

# 2008 Stormwater Needs Assessment Program

## Big Tree Creek/East Fork Lewis River (RM 26.30)/King Creek Subwatershed Needs Assessment Report

Clark County Public Works Clean Water Program

March 2009





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## Responsible County Officials

Program Name: Stormwater Needs Assessment Program  
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Funding source: Clark County Clean Water Fee  
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Otak, Inc. (Jeannine Johnson)



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## Acronyms and Abbreviations

B-IBI	Benthic Macroinvertebrate Index of Biological Integrity
BOCC	Board of County Commissioners
BMP	Best Management Practices
CCD	Clark Conservation District
CIP	Capital Improvement Program
CPU	Clark Public Utilities
CRFPO	Columbia River Fisheries Program Office
CWA	Clean Water Act
CWC	Clean Water Commission
CWP	Clean Water Program
DNR	Department of Natural Resources
EDT	Ecosystem Diagnostic and Treatment model
EIA	Effective Impervious Area
EIM	Environmental Information Management
EMAP	Environmental Mapping and Assessment
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FPIA	Focused Public Investment Area
FWS	Fall, Winter, Spring
GCEC	Gee Creek Watershed Enhancement Committee
GIS	Geographic Information System
GMA	Growth Management Act

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GPS	Geographic Positioning System
HPA	Hydraulic Project Approval
IDDE	Illicit Discharge Detection and Elimination
LCFEG	Lower Columbia Fish Enhancement Group
LCFRB	Lower Columbia Fish Recovery Board
LID	Low-Impact Development
LiDAR	Light Detection and Ranging
LISP	Long-term Index Site Project
LWD	Large Woody Debris
MS4	Municipal Separate Storm Sewer System
MOP	Mitigation Opportunities Project
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NTU	Nephelometric Turbidity Unit
NWIFC	Northwest Indian Fisheries Commission
ODEQ	Oregon Department of Environmental Quality
OWQI	Oregon Water Quality Index
PFC	Properly Functioning Condition
RM	River Mile
SCIP	Stormwater Capital Improvement Program
SCIPIT	Stormwater Capital Improvement Program Involvement Team
SCMP	Salmon Creek Monitoring Project
SCWC	Salmon Creek Watershed Council

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SNAP	Stormwater Needs Assessment Program
SWMP	Stormwater Management Program
SWMMWW	Stormwater Management Manual for Western Washington
TIA	Total Impervious Area
TIP	Transportation Improvement Program
TIR	Technical Information Report
TMDL	Total Maximum Daily Load
TP	Total Phosphorus
UGA	Urban Growth Area
UIC	Underground Injection Control
USFS	U.S. Forest Service
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
VBLM	Vacant Buildable Lands Model
VLWP	Vancouver Lake Watershed Partnership
WAC	Washington Administrative Code
WCC	Washington Conservation Commission
WDFW	Washington Department of Fish and Wildlife
WRIA	Water Resource Inventory Area
WSDOT	Washington Department of Transportation
WSU	Washington State University



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## Executive Summary

### Study Area

This Stormwater Needs Assessment report includes the Big Tree Creek, East Fork Lewis River (RM 26.30), and King Creek subwatersheds in the upper East Fork Lewis River watershed. The assessment addresses only those portions of these subwatersheds that are within unincorporated Clark County.

### Intent

Stormwater Needs Assessment reports compile and provide summary information relevant to stormwater management, propose stormwater-related projects and activities to improve stream health, and assist with adaptive management of the county's Stormwater Management Program. Assessments are conducted at a subwatershed scale, providing a greater level of detail than regional Water Resource Inventory Area (WRIA) or Endangered Species Act (ESA) plans. Stormwater Needs Assessments are not comprehensive watershed plans or stormwater basin plans.

### Findings

#### Watershed Conditions

The table on the following page summarizes conditions in the three study area subwatersheds including water quality, biological health, habitat, hydrology, and the stormwater system.

#### Ongoing projects and involvement

The Washington Department of Ecology is developing Total Maximum Daily Load (TMDL) for bacteria and temperature in the East Fork Lewis River watershed, including the assessment area.

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Category	Status
<b>Water Quality</b> Overall Fecal coliform bacteria Temperature	<ul style="list-style-type: none"> <li>• Fair to Good</li> <li>• Big Tree Creek fails the fecal coliform standard</li> <li>• All three are included in the East Fork Lewis River fecal coliform TMDL</li> <li>• All three fail the temperature standard</li> <li>• All three are included in the East Fork Lewis River temperature TMDL</li> </ul>
<b>Biological</b> Anadromous fish	<ul style="list-style-type: none"> <li>• Known use by winter and summer steelhead (East Fork Lewis River (RM 26.30) and King Creek); no anadromous use of Big Tree Creek</li> <li>• High regional recovery priority in East Fork (RM 26.30); medium in King Creek; low in Big Tree Creek</li> </ul>
<b>Habitat</b> NOAA Fisheries criteria  Riparian  Wetland	<ul style="list-style-type: none"> <li>• Road density percentage and Percent forested (Big Tree Creek) fall into the Non-Functioning category</li> <li>• Percent forested (EF 26.30 and King Creek), stream crossing density, and projected effective impervious area fall into the Properly Functioning category</li> <li>• Percent total impervious area is in the marginally functioning range</li> <li>• Riparian forest shade of 40-70% for all three</li> <li>• Large woody debris recruitment potential is primarily low in Big Tree Creek, low to high for King Creek, and mostly high for East Fork Lewis River (RM 26.30)</li> <li>• Primarily limited to riparian areas and floodplains</li> </ul>
<b>Hydrology and Geomorphology</b> Overall hydrology Future condition	<ul style="list-style-type: none"> <li>• No hydrologic data available, but likely typical for partly forested rural areas</li> <li>• Impervious area projected to remain at levels that do not alter hydrology if existing forest cover is retained or expanded</li> </ul>
<b>Stormwater (Unincorp. areas)</b> System description  Inventory System adequacy  System condition	<ul style="list-style-type: none"> <li>• Primarily road-side ditches</li> <li>• No public stormwater facilities; two private</li> <li>• Complete</li> <li>• Assumed adequate treatment</li> <li>• No flow control other than infiltration in ditches</li> <li>• No illicit discharge screening conducted</li> <li>• Offsite assessment for outfalls to critical areas found 13 of 14 outfalls in compliance (East Fork Lewis River (RM 26.30), and 2 of 2 in compliance (Big Tree Creek); no outfalls to critical areas in King Creek</li> </ul>

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### Opportunities

Opportunities for stormwater-related projects are very limited in this assessment area. One potential project was identified through this assessment: an outfall to a critical area in the East Fork Lewis River (r.m. 26.30) subwatershed was noted due to ongoing erosion and instability.

Non-project stormwater management recommendations address areas where CWP programs or activities could be modified to better address NPDES permit components or promote more effective mitigation of stormwater problems.

Management recommendations relevant to the study area include:

- Continue county support for Ecology's TMDL development process for bacteria and temperature
- Examine the use of small projects to improve stormwater retention and treatment in roadside ditches
- Consider fish barrier removal projects as existing roads and culverts are upgraded or replaced
- Develop a system to provide education about appropriate ditch maintenance practices to rural landowners
- Perform focused monitoring to locate fecal coliform sources (Big Tree Creek)



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## Introduction

This Stormwater Needs Assessment report includes the Big Tree Creek, East Fork Lewis River (RM 26.30), and King Creek subwatersheds. The Clean Water Program (CWP) is gathering and assembling information to support capital improvement project (CIP) planning and other management actions related to protecting water bodies from stormwater runoff.

### Purpose

The Stormwater Needs Assessment Program (SNAP), initiated in 2007, creates a system for the CWP to focus activities, coordinate efforts, pool resources, and ensure the use of consistent methodologies. SNAP activities assess watershed resources, identify problems and opportunities, and recommend specific actions to help meet the CWP mission of protecting water quality through stormwater management.

The overall goals of the SNAP are to:

- Analyze and recommend the best and most cost effective mix of improvement actions to protect existing beneficial uses, and to improve or allow for the improvement of lost or impaired beneficial uses consistent with NPDES objectives and improvement goals identified by the state GMA, ESA recovery plan implementation, TMDLs, WRIA planning, floodplain management, and other local or regional planning efforts.
- Inform county efforts to address the following issues related to hydrology, hydraulics, habitat, and water quality:
  - Impacts from current or past development projects subject to lesser or non-existent stormwater treatment and flow control standards.
  - Subwatershed-specific needs due to inherent sensitivities or the present condition of water quality or habitat.
  - Potential impacts from future development.

The CWP recognizes the need to translate assessment information into on-the-ground actions to improve water quality and habitat. Facilitating this process is a key requirement for the program's long-term success.

Results and products of needs assessments promote more effective implementation of various programs and mandates. These include identifying mitigation opportunities and providing a better understanding of stream and watershed conditions for use in planning county road projects. Similar information is also needed by county programs implementing critical areas protections and salmon recovery planning under the state Growth Management Act (GMA) and the federal Endangered Species Act (ESA).

### Scope

This report summarizes and incorporates new information collected for the SNAP as well as pre-existing information. In many cases it includes basic

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summary information or incorporates by reference longer reports which may be consulted for more detailed information.

SNAP reports produce information related to three general categories:

- Potential stormwater capital projects for county implementation or referral to other organizations
- Management and policy recommendations
- Natural resource information

Descriptions of potential projects and recommended program management actions are provided to county programs, including the Public Works CWP and Stormwater Capital Improvement Program (SCIP), several programs within the Department of Community Development, and the county's ESA Program. Potential project or leveraging opportunities are also referred to local agencies, groups, and municipalities as appropriate.

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## Assessment Approach

Priorities for Needs Assessment in Big Tree Creek, East Fork Lewis River (RM 26.30), and King Creek

Clark County subwatersheds were placed into a five year schedule for assessment using the procedures described in *Prioritizing Areas for Stormwater Basin Planning* (Swanson, July 2006).

