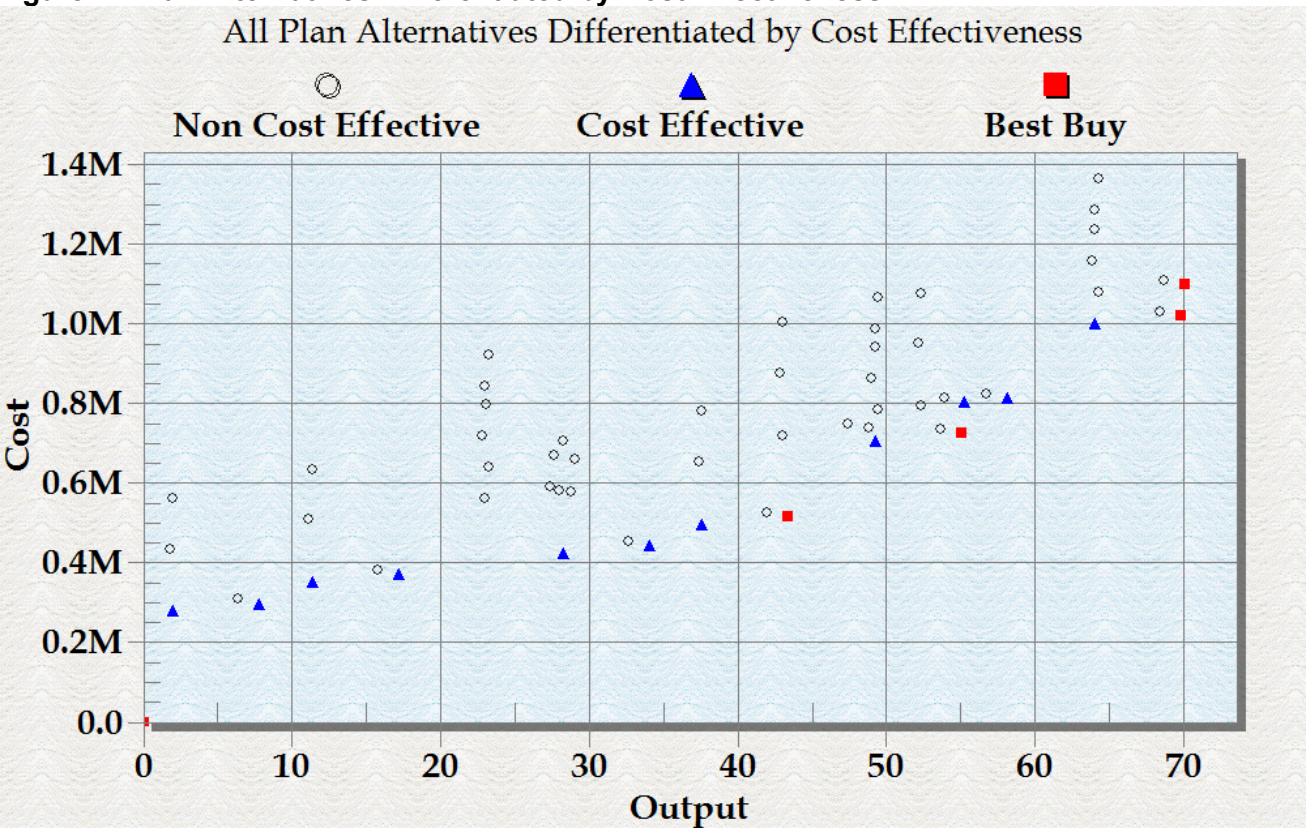
Once all combinations were derived and their cost and output estimates calculated, cost effectiveness analysis was performed in the following two steps:

- Identify any plans providing the same output at greater cost that other combinations and screen from further analysis
- Identify any plans providing less output at the same or greater cost as other combinations and screen from further analysis

This two-step screening was performed on the array of possible combinations for each of the planning areas. This cost-effectiveness screening resulted in identification of the array of plans that are referred to as the "Cost-Effective Set." If considering only the cost and output estimates, there is no rational reason to implement a non-cost effective plan.

Fourteen plans outlined in Table 8 were included in the Cost-Effective Set. Results from IWR-PLAN and lists of all Cost Effective Plans can be found in *Appendix B*.

Figure 12 Plan Alternatives Differentiated by Cost Effectiveness



Incremental Cost Analysis ("Best Buys")

Following the identification of cost-effective combinations of reach options, an incremental cost analysis was conducted on the Cost-Effective Set. This incremental cost analysis compares the difference in cost divided by the difference in output between the potential solutions to give an incremental cost per unit of output. To identify the "best-buys", the incremental costs per unit were compared to find the plan with the lowest incremental cost per unit beyond the no-action plan. This process was continued using the previously identified best-buy as the comparison plan, until all solutions had been analyzed, resulting in a set of best-buy plans.

All alternative plans including Reaches 1A, 1B, 1C, and 1D were eliminated from further consideration because they were not identified as "best buys". Table 11 lists all "best-buy" plans identified by IWR-PLAN during the incremental cost analysis, which include Reach 1E in combination with Reaches 2A, 2B, or 2C, and 3A or 3B.

Table 11 Best Buy Plans

Alternative Plan ID	Average Annual HBU	Average Annual Cost	Average Annual Cost per HBU	Incremental Cost	Incremental HBU	Incremental Cost Per HBU
FWOP condition/No-Action	0	0				
Alt 2: 1E, 2A, 3A	43.4	515,960	$11,897	$515,960	43.4	$11,897
Alt 3: 1E, 2B, 3A	55.0	724,428	$13,167	$208,468	11.65	$17,894

Alternative Plan ID	Average Annual HBU	Average Annual Cost	Average Annual Cost per HBU	Incremental Cost	Incremental HBU	Incremental Cost Per HBU
Alt 4: 1E, 2B, 3B	69.8	1,020,959	$14,627	$296,531	14.8	$20,063
Alt 5: 1E, 2C, 3B	70.1	1,099,627	$15,698	$78,668	0.25	$314,672

Incremental benefits of each plan, designated as Alternatives 2-5 (where the No Action Plan is Alternative 1) are described in Table 12.

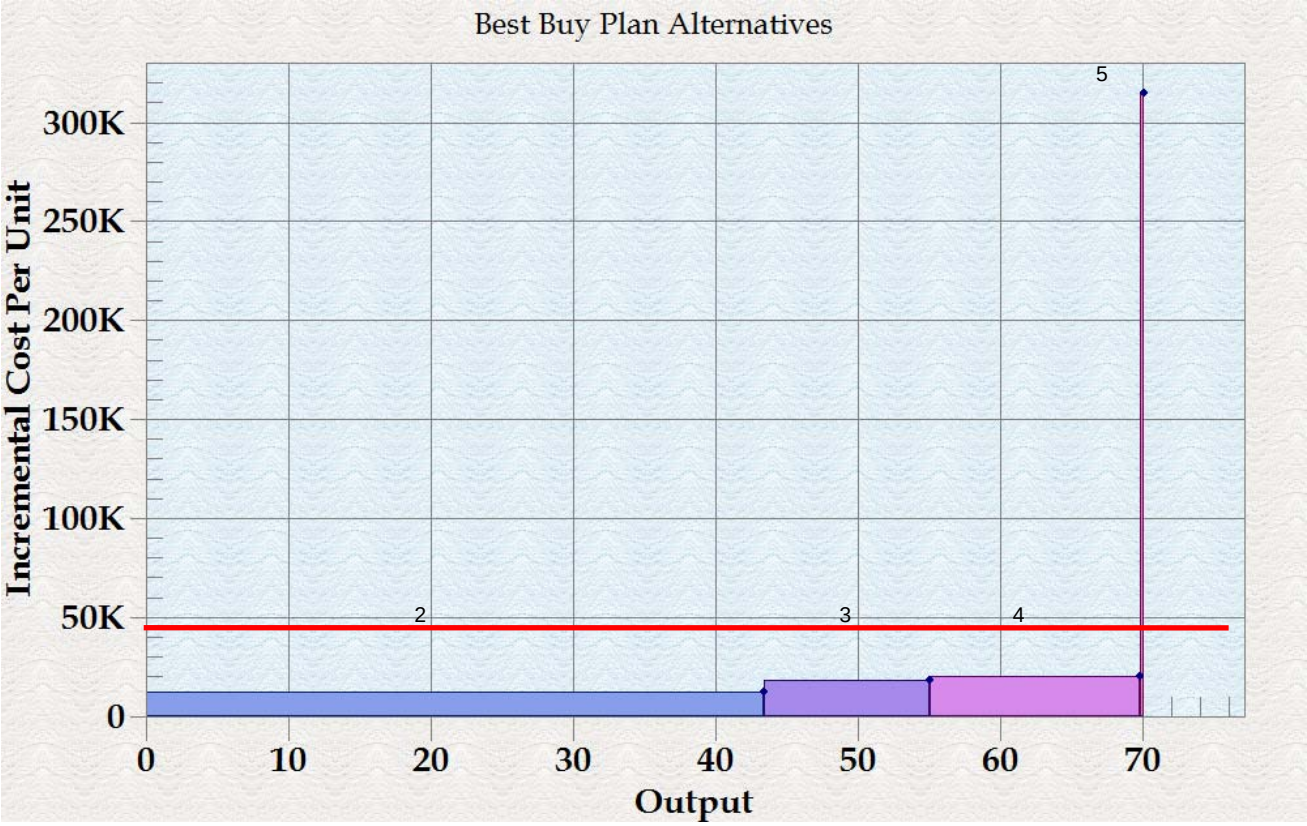
Table 12 Incremental Benefits of Best Buy Plans

Alternative Plan ID	Incremental Benefits
FWOP Condition/No Action	None
Alt 2: 1E, 2A, 3A	Generates 43.4 additional average annual HBUs over the FWOP. Reach 1E: • Improve connections between the McKenzie River and Cedar Creek • Fish passable and provides additional access to rearing habitats in the upstream portions of Cedar Creek • Improved bank stabilization in the area of the connection • Improvements to aquatic habitat structure by improving flows of cold water into Cedar Creek in the summer • Improved riparian habitat availability Reach 2A: • Improves bank stability within the reach • Reduces invasive species • Increases available riparian habitat throughout the reach • Improves the aquatic habitat structure through increased potential for LWD recruitment, improved instream cover, etc • Improves the habitat corridor function by creating continuous corridors of riparian habitat Reach 3A: • Improves channel and bank stability • Reduces invasive species • Increases available riparian habitat throughout the reach • Improves the aquatic habitat structure through increased potential for LWD recruitment, improved instream cover, etc • Improves the habitat corridor function by creating continuous corridors of riparian habitat
Alt 3: 1E, 2B, 3A	Generates 11.6 additional average annual HBUs over Alternative 2 by replacing Reach Option 2A with Reach Option 2B. Reach 2B: • Improved channel shape, bank stability, and bed stability by creating meanders • Additional increases in available riparian habitat • Additional reduction in invasive species • Additional improvements in habitat corridor function by removing piped

Alternative Plan ID	Incremental Benefits
	sections and improving summer flows into South Cedar Creek and adjacent channels
Alt 4: 1E, 2B, 3B	Generates 14.8 additional average annual HBUs over Alternative 3 by replacing Reach Option 3A with Reach Option 3B. Reach 3B: • Improved channel shape, bank stability, and bed stability at Blue Water Ponds • Additional increases in available riparian habitat • Additional reduction in invasive species • Additional improvements to aquatic structure by improving habitat inwater habitat along the banks of the Blue Water Ponds • Increased corridor function by connecting Cedar Creek to Keizer Slough
Alt 5: 1E, 2C, 3B	Generates 0.3 additional average annual HBUs over Alternative 4 by replacing Reach Option 2B with Reach Option 2C. • Minor improvements physical conditions along 69th Street Channel.

Figure 13 provides a graphical presentations of the best buy plans for the study area. Alternatives are identified by their Alternative ID number.

Figure 13 Cedar Creek Planning Area Best Buy Plans



The data points on the graphs in Figure 13 are per the plan number shown in the corresponding Table 8.

To interpret these results, the PDT looks for “jump” in cost (y-axis) and the resulting increase in benefit (x-axis). A small increase in costs with a large increase in benefit is easily justifiable whereas a large increase in cost with a small increase in benefit is requires more justification for selecting that alternative.

The following is noted:

- The first noticeable “jump” in cost occurs after Alternative 2. Another “jump” occurs after Alternative 4.

5.5. Planning Guidance (Selection) Criteria

Economic analysis is not the only factor the PDT is required to consider in selecting the National Ecosystem Restoration (NER) Plan. Per ER 1105-2-100, recommended plans should be evaluated for completeness, effectiveness, efficiency, and acceptability. The PDT used the criteria below to also inform its selection:

1. **Acceptability** An ecosystem restoration plan should be acceptable to State and Federal resource agencies, local governments and stakeholders in the area. There should be evidence of broad based public consensus and support for the plan.

2. **Completeness** A plan must provide and account for all necessary investments or other actions needed to ensure the realization of the planned restoration outputs. This may require relating the plan to other types of public or private plans if these plans are crucial to the outcome of the restoration objective. Real estate, O&M, monitoring, and sponsorship factors must be considered. Where there is uncertainty concerning the functioning of certain restoration features and an adaptive management plan has been proposed it must be accounted for in the plan.

3. **Effectiveness** An ecosystem restoration plan must make significant contribution to addressing the specified restoration problems or opportunities.

4. **Efficiency** An ecosystem restoration plan must represent a cost effective means of addressing the restoration problem or opportunity. It must be determined that the plan’s restoration outputs cannot be produced more cost effectively by another agency or institution.

5.6. Alternatives Considered but Dismissed from Further Evaluation

As shown in Table 13, Alternatives 2 and 3 were dismissed from further consideration by the PDT because neither plan meets the “completeness” criteria because the Blue Water Ponds in Reach 3 are not acquired under these alternatives. This would require non standard (i.e. non-fee title) real estate acquisitions which are considered non-standard estates by the Corps and would require long-term reliance on private property owners. Acquisition in fee for the purposes of this exercise was determined required to fulfill the completeness criteria.

In addition, reach option 3A provides less incremental uplift to natural resources than reach option 3B. As a result, Reach 3B better meets the goals and objectives for this Study, and Alternatives 2 and 3 (both of which include Reach 3A) were dismissed from further consideration and detailed study.

Table 13 Evaluation of Best Buy Plans Against Planning Criteria

Alternative Plan	Acceptability	Completeness	Effectiveness	Efficiency
Alt 1: FWOP/No Action	No	No	No	No
Alt 2: 1E, 2A, 3A	Yes	No	Yes	Yes
Alt 3: 1E, 2B, 3A	Yes	No	Yes	Yes
Alt 4: 1E, 2B, 3B	Yes	Yes	Yes	Yes
Alt 5: 1E, 2C, 3B	Yes	Yes	Yes	Yes

The restoration features in Alternative 4 provided approximately the same degree of restoration as those features in Alternative 5, but the cost per unit was substantially less. For this reason, Alternative 5 was dismissed from further evaluation because the benefits achieved per unit cost were not found to be sufficient when compared to Alternative 4.

5.7. National Ecosystem Restoration Plan and Recommended Restoration Plan

Alternative 4 was identified as the NER Plan due to its incremental cost performance and its ability to meet Corps planning criteria. This is also the recommended restoration plan proposed in consultation with the non-Federal sponsor on the plan's ability to restore and contribute to the planning objectives.

Table 14 Waterway Assessment Model Results and Habitat Scores for Reach Options

	WAM Physical Conditions Score	WAM Water Resources Score	WAM Natural Resources Score	WAM Score Divided By The Total Possible Score	HBUs
Reach 1E	37.0	30.0	37.0	0.80	16.0
Reach 2B	25.2	28.2	33.8	0.67	57.0
Reach 3B	31.0	29.0	47.0	0.82	93.5

To ensure the recommended restoration plan meets the goals and objectives, the PDT compared the plan to the goals and objectives and the results are shown in Table 15 below.

Table 15 Recommended Restoration Plan Performance Against Objectives

Objective	Measure of Success	Recommended Restoration Plan Anticipated to Achieve Measure of Success?	How Success Will Be Implemented
Increase riparian corridor widths and improve corridor quality by planting native species.	Riparian corridors double in width (where possible) and the majority of vegetation in the corridor is native.	Yes	Non-native vegetation will be removed and native plants will be planted to increase the buffer width.
Restore complexity of stream channels to remove channelization and enable establishment of in-stream habitat.	All restored channels maintain banks with natural slopes and do not show signs of erosion, downcutting, toe cuts, bank sloughing, or rotational slumping.	Yes	Banks will be stabilized via plantings and placement of boulders; the channel will be meandered and large woody debris and wetland benches will be added to increase complexity.
Improve waterway	All accesses restored	Yes	Existing structures in

Objective	Measure of Success	Recommended Restoration Plan Anticipated to Achieve Measure of Success?	How Success Will Be Implemented
connections between the McKenzie River and Cedar Creek to ensure availability of cold water flows in Cedar Creek year-round.	are fish passable and maintain hyporheic connection.		Reach 1 will be removed and replaced with open channels; open-bottom arches/culverts will be used in Reaches 2 and 3 to maintain connectivity.
Restore migratory corridors ensuring that restoration does not create a "habitat island."	All restored areas are directly connected to Cedar Creek and do not impede migration of fish and wildlife.	Yes	All waterways will be connected and accessible via open-bottom arches and riparian buffers will provide cover and refugia for migratory movements of fish and wildlife.
Increase miles of trails.	Additional miles of trails accessible to the public.	Yes	Trails and public use facilities will be constructed.

5.8. Other Evaluation Accounts

The Planning Guidance Manual requires evaluation of alternatives according to several evaluation accounts including the National Economic Development (NED), Regional Economic Development (RED), Environmental Quality (EQ), and Other Social Effects (OSE). Ecosystem restoration projects are also evaluated for National Ecosystem Restoration (NER) benefits. The plans formulated and evaluated for this project were all developed to provide ecosystem restoration benefits. There is no evaluation for a NED or RED plan as benefits are not monetized and no measurable economic benefits would accrue.

Environmental quality is described as favorable or unfavorable changes in the ecological, aesthetic, and cultural attributes of the study area natural and cultural resources. The potential environmental effects of the alternatives are described in Chapter 7.

Other Social Effects describes the potential effects of project alternatives in other areas not explicitly in the other accounts. This would include effects on the community, health and safety, displacement, energy conservation, environmental justice, and other non-monetary effects. Other social effects are summarized briefly by a variety of categories, below, but generally result in no measureable changes to other social considerations.