For SNAP purposes, Big Tree Creek, East Fork Lewis River (RM 26.30), and King Creek subwatersheds are categorized as “Largely Forested Land”. Subwatersheds in this category contain significant amounts of private land zoned for industrial forestry and DNR forest lands. These areas have few county roads and stormwater management is limited to mapping and evaluating the area draining to county outfalls, and possible habitat protection or restoration to mitigate for stormwater impacts to other parts of a watershed.

## Assessment Tools Applied in Big Tree Creek, East Fork Lewis River (RM 26.30), and King Creek

The SNAP utilizes a standardized set of tools for subwatershed assessment, including desktop mapping analysis, modeling, outreach activities, and a variety of field data collection. Tools follow standard protocols to provide a range of information for stormwater management. Though not every tool is applied in every subwatershed, the use of a standard toolbox ensures the consistent application of assessment activities county-wide.

Table 1 lists the set of tools available for use in the SNAP. Tools marked with an asterisk (\*) are those for which new data or analyses were conducted during the course of this needs assessment. The remainder of the tools or chapters are completed based on pre-existing information.

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<b>Table 1: Stormwater Needs Assessment Tools</b>	
Stakeholders *	Geomorphology And Hydrology Assessment
Outreach And Involvement *	Riparian Assessment
Coordination with Other Programs *	Floodplain Assessment
Drainage System Inventory *	Wetland Assessment
Stormwater Facility Inspection *	Macroinvertebrate Assessment
Review Of Existing Data *	Fish Use And Distribution
Illicit Discharge Screening	Water Quality Assessment
Broad Scale GIS Characterization *	Hydrologic Modeling
Rapid Stream Reconnaissance	Hydraulic Modeling
Physical Habitat Assessment	

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## Assessment Actions

### Outreach Activities

Outreach activities were limited and focused primarily on raising awareness about the SNAP effort. The following activities were completed:

- August 2008 – press release to local media.
- March 2008 & December 2008– articles in Clean Water Program E-Newsletter.
- April 2008 – SNAP information distributed with Clean Water Program information at Small Farm Expo: 69 participants.
- August 2008 – information on the SNAP program distributed at 10-day Clark County Fair.
- Clean Water Program web pages updated as needed on an on-going basis; 138 visitors to the SNAP Web page and 95 unique downloads of SNAP documents (note, these figures are under reported as tracking software only records top 20 pages and documents monthly).
- A description of the SNAP is included in Clark County’s annual stormwater management program plan submitted to Ecology.

Clark County Clean Water Commission members were also updated periodically on SNAP progress.

Tools available to educate in response to identified problem areas include the following:

- Site visits by clean water technical assistance staff.
- Letters detailing specific issues to individual landowners.
- General educational mailings to selected groups of property owners.
- Workshops on best management practices, including septic maintenance and mud, manure and streamside property management.
- Referral to other agencies, such as Clark Conservation District or WSU Extension, for educational follow-up.



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## Coordination with Other Programs

### Purpose

Coordination with other county departments and with local agencies or organizations helps to explore potential cooperative projects and ensure that the best available information is used to complete the assessment.

Coordination is a two-way relationship; in addition to bringing information into the needs assessment process, coordinating agencies may use needs assessment results to improve their programs.

### Methods

The CWP maintains a list of potential coordinating programs for each subwatershed area. Coordination takes the form of phone conversations, meetings, or electronic correspondence, and is intended to solicit potential project opportunities, encourage data and information sharing, and promote program leveraging.

Potential opportunities for coordination exceeded the scope of CWP and SNAP resources; therefore, not all potentially relevant coordination opportunities were pursued. Coordination was prioritized with departments and groups thought most likely to contribute materially to identifying potential projects and compiling information to complete the needs assessment.

### Results

See Analysis of Potential Projects for an overall list and locations of potential projects gathered during the needs assessment process. Projects suggested or identified through coordination with other agencies are included.

The following list includes departments, agencies, and groups contacted for potential coordination in the Big Tree Creek, East Fork Lewis River (RM 26.30), and King Creek needs assessment area:

- Lower Columbia Fish Recovery Board
- Clark County Legacy Lands Program
- Vancouver/Clark Parks and Recreation



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## Review of Existing Data

Data and information review is incorporated throughout this report in pertinent sections. A standardized list of typical data sources created for the overall SNAP effort is supplemented by subwatershed-specific sources as they are discovered. Data sources consulted for this report include, but are not limited to those listed below:

- LCFRB Habitat Assessments
- LCFRB Workplan / Project List
- Salmon Recovery Plan
- Clark County LISP/SCMP/Project Data
- Ecology 303D (list)
- Ecology EIM Data
- Clark County Consproj GIS Layer (conservation projects)
- Clark County 6-year and 20-year TIP
- Clark County Mitigation Opportunities Project
- Clark County 2005 Subwatershed Characterization
- Clark County 2004 Stream Health Report



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## Broad-Scale GIS Characterization and Metrics

The broad-scale characterization is a GIS-based exercise providing an overview of the biophysical setting for each subwatershed, background information for use in implementing other SNAP tools, and identification of potential acquisition or project sites. GIS data describes many subwatershed characteristics such as topography, geology, soils, hydrology, land cover, land use, and GMA critical areas. A standard GIS workspace including shape files for over 65 characteristics forms the basis for the characterization.

GIS data are generally used as a tool to complete the report and not presented in the report itself. Summary metrics are taken from existing reports and data; for example, Wierenga (2005) summarized many GIS characteristics for Clark County subwatersheds.

Some of these characteristics are described in greater detail in later sections.

The characterization includes three components:

- A set of four standard map products, as paper maps for SNAP use
- A summary table of selected subwatershed-scale metrics
- A brief narrative including comparison of metrics to literature values, conclusions about general subwatershed condition and potential future changes, and potential mitigation or improvement site identification.

## Map Products

Four standard SNAP map products are: 1) Stormwater Infrastructure and Hydrologic Soil Groups, 2) Critical Areas information, 3) Vacant Buildable Lands within UGAs, and 4) Orthophoto. These maps are printed out for tabletop evaluations.

## General Conditions and Subwatershed Metrics

### *General Geography*

The study area is in mountainous terrain near the eastern boundary of Clark County (Figure 1). Big Tree Creek and King Creek subwatersheds are tributaries to the East Fork Lewis River (RM 26.30) subwatershed. Part of the basin is outside Clark County, in Gifford Pinchot National Forest in Skamania County, and not part of this study. The area is almost entirely commercial forest in state forest lands, with a few smaller private forest lots and residences in lower elevation areas.

No county owned roads and associated stormwater drainage systems are present in King Creek Subwatershed. In Big Tree Creek and East Fork Lewis River (RM 26.30), Sunset Falls Road is the only county right-of-way. All other roads are privately owned and maintained.



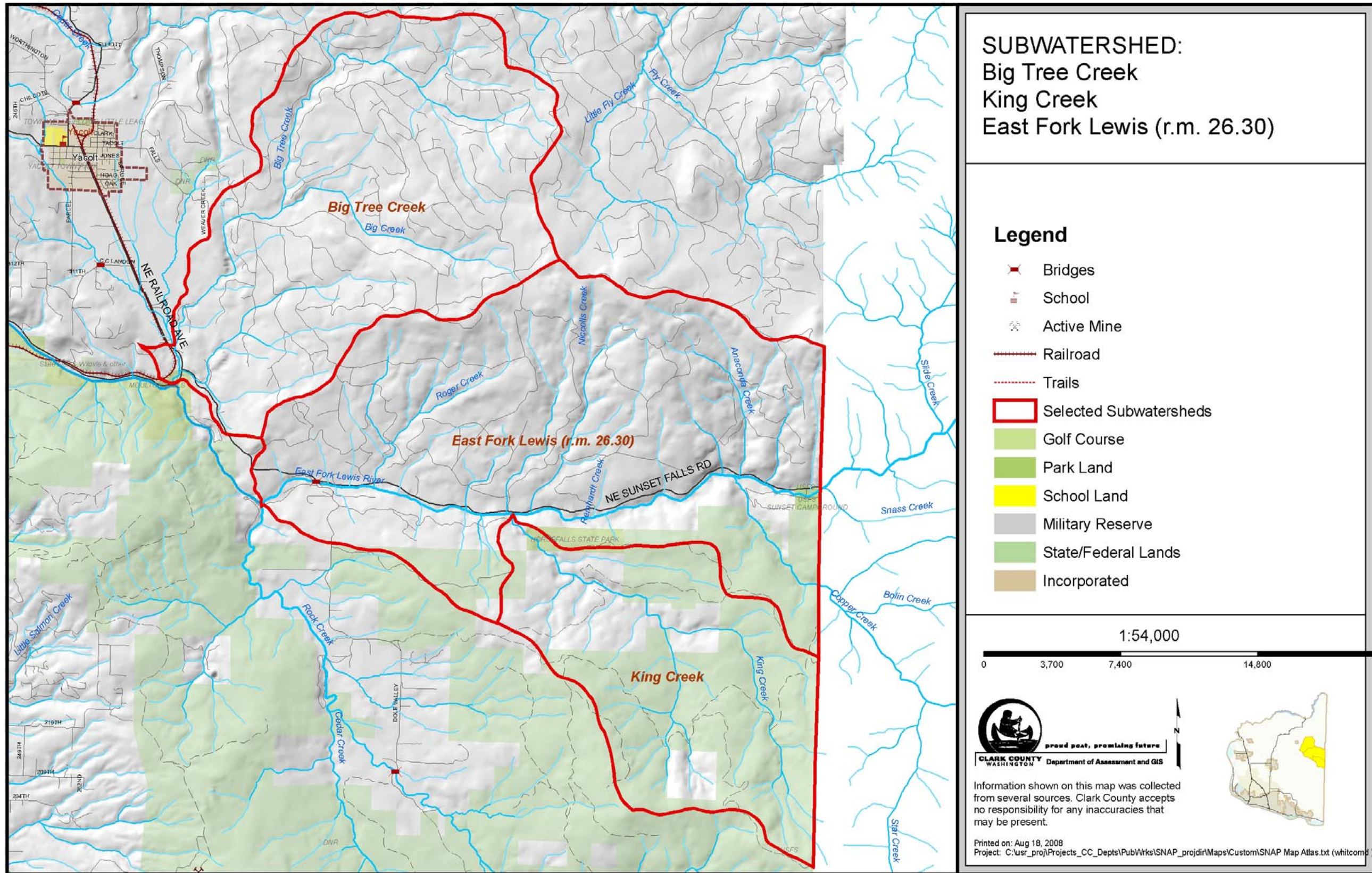


Figure 1: Big Tree Creek, East Fork Lewis River (RM 26.30), and King Creek Subwatershed Area Map



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### *Topography*

The study area is Western Cascade Mountain valleys cut into volcanic rock. The highest mountain tops are 3,400 feet on the northwest flank of Silver Star Mountain on the county boundary. Much of the area is between 800 feet and 2,200 hundred feet elevation. The East Fork Lewis River and its tributaries generally lack well formed floodplains and often form canyons.

### *Geology and Soils*

The study area is underlain by two principal geologic units; Oligocene volcanic andesite lava underlies most of the basin with an overlying, thin layer (less than 40 feet thick) of compacted Ice Age till. Till deposits are described as occurring north of the East Fork and below elevations of about 1,400 feet. Alluvial deposits occur along stream channels.

Soils formed on the volcanic andesite lavas and glacial deposits are generally well-drained mountain soils belonging to the Kinney Series and Olympic Series.

### *Hydrology*

The study area hydrologic framework is determined by geology and topography. Mountain streams are generally higher gradient and have little or no floodplain. Much of the precipitation leaves the area as rainfall runoff or shallow interflow, leaving streams with low flows in summer months.

No stream gauge data is available for this study area.

### *Subwatershed Metrics*

Subwatershed scale metrics provide a simple way to summarize overall conditions. Metrics are calculated from Landsat land cover analysis and current GIS data. Benchmarks for properly functioning and not properly functioning, are based on NOAA fisheries standards for salmon protection and restoration (1996 and 2003).

Overall, these metrics suggest that the study area has mostly functioning stream habitat (Table 2).

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<b>Table 2: Watershed Scale Metrics</b>					
<b>Metric</b>	<b>Big Tree Creek</b>	<b>King Creek</b>	<b>East Fork Lewis River (RM 26.30)</b>	<b>Functioning</b>	<b>Non-functioning</b>
Percent Forested (2000 Landsat)	51	90	80	> 65 %	< 50 %
Percent TIA (2000 Landsat)	9	4	5	< 5 %	> 15 %
Road Density 2007 data (miles/mile <sup>2</sup> )	5.9	3.2	4.2	< 2	> 3
Stream Crossing Density (crossings per stream mile)	2.2	0.6	1.7	< 3.2/mile	> 6.4/mile
Percent EIA estimated from the Comprehensive Plan	< 1	< 1	<1	< 10 %	> 10 %

### *Forest Cover*

The proportion of a watershed in forest cover is known to have a profound influence on watershed processes. Forest cover estimates are taken from a report summarizing land cover for Clark County (Hill and Bidwell, January 2003). Research in the Pacific Northwest has shown that when forest cover declines below approximately 65 percent, watershed habitat forming processes become degraded (Booth and Jackson, 1997). These include reducing riparian shade, less wood debris delivery to streams, increased stormwater runoff, and increased fine sediment delivery due to mass wasting.

The study area is largely forest tracts in various stages of growth that range from recently cleared to mature forest. Little area is cleared for pasture or residential use. Big Tree Creek is heavily logged and the 51 percent forest cover reflects this.

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### *TIA (Total Impervious Area)*

Total impervious area is one of the most widely used indicators of urbanization and coincident watershed degradation (Center for Watershed Protection, March 2003). Total impervious areas are estimated from land cover data in Hill and Bidwell (January 2003). While various organizations and publications categorize stream condition based on TIA, the NOAA fisheries standard is less than five percent as fully functional and greater than 15 percent as non-functioning. Impervious area estimates from Hill and Bidwell (March 2003) tend to be higher than expected for forested areas because clear cut areas can be categorized as forested urban land cover. This tendency to incorrectly map clear cuts is reflected in the nine percent TIA in Big Tree Creek, where there are many recent clear cuts.

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### *Road Density*

Road density, including all public and private roads, is an easily calculated development measure. Based on criteria set by NOAA Fisheries to protect salmon habitat, road densities fall within the non-functioning ( $>3$  road miles/mi<sup>2</sup>) category, suggesting degraded habitat.

### *Stream Crossing Density*

Stream crossing densities are easily measured using available road and stream channel data. The salmon protection standard considers larger fills over 60 feet wide, which would be approximately five to ten foot high road fill. The study area subwatersheds all have stream crossing densities within the functioning category ( $<3.2$  crossings/stream mile NOAA Fisheries criteria).

### *Future Effective Impervious Area*

Effective impervious area is the amount of impervious area that actually drains to a water body. Depending on factors such as soil types and level of development, effective impervious area is about half (lower intensity development) to almost equal (high intensity development) the TIA value.

The 2008 Comprehensive Plan guides development for the next few years and when used to estimate effective impervious area it can provide a metric for potential hydrologic impacts due to expected development. Virtually no future EIA changes should be seen in the study area due to forest zoning, Washington DNR ownership, and being outside the current Urban Growth Area.

### *Estimated Channel Stability Based on Forest Cover and EIA*

In a recent publication by Booth, Hartley, and Jackson (June 2002), a relationship between forest and percent EIA was presented as a graphic (Figure 2). According to this figure, streams in King Creek and East Fork Lewis River (RM 26.30) should have predominately stable channels. Big Tree Creek subwatershed could be categorized as marginally unstable to potentially unstable, based on the amount of clear cuts characterized as impervious area and the limited amount of mature forest.

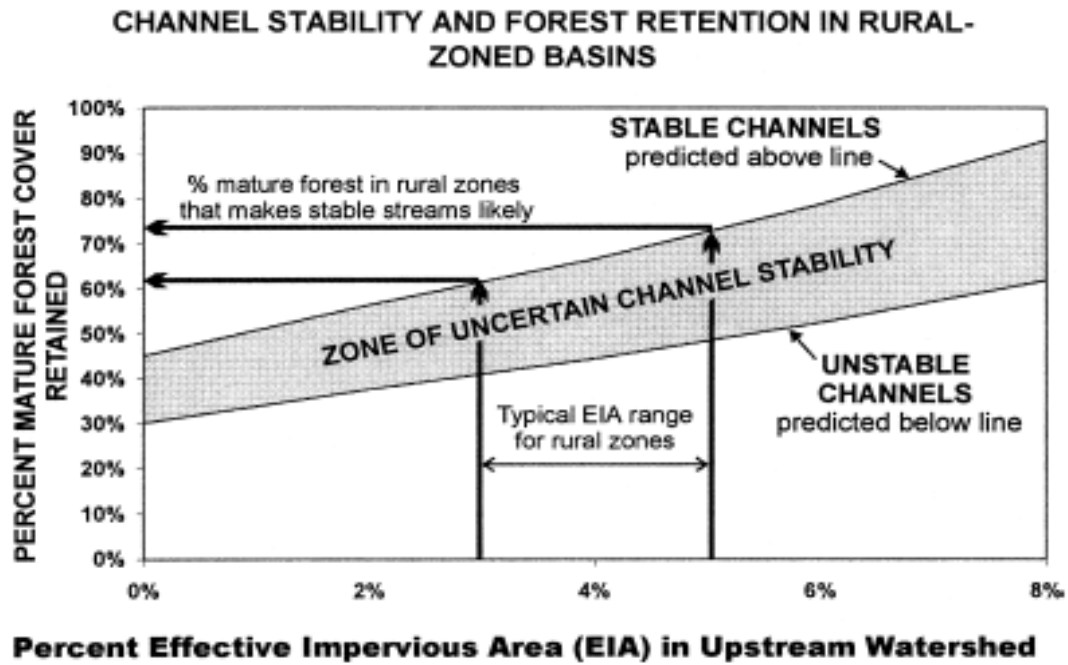


Figure 2: Channel Stability in Rural Areas (Booth, Hartley, and Jackson, June 2002)



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## Water Quality Assessment

The Water Quality Assessment summarizes and references available water quality data from the assessment area. A description of applicable water quality criteria is included, along with discussions of beneficial use impacts, likely pollution sources, and possible implications for stormwater management planning.

### Water Quality Criteria

For a full explanation of current water quality standards see the Ecology website at:

<http://www.ecy.wa.gov/programs/wq/swqs/index.html>

Under state water quality standards, Big Tree Creek is to be protected for the designated uses of: Char spawning/rearing; extraordinary primary contact recreation; domestic, industrial, and agricultural water supply; stock watering; wildlife habitat; harvesting; commerce and navigation; boating; and aesthetic values” (WAC 173-201A-600 and Table 602).

King Creek and East Fork Lewis River above river mile (RM) 24.6 are to be protected for the designated uses of: Core summer habitat; and, as above for Big Tree Creek.

Table 3 summarizes currently applicable water quality criteria for all creeks in the assessment area.