- Displacement/Impacts to Residences – There would be no displacement effects on residences. There will be impacts to properties via the acquisition of a portion of some properties adjacent to Cedar Creek and South Cedar Creek for the purpose of implementing riparian restoration measures. These impacts could impact residences as it relates to property value (positive or negative). All alternatives evaluated in this study involve property acquisition and these costs will be includes as part of the real estate acquisition process.

- Displacement/Impacts to Minority or Low Income Populations – There would be no displacement effects on minority or low income populations as none of the alternatives considered would remove existing structures or residences.
- Public Health and Safety –The installation of engineered log jams in the McKenzie River will be designed to avoid effects to public health and safety (i.e. by positioning to allow boaters to get around the feature and not leaving sweeper logs, branches, etc. that could snag boaters).
- Displacement/Impacts to Businesses – One business in Reach 3 will be relocated as a result of the tentatively recommended plan. Other alternatives would have avoided this relocation. Costs associated with the relocation will be borne as part of the real estate acquisition process and the business will be relocated to a location that will result in minimal long-term impacts.
- Displacement/Impacts to Recreation – There will be no displacements of recreation facilities. It is anticipated that access to recreation will be improved by implementation of the alternative plans.
- Community Growth – There would be continued community growth under the No Action and restoration alternatives, but this growth is not related to any action. The restoration of floodplain habitats would have incremental benefits to the community and future development by maintaining floodplain areas for flood storage and attenuation.
- Community Well Being – The No Action alternative would not change community wellbeing. The restoration alternatives would provide restored floodplain habitats, some of which would be publicly accessible, that could provide improved educational opportunities and also fishing opportunities.
- Aesthetics – The No Action alternative would not change existing aesthetics. The restoration alternatives would restore existing ponds and creeks to historic aesthetics of natural vegetation.

6. RECOMMENDED RESTORATION PLAN

6.1. Design Features

6.1.1. Design Features and Functions

Design features are portrayed graphically on Figures 14 through 16, Recommended Restoration Plans. Details of the design features are included in *Appendix C*. The appendix includes and overview of the design features and design calculations used to size the features. A monitoring plan is included as part of the recommended restoration plan, and details of the monitoring plan are provided in greater detail in Section 10.

Reach 1

The recommended restoration plan in Reach 1 include utilizing an existing McKenzie River side channel to divert flow into Cedar Creek from a point along the river that is more geologically stable (approximately 1,400 feet upstream from the current intake) and to create a fish friendly open water connection between Cedar Creek and the McKenzie River. The design will support diversions of summertime flows of McKenzie River water into Cedar Creek to between 10.0 and 15.0 cfs. High wintertime flows are 40 cfs. Instead of installing a water control structure (as originally discussed), the side channel will be modified using a constructed riffle to divert flows from the McKenzie into Cedar Creek while still maintaining hyporheic flow. Similarly, vegetation and strategically placed boulders will be used to stabilize the areas around the side channel. The existing intake structures will be removed and replaced with open-entrance channels to facilitate movement of aquatic organisms and fish. A small rock-weir downstream of the existing structures will be reinforced to maintain oxbow habitat for Oregon chub while simultaneously ensuring sufficient head for water flow into Cedar Creek and preventing erosion and possible head-cutting.

The existing intake structures are not fish-friendly, are blocked by debris, and do not function year-round. Installation of restoration measures will divert flows from the McKenzie River into Cedar Creek downstream of Hendrick's Bridge to maintain flows year-round, while also being ecologically balanced to maintain hyporheic flow, facilitate fish ingress/egress, and promote natural stream functions. Year-round flows support the productivity of invertebrates, fish and wildlife during the low-flow summer season when water is withdrawn from the creek for irrigation. The cool waters of the McKenzie River would also improve overall water temperatures in the creek to support cold-water life histories of ESA-listed salmonids. The constructed riffle would maintain critical functions including geomorphic stability and diversity of water depth, substrate, and velocity, thereby increasing overall habitat complexity.

Reach 2

The recommended restoration plan in Reach 2 improves the waterway connections between South and North Cedar Creek to permanently maintain flow in South Cedar Creek and restore riparian vegetation along South Cedar Creek. Channel restoration in South Cedar Creek occurs adjacent to the middle school to improve in-stream habitat conditions. The 69th Street Channel is converted to a low flow channel to improve aquatic habitat. Riparian restoration is completed and a segment of concrete channel is removed on the 72nd Street Channel. Flow is diverted back into the 75th Street Channel and more riparian vegetation is improved. A portion of the Gray Creek channel that is currently flowing through underground pipes is day-lighted and channel restoration along Gray Creek is completed to improve aquatic habitat. Recreational trails along many of the waterways are constructed to facilitate public access as part of the locally preferred option.

Much of the riparian zone throughout Reach 2 is dominated by reed canary grass (*Phalaris arundinaceae*), Himalayan blackberry (*Rubus armeniacus)*, and other invasive, non-native species. Control of non-natives will likely be accomplished via a combination physical removal and herbicide application to control regeneration. Native plant species will be selected as they best suit the landscape (riparian, aquatic, etc.) to benefit water quality and fish and wildlife habitat.

Improved waterway connections would divert water into desired channels and waterways to increase the spatial and temporal extent of aquatic and riparian habitat available to support fish, wildlife, and plants. Currently, South Cedar Creek periodically goes dry during the summer, low-flow season. In order to maintain year-round water to support aquatic and riparian habitats, a bottomless culvert/arch would be installed where Cedar Creek branches to divert water into South Cedar Creek in order to maintain year-round flows. Secondly, a second bottomless culvert/arch would be installed on Gray Creek to divert water into the remnant 75th Street Channel, which runs northwest to South Cedar Creek. Gay Creek currently empties into Gray Creek at the 75th Street Channel, historically ran north and fed directly into South Cedar Creek. Under the proposed actions, Gay Creek will continue to flow into the Gray Creek channel downstream of the new diversion structure.

Channel restoration is proposed for portions of Gray Creek adjacent to Thurston Elementary School and the downstream portion of South Cedar Creek. Upstream of the school property, the Gray Creek channel would be restored with added meanders and in-stream features (pools, LWD, basking structures, etc.) to mimic natural stream conditions. Similar restoration actions would occur at the downstream section of South Cedar Creek where it rejoins with North Cedar Creek. Downstream from Bob Artz Park, Gray Creek enters a pipe and a culvert before emptying into the 72nd Street Channel. The piped segment immediately south of the school property would be daylighted and the 72nd Street Channel box culvert would be removed to open the channel and restore natural aquatic habitat.

<u>Reach 3</u>
The recommended restoration plan in Reach 3 includes acquiring the Blue Water Ponds (and relocating the commercial/industrial interest currently operating). The banks of the ponds will be re-contoured to restore wetland/riparian habitat. Flow will be diverted from Cedar Creek to the ponds as a function of restoring backwater channels. Western Pond Turtle habitat will be restored, including installation of basking structures in and around the ponds. Riparian habitat is restored along 14,000 linear feet of waterways and some recreational access is constructed to facilitate public access and use of the ponds.

6.1.2. Engineering Guidance
ER 1110-2-1150 - Engineering and Design for Civil Works Project, indicates that technical engineering analysis is required and results are documented in the feasibility phase study. These analyses are required to support an appropriate level of plan formulation (including alternative evaluation, economic justification, and identification of a tentatively recommended plan, ER 1105-2-100. ECB 2012-18 was also used to provide guidance on the level of the detail demanded of a GI feasibility level study.

Figure 14 Recommended Restoration Plan Reach 1

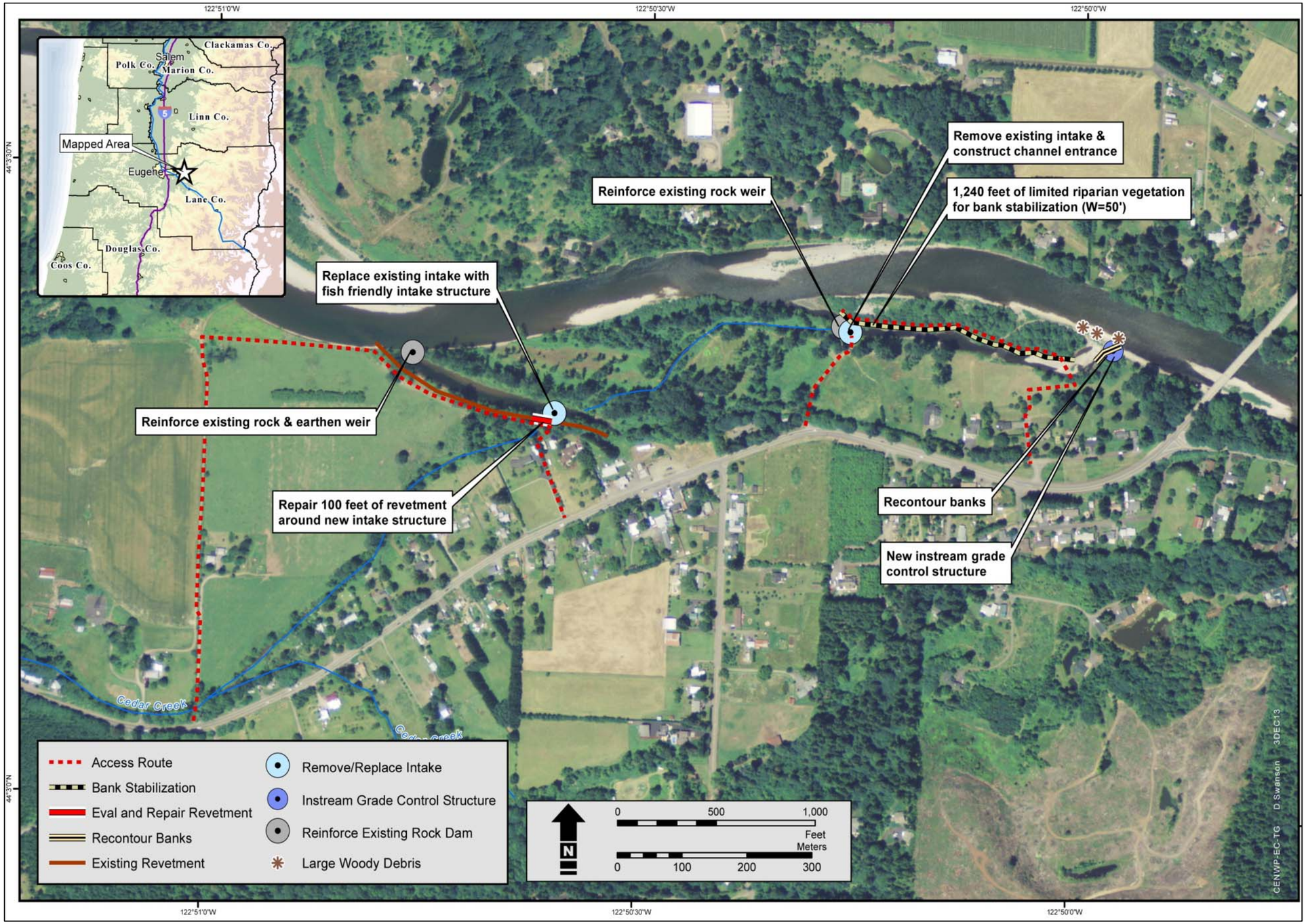


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Figure 15 Recommended Restoration Plan Reach 2

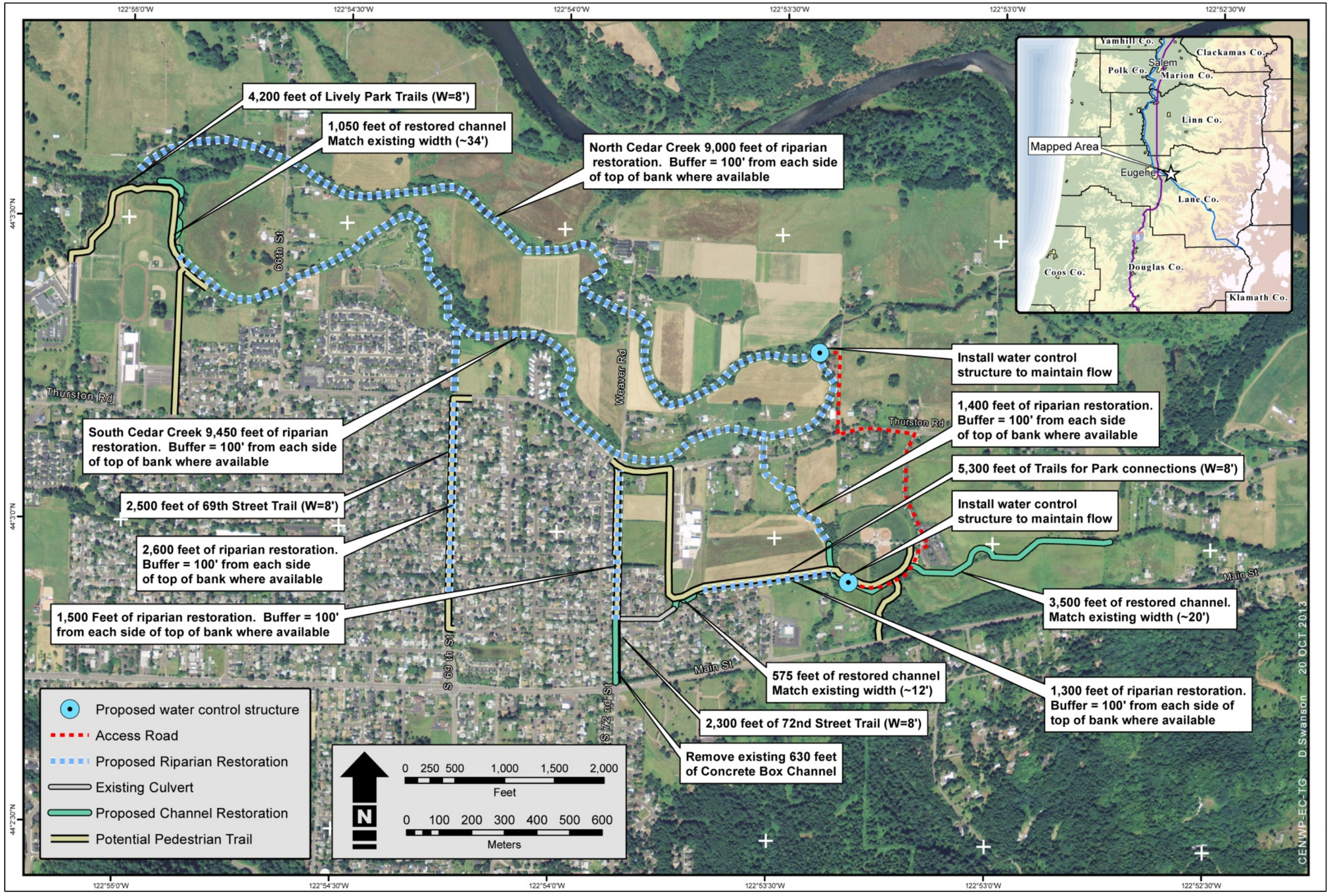

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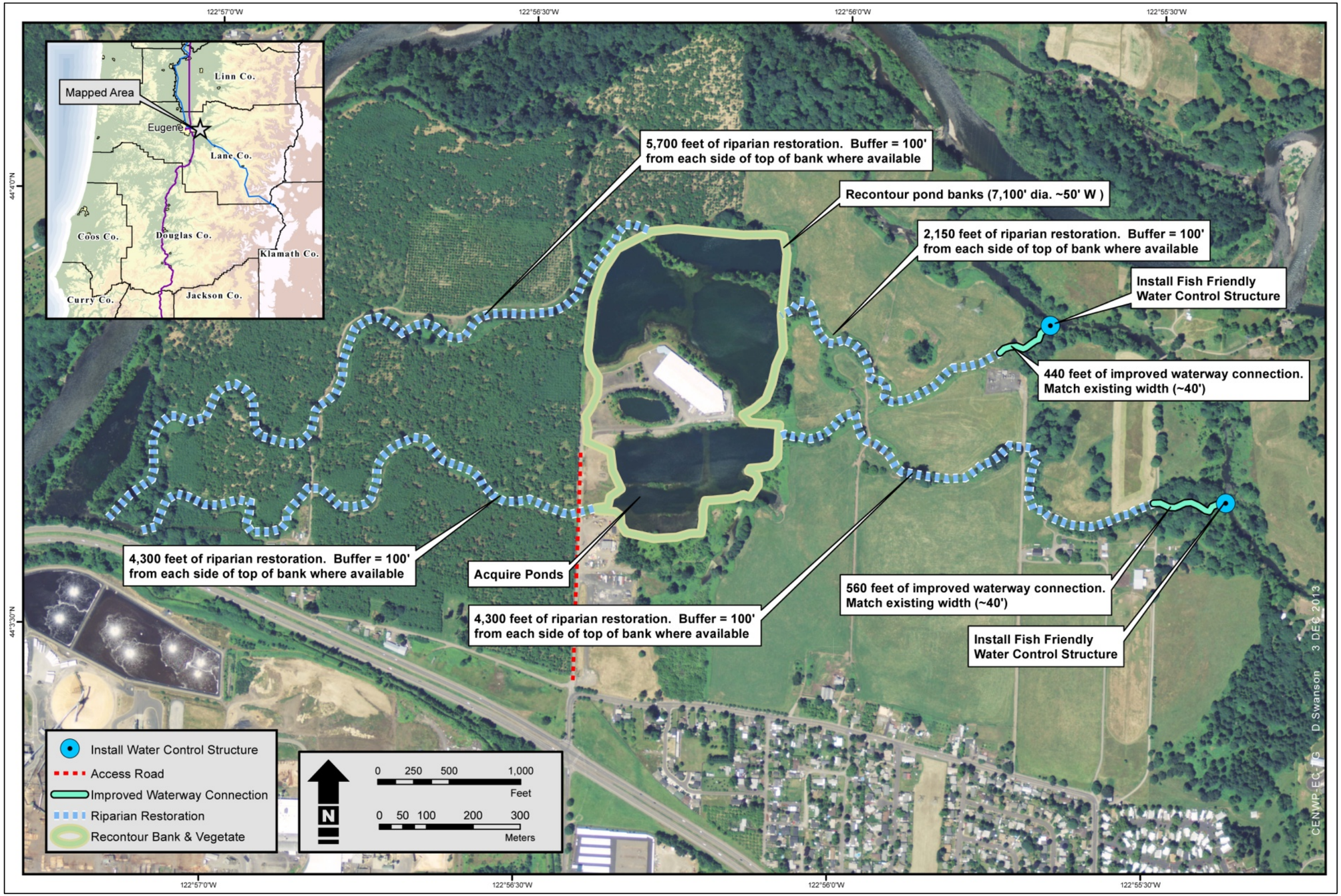
Figure 16 Recommended Restoration Plan Reach 3



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The primary engineering objectives considered during preparation of the feasibility level design were to:

- Provide engineering sufficient to ensure that potential life risk or damage to property issues have been identified/defined and if necessary, qualitatively and quantitatively addressed under the feasibility study.
- Provide engineering sufficient to support cost determination, reduce the level of uncertainty so that a corresponding reduction in (cost) contingency may be achieved.
- Provide engineering sufficient to support the needs of the habitat benefit analyses.