<b>Table 3: Applicable Water Quality Criteria</b>	
<b>Characteristic</b>	<b>Criteria</b>
Temperature	≤ 16.0 °C (60.8 °F) (Big Tree Creek ≤ 12.0 °C (53.6 °F) )
Dissolved Oxygen	≥ 9.5 mg/L
Turbidity	Shall not exceed 5 NTU over background when background is 50 NTU or less.
pH	6.5 – 8.5 units
Fecal coliform bacteria	Geometric mean fecal coliform concentration not to exceed 50 colonies/100mL, and not more than 10 percent of samples exceeding 100 colonies/100mL.
Aesthetics	Aesthetic values must not be impaired by the presence of materials or their effects, which offend the senses of sight, smell, touch, or taste.
Toxics	Toxic substances shall not be introduced, which have the potential to adversely affect characteristic water uses, cause acute or chronic toxicity to the most sensitive biota dependent upon those waters, or adversely affect public health.

Source: Washington Department of Ecology (<http://www.ecy.wa.gov/programs/wq/swqs/index.html>)

# 2008 Stormwater Needs Assessment Program

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## 303(d) Listed Impairments

The 2008 list of impaired waters may be found on the Ecology website at:

<http://www.ecy.wa.gov/programs/wq/303d/index.html>

Big Tree Creek and the East Fork Lewis within the East Fork Lewis River (RM 26.30) subwatershed are Category 5 listed for temperature on the 2008 303(d) list. King Creek is not listed in 2008.

Ecology is currently developing fecal coliform and temperature TMDLs for the East Fork Lewis River. All three of these subwatersheds are included in the TMDL, either directly or as tributary streams to a listed segment.

## Clark County Stream Health Report

In 2004, the CWP compiled available data and produced the first county-wide assessment of general water quality.

While no stream data were available for Big Tree Creek or King Creek, the report utilized a simple predictive model to assign probable stream health. Based on the amount of forested and developed area within the subwatershed, the probable health score for Big Tree Creek was poor to fair. The probable health score for King Creek was excellent.

Based on limited available datasets for general water quality and fecal coliform bacteria, the East Fork Lewis River in the East Fork Lewis River (RM 26.30) subwatershed had good stream health.

The 2004 Stream Health Report may be viewed on the county website at:

<http://www.clark.wa.gov/water-resources/stream.html>.

## Available Data

Water quality data for the study area consists primarily of stream temperature and bacteria data collected by Ecology in 2005 and 2006 during TMDL development. Complete data and available summaries for TMDL development may be viewed on the Ecology website at:

<http://www.ecy.wa.gov/programs/wq/tmdl/EForkLewis/index.html>

Data and information sources reviewed or summarized as part of this water quality characterization are listed in Table 4.

<b>Table 4: Data and Information Sources</b>	
<b>Source</b>	<b>Data and/or Report</b>
Ecology	East Fork Lewis River TMDL technical study for temperature and bacteria
Clark County Clean Water Program	2004 Stream Health Report and draft reports

# 2008 Stormwater Needs Assessment Program

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## Water Quality Summary

Ecology collected instream flow and fecal coliform data from station 27-BIG-0.05 (Big Tree Creek at Lucia Falls Road) during data collection for the East Fork fecal coliform TMDL. Continuous temperature data were collected from the following stations in this assessment area as part of the East Fork temperature TMDL:

- 27EFL27.0 (East Fork Lewis at Dole Valley Road)
- 27 EFL29.3 (East Fork Lewis at Co 12 Road)
- 27EFL32.5 (East Fork Lewis above Copper Creek)
- 27BIG00.05 (Big Tree @ Lucia Falls Road)
- 27KNG00.0 (King Creek near mouth)

Clark County has no existing monitoring stations in the assessment area.

## *Fecal Coliform Bacteria*

Based on 32 samples (16 wet season and 16 dry season), Big Tree Creek at Station 27-BIG-00.05 met state standards for fecal coliform bacteria during the dry season. During the wet season, the station met the geometric mean standard, but failed to meet the “10 percent not-to-exceed” standard.

During a dry period sampled in 2005, the Big Tree Creek station carried approximately six percent of the bacteria load measured in the East Fork watershed. During a rain event sampled in 2005, the approximate load was two percent of the total.

## *Water Temperature*

Temperature logging at the five stations listed above, indicated that the 7-Day Average Maximum temperatures were among the cooler measured within the East Fork. However, all five stations exceeded the current state standards applicable to each station.

## *Stream Health*

The most complete predictor of current stream health in the assessment area may be the simple land-use model utilized by the CWP for the 2004 Stream Health Report.

Based on that model, it is likely that water quality in Big Tree Creek is impaired by similar pollutants as other subwatersheds with relatively limited intact forest areas and significant levels of rural development, which may include temperature, sediment, fecal coliform bacteria, nutrients, and flow extremes. The actual extent of impairment is unknown, but the available data suggest that both temperature and fecal coliform are problems.

## 2008 Stormwater Needs Assessment Program

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### Implications for Stormwater Management

Table 5 lists general water quality concerns in the assessment area and potential solutions for each. Solutions listed in bold indicate areas where CWP activities can have a positive impact. It should be noted that CWP activities, though important, are not likely to achieve water quality improvement goals on their own. Other county departments, local agencies, and not least of all, the public, must all contribute to water quality improvement.

## 2008 Stormwater Needs Assessment Program

**Table 5: Likely Water Quality Concerns, Sources, and Solutions for Big Tree Creek, East Fork Lewis River (RM 26.30), and King Creek**

<b>Characteristic</b>	<b>Beneficial Use Affected</b>	<b>Potential Sources</b>	<b>Mechanism</b>	<b>Solutions (bold indicates direct Clean Water Program involvement)</b>
Fecal coliform bacteria	Extraordinary primary contact recreation (Big Tree Creek)	failing septic systems	groundwater seeps	<b>Storm sewer screening for source identification and removal</b> <b>Education programs</b> Agricultural Best Management Practices Septic system inspection and maintenance
		livestock, wildlife, pets	overland runoff storm sewers/ditches direct access	
Water temperature	Char spawning/rearing  Core summer salmonid habitat (anadramous)	vegetation removal	direct solar radiation	<b>Stormwater infiltration to increase baseflow</b> Streamside planting/vegetation <b>Riparian preservation through acquisition</b> <b>Education programs</b>

## 2008 Stormwater Needs Assessment Program

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## 2008 Stormwater Needs Assessment Program

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### Drainage System Inventory

Clark County's drainage system inventory resides in the StormwaterClk GIS database and is available to users through the county's Department of Assessment and GIS, or viewable on the internet through the Digital Atlas located at:

<http://gis.clark.wa.gov/imf/imf.jsp?site=digitalatlas&CFID=56651&CFTOKEN=98300052>

Drainage system inventory is an ongoing CWP work effort focused on updating the StormwaterClk database to include all existing stormwater drainage infrastructure.

The work effort during 2008 in the Big Tree Creek, East Fork Lewis River (RM 26.30), and King Creek subwatersheds was focused on identifying and mapping previously unmapped discharge points and stormwater conveyance. Table 6 indicates the number of features previously inventoried in StormwaterClk prior to 2008 SNAP work, and the number of features added to the database as a result of 2008 SNAP and mapping project implementation.

The drainage system inventory for these three subwatersheds is generally completed. Inventory is ongoing in 2009 as part of a county-wide inventory update.

<b>Table 6: Drainage System Inventory Results, Big Tree, East Fork Lewis River (RM 26.30), and King Creek</b>		
<b>Database Feature Category</b>	<b>Previously Inventoried</b>	<b>Added to Database during 2008</b>
Inlet	0	0
Discharge Point (outfall)	0	106
Flow Control	0	0
Storage/Treatment	0	0
Manhole	0	0
Filter System	0	0
Channel	5	326
Gravity Main	9	125
Facilities	2	0



# 2008 Stormwater Needs Assessment Program

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## Stormwater Facility Inspection

The stormwater facility inspection process includes two components:

- A public stormwater facility inspection using state and county standards.
- An off-site inspection to check for problems such as downstream bank erosion.

### *Component 1: Public Stormwater Facility Inspection*

Based on the county's StormwaterCLK database, as of October 2008, there were no mapped public stormwater facilities in the assessment area.

### *Component 2: Offsite Assessment*

#### Purpose

Discharge from stormwater outfalls can cause moderate to severe erosion as stormwater moves through the riparian zone and to the receiving water. Erosion creates a source of sediment to the stream due to incision and slope failures. It can also increase slope instability problems.

The Offsite Assessment project detects possible offsite or downstream problems associated with the county's storm sewer system, particularly from facility outfalls that discharge to critical areas.

#### Methods

County-owned and operated stormwater outfalls meeting one or more of the following criteria were included in the offsite assessment:

- Within 200 feet of a critical area such as a stream channel,
- Within 300 feet of a headwater stream,
- Located on public land,
- Discharges stormwater from a public-dedicated facility that is currently under the two year private maintenance warranty bond.

The offsite assessment inspects all outfalls that discharge into critical areas, as well as a 300 foot survey downstream of the outfall to look for any adverse impacts that may be caused by stormwater discharges.

If any outfall fails to meet the general outfall design criteria or is contributing to a downstream erosion problem, the outfall is not in compliance. Non-compliant outfalls are referred to the appropriate Public Works program for maintenance or repair.

# 2008 Stormwater Needs Assessment Program

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## Results

Based on the County's StormwaterCLK database, as of June 2008, there were no mapped outfalls in the King Creek subwatershed that discharged into critical areas.

Big Tree Creek subwatershed contained two mapped outfalls that discharged into critical areas. Figure 3 summarizes notable outfall assessment activities, including general outfall locations in the Big Creek subwatershed.

East Fork Lewis River (RM 26.30) subwatershed contained 14 mapped outfalls that discharged into critical areas. One unmapped outfall was discovered during field activities and was assessed. Figure 4 summarizes notable outfall assessment activities including general outfall locations in the East Fork Lewis River (RM 26.30) subwatershed.

As summarized in Table 7, 17 outfalls that discharged into critical areas were assessed in the Big Creek and East Fork Lewis River (RM 26.30) subwatersheds. Both of the outfalls in the Big Creek subwatershed were found to be in compliance. In the East Fork Lewis River (RM 26.30) subwatershed, 14 mapped outfalls that discharged into critical areas were assessed. All mapped outfalls were found to be in compliance. One unmapped outfall discovered during field activities was not in compliance due to a serious erosion and instability problem.

## Potential Projects

The outfall assessment project initiated one referral to a Clean Water Program Engineer. It was discovered that a serious erosion problem was occurring at an unmapped outfall. The repair of this outfall is included in the Analysis of Potential Projects section.

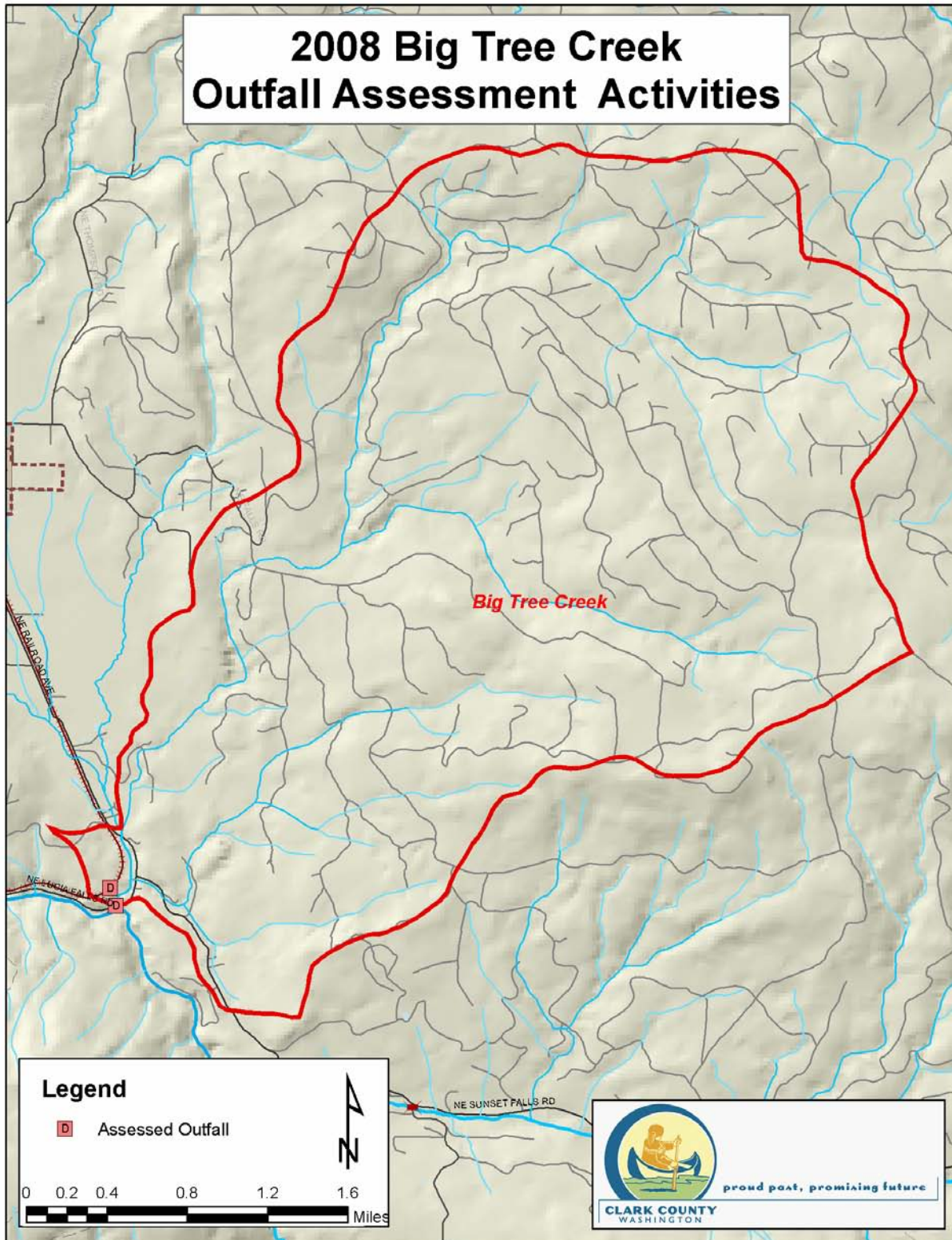


Figure 3: Summary of 2008 Outfall Assessment Activities in Big Tree Creek Subwatershed



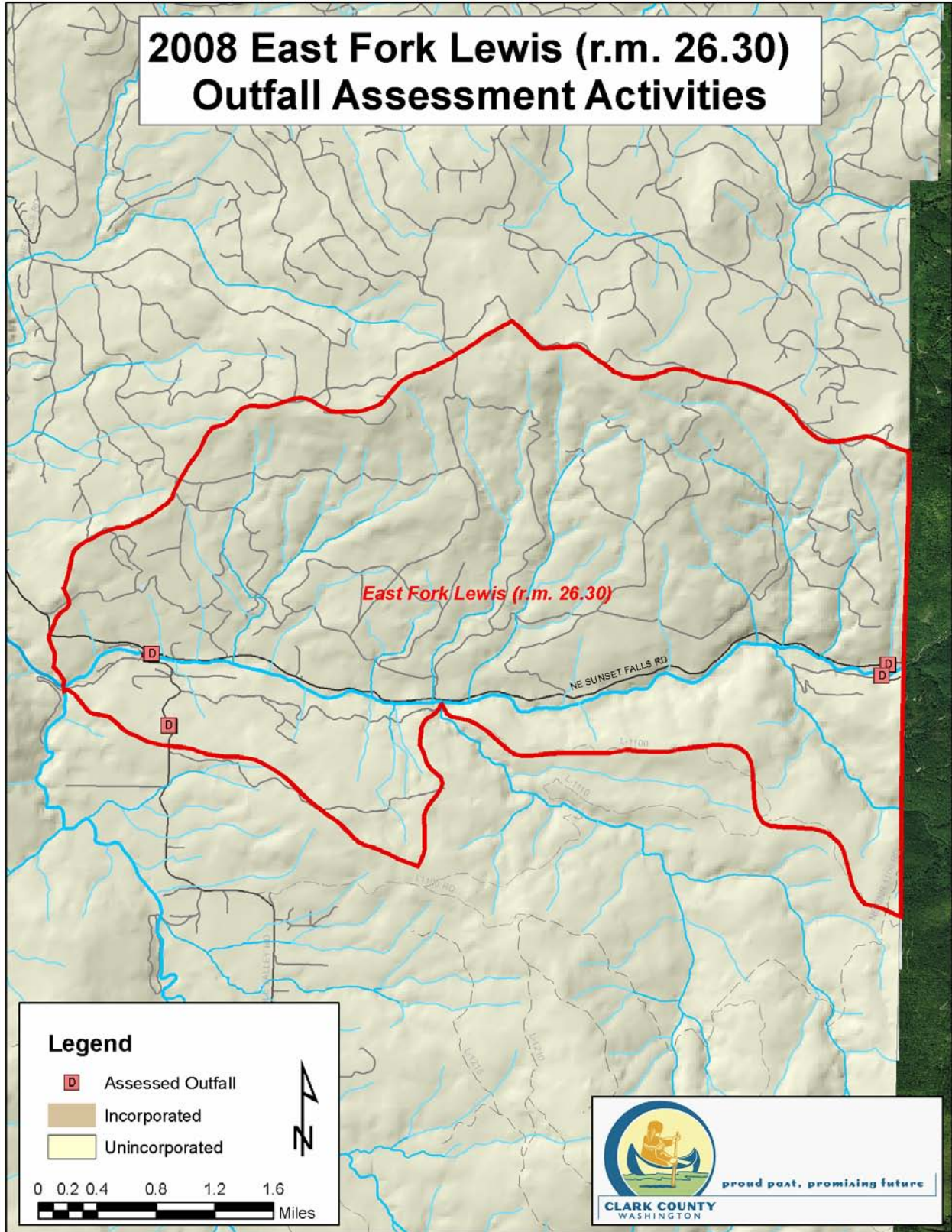


Figure 4: Summary of 2008 Outfall Assessment Activities in East Fork Lewis River (RM 26.30) Subwatershed

## 2008 Stormwater Needs Assessment Program

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<b>Table 7: 2008 Outfall Assessment Project Activity Summary of Big Tree Creek and East Fork Lewis River (RM 26.30) Subwatersheds</b>	
<b>Metric</b>	<b>Number</b>
# of outfalls assessed	17
# of outfalls compliant	16
# of noncompliant outfalls	1
# of referrals initiated	1
# of referrals ongoing	1
# of outfalls fixed	0

## 2008 Stormwater Needs Assessment Program

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### Illicit Discharge Detection and Elimination Screening

Illicit discharge screening was not conducted.



## 2008 Stormwater Needs Assessment Program

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### Stream Reconnaissance and Feature Inventory

A rapid stream reconnaissance and feature inventory was not conducted.



# 2008 Stormwater Needs Assessment Program

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## Physical Habitat Assessment

### Purpose

Physical habitat assessments provide direct measurements of stream channel morphology, habitat conditions, and riparian conditions for specific stream reaches. This information can be used for planning projects and interpreting hydrologic, macroinvertebrate, and geomorphologic information at reach and subwatershed scales.

### Methods

Physical habitat measurements were made on a portion of the mainstem in the East Fork Lewis River (RM 26.30) subwatershed (RM 29 to RM 29.6 with the upper extent of the reach at Horseshoe Falls) and its tributary King Creek (lowermost 1.1 miles) by S.P. Cramer (January 2005) for the Lower Columbia Fish Recovery Board. The project followed modified USFS Level II protocols. No physical habitat survey information is available for Big Tree Creek.