The predominant engineering criteria driving the conceptual designs during feasibility study was hydrologic and hydraulic related (e.g. design flows). However, civil/geotechnical criteria did impact conceptual designs presented in this document. Civil layout conceptual designs criteria accounted for site topography and geotechnical criteria for appropriate type soils was utilized. Civil criteria indicated if a site is inappropriate or if there were known insurmountable hazardous materials issues and/or costly utility conflicts, etc. The level of analysis was subject to available data. Regional and site geology was determined with available general soils survey data, well logs, etc.

Proposed structures are limited to replacing the existing “fish-unfriendly” intake structures in Reach 1, and installing open bottom arches in Reach 3 to improve connectivity of Cedar Creek. It was believed that these structures could be incorporated into the existing project design and cost assumptions even if difficult soil conditions are encountered.

For this study civil/geotechnical criteria for proposed channel side cuts were designed to provide a stable, self supporting condition generally of the order of approximately two horizontal to one vertical maximum slopes. Final stable slope designs will depend on soil strengths, groundwater conditions, and channel flows to be evaluated as design progresses.

Design guidance was necessary for sizing potential management measures (i.e. channels, diversions, etc.) at each reach.

- The waterway connections (e.g. corregated metal pipe archway) diverting flows into Cedar Creek were sized to convey wintertime flows of forty cfs and low summertime flows of ten to fifteen cfs. This was pursuant to existing City of Springfield Public Works’ criteria.

- The design event for drainage facilities in FEMA designated regulatory floodplains and floodways, applicable for Special Flood Hazard Areas (SHAs), was the one percent chance flood (100-year) event as determined by FEMA and regulated through the National Flood Insurance Program participating community, Lane County.

For cost estimation and analysis purposes, trapezoidal channels were used. As design progresses further detail will provide the optimum configuration. For example, it is typical practice for ecosystem restoration projects to design a two stage channel to convey low flows and high flows in different portions of the channel. Configurations are given in *Appendix C*.

6.1.2.1. Induced Flooding and Life Loss Risks Resulting from the Tentatively Recommended Plan

The study purpose does not include Flood Risk Reduction; hence the study is not subject to this regulation. The sole purpose of the project is ecosystem restoration and it is not intended to address flooding and local stormwater issues. The potential for induced flooding causing adverse flood

impacts possibly resulting in life and property loss is understood. For this reason, the tentatively recommended plan measures and alternatives must be evaluated for potential flood impacts and these must be avoided.

For the Cedar Creek and the McKenzie River, FEMA has designated a coincident 100 year flood inundation boundary base flood elevations (BFEs). Existing inundation boundaries were identified for the recommended restoration plan using FEMA Flood Insurance Study (FIS) information (i.e. developed for Lane County and Incorporated areas, etc). Regulated Floodplain mapping is graphically summarized in *Appendix C*.

When evaluating the potential impacts to the FEMA floodplain it was assumed that new facilities would be designed to equal or exceed the capacity of existing channel and not increase the existing floodplain by more than one foot (existing Lane County Floodplain ordinance criteria). This is standard design practice, but should be reevaluated and verified as design progresses.

During evaluation of the recommended restoration plan, the PDT assessed the potential impacts on the floodplain. The recommended plan includes measures to introduce relatively low flows, forty cfs maximum flow, via diversions into the Cedar Creek floodplain. The flow increase has no impact relative to the magnitude of the one percent chance flood event (100-year flood), approximately 980 to 1,895 cfs. As a result, the tentatively recommended plan will not adversely influence the floodplain.

The tentatively recommended plan includes channel restoration as well as riparian improvements. As design progresses, a baseline assessment will be performed and compared to the alternative floodplain effects as modeled in a FEMA approved backwater model (i.e. HEC-RAS). During the study, best professional judgment was used as well as basic design calculations performed to make a preliminary assessment that the tentatively recommended plan is feasible without adversely impacting the regulatory floodplain.

6.2. Cost Estimate

The cost of the recommended restoration plan is presented in Table 17 and all costs are presented using 2013 price indices.

6.2.1. Project Cost Estimate for the Tentatively Recommended Plan

The current construction cost estimate for the tentatively recommended plan is shown in Table 16.

6.2.2. Operations and Maintenance Costs

Over the lifetime of the project (50 years), there will be O&M needs for both recreation and non-recreation components of the project. Estimated O&M costs are included in Table 16.

6.2.3. Non-Federal Responsibilities

The local sponsor will provide all necessary lands, easements, rights-of-way, relocations, and excavated or dredged material disposal areas (LERRDs) for construction and operations and maintenance of the projects in perpetuity. Corps policy precludes cost share credit for LERRDs above 25 percent. Table 17 outlines the non-Federal sponsor's financial responsibilities for implementing the plan.

Table 16 Tentatively Recommended Plan Preliminary Cost Estimate (2013 Index)

Reach	Location	Option	Restoration Construction Costs	Recreation Construction Costs	Engineering and Design	Lands, Easements, Rights-of-Way, Relocations, and Disposal (LERRDs)	Construction Management (includes monitoring)	Total Estimated Project Cost	Average Annual O&M Cost
1	McKenzie River/Cedar Creek	E	$ 881,000		$ 225,000	$ 76,000	$ 136,000	$ 1,318,000	$ 9,000
2	Urban Areas	B	$ 8,947,000	$ 796,000	$ 2,795,000	$ 5,290,000	$ 1,426,000	$ 19,254,000	$ 17,100
3	Blue Water Ponds, Keizer Slough	B	$ 1,788,000		$ 571,000	$ 9,176,000	$ 298,000	$ 11,833,000	$ 2,100
		Total	**$11,616,000**	**$ 796,000**	**$ 3,591,000**	**$ 14,542,000**	**$ 1,860,000**	**$ 32,405,000**	

Percent of Total Project Cost Attributed to Recreation	2%
Percent of Total Project Cost Attributed to Real Estate	45%

* Corps policy limits real estate costs that count toward cost share to 25% of the Total Estimated Project Cost. As such, only $8,101,250 of the LERRDs will count toward the local sponsor's cost share responsibilities.

Cost Share Breakdown

Federal Cost Share Requirements for Engineering and Design (50%)	$ 1,795,500
Federal Cost Share Requirements (65% of qualifying restoration costs; 50% recreation costs)	$ 14,423,213
Local Sponsor Cost Share Requirements for Engineering and Design (50%)	$ 1,795,500
Local Sponsor Cost Share Requirements (35% of qualifying restoration costs; 50% recreation costs)	$ 7,950,038

Total Local Sponsor Financial Requirements

Additional LERRDs Responsibility	$ 6,440,750
Cost Share Requirements	$ 9,745,538
	$ 16,186,288

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Table 17: Non-Federal Sponsor Cost Share Responsibilities

Activity	Activity Cost	Federal Cost	Non-Federal Cost
PED: 50/50 cost share	$3,591,000	$1,795,500	$1,795,500
LEERDs not eligible for cost share	$6,440,750	$0	$6,440,750
Restoration Construction (including eligible LERRDs): 65/35 cost share	$21,577,250	$14,025,213	$7,552,037
Recreation Construction: 50/50 cost share	$796,000	$398,000	$398,000
Total	$32,405,000	$16,218,713	$16,186,288

The non-Federal sponsors have indicated support for the recommended restoration plan and are financially capable of meeting the financial responsibilities.

The non-Federal sponsors will provide their share-of-cost thirty days prior to the solicitation for bids. The non-federal is also responsible for all O&M requirements, as outlined above and described in more detail in *Appendix B*.

6.3. Real Estate

Approximately 230 acres of property would be required to implement the recommended restoration plan. All acquisitions would be through willing sellers and proposed restorations would not require changes to land use plan designations or zoning categories. The non-Federal sponsors have demonstrated their willingness to successfully acquire lands for plan implementation. Total costs for real estate can be found in Table 16.

Potentially affected parcels have been identified, however there is not sufficient design completed at the feasibility phase to negotiate acquisitions with the landowners. Further, with a 20-year implementation schedule, the PDT has determined it is premature to enter into real estate negotiations at this stage. Potential for landowner willingness to sell will be a factor in the implementation process and may affect project implementation scheduling as those with willing landowners will likely be implemented first.

6.4. Construction Issues

The anticipated ecosystem restoration is primarily earth work and riparian plantings. Challenges in performing the work will be related to groundwater issues, dewatering and fish removal, diversion of water, turbidity control, traffic and pedestrian control, working around utility lines, and using heavy equipment in and near residential areas. Working in creek drainages and below normal groundwater levels will require a contractor who has experience and can deal with wet conditions and ecologically sensitive areas. Geotechnical borings should be drilled during the site-specific planning stages so that the ground conditions are known during the bidding phase, and the construction contractors can plan their activities appropriately.

Use of heavy equipment in water-saturated soils is likely to be an issue during construction. Low-ground-pressure excavators and dozers and probably track-haul trucks should be utilized for these conditions to minimize damage to sensitive habitats. Other equipment and tools such as small brush cutting equipment for clearing and grubbing operations is not likely to be a problem.

The work will likely be performed with relatively small crews of four to eight people. Truck drivers will haul undesirable soil and materials offsite and bring needed materials onsite. In water work will be particularly difficult at Cedar Creek due to proximity of the McKenzie River and various sloughs. Specific measures could include temporary cofferdams to support dewatering and possibly stream bypass measures if required. The timing of work would coincide with in-water work windows developed by the State of Oregon for the protection of fish and aquatic wildlife.

6.5. Non-Federal Sponsor Support

The non-Federal sponsors have expressed commitment to supporting the implementation of the recommended restoration plan. This would include assistance with design refinement, modeling, land acquisition, and long-term management and maintenance of Cedar Creek.

6.6. Schedule

The following preliminary schedule has been prepared for this plan.

Table 18 Construction Schedule for Recommended Restoration Plan

	Project Construction Schedule			
	Plans & Specs (Federal Fiscal Years)	Sponsor Certify Lands (Federal Fiscal Years)	Initiate Construction (Federal Fiscal Years)	Complete Construction (Federal Fiscal Years)
Reach 1	2015-2016	2017-2018	2019	2020
Reach 2	2020-2021	2021-2022	2023	2025
Reach 3	2026-2027	2028-2029	2030	2032

6.7. Risk and Uncertainty

The proposed restoration to aquatic, riparian, and wetland habitats within waterways and floodplains of the planning areas will produce environmental benefits provided the measures selected meet project goals are correctly designed, applied, monitored, and maintained over the project life cycle. These proposed restorations will also produce environmental benefits provided that natural and human-caused events outside of the control of project sponsors, that are difficult if not impossible to predict, do not occur. Examples include: catastrophic climate and hydrologic variations causing extreme droughts and floods; and unpredictable human behaviors or events that could cause major land use impacts, such as structural threats to dams.

These projects were conceived using the best and most sophisticated hydrologic and hydraulic modeling available, setting out realistic and achievable objectives, using proven design standards, and applying local policies of “adaptive management” to improve and inform future restoration projects.

Ecosystem restoration management continually confronts situations in which decisions must be made in the face of uncertainty and risk. It is suggested that the appropriate response to uncertainty depends on the likelihood of occurrence and the impact should the risk occur. On-going project monitoring and adaptive management may be the most effective ways to address uncertainty on the ground. Project monitoring and adaptive management are key implementation measures of this project.

Risks to the plan include the following:

- **Climate Change.** Climatic variation could occur over the 50-year life of the plan causing fluctuations in temperature and rainfall amounts resulting in wetter or drier conditions than is

typically experienced, on average, today. These fluctuations could result in changes to the composition of native plant and animal communities, however, these changes would be gradual over time. This risk exists in the study area and throughout the Pacific Northwest. The following data is from a study prepared in 2009 by Oregon State University (OSU), Climate Change Research Institute (OCRI). It is presented to illustrate potential precipitation and temperature changes that are projected to occur within the next few decades.

The report synthesizes potential climate change in the lower Willamette basin, "Projected Future Conditions in the Lower Willamette River Sub basin study of Northwest Oregon: Clackamas, Multnomah County. The following table summarizes findings for the end of the century, but is useful for informing the potential trends through the 50-year planning horizon. The proposed alternatives could be implemented over the next 25 years. Therefore, projected climate changes could be realized within the service life of the Recommended Restoration Plan. Table 19 summarizes potential climate change effects in the lower Willamette watershed and Springfield, OR.

Table 19 Projected End of Century Climate Change Summary for lower Willamette Valley

	A1b Scenario (Business as Usual)	**B1 Scenario (Green Energy)**
Summer Air Temp (F^o)	10 – 15 degree increase	5 – 10 degree increase
Winter Air Temp (F^o)	3 – 5 degree increase	3 – 5 degree increase
Summer Precipitation	Drier (mixed results)	Drier (mixed results)
Winter Precipitation	Wetter (mixed results)	Wetter (mixed results)
Stream flow	Higher winter, lower summer	Higher winter, lower summer
Snowpack	Large decrease	Large decrease

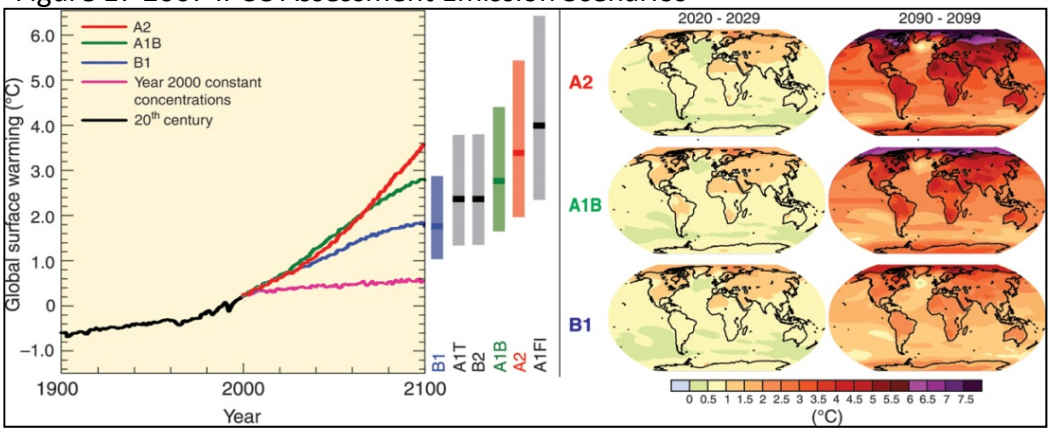
Source: Lower Willamette Valley Climate Preparedness Project modeling results provided at project workshops. Detailed modeling report (Oregon Climate Change Research Institute and Climate Leadership Initiative 2009) available here: http://www.theresourceinnovationgroup.org/storage/LW_ModelResults_Full_Final12.09.pdf.

Note, the A1B scenario (business as usual) is a medium-high end scenario of increasing global temperatures due to increasing rates of greenhouse eminent. B1 (green energy) is a more optimistic future project, where gas emissions are controlled due to technological innovation and widespread adoption of sustainable practices. More information may be found at http://cses.washington.edu/cig/fpt/climatemodels08.shtml.

It was also found that most warming could occur along the I-5 corridor. The projections also showed a sharp shift to a rain driven processes in the basin. Snow water equivalent was forecast to decline eight percent by end of century. Based on this and similar information:

- Likelihood of climate change occurring within 50-years and subsequently posing a risk to the success of the plan: **High**
- Impact should that change occur: **Medium**

Figure 17 2007 IPCC Assessment Emission Scenarios



Regional stakeholders will need to respond to climate change risk, uncertainty and the effects on the habitat, with restoration projects that are robust and resilient to expected temperature, as well as precipitation changes.

Although the details of the final response is far from certain it is likely that management measures adopted regionally will compensate for increased ambient air and water temperatures, as well as lower base flows in the summer time. Fortunately, general ecosystem restoration management measures can ameliorate climate change impacts. Riparian plantings can provide cover which mitigates for increased ambient air temperature and diversion of flows will have beneficial effects offsetting potential lower base flows over time.

- **Land Use Change.** While Oregon's statewide planning law provides a framework for considering land use expectations over the next 25-year period, those expectations can be changed at any time due to unexpected economic influences. This risk exists in the study area.
  - Likelihood of changes to land use that would remove features constructed as part of the proposed plan: **Low**
  - Impact should land uses change resulting in removal of features constructed as part of the plan: **High**

- **Hydrologic Change.** Without considering the potential impacts from climate change, the proposed alternatives and management measures for Reaches 1-3 are highly unlikely to create an adverse hydrologic change or detrimental impacts to existing flow patterns. The basis for this conclusion is the relatively minor changes to existing flows under the Recommended restoration plan. For example, in Cedar Creek proposed flows increases of 40 cfs (over the entire Cedar Creek floodplain) are minimal. Therefore:
  - Likelihood of adjacent hydrologic change: **Low**
  - Impact of adjacent hydrologic change: **Low**

- **Inability to acquire lands.** Alternatives under consideration include land acquisition. The inability to acquire lands from willing sellers or to ensure easements are in place to assure that features constructed as part of the plans remain in place in the future could impact the overall benefits achieved by the plans. This risk exists in the study area.
  - Likelihood of inability to acquire lands: **Moderate**
  - Impact of inability to acquire lands: **Moderate**

- **Funding availability.** Funding to build and maintain all of the proposed projects over the 25-year construction period is an area of uncertainty. This is a risk for the local sponsor. Non-Federal sponsors must be adaptive to the wider spectrum of funding options available in the event the Federal Government's budget is not able to provide the matching share as expected. To that degree, all future construction projects must be able to "stand on their own" as well as fit into the broader watershed system in the event funding is not available to complete remaining upstream or downstream future projects. Each subsequent project must be reviewed to determine the financial capabilities of both the non-Federal sponsor and the federal government to determine whether the project as envisioned is still viable or if adjustments must be made. This risk exists in the study area.
    - Likelihood of funding constraints: **Moderate**
    - Impact of funding constraints: **High**

The feasibility study utilized an approach which emphasized using existing data and risk informed decision making techniques (i.e. risk register and supplemented with project synopsis) to address the most important risk elements. This document identifies and outlines decisions made by the PDT in redressing some of the previous identified deficiencies.