### Results

The S.P. Cramer report includes a good narrative summary of the habitat survey results, including figures and tables, some of which are presented here. The full report may be found on the CWP website at:

<http://www.clark.wa.gov/water-resources/documents-monitoring.html#strmac>

The East Fork Lewis River (RM 26.30) survey reach has a moderate gradient and its habitat type consists of about 58 percent pool, 39 percent riffle, and three percent pool tailout. The King Creek reach also has a moderate gradient and consists of about 71 percent riffle, 25 percent pool, two percent pool tailout, and two percent glide.

Information in the S.P. Cramer report noted that the surveyed East Fork streambed is primarily cobble, boulders, and gravel, with less than 14 percent in bedrock or sand. Embeddedness in the surveyed East Fork reach was generally rated low with 71 percent in the 0 percent to 25 percent embedded category. King Creek's surveyed streambed is dominated by gravel and cobble. Embeddedness for the King Creek reach was generally rated low with 61 percent in the 0 percent to 25 percent embedded category.

Table 8 summarizes habitat evaluations based on Washington Conservation Commission and NOAA Fisheries Properly Functioning Condition standards (Cramer, 2005, p217).

## 2008 Stormwater Needs Assessment Program

<b>Table 8: Washington Conservation Commission and NOAA Fisheries Properly Functioning Conditions</b>				
	<b>East Fork Lewis River (RM 26.30)</b>		<b>King Creek</b>	
<b>Parameter</b>	<b>WCC<sup>1</sup></b>	<b>PFC<sup>2</sup></b>	<b>WCC<sup>1</sup></b>	<b>PFC<sup>2</sup></b>
% Pool by Surface Area	Good		Poor	
Pool Frequency		Not Properly Functioning	Fair	At Risk
Pool Quality		Properly Functioning		At Risk
LWD		Not Properly Functioning		Not Properly Functioning
Substrate		Properly Functioning		At Risk
Streambank Stability	Good	Properly Functioning	Good	Properly Functioning
Barriers	Good	Properly Functioning	Good	Properly Functioning

<sup>1</sup> Available Rating: Good; Fair; Poor

<sup>2</sup> Available Ratings: Properly Functioning; At Risk; Not Properly Functioning

## 2008 Stormwater Needs Assessment Program

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Geomorphology and Hydrology Assessment  
A geomorphology assessment was not conducted.



# 2008 Stormwater Needs Assessment Program

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## Riparian Assessment

### Purpose

The riparian assessment characterizes existing conditions based on available data, to identify general riparian needs and potential areas for rehabilitation projects. Riparian enhancement projects, such as installation or protection of native plantings within riparian areas, can provide for increased future shading and woody debris recruitment, which can further provide an opportunity for stormwater-related watershed improvement.

The need for riparian rehabilitation tends to be widespread and exceeds the scope and resources of the CWP mission of stormwater management. Therefore, potential riparian projects are usually referred to agencies such as the LCFRB, Lower Columbia Fish Enhancement Group (LCFEG), Clark Public Utilities, Fish First, the Washington State University (WSU) Watershed Stewards Program, and the Clark Conservation District for possible implementation.

This section focuses on opportunities likely to be considered by the CWP SCIP which are primarily on publicly owned lands within high priority salmon-bearing stream reaches as defined by LCFRB salmon recovery priorities.

### Method

Where possible, the assessment is based on GIS data from existing reports, primarily the Habitat Assessment report prepared for the Lower Columbia Fish Recovery Board (S.P. Cramer and Associates, 2005). This report applies primarily to salmon-bearing stream reaches; therefore, it does not provide information for many smaller streams. Results are based on aerial photo interpretation using Washington Forest Practices Board methods for LWD delivery and channel shade estimates.

In streams where no data exists from the LCFRB characterization, an examination of current orthophotographs is used to make a general assessment of riparian conditions and identify areas where restoration or preservation projects may be appropriate.

Many riparian project opportunities are discovered through other SNAP activities, including Rapid Stream Reconnaissance feature inventories and geomorphological assessments. Potential projects discovered through these activities are discussed in the respective sections, and most are included on a final list for referral to outside agencies.

The 2005 LCFRB Habitat Assessment report was also reviewed for specific project opportunities within each subwatershed. Potential project sites have been reviewed and verified through field reconnaissance and are detailed in the results.

# 2008 Stormwater Needs Assessment Program

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## Results

Results are based primarily on the 2005 LCFRB Habitat Assessment for the King Creek and the East Fork Lewis River (RM 26.30) subwatersheds. The full characterization report is available on the Clark County website at:

<http://www.clark.wa.gov/water-resources/documents.html#mon>

For areas within the subwatersheds not included in the habitat assessment (Big Tree Creek subwatershed), large woody debris (LWD) recruitment potential and shade rating analyses were based on a qualitative review of 2007 orthophotographs.

At the subwatershed scale, the LCFRB rated the riparian conditions within Big Tree Creek, East Fork Lewis River (RM 26.30), and King Creek as moderately impaired.

### *Riparian (LWD Delivery)*

Figure 5 shows the LWD delivery potential.

The surveyed reach of King Creek consists of predominately low LWD recruitment levels, while the areas upstream of the surveyed reach range from low to high LWD recruitment levels based on orthophotography review. The left bank tributary to King Creek also ranges from low to high recruitment levels.

The Big Tree Creek subwatershed was not surveyed as part of the 2005 Habitat Assessment, consequently LWD recruitment levels are based solely on orthophotography review. Big Tree Creek appears to have low LWD recruitment levels along the majority of its length, with the exception of a reach near its mouth. Big Creek, the left bank tributary to Big Tree Creek also appears to have low LWD recruitment levels, based on orthophotography review.

The majority of the mainstem of the East Fork Lewis River has high LWD recruitment potential along the approximate six-mile distance surveyed within the subwatershed. Copper Creek, a tributary to the East Fork above King Creek, has moderate to high levels of LWD recruitment along its surveyed and non-surveyed reaches based on orthophotography review.

# King, Big Tree and East Fork Lewis (26.30) 2004 LCFRB LWD

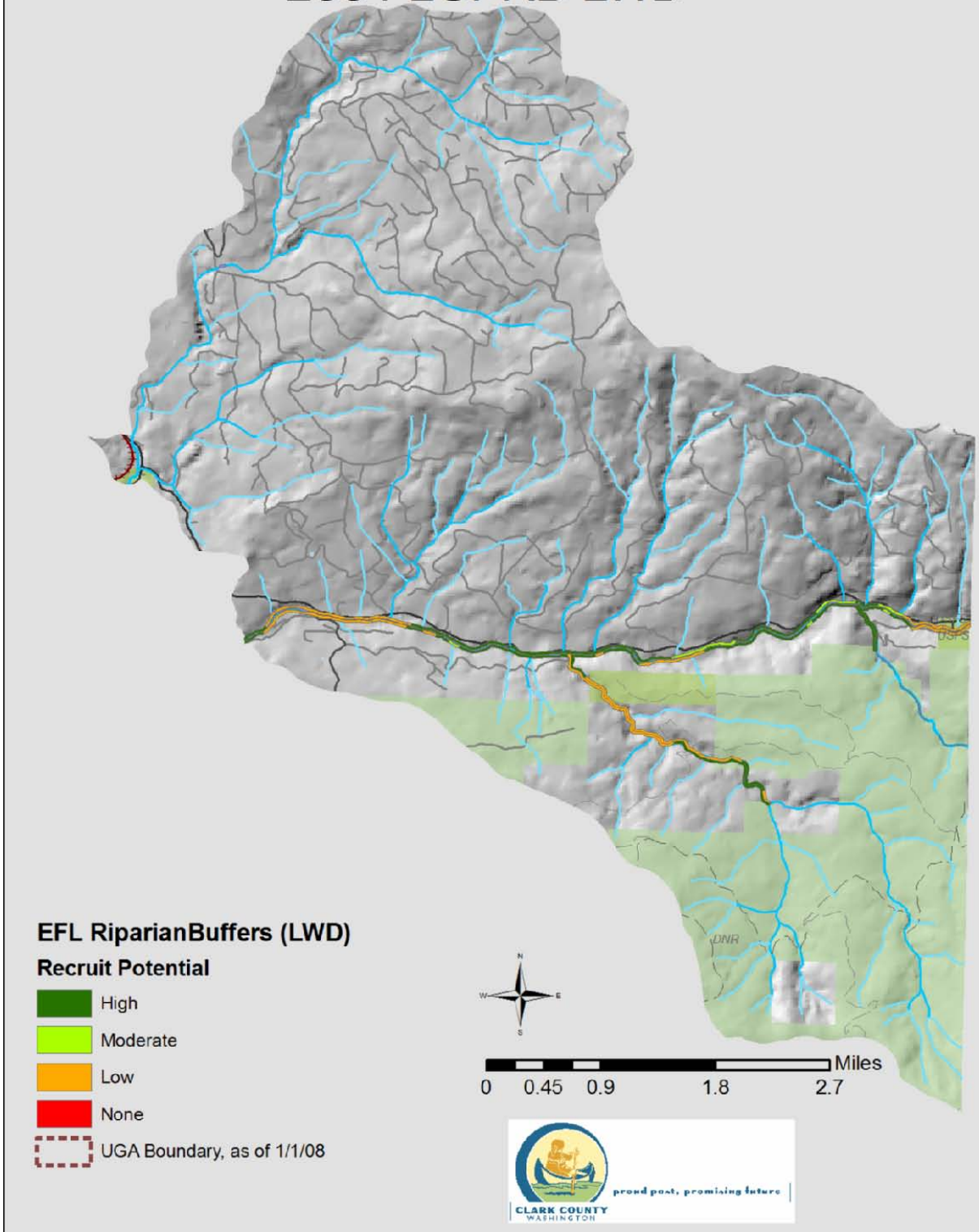


Figure 5: Big Tree Creek, East Fork Lewis River (RM 26.30), and King Creek LWD Recruitment Potential (adapted from S.P. Cramer and Associates, 2005)

# 2008 Stormwater Needs Assessment Program

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## *Shade*

Figure 6 shows the shade ratings from the 2005 LCFRB Habitat Assessment.