6.8. Areas of Controversy

There are no known areas of controversy with this Study. As design progresses more detailed bathymetric surveying, geomorphic, sediment transport and hydraulic analysis will be obtained or analyses performed to ensure that designs are sustainable once implemented.

6.9. Unresolved Issues

The primary unresolved issue that has been identified is the high cost of real estate for this plan. Corps policy requires limitations on real estate costs to 25% for ecosystem restoration projects. Acquisition activities for an industrial business in Reach 3 are anticipated to be high. In addition, several utility corridors are located in the study area resulting in nearly $2,000,000 in estimated utility relocation costs. These real estate actions have resulted in estimation that real estate costs are nearly 45% of the total estimated project cost.

The non-Federal sponsors have agreed to pay the LERRDs costs above 25% with the understanding that these costs will not contribute to their cost share responsibilities. A request for policy exclusion will be made and completed prior to completion of the Feasibility Phase.

6.10. Implementation Requirements

The Corps is currently drafting a Project Partnership Agreement with the non-federal sponsor that would detail all cost sharing requirements and allocation of work-in-kind and LEERDS. The non-federal sponsor (City of Springfield) would acquire all required real estate (fee or easements) prior to construction of any project, as necessary.

6.11. Operations, Maintenance, Repair, Replacement and Rehabilitation

O&M of the restored waterways would be undertaken by the City of Springfield or other cooperating agency and is likely to be based on ultimate ownership and whether the waterway lies within or outside the UGB. All obligations and requirements with regard to O&M would be stipulated in the Project Partnership Agreement for construction. Anticipated O&M will be as follows:

Urban Waterways

O&M along the waterways lying in or immediately adjacent to the UGB would primarily be the responsibility of the City of Springfield that currently has responsibility for most of those waterways. That includes South Cedar Creek, the 69th, 72nd, and 75th Street Channels, Gray Creek, and Gay Creek.

It is anticipated that the City's regular O&M activities following implementation of the proposed restorations would include the following:

Structure Upkeep: Operating and cleaning the constructed riffle and the open bottom culverts/archways installed at the divergence of South Cedar Creek and North Cedar Creek to maintain optimal flow and remove any debris that accumulates.

Vegetation Management: Where access allows, the City would mow the top of bank and upper slopes of both major and minor flood control channels several times each season. This is both for bank stability inspection purposes and to keep grass and weeds in compliance with the City's own nuisance vegetation codes. Where other mowing constraints provide an opportunity, trees and large shrubs would be encouraged to grow along the upper slopes and top of bank within the mow zone. Along the channel banks, the City would use a more selective vegetation removal technique, which emphasizes leaving vegetation, especially near the toe, while also keeping the central flow channel free from any woody vegetation that could snag other waterborne debris and create impediments to flow. This technique is informally called *green piping* as it allows bank stabilizing vegetation to grow vertically up out of the flow channel and form a canopy over the channel to provide shade, wildlife habitat, and natural resource aesthetics. The amount, type, and frequency of vegetation removed on each channel would be evaluated annually in order to ensure that the system continues to meet its flood conveyance objectives. Timing of mowing would be planned to accommodate flowering plants and breeding birds.

Bank Repair: Where bank stability problems are occurring, the City would employ various forms of bio-engineering to resolve the problem. While it is often still necessary to excavate out slumped materials, the City would attempt to minimize the amount of rip-rap placed into the channel, confining it primarily to repair areas at the toe of the channel. After bioengineering is completed, the area would be replanted with native species that help bind the repair and provide the opportunity for increasing water quality and natural resource benefits.

Cleaning and Debris Removal: Removal of obstructions such as sediment, woody debris, and beaver dams would be evaluated on the potential benefits and liabilities. Obstructions would be removed when necessary to maintain channel capacity. Where capacity is not compromised, debris may be left in place as a beneficial habitat element. Junk, trash, and other human discarded materials would be removed on a routine basis and illegal camping would also be discouraged in order to meet the management objectives.

Trails: Maintenance of soft surface trails would include periodic removal of downed trees and tree limbs, erosion repair where necessary, and periodic resurfacing with wood chips or bark dust.

Cedar Creek Connections

The connections and associated constructed riffle that diverts flow from the McKenzie River would continue to be maintained by the *Cedar Creek Irrigation Association*. O&M activities include keeping the channel operational and free from debris and sediment and regulating flow volumes through the intake gates. The Springfield Utility Board (SUB) and the City of Springfield would work closely with the Cedar Creek Irrigation Association to ensure optimal flows exist to maintain water quality in

Cedar Creek, provide fish habitat and passage, and to recharge groundwater in the vicinity of the SUB well fields.

Blue Water Ponds

Primary O&M activities on Blue Water Ponds after implementation of the proposed restorations would include the control of exotic vegetation along the ponds and associated waterways, maintenance of any recreational facilities, and the operation of the two water control structures that divert flow from Cedar Creek toward the ponds. The ponds themselves would be maintained by the City of Springfield, Park and Recreation District, land trust, or other Non-Governmental Organization that purchases the property, in addition to the water control structures implemented during construction.

7. ENVIRONMENTAL CONSEQUENCES*

7.1. Overview*

The primary objective of this Study and the proposed actions associated with Cedar Creek is to restore environmental conditions that have degraded over time as a result of urbanization, agricultural practices, hydrologic changes, and other factors. The recommended restoration plan was formulated and evaluated for the project goals to:

1. Restore natural habitats along waterways, including main and side channel in-stream habitat, riparian, and wetland habitats and their ecological functions.
2. Restore access to quality habitat, including removing barriers and improving connectivity, and increasing habitat quantity for select species, including juvenile salmonids, bull trout and Oregon chub in Cedar Creek.
3. Restore quality places for public use and community development by restoring waterway corridors.

To meet the Study Purpose and Need, overarching goals and objectives, the site-specific restoration projects in the study area will be implemented over a number of years as funding and property is secured. The purpose of this document is to consider the environmental consequences of implementing restoration measures in Cedar Creek, as well as the expected effects if no actions are implemented. Implementation of the No Action Alternative is expected result in habitat conditions that continue to degrade and further threatened the survival and existence of ESA-listed species and their critical habitats. Successful implementation of the recommended restoration plan is expected to result in long-term ecological benefits that outweigh any short-term negative impacts associated with construction activities in the project areas.

Projects designed to meet Study Goals will provide more consistent year-round flow through Cedar Creek by installing a constructed riffle at the confluence of the McKenzie River. Open bottom arches and fish passable structures would benefit threatened and endangered fish, as well as other aquatic species by providing access to valuable rearing habitat. Channel widening and the creation of side channels will also improve the overall quality and connectivity of floodplain, riparian, and aquatic habitats. Daylighting a portion of Cedar Creek that is currently piped and diverting flows into a historic, abandoned channel would restore the quantity and quality of available habitat. Planting native vegetation and controlling non-native, invasive vegetation would restore riparian habitats, which further improves water quality by providing shade, filtration, and erosion control, as well as providing habitat refugia for terrestrial species. New recreational trails will provide connections and educational opportunities for residents and visitors.

7.1.1. Topography

Under the No Action Alternative, topography within the study area is anticipated to remain the same as the existing condition.

Under the recommended restoration plan, large changes to the topography across either study area are not anticipated.

7.1.2. Geology

Except for the area where new waterway connections and archways will be installed, which is dominated by sand and gravel bars, the geology throughout the other reaches of Cedar Creek generally consist of fine-grained clays, silts and sands, underlain at depth by inter-bedded sands and gravels. The geologic conditions are generally consistent with the restoration projects needs. From a geotechnical perspective, site alterations would primarily involve grading activities. While the exact location of the connections and technical features are yet to be determined, the geologic environment of the general area is well understood, and the extent and size of the structure is small and, therefore, impacts are not anticipated to be substantial.

Under the No Action Alternative, geological characteristics are anticipated to remain the same as the existing condition.

Under the recommended restoration plan, geological conditions are anticipated to remain unchanged as well. No substantial changes to geologic features, landforms, or soil conditions will occur as a result of implementing the recommended plan.

7.1.3. Soils

Due to the large geographic area included in the Study, geotechnical investigations of the entire study area is not economically justified at this time. The PDT utilized local knowledge of the study area to inform the assessment of impacts to study area soils. This local knowledge was determined to be sufficient to identify areas of critical geotechnical concern (none were identified) and inform the decision-making process.

Soils in the study area consist of floodplain soils, mostly sandy loams. The McKenzie River, and Cedar and South Cedar Creeks, are surrounded by fluvents, which are deep well drained soils formed in recently deposited sediment, and typically composed of sand, silt, and gravel with loose, open gravel or sand substrate.

If the No Action Alternative is implemented, and no restoration of the creek channel or in-stream habitat occurs, conditions are expected to continue to decline. Impacts to geology and soils in the study area could be substantial, where erosion, incision and bank slumping continues, resulting in a loss of soils, increased sedimentation of in-stream habitats, and an increased risk of bank failure. Implementation of the recommended restoration plan would alleviate problems associated with erosion in the stream channel. Soils and local geology would benefit from the increased stability of banks and side slopes.

A number of areas are proposed for restoration projects that will repair and stabilize stream channels or reshape waterways to a more natural condition. In these areas, soils would be excavated and redistributed within and along waterways and ponds (where appropriate) to improve local site conditions. Fill would be balanced on-site to the extent possible. Local experiences with these types of restoration projects indicate that removal of excavated materials is sometimes required. Overall, activities associated with soil disturbance are projected to positively impact environmental conditions and negative effects are not anticipated to be considerable over the long-term.

7.1.4. Hydrology and Hydraulics

Under the No Action Alternative, hydrology and hydraulics in Cedar Creek are expected to remain in a degraded state and further decline over time. Pools and other complex microhabitats would be in-filled from suspended sediments resulting from upstream erosion events. Without replacing or clearing the intake structures at the confluence of Cedar Creek and the McKenzie River, fish

passage would not exist, restricting use of this valuable off-channel habitat.

Recommended restoration plan measures are anticipated to provide a higher duration of flows in Cedar Creek than what currently exists. The aquatic habitats in these areas as well as associated terrestrial habitats are expected to be improved over the long term. Alternatives could have some short-term negative impacts due to construction, including diversion of flow and locally restricted access to portions of the stream channel. However, temporary disturbance to areas would be minimized and all areas would be fully restored following construction activities.

McKenzie River diversion rights are not anticipated to be impacted. The positive effects of the proposal outweigh any short-term negative effects to water resources associated with construction activities.

7.1.5. Water Quality

Under the No-Action Alternative, long-term impacts from poor water quality would further degrade habitat conditions by limiting fish and aquatic wildlife use of in-stream and wetland habitats.

Potential climate and hydrologic shifts could exacerbate problems associated with water quality and the existing limitations of urban channels. Channel incision, bank failure, and increased toe erosion, will likely worsen as increased frequency and quantity of storm water runoff increases during the winters. Higher flow volumes and more intense rainfall would increase upstream channel incision. Greater flow velocities and hydraulic stresses would increase channel bank erosion and increase sediment loads deposited in the flatter valley. It is also likely that warmer ambient air conditions within the basin will have adverse water temperature impacts. However, the exact quantification of changes in temperature, flow duration and other water quality parameters cannot be determined at this point. However, in general, projected changes could have an overall detrimental impact to water quality from the sedimentation, as well as temperature perspectives.

On-going activities conducted by the City of Springfield and other local entities are expected to ensure that waters in the Study Area will meet State of Oregon and EPA Clean Water Act TMDL standards within the 50-year planning horizon. It is also expected that the City will take measures to improve ambient water quality standards to improve to comply with state standards during the Study planning horizon.

Under the recommended restoration plan, project construction activities requiring the use of heavy equipment and excavation may temporarily impact water quantity and quality and compact soils, resulting in reduced groundwater infiltration and pollutant uptake functions. Pollutant emissions due to runoff of oils, fuels or grease, and erosion resulting from grading activities may also impact groundwater. Although construction projects on waterway segments would occur during low-flow conditions to the extent practicable, the work may result in short-term impacts to water quality parameters, particularly sediment, dissolved oxygen, and temperature; best management practices would be implemented to minimize, reduce and avoid any and all impacts to water quality. Short-term impacts are expected to be offset by long-term benefits to water resources and aquatic habitats.

The recommended restoration plan is expected to have long-term positive impacts on water resources in the study area. Water temperatures are expected to decrease as McKenzie River flows are introduced into Cedar Creek, Blue Water Ponds, and Keizer Sloughs, improving habitat conditions for rearing juvenile salmonids. Replacing the intake structure with a constructed riffle would re-establish a reliable and sustainable supply of clean, cold water into Cedar Creek and sustain flows during the summer months when temperatures become limiting for cold-water

organisms. Waterway connections are expected to maintain flows in side channels throughout the lower Cedar Creek system. Connecting Cedar Creek to the Blue Water Ponds in Reach 3 will provide additional flushing, drawing on cold groundwater resources to further cool the system. Restoration of riparian vegetation throughout the study area would also improve groundwater infiltration, pollutant filtration, facilitate temperature control via increased shading, and increase the structural stability and in-stream complexity of channels.

7.1.6. Socioeconomic Conditions

This section is a discussion of potential socioeconomic impacts that could occur following the implementation of the measures outlined in the recommended restoration plan.

Community and Regional Growth

Under the No Action Alternative, no changes to community and regional growth are expected. Development and maintenance of existing public facilities would continue as under current conditions.

No long-term adverse impacts to the growth of the community or region are expected to result from implementation of the recommended restoration plan. Improvements to infrastructure and improved recreational facilities are anticipated to generally benefit the community and may provide an economic boost as more visitors are attracted to the Cedar Creek corridor. The PDT does not anticipate the regional growth would be influenced as a result of project implementation beyond growth and development that is expected to occur naturally.

Community Cohesion

No long-term impacts to community cohesion are anticipated under the No Action Alternative in the study area. If no restoration actions are implemented, habitat conditions are expected to decline, which would in turn adversely affect the long-term value of adjacent property, potentially causing very slight changes in use of these areas and community neighborhoods around the project areas.

No long-term adverse impacts on community cohesion will be expected as a result of implementing the recommended restoration plan. Implementation of the recommended restoration plan will not result in permanent changes to the population of any community, segment, or separate parts of the communities or neighborhoods, change income distribution, cause relocation of residents, or alter the quality of life. It is expected that communities in the immediate vicinity of site-specific project actions may experience short-term and minor disruption if traffic is impacted as a result of the construction activities. However, these impacts are unlikely to influence the public to a degree that alters the quality of life in a manner which would necessitate relocating, changing jobs, or otherwise redistribute the community. While property values for lands immediately adjacent to restoration sites might increase following project implementation, it is not expected that values and the associated taxes would impact the taxpayers in this region.

Plan implementation would be in compliance with existing land use regulations. The development of the recommended restoration plan has included public involvement to accommodate community input and facilitate community support for the goals and objectives of the plan. Any specific impacts on a site-scale would be evaluated as projects are implemented within established land use policies of the local entities.

Employment and Labor Force

If no restoration actions are implemented, there would be no additional employment needs for the community, outside of regular repair, maintenance and minor development actions typical of any urban metropolitan area. If development occurs in the study area, some temporary construction

work would be generated, but this is not expected to be more than what would be generated under existing conditions.

The recommended restoration plan is expected to increase demand for temporary employment associated with construction activities, more so than the No Action Alternative. The current business located in Reach 3 will be relocated. As such, employment at that facility is not expected to be negatively affected. There are no negative, permanent impacts expected to impact employment or labor force in the Eugene-Springfield metropolitan area.

7.1.7. Environmental Justice

Under the No-Action Alternative, as the population ages within the study area it can be expected that elderly portions of the environmental justice populations in the study area may increase. Economic development programs in the City of Springfield may reduce overall poverty or provide aid to disabled persons. Additionally, ethnic diversity within the United States as a whole is increasing; this can be expected to occur in the study area as well.

Implementation of the recommended restoration plan in the vicinity of environmental justice populations will improve quality of life for these populations by providing access to recreational opportunities and improved environmental quality. No displacements of these populations are anticipated and no disproportionate long-term negative impacts are anticipated as a result of implementing the recommended restoration plan.

It is possible that these populations may experience temporary negative impacts from construction, such as increase noise levels or dust. However, these impacts will be minimized through application of best management practices and compliance with local construction ordinances.

7.1.8. Cultural Resources

The Confederated Tribes of Grand Ronde Community and the Confederated Tribes of Siletz are the federally recognized Tribes whose traditional homelands and territories lie closest to the APE. Each tribe must be officially consulted prior to project initiation to determine if they have any comments, concerns or questions about any aspect of the project undertakings. No NHPA consultations have taken place at present. However these will be completed prior to completion of the feasibility phase.

An initial review of previous archaeological surveys conducted within the APE revealed that only limited areas have been previously assessed for cultural resources. However, those investigations do not satisfy the current professional archaeological investigative standards set by SHPO. Likewise, no other location within the APE has been previously assessed for cultural resources. Given that the entire APE lies within locations and landforms considered high probability for encountering prehistoric and historic cultural resources, it is recommended that all locations within the APE where potential development-related ground disturbances may occur the APR will be investigated by a professional archaeologist to determine whether any significant cultural resources may be affected by the proposed undertaking activities prior to completion of the feasibility phase.

7.1.9. Land Use

Property Values and Tax Revenues

Studies examining the relationship of land values of adjacent properties to open space/natural resource areas found that property values tend to go up following either preservation or restoration measures. This increase in value is the result of benefits received from open space and natural habitats providing aesthetic and recreational values to adjacent properties. As such, under the No Action Alternative, if project objectives are not implemented and the existing condition continues, property values are not expected to go up.

It is anticipated that property values of lands adjacent to the recommended restoration plan will follow this trend and increase following project implementation. In general, higher land values tend to result in higher tax revenues. For properties that would be acquired in fee title for project implementation by the local governmental sponsor, tax revenues on these properties would go down proportionately as those parcels are not subject to taxation.

Public Facilities and Services

Under the No Action Alternative, no new pedestrian trails, paths, or public use facilities would be developed. Existing public use facilities are expected to be maintained by the City of Springfield, and public use of these areas would continue as under current conditions. The City has plans to increase and develop additional recreational facilities and trails throughout the study area. However, without implementation of the recommended restoration plan these facilities and parks may not have the over-arching connectivity as what is proposed in the recommended restoration plan.

The recommended restoration plan is expected to have positive effects on existing and new public facilities in the form of new pedestrian trails along Cedar Creek where the trails would provide connection to other existing public facilities like parks and schools. Any potential site-specific impacts to public facilities and services involving the use of public parks, tourism, and recreational areas will be positive and benefit all members of the public.

Business and Industrial Development

Similar to the community cohesiveness, no long-term impacts to business and industry development are anticipated under the No Action Alternative. If no restoration actions are implemented, habitat conditions are expected to decline, which could in turn adversely affect the long-term value of adjacent properties which could cause some slight changes to use of the areas. It is possible that some additional lands may be developed for business or industrial use, which would positively benefit business interests, but would further degrade habitat conditions, and possibly decrease residential property values around Cedar Creek.

The recommended restoration plan is expected to have limited adverse impact to business growth. Some of the restoration projects would enable farming and nursery uses in the study area to continue operation with the reestablishment of a sustainable and reliable water supply for downstream irrigation uses. The other most likely long-term impact to business activity would be related to recreational activities as pedestrian and multi-use paths are developed and improved. Small retail establishments in the area might see increased business activity as parks and schools are connected to multi-use paths and used by the public, increasing pedestrian activity.

Prime Farmlands/Farm Displacement

There would be adverse affects to the existing character of farmlands in the project area if the No Action Alternative is implemented. Habitat conditions are expected to further degrade the channel banks of Cedar Creek via erosion and incision of the stream. If no actions are taken to address these problems, it is expected that topsoil could continue to wash into the stream channel during rain events, further increasing the issues of erosion throughout this off-channel habitat. Furthermore, bank failures would continue to reduce the acreage available for farm and agricultural development.

The recommended restoration plan would impact prime farmland soils within project areas primarily by riparian restoration, channel widening, and improved connectivity. Out of 1,800 total acres in the study area, approximately four percent, or 74 prime farmland acres, would be affected by project activities. An analysis of the 74 acres shows that approximately one-third of those acres within the recommended restoration plan are currently in residential or industrial uses, which means that

development has occurred since the classification of prime farmland soils. Restoration of channel habitat in these areas would not further impact these farmlands, or change their use for crops or pasture lands. Approximately two-thirds of the remaining prime farmland acres are in agricultural uses, however, the majority of those acres within the recommended restoration plan are stream channels or vegetated riparian areas, and construction activities would result in very few agricultural acres taken out of production.

Plan implementation is not anticipated to modify the characteristics of lands designated as prime farmland; rather, plan implementation would change the land use and improve the overall habitat conditions but not change the farmland designation. Under the recommended restoration plan, the restored features of these acres would improve the health of the impacted lands, as well as potentially those adjacent agricultural lands. Removing these lands from productivity is not expected to have greater adverse impacts from use conversion than if the lands were developed.

7.1.10. Recreation

The study area has a variety of public parks and public lands that provide open space recreational opportunities. Any use of existing facilities is expected to stay the same under the No Action Alternative. Minor improvements to these facilities could occur, including regular maintenance activities. The City may build or create additional recreational features under the No Action Plan, but these actions would be dependent upon available funding and priorities.

In the recommended restoration plan, recreational opportunities are expected to expand through connecting trails and construction of minor recreational facilities near the Blue Water Ponds. Beneficial impacts would result from project activities near schools as recreational elements combine with expanded educational opportunities. Any negative short-term construction impacts, such as trail construction, would be minimal and would not prevent continued park use during project activities.

7.1.11. Vegetation and Habitat Types*

Under the No-Action Alternative, the potential for improving habitat connectivity between and among the existing riparian habitats and waterways will be reduced. Existing streams will remain at risk to urban encroachment and loss of water quality function if no action is taken to improve aquatic and riparian conditions. Higher runoff rates and volumes associated with urban hydrology tend to harm sensitive, riparian species more than invasive plants. The No-Action Alternative will likely contribute to additional loss of native habitat to encroachment by invasive species.

Existing acres of open water, riparian, and wetland habitats are projected to decrease under the No Action Alternative, from 2,269 acres to 2,038 acres, over the 50-year planning horizon. Under the No-Action Alternative, the potential for improving habitat connectivity between and among the relatively few existing higher quality sites will be reduced, especially for the headwater streams and the downstream sections of Cedar Creek, Gray Creek, 75th Street Channel, and the McKenzie River. Projects undertaken in the future by the City of Springfield or other local partners will not likely address habitat restoration at the watershed scale, and without this, habitat connectivity will not be addressed at a wider scale where it is most needed.

Through implementation of the recommended restoration plan, native wetland plant species would benefit from increased riparian vegetation and diversity and complexity of wetlands and aquatic habitats will benefit from implementation of the recommended restoration plan. The diversity and distribution of habitat types is expected to increase where habitat component are installed. For example, the placement of large woody debris and boulders provides additional habitat available for fish and wildlife. These micro-habitats would only be available by implementing the recommended

plan. In addition, Removal of invasive, non-native plant species along the channel banks would benefit plant communities by reducing competition, releasing the existing native seed bank in some areas, and making existing nutrient resources available for uptake.

7.1.12. Air Quality

No long-term impacts (positive or negative) to air quality are expected from implementing either the No Action Alternative or the recommended restoration plan. As discussed earlier, air quality in Lane County is primarily dependent on major roads and traffic volumes in the area. It is unlikely that major roadways would experience a significant re-routing in the study area or an increase in traffic volumes during the project horizon with or without restoration.

During the construction phase of some restoration features, there are likely to be short-term air quality impacts associated with construction equipment in the form of increased levels of engine emissions and dust. These impacts are not anticipated to be substantive and would not persist following construction. If the No-Action Alternative is implemented and future development occurs in the project area, traffic volumes may increase regardless of implementation of the restoration plan proposed herein. However, it is unlikely to increase to a level that causes detrimental impacts to air quality in the region.

7.1.13. Noise

No major, long-term changes in noise levels are expected under the No-Action Alternative or the recommended restoration plan. Current noise levels vary throughout the watershed, but most waterway reaches are affected by noise from local roads with moderate to light traffic. The exceptions are Gray Creek and the 72nd St. Channel which are close to Highway 126, a state roadway with moderate average daily volumes. Traffic counts on Hwy 126 near I-5 show 2009 average daily traffic estimate of approximately 60,000 cars and trucks; however traffic counts near 72nd Street are expected to be lower. Noise levels are not expected to change with or without implementing restoration measures. Traffic volumes are expected to stay similar to current conditions throughout the planning horizon (50 years).

Even along “high traffic” portions this section of highway, baseline noise levels from ambient traffic generally are below 55 dB, which is in the acceptable range. A temporary and minor increase in noise levels can be expected in associated with the construction phase of some restoration projects. Noise associated with construction equipment, similar to road maintenance or utility projects, would affect localized areas for limited time periods. There are a few noise-sensitive facilities, such as schools and medical clinics, in some project areas but not in close proximity. It is possible to mitigate construction related noise impacts through a variety of BMPs.

7.1.14. Hazardous and Toxic Materials

It is not anticipated that HTRW would be impacted during implementation of the No Action Alternative or the recommended restoration plan. No sites with HTRW issues are recommended for restoration and it is not anticipated that HTRW issues will arise prior to plan implementation.

7.2. Fish and Wildlife*

Under the No-Action Alternative, existing environmental conditions for fish and wildlife will continue to degrade over time due to loss of habitat, encroachment of invasive species and urban development. Limited or reduced habitat restoration will occur and connectivity between areas of habitat and migratory corridors will be lost as development increases over time. It is expected that local governments will implement small scale habitat improvement projects in an effort to delay or avoid the continued degradation; however, habitat connectivity may be lost throughout the

watershed because of this “piecemeal” restoration approach. These losses may contribute to existing species of fish and wildlife becoming rare or possibly even extirpated from the study area.

With implementation of the recommended restoration plan, habitat restoration measures would have long-term beneficial effects for a variety of fish and other aquatic species. Positive impacts include decreased water temperatures for cold-water species, especially during low flow months in the summer when temperatures naturally increase; increased diversity and distribution of habitat types throughout the watershed; increased channel complexity following installation of habitat features; increased diversity and quantity of riparian vegetation following removal and management of non-native plant communities; and increased diversity of aquatic habitats and wetland areas. Channel widening and reshaping is expected to benefit aquatic and wildlife habitat in the long-term, allowing the channel to fluctuate naturally within a defined area.

Construction actions are expected to result in temporary, short-term impacts to the availability and quality of habitat areas during plan implementation. Waters may experience increased levels of turbidity, but levels are expected to temporary and localized. Some portions of habitats may not be accessible during construction, but all areas will be restored following implementation of the restoration features. In addition, all actions will follow best management practices to minimize and reduce adverse impacts to fish and wildlife during construction.

The habitat restoration actions that will be implemented will benefit a multitude of plants and wildlife species. The Oregon Conservation Strategy has identified key species in the McKenzie River area, including Western meadowlark, bull trout, Oregon chub, and Western pond turtle. The proposed projects is expected to benefit these and other targeted species by creating nesting and rearing habitat, expanding and creating high quality riparian areas, improving in-stream habitat, improving water quality.

7.3. Threatened, Endangered, Candidate and Rare Species*

NEPA coordination requires that the Corps consult with agencies with jurisdiction over ESA-listed threatened and endangered species likely to occur in the planning area, namely the USFWS and NMFS. The proposed project activities in Cedar Creek require consultation with both NMFS and USFWS, and species under the jurisdiction of both agencies are present in the study area. The status of these species was described in earlier sections of this report, and the possible effects to these species are detailed below.

Under the No Action Alternative, access into Cedar Creek from the McKenzie River would be inaccessible to fish. The existing intake structure is blocked and is not fish passable. As a result, only resident fish would have access to the off-channel habitats of Cedar Creek. However, these fish would experience increased water temperatures and degraded water quality. Threatened and endangered fish species in the McKenzie River would only benefit from the off-channel habitats of Cedar Creek when the river overflowed its banks during high flow events. This benefit would be temporary and would occur infrequently, only when river flow in the McKenzie was sufficient to flow overland, carrying fish and debris into the stream channel.

However, under the recommended restoration plan, the greatest beneficial impact would be connectivity of the Cedar Creek System to the McKenzie River. In addition, improved connectivity of the lower reaches of Cedar Creek would ensure year-round flow would be available for fish and wildlife, including threatened and endangered species present in the study area. Facilitating fish access to the off-channel habitat found in the Cedar Creek system would greatly benefit juvenile salmonids, increasing the quantity and quality of valuable rearing habitats, thereby increasing survival during outmigration to the estuary.

UWR Chinook salmon (T)
The recommended restoration plan restores riparian vegetation, reduces erosion, and increases connectivity in Cedar Creek and its side channels. These actions would benefit juvenile Chinook by providing additional refugia during storm events and year-round access to rearing habitat.

In addition, the recommended restoration plan will directly benefit designated critical habitat for this species through installation of a constructed riffle upstream of the existing structure in the McKenzie River that allows an open water, fish-friendly connection as well as maintaining hyporheic flow. In addition, improving the connectivity throughout Reaches 2 and 3 via open bottom arches or culverts would maintain flow in South Cedar Creek during the summer, facilitating use of this valuable habitat. Restoring riparian vegetation for shading, filtration, and habitat further improves water quality.

Much of this habitat is not currently accessible to juvenile Chinook, unless they enter from the downstream outfall of Cedar Creek. For this reason, it is unlikely that many juveniles would be present during construction activities and therefore it is not expected that construction activities would adversely affect juvenile Chinook. Adults are not present in Cedar Creek and similarly, they would not be present during construction and therefore would not be affected by project related activities. Continued consultation and coordination with the resource agencies (NMFS) during site-specific project development is anticipated to provide direction for how best to minimize direct impacts this species. Any work requiring in-stream activities would be preceded by fish salvage operations to minimize the instance of ‘take’ to reduce and eliminate violations to the ESA. These activities would be coordinated with ODFW and NMFS prior to project implementation.

Bull trout (T)
Critical habitat for bull trout only occurs in the McKenzie River, which is the northern border of the study area. The only direct impact from the recommended restoration plan to this habitat would come from diversion of water from the McKenzie River into Cedar Creek. The diversions are designed to provide sufficient flow to Cedar Creek without appreciably or measurably decreasing McKenzie River in-stream flow. To the extent that the plan would improve water quality in Cedar Creek, this is expected to improve downstream water quality in the McKenzie River where Cedar Creek returns water to the McKenzie., positively impacting bull trout and their habitats. The plan would contribute cooler stream temperatures, more stable channel beds, and greater riparian habitat diversity and cover in the Cedar Creek system, which may be used by bull trout juveniles and immature adults during their seasonal migrations.
Like Chinook, on-going consultation and coordination with the resource agencies (USFWS) during site-specific project development is anticipated to provide direction for how best to minimize direct impacts this species. Any work requiring in-stream activities would be preceded by fish salvage operations to minimize the instance of ‘take’ to reduce and eliminate violations to the ESA. These activities would be coordinated with ODFW and USFWS prior to project implementation.

Oregon Chub (T)
Within the Cedar Creek Planning Area, Oregon chub are found in meander channels and backwater ponds along the McKenzie River in Big Island, northeast of Cedar Creek’s outlet into the McKenzie. In addition, chub have recently been found in the slough habitat in Cedar Creek downstream of the existing intake structures. To the extent that meandering channels are improved to provide more riparian vegetation for shading, filtration, and fish friendly connections, the recommended restoration plan has the potential to expand habitat (and access to habitat) for this listed species. Furthermore, project features in Reach 1 will include strengthening the earthen weir downstream of the constructed riffle. These actions will be implemented to ensure the longevity of the weir which

protects the oxbow/slough habitat upon which chub depend, providing long-term benefits to this rare species. In addition, adding large woody debris and boulders to the weir will increase aquatic complexity and provide refugia for chub, increasing the quality of these areas for chub.

There are likely to be short-term effects to critical habitat due to in-stream construction activities, which may increase turbidity and sediments in downstream reaches. These and any other impacts are expected to be short-term and of local extent, and would be additionally outweighed by long-term positive impacts of implementing the recommended restoration plan.

7.4. Cumulative Effects in the Study Area*

Cumulative impacts are defined as:

> "A cumulative impact is defined as the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions (from the Council on Environmental Quality, Regulations for Implementing the Procedural Provisions of the NEPA, 40 CFR Parts 1500-1508).
>
> A U.S. Environmental Protection Agency (EPA) report states that cumulative impacts of an action can be viewed as the total effects on a resource, ecosystem, or human community of that action and all other activities affecting the resource no matter what entity (Federal, non-Federal, or private) is taking the actions (EPA 315-R-99-002)."

Euro-American settlement of the Willamette Valley has incurred dramatic changes to the floodplain beginning in the early 1800s. As communities were established in the floodplains and agriculture dominated the landscape, dams and revetments were constructed to minimize the risk of flood and prevent damages resulting from high flow events. These changes have significantly altered the region, disconnecting historic stream channels from river mainstems, which further impacts riparian and wetland habitats and greatly reduced their quality and viability, and distribution across the landscape. Reductions in these valuable habitat types have had additional adverse affects to regional flora and fauna.

Reasonably foreseeable future actions in the study area of the McKenzie River and Cedar Creek include the following:

- As yet unidentified, but likely continued residential development on privately owned lands within the floodplains of the McKenzie River, the City of Springfield, and the Thurston Hills area;
- Implementation of water quality improvements by the City of Springfield and Lane County, associated with the TMDL Implementation Plans. These actions may include riparian restoration for shade credits along the mainstem McKenzie River and their tributaries, further treatment of wastewater and other point source discharges via tertiary treatment and the use of infiltration areas, wetlands, or direct injection into the ground;
- The implementation of fish passage, water quality (selective withdrawal), and restoration actions by the Corps for compliance with the Biological Opinions (NMFS 2008a; USFWS 2008). Specific actions required in the Biological Opinions for the McKenzie subbasin include temperature control projects at Cougar Dam.
- The installation of fish screens or other fish protection devised per NOAA standards on all dams/diversions/intakes associated with Bureau of Reclamation water contracts in the subbasin;

- Other restoration actions undertaken by a variety of stakeholders in the subbasin, particularly the McKenzie River Watershed Council. The Council's strategy to protect and restore fish and wildlife habitat, water quality and quantity, and promote community stewardship is outlined in the McKenzie River Conservation Strategy and include riparian plantings, fish and wildlife improvement, water quality monitoring, flow and fish passage actions (Runyon 2002).

Neither the No Action Alternative nor the recommended plan is likely to have cumulative effects on socio-economic conditions, recreation, cultural resources, hazardous materials, air quality, or noise within the study area. Thus, these elements of the environment are not discussed further in the context of cumulative effects.

The No Action alternative will not include undertaking any actions, but there will be on-going and future cumulative effects from the reasonably foreseeable future actions and climate change on hydrology and hydraulics, geomorphology, water quality, fish and aquatic habitat, terrestrial species and habitats, wetlands, and threatened and endangered species. The direct effects are described previously in this chapter and are expected to negligible to the overall quality and quantity of natural and human resources in the study area. Overall, while regulatory mandated actions and other restoration projects are intended to provide improvements in hydrologic conditions and stimulate some geomorphic change (within allowable flood risk management requirements) and will tend to improve the quality of both aquatic and floodplain/riparian habitats and contribute towards listed species recovery, continued population growth and development along with climate change effects will tend to counterbalance the overall effects at the study area scale with some additional degradation of habitats, water quality, and hydrology/hydraulics and geomorphic conditions. Overall, the cumulative effects under the No Action Alternative are expected to minor because existing regulations are effectively in place to reverse and slow the development and urbanization of natural areas, which is the leading cause of detrimental environmental effects to resources of concern.

It is anticipated that implementation of the recommended restoration plan would incrementally reverse some of the cumulative adverse effects that have occurred in the study area via the direct conservation and restoration of regionally and nationally significant ecological resources. Replacing the intake structures at the confluence of Cedar Creek and the McKenzie River would restore fish access and use of Cedar Creek. Additional improvements to the riparian habitat along the stream corridor, together with construction actions to realign and increase complexity to select stream reaches would further increase the functional quality and physical structure of the stream, restoring a more naturally dynamic system and ecosystem processes.

At this time, this Study serves to address environmental consequences and affected resources at the watershed scale and not enough detail is available to discuss specific impacts to the environment as a result of project implementation. At the broad scale, the recommended restoration plan, in combination with other restoration actions occurring in the broader Upper Willamette River watershed, would have a positive cumulative effect on the watershed. Implementation of urban comprehensive plans is expected to continue in the future. This Study has been informed by those existing comprehensive plans and is assured not to conflict with them, but rather have a compounding benefit from the combined successful implementation. Urban development in the City of Springfield must adhere to strict development guidelines that reduce the potential for negative impacts. As such, it is anticipated that implementation of these urban comprehensive plans and future development actions would not offset the benefits realized through implementation of the recommended restoration plan.