The surveyed reach of King Creek had shade levels ranging from 40 to 70 percent. Reaches upstream of the surveyed reach have similar shade levels based on orthophotography review. The left bank tributary to King Creek also appears to have shade levels ranging from 40 to 70 percent.

Big Tree Creek appears to have shade levels ranging from 40 to 70 percent along the majority of its entire reach based on orthophotography review. Big Creek, the left bank tributary to Big Tree Creek, appears to have similar shade levels to Big Tree Creek, with the exception of several areas of higher shade levels (70 to 90 percent) where the riparian area consists of dense coniferous forest.

The majority of the mainstem of the East Fork Lewis River has shade ratings of 40 to 70 percent along the approximate six-mile surveyed distance. Copper Creek has shade levels of 40 to 90 percent along its surveyed and non-surveyed reaches, based on orthophotography review.

## Management Recommendations

Overall recommended management activities for the Big Tree Creek, East Fork Lewis River (RM 26.30), and King Creek subwatersheds are the protection of existing riparian forests. Also important is the enhancement of rip-rapped banks, primarily seen in the East Fork Lewis River (RM 26.30) subwatershed, and invasive species removal.

## Potential Projects

This assessment did not discover any specific potential project opportunities likely to be suitable for consideration by the CWP SCIP for improvement of LWD recruitment or shade levels.

Specific priority project areas listed in the S.P. Cramer and Associates (2005) report are areas impacted by near-stream logging within the lowermost 650 feet of King Creek.

Recommended restoration projects in the King Creek and Big Tree Creek subwatersheds include patch cutting of riparian hardwoods and replanting with conifers in areas dominated by hardwoods and in areas where clear-cutting and historical fires have impacted the riparian zone.

Recommended restoration projects in the East Fork Lewis River (RM 26.30) subwatershed include riparian forest restoration on private residential land and restoration for highway and forest/logging road impacts within riparian areas.

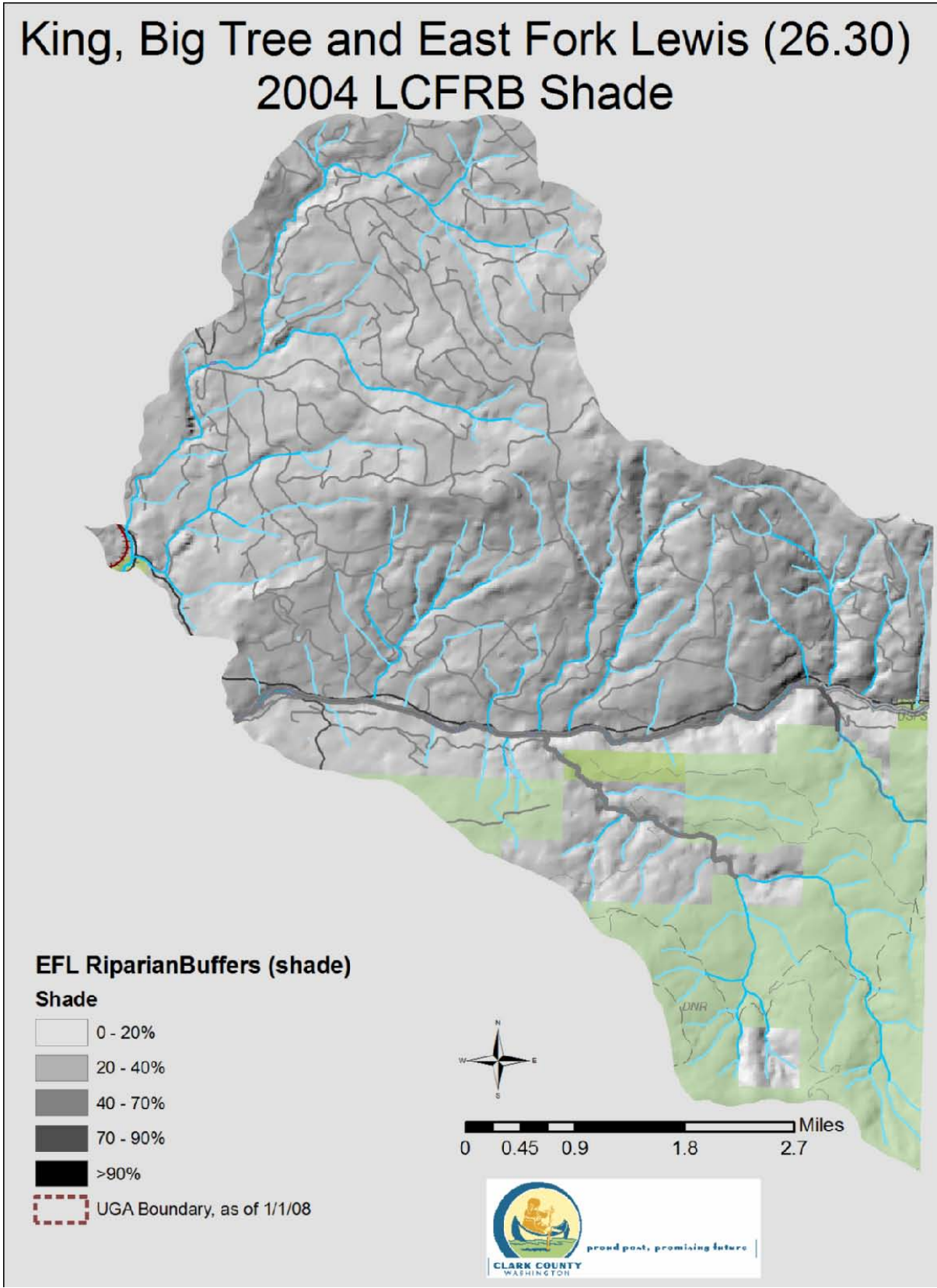


Figure 6: Big Tree Creek, East Fork Lewis River (RM 26.30), and King Creek Shade Values (adapted from S.P Cramer and Associates, 2005)



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### Floodplain Assessment

A floodplain assessment was not conducted.



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## Wetland Assessment

### Purpose

Wetlands perform important hydrologic, water quality, and habitat functions. The primary reasons for the wetlands assessments are to:

- Describe wetland conditions related to how they influence hydrology, water quality, and habitat;
- Identify priority potential wetland projects to mitigate for stormwater impacts; and
- Make management recommendations for wetlands related to stormwater management.

A primary objective of the wetland assessment is to identify sites containing modestly sized degraded or ditched wetlands where minor construction projects can be used to improve wetland hydrology. Improved wetland function can reduce peak storm discharges, increase groundwater recharge, and improve habitat through increasing biodiversity, species population health, and organic input.

### Methods

The assessment includes review of existing GIS data for wetlands. Primary information sources referenced are the county wetlands atlas, Draft Watershed Characterization of Clark County Version 3 (Ecology, 2007), and personal communication with other county programs.

Stream Reconnaissance and Geomorphology/Hydrology assessments may also discover potential wetland-related project opportunities. Potential project sites have been reviewed and verified through field reconnaissance and are detailed in the results section below.

Tax-exempt parcels often indicate the presence of publicly owned land, schools, or churches where large parcel sizes and opportunities for leveraging may exist. Potential wetlands were overlaid with tax-exempt parcels and with county vacant buildable lands model (VBLM) information to identify possible wetland enhancement opportunities.

### Results

Figure 7 shows potential wetland areas within the Big Tree Creek, East Fork Lewis River (RM 26.30), and King Creek subwatersheds based on data from the county wetlands atlas, including the Clark County wetland model, National Wetlands Inventory, and high-quality wetlands layer.

The Big Tree Creek subwatershed has expanses of potential wetland areas associated with the Big Tree Creek and Big Creek riparian corridors and floodplains.

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In the King Creek and East Fork Lewis River (RM 26.30) subwatersheds, potential wetlands are primarily associated with the stream channel floodplains of King Creek, the East Fork of the Lewis River, and its tributary, Copper Creek.

Although there were many areas of potential wetlands, review of the wetland inventories and studies did not identify any specific project opportunities within publicly held or tax-exempt lands within the assessment area.