The recommended plan will have temporary adverse direct effects during construction on water quality, but it is unlikely that there will be other reasonably foreseeable future actions occurring in the immediate proximity or at the same time as the recommended plan so the temporary construction effects such as increased turbidity, disturbance, fish handling, etc. are not likely to cumulatively interact with other projects.

7.4.1. Hydrology and Hydraulics

In the long-term, the recommended plan will incrementally reverse some of the cumulative adverse effects that have occurred in the project area by restoring a more natural hydrologic connection between the Cedar Creek and the McKenzie River, and the respective floodplain. While this project will not directly affect flows in the McKenzie, it will allow flows in Cedar Creek to be more consistent in volume and seasonality. The recommended plan will incrementally help ameliorate some of the cumulative adverse effects on hydrology and hydraulics in the study area.

7.4.2. Geology and Soils

The recommended restoration plan is intended to create some limited geomorphic responses to the floodplain and substantial riparian restoration will restore riparian habitats over the long-term. This would stimulate sediment sorting and deposition in Cedar Creek, enhancing in-stream habitats. However, the recommended plan will not substantially restore natural geomorphic processes. The recommended plan will help ameliorate some of the cumulative adverse effects on geomorphology and help the study area to remain more resilient in the face of climate change by allowing sediment and wood processes to continue in the floodplain.

7.4.3. Water Quality

The recommended restoration plan is intended to promote groundwater recharge and flushing where Cedar Creek connects to the Blue Water Ponds and the McKenzie River. This may have minor overall cumulative benefits to water temperature by somewhat increasing groundwater flows back into the river. Other actions required for TMDL compliance by stakeholders will likewise reduce temperatures and improve water quality parameters. However, climate change will continue to increase air and water temperatures. The recommended plan will help the study area to remain more resilient in the face of climate change by incrementally enhancing water quality, in addition to promoting groundwater recharge and subsequent discharge to the rivers.

7.4.4. Fish and Aquatic Habitat

The recommended restoration plan is intended to restore large areas of aquatic and floodplain habitat for fish refugia and rearing. This will help to ameliorate some of the cumulative adverse effects on fish and aquatic habitat which are the result of decades of dam construction and widespread loss of habitat. Restoration of these habitats will provide important refuge areas in the face of climate change. Overall, the recommended plan will also work in concert with other restoration actions in the study area to help to reverse cumulative effects experienced by fish and aquatic organisms.

7.4.5. Terrestrial Species and Habitats.

The recommended restoration plan will restore riparian habitats that are important for migratory birds, mammals, and other terrestrial species. This will incrementally help to ameliorate some of the adverse cumulative effects that have occurred to terrestrial species and habitats over time. Restoration of the riparian zone will increase the biodiversity and distribution of native plants along Cedar Creek, providing a more-connected migratory corridor for some wildlife. The recommended plan will also work in concert with other restoration actions in the study area and adjacent upland areas to help to provide better linkages both along the rivers and from aquatic to upland habitats.

7.4.6. Wetlands.

The recommended restoration plan will improve wetland habitats on the project sites by removal of invasive species and increasing the area of shallow water habitat to be revegetated with native species. In the scale of the study area, this may help to maintain wetland habitats in critical areas for species that use wetlands and promote linkages between the rivers and uplands. However, wetland habitats, while they will continue to be regulated in the future, are likely to become more fragmented over time, even with future restoration actions.

7.4.7. Threatened, Endangered and Special Status Species

The recommended restoration plan will improve habitats for several listed species, particularly salmonids and chub. While the recommended plan is only one component of the recovery requirements, it will incrementally help in the recovery of these species. Other restoration actions in the study area are also directed at recovery of listed species and will also contribute towards their recovery. However, it is unclear, even with the reasonable foreseeable future actions, if species will be recovered within the period of analysis and what level of contribution the proposed restoration plan will have towards recovery.

7.4.8. Human Environment

For the human elements of the environment, the recommended restoration plan will have no cumulative effects as the temporary induced increases in traffic, air emissions, and construction equipment noise would be minor and comply with all County codes. The recommended plan will have cumulative beneficial effects on recreation where planned recreational trails and public use areas are developed in conjunction with the successful restoration of the sites and improved safety conditions. In general, implementation of the recommendation restoration plan would coincide with other restoration actions elsewhere in the Willamette Valley, include the Corps' Willamette Floodplain Project that is currently in the PED phase.

7.5. Relationship between Short-term Uses and Long-term Productivity

The temporary use of construction equipment and materials during construction would be minor in the scale of energy use, air quality and noise effects in light of the long-term benefits realized by restoring floodplain processes and habitats. By restoring these habitats, the sites will become more ecologically functional, useful for future conservation efforts, and increase recreational uses.

However, restoration actions in the study area will restrict future floodplain development along the channels, and severely limit their use for further gravel mining and development. In the long-term, the benefits of restoration are expected to reduce the use of energy and further improve air quality and reduce noise effects within the floodplain. The proposed restoration plan is highly unlikely to adversely affect the regional economy and may provide minor beneficial economic effects by dampening the adverse effects of flood damages and provide a suitable venue for recreation, increasing aesthetics and quality of life for nearby residents.

7.6. Unavoidable Adverse Impacts

Important, sensitive resources may be negatively impacted by temporary and localized construction activities in the study area, including aquatic and wetland habitats, water resources, riparian habitats, threatened, endangered, and rare species, and recreational trails. Additionally, critical habitat for Chinook salmonids and Oregon chub may be temporarily affected during construction activities. In spite of the adverse effects from construction activities, the overall impact to natural habitats and ecological functions would be beneficial through time and these unavoidable adverse

impacts are expected by be outweighed by the functional benefits of increasing the availability and access to higher quality habitats for fish and wildlife.

As site-specific projects are designed in more detail during PEd, the Corps will attempt to avoid impacts to any architectural, archeological, or other historic object or property.

7.7. Mitigation Measures

Construction practices would be implemented to minimize any adverse effects to the maximum extent practicable. Efforts include the implementation of erosion and pollution control measures (i.e. silt curtains, silt fencing, mulching), working in waters during allowable in-water work windows, work area isolation (such as using coffer dams and silt curtains), fish salvage and removal (per an approved fish salvage plan and valid Scientific Collection Permit approved by NMFS or USFWS and ODFW), noise reduction measures for pile driving such as using coffer dams and driving piles out of waters, and other appropriate measures to be developed during the design phase.

7.8. Environmental Operating Principles

The United States Army Corps of Engineers Environmental Operating Principles were developed to ensure that Corps of Engineers missions include totally integrated sustainable environmental practices. The Principles provided corporate direction to ensure the workforce recognized the Corps of Engineers role in, and responsibility for, sustainable use, stewardship, and restoration of natural resources across the Nation and, through the international reach of its support missions.

Since the Environmental Operating Principles were introduced in 2002 they have instilled environmental stewardship across business practices from recycling and reduced energy use at Corps and customer facilities to a fuller consideration of the environmental impacts of Corps actions and meaningful collaboration within the larger environmental community.

The concepts embedded in the original Principles remain vital to the success of the Corps and its missions. However, as the Nation's resource challenges and priorities have evolved, the Corps has responded by close examination and refinement of work processes and operating practices. This self-examination includes how the Corps considers environmental issues in all aspects of the corporate enterprise. In particular, the strong emphasis on sustainability must be translated into everyday actions that have an effect on the environmental conditions of today, as well as the uncertainties and risks of the future. These challenges are complex, ranging from global trends such as increasing and competing demands for water and energy, climate and sea level change, and declining biodiversity; to localized manifestations of these issues in extreme weather events, the spread of invasive species, and demographic shifts. Accordingly, the Corps of Engineers is re-invigorating commitment to the Environmental Operating Principles in light of this changing context.

The Environmental Operating Principles relate to the human environment and apply to all aspects of business and operations. They apply across Military Programs, Civil Works, Research and Development, and across the Corps. The Principles require a recognition and acceptance of individual responsibility from senior leaders to the newest team members. Re-committing to these principles and environmental stewardship will lead to more efficient and effective solutions, and will enable the Corps of Engineers to further leverage resources through collaboration. This is essential for successful integrated resources management, restoration of the environment and sustainable and energy efficient approaches to all Corps of Engineers mission areas. It is also an essential component of the Corps of Engineers' risk management approach in decision making, allowing the organization to offset uncertainty by building flexibility into the management and construction of infrastructure.

The re-energized Environmental Operating Principles are:

- Foster sustainability as a way of life throughout the organization.
- Proactively consider environmental consequences of all Corps activities and act accordingly.
- Create mutually supporting economic and environmentally sustainable solutions.
- Continue to meet our corporate responsibility and accountability under the law for activities undertaken by the Corps, which may impact human and natural environments.
- Consider the environment in employing a risk management and systems approach throughout the life cycles of projects and programs.
- Leverage scientific, economic and social knowledge to understand the environmental context and effects of Corps actions in a collaborative manner.
- Employ an open, transparent process that respects views of individuals and groups interested in Corps activities.

7.9. Conclusions*

As development of the Study has progressed, the PDT determined that implementation of the recommended restoration plan would not result in permanent adverse environmental impacts. In addition, effects were determined to be *not significant*, negating the need to prepare an Environmental Impact Statement. This determination is based on the evaluation and discussion of effects described in Chapter 7, specific to Cedar Creek. Project actions are not expected to result in significant impacts to the human environment, as defined the Center for Environmental Quality's Regulations for Implementing NEPA (40 CFR §1508.27).

While there may be some negative impacts associated with the proposed actions related to short-term, construction-based activities, the projected long-term benefits to aquatic, riparian, and wetland habitats, water resources, and improved social opportunities, will far outweigh any short-term adverse or detrimental effects resulting from construction and implementation activities.

8. PUBLIC INVOLVEMENT*

8.1. Public Outreach

Involving the public in a meaningful way throughout the Study has been central in assuring that the study produces not only a scientifically sound and technically feasible plan, but one that is widely accepted and implementable. The overall purpose of the public outreach program was to keep the public up to date on the progress of the Study and to seek direct input and feedback from the public that was used to shape the restoration proposals. Public input was specifically sought on the Study scope; identification of problems, opportunities, and issues; and evaluation of restoration options.

The citizen involvement strategy combined a number of outreach techniques and was a combination of Corps requirements and the local partner's preferences. Key elements of the public outreach component used during the Study are as follows:

Project Website (www.metrowaterways.org)
A Study website was developed and maintained as a key element of the citizen involvement strategy. Project maps, fact sheets, summary reports, and other related materials have been regularly posted on this site as they were produced. The site has also been used to help advertise the workshops and a questionnaire was posted for electronic input. As an indication of use, during the first two month period after the web site was created (December 2004), it received a total of 641 visits and 331 unique visitors. This web site was regularly updated from 2004-2008. No updates have been made to the project websites since 2008.

Study Informational Flyer
A total of 6,000 informational flyers were printed in December 2004 and distributed by mail to approximately 5,500 interested parties and potentially affected property owners and residents. In addition, the flyer was distributed at the January 2005 workshops. A copy of this flyer is posted at www.metrowaterways.org.

Questionnaire
A study questionnaire was created and distributed as part of the 5,500 piece mail-out to the interested parties and potentially affected parties list as was also posted on the web site in January 2005. A total of 199 completed questionnaires were returned. This survey was approved by the Office of Budget and Management (OMB). The results of this questionnaire are included in the Citizen Involvement Summary Report at www.metrowaterways.org.

Interested Parties
Central to the citizen involvement strategy was the development of an *interested parties list.* The list was initially established via input from non-Federal sponsors and participating watershed councils, and has grown incrementally through the course of the study. The list includes a wide array of watershed interests and currently includes approximately 700 names and organizations.

Public Outreach Events
A total of three sets of outreach events, or public workshops, were held during the development of the plan:

- **Outreach Event One** was held on January 19, 2005 in Springfield and focused on introducing the public to the Study and to the priority planning corridors as well as seeking feedback on the project scope, issues, and opportunities. The workshop had a

similar format that included a PowerPoint presentation and a question and answer period. The workshop focused on Cedar Creek. See *Appendix D* for a summary of input received at this event.

- **Outreach Event Two** was held on February 16, 2006 in Springfield with a focus on Cedar Creek. These workshops included a presentation on the key findings from the Without-Project Conditions Report and developing guiding principles to be used for the development of the restoration options. See *Appendix D* for a summary of input received at this event.

- **Outreach Event Three** was held in February 2008 in Springfield focused on the Cedar Creek Planning Area. The purpose of these workshops was to present the proposed restoration options and receive feedback.

The Integrated Feasibility Study/Environmental Assessment was released for public comment on January 14, 2014. Comments will be responded to and any issues will be resolved after the comment period closes.

9. COMPLIANCE WITH ENVIRONMENTAL REGULATIONS*

9.1. National Environmental Policy Act*

This integrated Feasibility Report and Environmental Assessment has been prepared to achieve NEPA compliance for the proposed restoration plan. This report describes existing environmental conditions within the study area, the proposed action and alternatives, potential environmental impacts of the proposed restoration plan, and measures to avoid and minimize environmental impacts. Public review of the draft report occurred in January and February of 2014. Comments received during the review have been evaluated and changes incorporated as appropriate into this final report.

A Finding of No Significant Impact (FONSI) has been determined and is included in *Appendix F*.

9.2. Endangered Species Act*

The Endangered Species Act (ESA) of 1973, as amended, declares that all federal agencies "…utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species and threatened species listed pursuant to Section 4 of this Act". Section 7 of the ESA requires federal agencies to ensure that any agency action (any action authorized, funded, or carried out by the agency) is not likely to jeopardize the continued existence of any threatened, endangered, or proposed species. Agencies are further required to develop and carry out conservation programs for these species.

In accordance with Section 7(a)(2) of the ESA, federally funded, constructed, permitted, or licensed projects must identify and evaluate any threatened and endangered species, and their critical habitat, that may be affected by an action proposed by that agency.

As of January 2014, the Corps is in consultation with both NMFS and USFWS for the effects to listed species. The Corps determined that the recommended restoration plan "*may affect, likely to adversely affect*" Upper Willamette Chinook salmon and Oregon chub, and "*may affect, not likely to adversely affect*" bull trout. In addition, the Corps determined there would be "*no effect*" to other species potentially present in Lane County, including northern spotted owl, Fender's blue butterfly, Golden Indian paintbrush, Willamette daisy, Howellia, Bradshaw's lomatium, and Kincaid's lupine. None of these species are expected to be present in the study area because the specific habitat component(s) for each species is not present in the action area.

The Corps anticipates receiving Biological Opinions from both NMFS and USFWS by June of 2014 to complete the consultation process. All specific conservation measures recommended in both plans will be detailed in this study document and incorporated into the final design plans during PED.

9.3. Clean Air Act*

The Clean Air Act established a comprehensive program to preserve, protect and enhance air quality throughout the United States based on permitting of stationary sources of air pollution emissions, restricting the emission of toxic substances from stationary and mobile sources, establishing National Ambient Air Quality Standards and noise pollution standards. All federal actions resulting in the emission of air pollutants must comply with all federal, state, interstate and local requirements for control and abatement of air pollution in the same manner and extent as any non-governmental entity, unless the activity is explicitly exempted by the EPA.

The Recommended restoration plan does not involve the release of regulated substances. Neither does the plan use an incinerator, open burning, or releasing hazardous substances and/or chemicals. All motorized equipment used for construction activities is not expected to result in excess levels of noise pollution, emissions, or greenhouse gas emissions. All equipment would be required to meet State air quality standards, and any low-level noise pollution emitted during the proposed activities would be temporary, localized, and of short-term duration. For these reasons, the recommended plan is in compliance with the Clean Air Act.

9.4. Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)*

CERCLA established a method to assign liability to parties responsible for the release of hazardous wastes and polluted sites. This Act also established a trust fund to pay for their cleanup to reduce associated dangers to public health and the environment.

The recommended restoration plan does not occur within the boundaries of a designated Superfund site as identified by the EPA, or the State of Oregon for a response action under CERCLA. Further, none of the proposed project sites are included on the National Priorities List. Therefore, this Act is not application to the recommended restoration plan.

9.5. Clean Water Act*

Section 404 of the Clean Water Act authorized a permit program for the disposal of dredged or fill material into waters of the United States, and defined conditions which must be met by federal projects before they may make such discharges. The Corps retains primary responsibility for this permit program. The USACE does not issue itself a permit under the program it administers, but rather demonstrates compliance with the substantive requirements of the Act through preparation of a 404(b)(1) evaluation.

The recommended plan meets the criteria for qualifying under Nationwide Permit #13, 27, and 33 for bank stabilization, aquatic habitat restoration, establishment and enhancement activities and construction related activities. Within the State of Oregon, Nationwide Permit #13, 27, and 33 qualifying projects are pre-approved under the Section 401 Water Quality Certification and these projects should comply with the general conditions of the State's water quality program. The Corps will comply with the Section 404 Nationwide Permit General and Regional Conditions, and the State's Section 401 general conditions to meet water quality standards.
During the design phase, further coordination with Oregon Department of Environmental Quality (DEQ) would be conducted to document the proposed work area isolation and dewatering plans at each individual site and to develop construction water quality monitoring plans.

Section 402 of the Act requires a National Pollutant Discharge Elimination System (NPDES) permit and the associated implementing regulations for General Permit for Discharges from large and small construction activities for construction disturbance over one acre. As necessary, this permit would be obtained for each project site during the design phase.

A Memorandum for the Record has been prepared documenting the use of these Nationwide and NPDES permits and justification for their use according to the application of the general guidance criteria outlined in the permits and regional conditions. This memorandum documents compliance with this Act.

9.6. Farmland Protection Policy Act*

Without authorizing federal agencies to regulate the use of private or non-federal lands, the Farmland Protection Policy Act (7 U.S.C. 4201 *et seq*.) encourages federal agencies to minimize the impact of federal programs on the unnecessary and irreversible conversion of farmland (prime or unique) to nonagricultural uses. It follows that federal programs shall be administered in a manner that, as practicable, will be compatible with state and local government and private programs and policies to protect farmland.

Some impacts to prime farmlands would result from project implementation of the recommended restoration plan. However, impacts will not change the formal designation such that farmlands would be developed for urban and/or industrial use. Also, impacts to farmlands result in very few acres of farmland being taken out of production as a result of habitat restoration. As these projects advance toward PED, the Corps will coordinate with the Natural Resources Conservation Service to document impacts to prime farmlands.

9.7. Fish and Wildlife Coordination Act*

The Fish and Wildlife Coordination Act (16 U.S.C. 661) requires that wildlife conservation receive equal consideration and be coordinated with other features of water resource development projects. This goal is accomplished through Corps funding of a Coordination Act Report or preparation of a Planning Aid letter, both of which provide the basis for recommendations for avoiding or minimizing such impacts.

Coordination with USFWS has been ongoing throughout the study process and the Corps anticipates receiving a list of recommendations for avoiding and minimizing impacts to fish and wildlife resources from USFWS prior to the completion of the feasibility phase.

9.8. Migratory Bird Treaty Act*

The Migratory Bird Treaty Act (16 U.S.C. 703 *et seq*.) makes it unlawful to pursue, hunt, take, capture or kill; attempt to take, capture or kill; possess, offer to sell, barter, purchase, deliver or cause to be shipped, exported, imported, transported, carried or received any migratory bird, part, nest, egg or product, manufactured or not.

Through implementation of the recommended restoration plan, all construction activities would be coordinated to avoid disturbing nesting and migratory birds to the greatest extent possible. However, it is anticipated that some birds would be disturbed and possibly displaced during the course of construction, either from vegetation removal or noise and associated activity from construction equipment and traffic. Vegetation removal may be necessary to facilitate access to the stream channel for in-water work, and all removal actions would be timed such that nesting behaviors are not disrupted (i.e. site preparations would occur outside of the breeding season). Following implementation of the plan, vegetation would be replanted to replace lost canopy and cover. While it may take several years for the restored vegetation to be functional, it is expected that post-project habitat conditions would better support migratory birds than current conditions.

9.9. National Historic Preservation Act*

The National Historic Preservation Act (16 U.S.C. 470) requires that the effects of proposed federal undertakings on sites, buildings, structures, or objects included on or eligible listing on the National Register of Historic Places must be identified and evaluated. A preliminary database assessment has been conducted to determine if previously-documented historic or prehistoric sites listed on the National Register are located within or adjacent to the APE. No National Register-listed sites were

identified within or near the APE. Furthermore, no locations within the APE have been previously-assessed for potentially eligible cultural resources. Coordination of this project and potential effects on cultural resources within or near the APE needs to be initiated with SHPO and affected Tribes.

9.10. Magnuson-Stevens Fishery Conservation and Management Act*

The evaluation of project impacts to essential fish habitat (EFH) is being conducted as part of the Section 7 consultations with NMFS. Conservation measures will be included as part of the proposed action in order to adequately avoid, minimize, or otherwise offset potential adverse effects to EFH.

9.11. Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d)*

The Bald and Golden Eagle Protection Act (BGEPA) prohibits the taking, possession or commerce of bald and golden eagles, except under certain circumstances. Amendments in 1972 added penalties for violations of the act or related regulations.

Although bald eagles are generally known to occur in the Study Area, no take of either bald or golden eagles is likely to occur during project construction. No nests are known to be present. The habitat in the study area, while sufficient for foraging purposes (especially along the McKenzie River near the confluence with Cedar Creek), is generally urbanized and not preferred for nest construction or brood rearing. Therefore, no adverse effects to eagles are anticipated and the proposed action is in compliance with this Act. BGEPA management guidelines would be followed if any bald eagle nests are identified during the design or construction phases. Generally, the proposed restoration activities can be classified as Category A activities. If nests are constructed or identified, buffers of 660 feet should be maintained around nests if the construction work is visible from the nest. Buffers of 330 feet should be maintained around nests if the construction work is not visible from the nest.

9.12. Rivers and Harbors Act*

This Act regulates project activities in navigable waters and harbors, including river improvements. Specifically, Section 10 of the Rivers and Harbors Act regulates structures in or over any navigable waters of the U.S., the excavating from or depositing of material into any such waters, or the accomplishment of any other work affecting the course, location, condition, or capacity of such waters.

As site-specific project designs are developed during PED, project activities would be designed such that all actions in all navigable waters (which include Cedar Creek) are in compliance with this Act.

9.13. Wild and Scenic Rivers Act (16 U.S.C. 1271-1287)*

The Wild and Scenic Rivers Act prohibits federal support of actions that would adversely affect a river's free-flowing condition, water quality, and/or outstanding resource values. No portions of Cedar Creek are designated as Wild and Scenic, therefore Act is not applicable to the proposed restoration activity.

A portion of the McKenzie River was designated in 1988 under the Wild and Scenic Rivers Act. The river provides extensive recreational opportunities to fish, hike, raft and kayak along its length. The McKenzie River is also well known for its exceptional water quality, providing valuable fish and wildlife habitat and supporting threatened and endangered species, including Chinook salmon and bull trout. For these reasons, the upper portion of the river has 12.7 miles designated for recreational purposes, noting the "outstandingly remarkable values of fish, scenic quality, recreation, hydrology

and geology, and water quality." Because this designation is outside of the project area and this Act is not applicable to the study area.

Any restoration activity at Cedar Creek will not adversely affect the McKenzie River, its condition, water quality, or recreational opportunities. The designated section of the river is approximately 50 river miles upstream from the project site and includes the upper-most section of the McKenzie River where it exits Clear Lake. The designation, excluding Carmen and Trail Bridge reservoirs, extends downstream to Scott Creek where it enters the McKenzie River, approximately 2500 feet upstream from Belknap Springs at RM 75.

9.14. Executive Order 11593, Protection and Enhancement of the Cultural Environment*

This executive order advises federal agencies to provide leadership in preserving, restoring and maintaining the historic and cultural environment of the Nation. Federal agencies are directed to administer the cultural properties in a spirit of stewardship and trusteeship for future generations, initiating measures in such a way that federally owned and non-federally owned sites, structures and objects of historic, architectural or archaeological significance are preserved, restored and maintained for the inspiration and benefit of the people.

At present, it is undetermined if implementation of the recommended restoration plan will have effects on the area's historic and cultural environment. Additional archaeological ground assessments must be conducted within the APE to determine potential effects of the proposed undertaking activities. Furthermore, consultations about the undertaking and possible impacts must be initiated and continued with SHPO and interested Tribes. After completion of necessary determinations of effect, plans would ideally be designated such that, where identified, all historic properties and significant cultural resources are avoided, preserved, maintained and/or mitigated, based on consultations with SHPO, affected Tribes and other interested parties, during and following implementation.

9.15. Executive Order 12898, Environmental Justice*

Executive Order 12898 directs every federal agency to identify and address disproportionately high and adverse human health or environmental effects of agency programs and activities on minority and low-income populations. Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. The federal government has this goal for all communities and persons across this nation. It would be achieved when everyone enjoys the same degree of protection from environmental and health hazards, equal access to the decision-making process, and the opportunity to have a healthy environment in which to live, learn, and work.

Title VI/Environmental Justice populations in the study area are smaller percentages of the general population compared to same populations in the region. Within the APE, the density of senior citizen population is lower than the general population in the study area. The disabled population is 1.3 percent less than that population in the study area as a whole. Within the APE, the percent minority by block group is the same as in the study area as a whole, and less than the regional percentage. The percent disabled by block group is consistent throughout the APE, and is 0.2 percent lower than the county population. The percentage of households in poverty by block group in the APE is significantly lower in the eastern two-thirds and similar to the County percentage in the western third of the APE. No Title VI/Environmental Justice population would be disproportionately affected by any project activities. Proposed projects would increase neighborhood walkability and educational opportunities for school-

aged children would have a beneficial effect for these populations, as well as the community as a whole.

The recommended restoration plan is not anticipated to displace people, buildings, households, or businesses with the possible exception of the industrial use at Blue Water Ponds. Adverse impacts to land use are anticipated to be non-existent or minor. For these reasons, the proposed restoration plan is in compliance with this Executive Order.

9.16. Executive Order 11988, Floodplain Management, May 24, 1977*

Executive Order 11988 requires federal agencies to evaluate the potential effects of the proposed action on floodplains and avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of the floodplain, and to avoid direct and indirect support of floodplain development where there is a practicable alternative. In accomplishing this objective, “each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by flood plains.“

The recommended restoration plan would not create a change that would affect occupancy or modification of the floodplain and therefore the plan is in compliance with this Executive Order. Further, the plan would ensure that the project sites are not developed in the future as a result of project implementation. In PED, projects would be designed to ensure compliance with this order with regards to development of the floodplain, as well as cumulative effects to the floodplain such that impacts have a “zero rise” in flood elevations per Corps regulations.

9.17. Executive Order 11990, Protection of Wetlands, May 24, 1977*

The purpose of this executive order is to minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. In planning their actions, federal agencies are required to consider alternatives to wetland sites and limit potential damage if an activity affecting a wetland cannot be avoided.

While the recommended restoration plan may temporarily impact some wetlands during construction activities in gaining access to the in-stream channel habitat for restoration. These actions would be minimized to the extent possible during design development, such that staging and stockpile areas and access roads avoid sensitive wetland areas to the greatest extent possible. Where areas cannot be avoided, the wetlands would be restored to pre-project condition. A wetland delineation of project sites will identify wetlands in the Planning Area prior to construction and all construction actions would be coordinated with DEQ to minimize adverse impacts, both permanent and temporary, to wetlands.

In addition, no permanent fill of wetlands is proposed and it is expected that existing wetlands would improve as a direct result of plan implementation. Additional wetland habitat is likely to develop where portions of the stream channels are widened and benches are constructed; these habitats may transition to seasonal or semi-permanent wetland types. This is especially likely where the underlying soils are of the type to support wetland habitats. It is anticipated that these new wetland areas may develop throughout the project horizon as a direct result of plan implementation. As a result of this expectation, the recommended restoration plan is in compliance with this Executive Order.

9.18. Executive Order 13175, Consultation and Coordination with Indian Tribal Governments, November 6, 2000*

Executive Order 13175 requires federal agencies to formulate "an accountable process to ensure meaningful and timely input by tribal officials in the development of regulatory policies that have tribal implications." This consultation is meant to work towards a mutual consensus and is intended to begin at the earliest planning stages, before decisions are made and actions are taken.

Two tribes have been identified as potentially having interest in the Study Area: the Confederated Tribes of the Grand Ronde and the Confederated Tribes of the Siletz Indians. To comply with federal and Corps guidance, letters were mailed to two identified interested tribes on 19 October 2012 to solicit concerns and feedback. To date, no feedback has been received.

9.19. Executive Order 13186, Migratory Birds*

This order further strengthens the Migratory Bird Treaty Act, the Bald and Golden Eagle Protection Act, the Fish and Wildlife Coordination Act, the Endangered Species Act and the National Environmental Policy Act. Federal actions resulting in any "take" (intentional or otherwise) of a migratory bird are required to develop Memoranda of Understanding (MOU) with USFWS to promote the conservation of migratory bird populations and resources.

The Department of Defense (DoD) has an MOU with the USFWS, signed 31 July 2006, to comply with this executive order. However, the MOU expired five years after the date of signature and is currently outdated. The MOU is unclear about the applicability of federally proposed actions on non-DoD managed lands, as well as those actions executed under the Civil Works program.

Assuming the language of the MOU is (currently) relevant to the parameters of this Study and the Recommended restoration plan, the MOU states the DoD shall, among other things, "encourage incorporation of comprehensive migratory bird management objectives in the preparation of DoD planning documents (…including NEPA analyses)." Comprehensive planning efforts include regional conservation plans, where available. The Recommended restoration plan is expected to restore aquatic habitats and enhance the associated riparian areas where specific actions would benefit the ecosystem processes and functions supporting migratory birds. By adhering to the above named Acts and regional conservation plans (as discussed in Sections 2.2 and 2.3), in addition to timing construction activities to fall outside of normal nesting behaviors, project actions would be in compliance with this executive order as it pertains to comprehensive management strategies.

9.20. Executive Order 13514, Federal Leadership in Environmental, Energy, and Economic Performance*

This executive order requires that Federal agencies shall increase energy efficiency; measure, report and reduce their greenhouse gas emissions from direct and indirect activities; conserve and protect water resources through efficiency, reuse and storm-water management; eliminate waste, recycle and prevent pollution; leverage agency acquisitions to foster markets for sustainable technologies and environmentally preferable materials, products and services; design, construct, maintain and operate high performance sustainable buildings in sustainable locations; strengthen the vitality and livability of the communities in which federal facilities are located; and inform federal employees about and involve them in the achievement of these goals.

Implementation of the recommended restoration plan positively supports this executive order by conserving and protecting water resources through the restoration of Cedar Creek. In addition, it is expected that project activities would result in long-term impacts which would strengthen the vitality and livability of the communities adjacent the project sites, further supporting the intent of this order.

9.21. Local Land Use Plans and Regulations*

9.21.1. Eugene-Springfield Metropolitan Area General Plan of 1990, as Updated

The recommended restoration plan does not propose new land use policy. Rather it reflects and builds on existing policies, plans, and guidance for protecting citizens and property from storm events, improves habitat for fish, aquatic and wildlife species, improves water quality beneficial uses for humans, fish, aquatic, and terrestrial species, and improves recreational opportunities for citizens of the regional area.

9.21.2. Lane County Rural Comprehensive Land Use Plan of 1984, as Updated

The proposed restoration actions are consistent with the land use policies of Lane County.

9.21.3. Land Use Regulations

The proposed restoration actions are consistent with the land use zones of Eugene, Springfield, and Lane County. Prior to project construction, all necessary land use approvals and permits would be obtained through the respective jurisdiction. Proposed restoration actions do not change current zoning or Metro Plan designation and would be implemented based on voluntary property owner participation.

10. ECOLOGICAL MONITORING AND ADAPTIVE MANAGEMENT

Monitoring and adaptive management will conform with the requirements of Section 2039 of WRDA 2007 and subsequent Corps implementation guidance, and monitoring will be conducted until such time as the Corps determines that the project has achieved success. This monitoring and adaptive management plan has been developed to ensure the success of the recommended restoration plan in meeting project objectives and a process to identify if any adaptive management actions are warranted during the 10-year period. Monitoring is proposed to occur for 10 years as geomorphic changes and vegetation community conditions develop slowly and a shorter period of monitoring may not detect sufficient changes or threats to the success of the project. The proposed monitoring plan will measure the following key elements: vegetation, connector channel hydrology and hydraulics, river and floodplain morphology, wildlife, physical habitat, and fish and typical methods are described as the basis for the monitoring cost estimate in this section. Detailed protocols (including specific sampling locations) will be developed further for each site during the design phase. Photo-monitoring will also be conducted to document site changes over time including vegetation establishment and physical habitat features.

The non-Federal sponsor will conduct all monitoring activities for 10 years after completion of construction at each site as part of the total project cost-share. The total estimated monitoring costs are $90,000. Any monitoring conducted after 10 years would not be part of the total project cost and will be 100% non-Federal costs.

Plan Goals and Objectives:

Goal #1, *Restore natural habitats along waterways, including main and side channel in-stream and riparian habitats and their ecological functions*

Objectives

A. increase riparian corridor widths and improve corridor quality by planting native species
B. restore channel complexity of stream channels to remove channelization and increase structural diversity and complexity of instream habitat

Goal #2, *Improve access to quality habitat, including removing barriers, improving connectivity, and increasing habitat quantity for all species*

Objectives

A. improve fish and wildlife “friendly” connections from the McKenzie River to Cedar Creek and ensure availability of cold water flows in Cedar Creek year-round
B. restore migratory corridors ensuring that restoration does not create “habitat islands”

The monitoring elements described below are proposed for monitoring the success in meeting each objective.

Increase riparian corridor widths and improve corridor quality by planting native species

Target:

1. Increase riparian corridors to 50 feet wide on either side of the stream channel (where space is available) and the majority of vegetation in the corridor is native.

Monitoring Protocol:

1. Establish a total of ten permanent vegetation plots throughout the study area to be representative of the plant communities and restored areas within the project site. Permanent plots shall be 33 foot diameter circular plots (centerpoint of each plot will be documented via GPS coordinates to reoccupy in each of sampling). Percent cover will be visually assessed and documented for each strata (herbs, shrubs, trees, woody vines) and each species with more than five percent cover. Sampling will occur in Years 1, 3, 5, and 10 following construction. Percent survival of planted stock should be a minimum of 80 percent during Years 1 and 3 otherwise supplemental plantings will be required to replace plants that have died. Percent cover of native species will be measured in the permanent plots and should reach 30 percent in year 1, 50 percent in year 3, and >80 percent in years 5 and 10 (total percent cover in all strata). Estimated cost $10,000 per year; total $40,000.
2. Map non-native vegetation species throughout restored areas on each site in Years 1, 3, and 5 after construction and document percent cover in all locations with more than 100 square feet of presence. Document average percent cover by species across the site and estimate total area of infestation. Estimated cost $5,000 per year; total $15,000.

Adaptive Management Trigger(s):

1. If native plant survival or percent cover does not meet targets in any year of monitoring then the non-Federal sponsor will undertake supplemental plantings to achieve the targets. The Corps and non-Federal sponsor will evaluate at the end of 10 years the overall quality of habitat in each restored plant community to identify if success has been achieved.
2. If average non-native invasive species cover exceeds 25 percent cover in any of the monitoring years then the non-Federal sponsor will undertake invasive species removal actions such as pulling, mowing, and spot application of herbicide.
3. Corps and non-Federal sponsor to evaluate habitat suitability indices and presence/absence of native amphibians and birds and modify models as appropriate based on quantitative data of presence relative to specific model parameters.

Restore channel complexity of stream channels to remove channelization and increase structural diversity and complexity of instream habitat

Target:

2. All restored channels maintain banks with natural slopes and do not show signs of erosion, downcutting, toe cuts, bank sloughing, or rotational slumping during the monitoring period.

Monitoring Protocol:

1. At Years 5 and 10 after construction, evaluate creek morphology using river cross-section surveys (total of 100) and compare and correlate any changes to potential effects from restoration actions. Estimated cost $15,000 each year; total of $30,000.

Adaptive Management Trigger:

1. If any of the targets are not achieved by the year specified, then a modified design should be considered after a causal analysis is completed.

Target:

3. Improve at least one connection between the McKenzie River and Cedar Creek and ensure it is fish passable

Monitoring Protocol:

1. Conduct site visits annually to ensure connections between the McKenzie River and Cedar Creek are unimpeded. Estimated cost $500 per year; total $5,000.

Adaptive Management Trigger(s):

1. If connections are blocked, determine if additional O&M is required or if new design considerations should be made.

Target:

4. All restored areas are directly connected to Cedar Creek and the McKenzie River and do not impede migration of fish and wildlife.

Monitoring Protocol:

1. Conduct site visits annually to ensure connections between the McKenzie River and Cedar Creek are unimpeded. No additional cost.

Adaptive Management Trigger(s):

1. If connections are blocked, determine if additional O&M is required or if new design considerations should be made.

Adaptive management would be triggered by the above identified conditions if the monitoring targets are not met. At this time, it is difficult to predict which specific triggers might not be met, but for purposes of estimating an adaptive management cost, it is assumed that a potential condition that could result is blockage of the side channel connecting the McKenzie River and Cedar Creek. Thus, for purposes of estimating the potential cost of adaptive management, it is assumed that additional design is needed to ensure blockage free flows and additional annual O&M to maintain them. The cost of design is estimated at $50,000 and structural modifications at $300,000. Increase annual expenditures would double for O&M increasing the cost by $9,000. Thus the potential cost of adaptive management is estimated at $350,000 ($465,000 with contingency) over the 10-year period of this monitoring and adaptive management plan.

Adaptive management actions may be identified prior to completion of the 10-year monitoring, or could also be identified later during any extended non-Federal sponsorship monitoring.

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11. CONCLUSIONS AND RECOMMENDATIONS

This Feasibility Report with Integrated EA has included an examination of all practicable alternatives for meeting the study purpose and need for the study area. The recommended restoration plan is an incrementally justified and cost-effective approach, which meets the study objectives for ecosystem restoration of national and regionally significant resources and there is a demonstrated a federal interest in restoring these resources.

The recommended restoration plan will increase the quantity and quality of aquatic habitats and increase access to Cedar Creek and its side channels. The plan provides positive ecosystem benefits in terms of aquatic habitat restoration, water resource protection, repair of degraded physical conditions, and provision of multiple social benefits.

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12. LIST OF PREPARERS AND PARTICIPANTS*

The Metro Waterways Study Feasibility Report and associated appendices were prepared under the guidance of the U.S. Army Corps of Engineers, Portland District office with staff assistance from the non-Federal sponsor organizations, and the TAP, with consulting services and coordination provided by Lane Council of Governments. Staff who served on the SMT during a portion of the study are identified by "(SMT)" following their name.

12.1. U.S. Army Corps of Engineers

Name:	Title or Key Task During Study:
Eric Bluhm	Project Manager, Plan Formulation (SMT) (2002 -2012)
Amy Gibbons	Project Manager, Plan Formulation/Plan Formulation (SMT) (2012-Present)
Keith Duffy	Technical Lead/Hydraulic Engineer (2012-Present)
Chris Humphrey	Geology/Geotechnical Engineering (2012-Present)
Joe Russell	Cost Engineering (2012-Present)
Doris Cope	Real Estate (2012-Present)
Chris McCann	Economics and IWR Model (2012-Present)
Kristine Lightner	Wildlife Biologist, NEPA Specialist (2012-Present)
Doug Swanson	Geography, GIS Specialist (2012-Present)
Dan Mulligan	Archaeologist (2013-Present)

12.2. Non-Federal Sponsor Staff

12.2.1. City of Springfield

Name:	Title or Key Task During Study:
Len Goodwin	Public Works Director (SMT)
Ed Black	Public Works Maintenance (SMT)
Todd Miller	Environmental Services (SMT)
George Walker	Stormwater Facilities Planner
Chuck Gottfried	Waterway Assessments, Design (SMT)
Susie Smith	Environmental Services, Project Formulation
Mark Metzger	Planning
Al Peroutka	Engineering
Greg Ferschweiler	Waterway Assessments

12.2.2. Lane County

Name:	Title or Key Task During Study:
Stephanie Schulz	Planning, Waterway Assessment (SMT)
Keir Miller	Planning

12.3. Lane Council of Governments

Name:	Title or Key Task During Study:
Jeff Krueger	Principal Landscape Architect, Local Coordination (SMT)
Tim Bingham	Senior Planner (SMT)
Hilary Dearborn	Associate Landscape Architect (SMT)
Bill Clingman	GIS Mapping
David Richey	GIS Mapping
Steve Gordon	Principal Planner, Project Formulation
Scott Shine	Assistant Planner, Waterway Assessments

12.4. Technical Assistance Pool

The Technical Assistance Pool (TAP) was assembled at the beginning of the study to provide input and technical assistance as needed. The TAP members participated in reviewing assessment results, developing the restoration alternatives, and reviewed and reviewing draft plans and appendices. The TAP consisted of a variety of scientists, planners, real estate specialists, natural resource specialists from federal and state agencies, local watershed councils, utilities, land trusts, and the private sector.

Name:	Affiliation:
Eric Wold	City of Eugene
Kevin Finney	City of Eugene
Trevor Taylor	City of Eugene
Scott Duckett	City of Eugene
Sarah Medary	City of Eugene
Terry Colvin	City of Eugene
Mark Snyder	City of Eugene
Brian Elliot	City of Eugene
Jack Long	City of Eugene
Robin Hostick	City of Eugene
Ryan Turner	City of Eugene
Therese Walch	City of Eugene
Lauri Mullen	City of Eugene
Russ Royer	City of Eugene
Jesse Cary Hobbs	City of Eugene
Lee Shoemaker	City of Eugene
Karl Morganstern	Eugene Water & Electric Board
Steve Newcomb	Eugene Water & Electric Board
Nancy Toth	Eugene Water & Electric Board
Jeff Ziller	Oregon Department of Fish & Wildlife
Ben Meyer	National Marine Fisheries
Ann Mullan	National Marine Fisheries
Mindy Simmons	National Marine Fisheries
Jason Nuckols	The Nature Conservancy
Bruce Newhouse	Salix Associates
Jared Rubin	Oregon Department of Environmental Quality
Michael Mattick	Oregon Department of Water Resources
Rebecca Gershow	Willamalane Park and Recreation District
Greg Hyde	Willamalane Park and Recreation District
Karen Strohmeyer	Cascade Pacific RC&D

Tom Burnham	Natural Resource Conservation Service
Dave Downing	East Lane Soil & Water Conservation District
Dana Erikson	Long Tom Watershed Council
Larry Six	McKenzie Watershed Council
John Brown	Real Estate Appraiser
Chuck Davis	Springfield Utility Board
Peter Rufier	Metropolitan Wastewater Management Commission
Randy Moore	Oregon Department of Geology and Mineral Industries
Gloria Holthaus	Oregon Department of State Lands
John Marshall	US Fish and Wildlife Service
Steve Calish	US Bureau of Land Management
Pat Johnson	US Bureau of Land Management
Charles Fairchild	US Bureau of Land Management

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- O*pen Waterway Maintenance Plans* (Taylor and Long, 2003)
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- *Willamette River Fish Recovery: Upper Willamette River Conservation and Recovery Plan for Chinook Salmon and Steelhead* (August 2011)
- *Memorandum for Record and Memorandum for Chief*
- *Memorandum of Understanding - BLM and U.S. Army Corps of Engineers*

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14. ACRONYMS AND ABBREVIATIONS

APE	Area of Potential Effect
AQI	Air Quality Index
BFE	Base flood elevation
BiOp	Biological Opinion
BLM	US Bureau of Land Management
BMP	Best Management Practices
CCIFCA	Cedar Creek Irrigation and Flood Control Association
CE/ICA	Cost Effectiveness and Incremental Cost Analysis
Cfs	cubic feet per second
CIG	Climate Impacts Group
CIP	Capital Improvement Project
City	City of Springfield
CLOMR	Conditional Letter of Map Revision
Corps	US Army Corps of Engineers
County	Lane County
CWA	Clean Water Act
DCH	Designated Critical Habitat
DEQ	Oregon Department of Environmental Quality
DO	Dissolved Oxygen
DOD	Department of Defense
E	(ESA-listed) Endangered
EA	Environmental Assessment
ESA	Federal Endangered Species Act
ECO-PCX	US Corps of Engineers Planning Center of Expertise for Ecosystem Restoration
EWEB	Eugene Water and Electric Board
FEMA	Federal Emergency Management Agency
FWOP	Future Without Project
GWMA	Groundwater Management Area
H&H	Hydrology and Hydraulics
HEC-RAS	Hydrologic Engineering Centers – River Analysis System
IWR	Institute for Water Resources
LCOG	Lane Council of Governments
LERRDs	Lands, easements, rights-of-way, relocations, and excavated or disposal areas
LOMR	Letter of Map Revision
LRAPA	Lane Regional Air Protection Agency
MCASES	Micro-Computer Aided Cost Estimating System
NED	National Economic Development
NEPA	National Environmental Policy Act
NER	National Ecosystem Restoration
NFIP	National Flood Insurance Program
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NRCS	US Natural Resources Conservation Service
NRHP	National Register of Historic Place
NWI	National Wetlands Inventory
OCCRI	Oregon Climate Change Research Institute

ODFW	Oregon Department of Fish & Wildlife
O&M	Operations and Maintenance
OSU	Oregon State University
PED	Pre-construction, Engineering, and Design
PDT	Project Development Team
PNW	Pacific Northwest
PROS	Parks, Recreation, and Open Space Comprehensive Plan
RED	Regional Economic Development
RWD	Rainbow Water District
SC	Species of Concern
SFHA	Special Flood Hazard Area
SHPO	State Historic Preservation Office
SMT	Study Management Team for Metro Waterways Study
Sponsors	Cities of Eugene and Springfield and Lane County
SUB	Springfield Utility Board
STEP	Salmon Trout Enhancement Program administered through ODFW
Study	Springfield Metropolitan Waterways Feasibility Study
T	(ESA-listed) Threatened
TAP	Technical Assistance Pool for Metro Waterways Study
TNC	The Nature Conservancy
TMDLs	Total Maximum Daily Loads
UGB	Urban Growth Boundary
USDA	US Department of Agriculture
USEPA	US Environmental Protection Agency
USGS	US Geological Survey
USFWS	US Fish & Wildlife Service
UW	University of Washington
UWR	Upper Willamette River
WAM	Waterway Assessment Model
WRDA	Water Resources Development Act

15. GLOSSARY

Adaptive management: a structured, iterative process of optimal decision making in the face of uncertainty, with an aim to reducing uncertainty over time via system monitoring.

Area of Potential Effect: used in environmental review, the geographic area or areas within which an undertaking may cause changes in the character or use of historic properties, if any such properties exist [36 CFR 800.2(c)].

Assessment methodology: see Channel assessment matrix below. See also physical conditions assessment, natural resources assessment, water quality assessment, and recreation assessment below.

Biological opinion: document which includes: (1) the opinion of the Fish and Wildlife Service or the National Marine Fisheries Service as to whether or not a Federal action is likely to jeopardize the continued existence of listed species, or result in the destruction or adverse modification of DCH; (2) a summary of the information on which the opinion is based; and (3) a detailed discussion of the effects of the action on listed species or DCH. [50 CFR §402.02, 50 CFR §402.14(h)]

Cedar Creek Planning Area: defined by the watershed boundary for Cedar Creek, includes numerous branches of the urban stream network and headwater streams, and covers 9,472 acres.

Critical habitat: for listed species consists of: (1) the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of section 4 of the Act, on which are found those physical or biological features (constituent elements) (a) essential to the conservation of the species and (b) which may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of the Act, upon a determination by the Secretary that such areas are essential for the conservation of the species. [ESA §3 (5)(A)] DCHs are described in 50 CFR §17 and 226.

Channel assessment matrix: the output of the model used to assess the condition of all significant waterway reaches within the Cedar Creek Planning Area based on existing conditions. The assessment methodology is an adaptation of several existing standard federal and state methodologies customized for local conditions, developed specifically for use in the Metro Waterways Study. For more information, see Section 3 (or 2.6) (Plan Formulation) and Appendices A and B.

Corps' Campaign Plan (CP): The U.S. Army Corps of Engineers (USACE) Campaign Plan (CP) (FY) 2011 – Revised Edition is the primary vehicle for designing, organizing, integrating, and executing strategies, actions and outcome based measures in the CP. The CP includes Objective Champions strategies using the ends-ways-means construct with associated Enterprise level outcome based metrics. The USACE Campaign Plan will guide policy decisions on how the Corps organizes, trains, and equips our personnel; how the Corps plans, prioritizes, and allocates resources; and how it responds to emerging requirements and challenges.
http://www.usace.army.mil/About/CampaignPlan.aspx

Cumulative effects: are those effects of future State or private activities, not involving Federal activities, which are reasonably certain to occur within the action area of the Federal action subject

to consultation. [50 CFR §402.02] This definition applies only to section 7 analyses and should not be confused with the broader use of this term in the National Environmental Policy Act or other environmental laws.

Designated critical habitat: See Critical habitat above.

Detention/flow controls: Rock weirs or grade control in the form of constructed riffles at channel bottom address the issue of erosion or downcutting particularly at points where culverts outflow to headwater streams. Also detention ponds or step pools to retain the increased volume of flow, slowing the rate of release to minimize the hydraulic pressure at the culvert outfall. These structures function to both reduce volumes and reduce velocity of flow during peak flow, reducing habitat degradation.

Drop structure: a waterway feature, usually a series of steps in the channel bottom, to address a point where channel drops over a concrete lip, and designed to prevent channel incision. Drop structures may in some cases block fish passage.

Ecosystem restoration: as defined by the Corps, ecosystem restoration includes components such as water quality improvement, restoration of floodplain function, and recreational features, the overall objective *"to restore ecosystem structure, function, and dynamics processes to a less degraded, more natural condition." "Indicators of success would include the presence of a large variety of native plants and animals, the ability of the area to sustain larger numbers of certain indicator species or more biologically desirable species, and the ability of the restored area to continue to function and produce the desired outputs with a minimum of continuing human intervention. Those restoration opportunities that are associated with wetlands, riparian and other floodplain and aquatic systems are most appropriate for Corps involvement."*
ER 1105-2-100 3-5 b (1). (USACE Planning Guidance Notebook, Engineering Regulation 1105-2-100)

Effects of the action: the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action. These effects are considered along with the environmental baseline and the predicted cumulative effects to determine the overall effects to the species for purposes of preparing a biological opinion on the proposed action. [50 CFR §402.02] The environmental baseline covers past and present impacts of all Federal actions within the action area. This includes the effects of existing Federal projects that have not yet come in for their section 7 consultation.

Endangered species: any species which is in danger of extinction throughout all or a significant portion of its range. [ESA §3(6)]

Executive Team: The Executive Team is the major coordinating body for intergovernmental and interagency management of the *Eugene-Springfield Metropolitan Waterways General Investigation Feasibility Study (Metro Waterways Study)*. The Executive Team has been established to enable partner agencies to effectively share in the efficient and coordinated management of the Metro Waterways Study. The Executive Team is responsible for the overall management of the study and will meet periodically to review study progress, finances, and findings as developed and reported by the Study Team.

High flow by-pass: a structure or waterway feature that redirects water flow during storm events to detention pond, side channel, or floodplain, with the purpose of reducing channel bank erosion, channel bank failure and stream sedimentation and protecting aquatic habitat.

Indirect effects: those effects that are caused by or will result from the proposed action and are later in time, but are still reasonably certain to occur. [50 CFR §402.02]

Listed species: any species of fish, wildlife or plant which has been determined to be endangered or threatened under section 4 of the Act. [50 CFR §402.02]

Measures: see restoration measures below.

Metro Waterways Study: The Eugene-Springfield Metropolitan Waterways Study (Study) was initiated as a way to provide a better understanding of existing problems and opportunities related to area waterways and to identify solutions to improve these waterways. The study provides an integrated, comprehensive, and long-range plan for restoring and maintaining the waterway system within this area for multiple objectives. The Portland District of the U.S. Army Corps of Engineers (Corps) partnered with the cities of Eugene and Springfield, Lane County, and the Eugene Water & Electric Board, with the U.S. Bureau of Land Management (BLM) participating as a Cooperating Agency.

Natural resources assessment: category used in the Metro Waterways assessment model to measure ecosystem components. Includes riparian width, habitat diversity, percent cover of invasive species, aquatic habitat structure, connectivity, and species present.

Option: See Reach option below.

Physical conditions assessment: category used in the Metro Waterways assessment model to measure ecosystem components. Includes physical channel characteristics such as bank profile, channel gradient, channel type, bank stability, bed stability, sediment.

Plan formulation: part of the Corps' six-step planning process for ecosystem restoration projects that requires an analysis of potential alternatives that would achieve the goals of environmental restoration. Various alternates are compared to the without-project condition.

Reach option or reach restoration option: restoration measures, such as re-shaping channel to create meanders and side channel habitat, riparian restoration to improve aquatic habitat by shading, filtration, and connecting the waterway to floodplain habitat, etc., are combined and applied to distinct stream reaches to create one possible set of restoration measures, thus creating one "restoration option." These options are designed to address the specific stream reaches of Cedar Creek, defined with beginning and end points based on similarity of existing conditions in aquatic and/or floodplain habitat, which were assessed and found to be significantly degraded.

Recreation assessment: category used in the Metro Waterways assessment model to measure existing conditions. Includes public access, existing facilities, community served through access. This category is not used to calculate habitat output units.

Restoration measures: actions that have the effect of improving measurable functions of the waterway ecosystem. Examples include: invasive species removal, channel widening, channel realignment and contouring to reduce flows, provide greater amount and diversity of aquatic habitat, replacing culverts to improve fish passage, installing high flow bypass to reduce channel scour and bank failure, bridge replacement to relieve hydraulic "pinch points", replanting native species to increase riparian diversity and increase shade, wetland restoration in channel floodplain where existing rare species habitats could be expanded.

Study Management Team (SMT): The SMT includes staff representatives from the local partners, LCOG, and the Corps who met on a monthly or quarterly basis to direct implementation of the study.

Section 7: Section 7 of the Endangered Species Act (Act) [16 U.S.C. 1531 et seq.] outlines the procedures for Federal interagency cooperation to conserve Federally listed species and DCHs.

Technical assistance pool (TAP): Includes representatives from Federal and State agencies, watershed councils, local land trusts, and utilities that was assembled at the beginning of the Metro Waterways study to review assessment results and provide input in developing the restoration options and provide technical assistance as needed.

Recommended restoration plan: Using the plan formulation process, comparing a variety of alternative plans, the restoration plan is chosen which most successfully maximizes benefits compared to costs.

Threatened species: any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. [ESA §3(20)]

TMDL: Total Maximum Daily Load is a calculation of the maximum amount of a pollutant that a waterbody can receive and still safely meet water quality standards under section 303(d) of the Clean Water Act.

Water quality assessment: category used in the Metro Waterways Assessment Model (WAM) to measure ecosystem components. Includes filtration, aeration, shade/temperature moderation, channel bank stability.

Waterway assessments: Assessment methodology developed specifically for use in the Metro Waterways Study and applied to the Cedar Creek Planning Area. The assessment methodology was an adaptation of several existing standard federal and state methodologies that were customized for local conditions.