# King, Big Tree and East Fork Lewis (26.30) Potential Wetlands

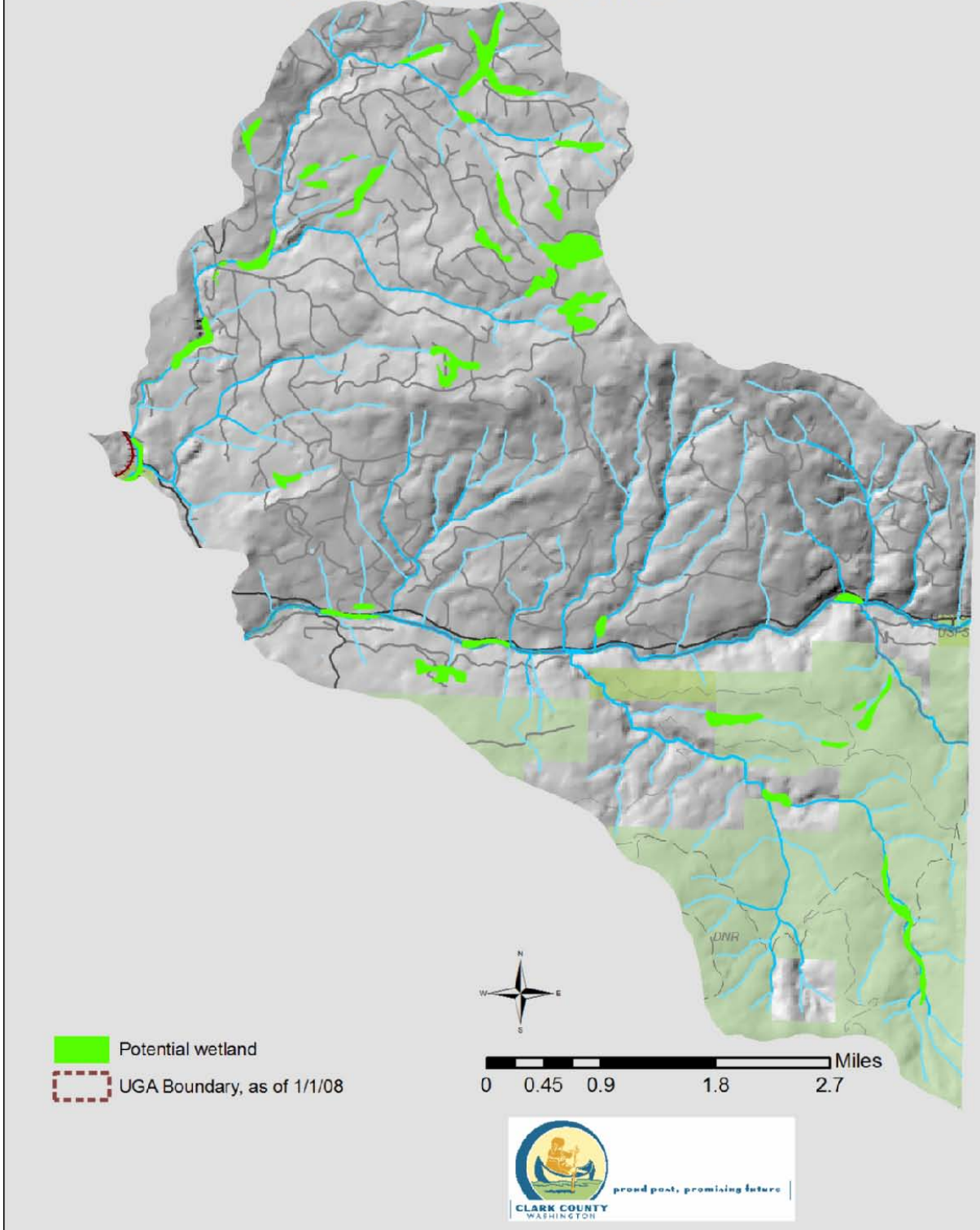


Figure 7: Big Tree Creek, East Fork Lewis River (RM 26.30), and King Creek Potential Wetlands

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### *Draft Watershed Characterization*

The Washington Department of Ecology completed a prototype watershed assessment to assist in planning wetland and riparian habitat restoration and preservation projects. The Draft Watershed Characterization (Washington Department of Ecology, 2007) may be found on the Clark County website at: <http://www.clark.wa.gov/mitigation/watershed.html>

The study area is within the rain-on-snow and snow-dominated mountainous unit. This unit is characterized by rain-on-snow and snow dominated precipitation, generally shallow groundwater flow patterns, consolidated bedrock, and steep topography (Ecology, 2007).

Figure 8 depicts priority areas for protection and restoration of hydrologic processes county-wide based on an analysis of the relative importance and level of alteration in each subwatershed.

## 2008 Stormwater Needs Assessment Program

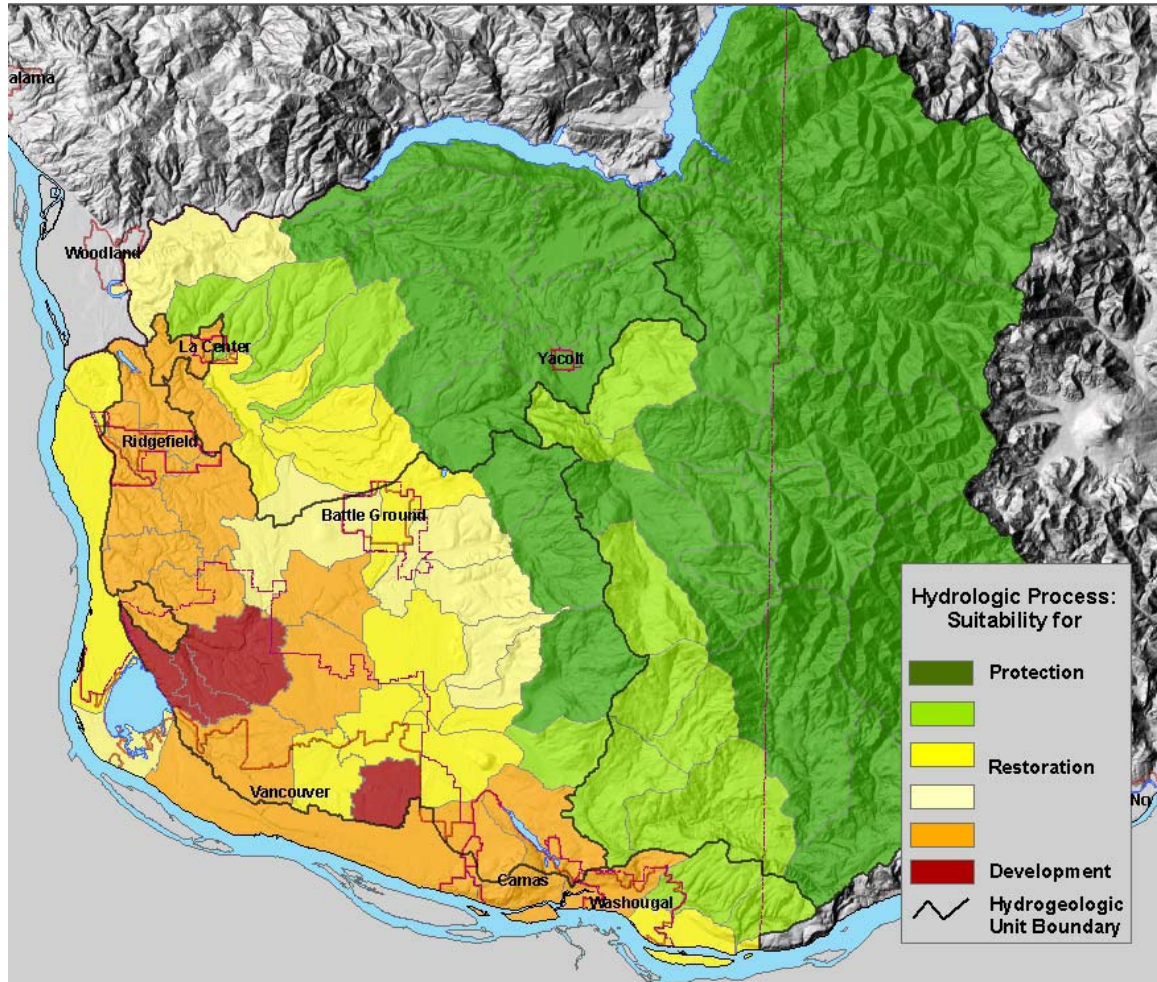


Figure 8: Priorities for suitability of areas for protection and restoration for the hydrologic process (from Draft Watershed Characterization of Clark County (Ecology, 2007)).

In general, green areas have higher levels of importance for watershed hydrologic processes and limited alteration and should be considered for protection. Yellow areas have a higher level of importance for watershed hydrologic processes and a higher level of alteration and should be considered for restoration unless watershed processes are permanently altered by urban development. Orange to red areas have lower levels of importance for watershed processes and higher levels of alteration and should be considered as more suitable for development. Because orange areas represent a transition from restoration areas, planning measures employing both restoration and appropriately sited development should be considered (Ecology, 2007).

Protection (“green”) is the focus for the Big Tree Creek, East Fork Lewis River (RM 26.30), and King Creek subwatersheds. The Draft Watershed Characterization suggests measures to protect watershed hydrologic processes by maintaining forest cover. Additionally, restoration projects should be undertaken within the rain dominated and rain-on-snow and snow-dominated mountainous

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units since they would have a higher level of potential success relative to other more highly altered units in the county (Ecology, 2007).

### Potential Projects

This assessment did not discover any specific potential projects to improve wetland hydrology within the assessment area.

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### Macroinvertebrate Assessment

No benthic macroinvertebrate survey information is available.



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## Fish Use and Distribution

### Purpose

Fish distribution refers to salmon and steelhead use. This information helps to identify stream segments where land-use changes may impact fish populations, informs management decisions, and aids in identifying and prioritizing potential habitat improvement and protection projects.

### Methods

Fish distribution is mapped from existing Clark County GIS information, which reflects data collected and analyzed by the Northwest Indian Fisheries Commission (NWIFC). Fish distribution data for Clark County is available on the County's website.

Several sources of barrier assessment data are available and are briefly summarized here, including:

- WDFW passage barrier database
- SalmonScape (<http://wdfw.wa.gov/mapping/salmonscape/>)
- Clark County 1997 passage barrier data
- Clark Conservation District/LCFRB passage barrier dataset

Many stream crossings have not been assessed for passage barrier potential, and the extent of public and private road crossings is a good indicator of the potential for additional barriers. Road crossings were mapped by overlaying the county road layer with LiDAR-derived stream data.

The barrier assessment data was also reviewed for specific project opportunities within each subwatershed. Potential project sites have been reviewed and verified through field reconnaissance and are detailed in the results section below.

### Results/Summary

#### *Distribution*

The fish distribution mapped from Clark County GIS information (Figures 9 and 10) varied from fish distribution data originating from the SalmonScape database. These differences are identified within the individual subwatershed discussions below.

The available evidence suggests that anadromous fish use within the King Creek and East Fork Lewis River (RM 26.30) subwatersheds includes winter and summer steelhead (Figures 9 and 10). Within the King Creek subwatershed, the data originating from SalmonScape shows presumed winter steelhead distribution ending further upstream than county mapping data indicates. Known summer steelhead distribution based on SalmonScape extends further upstream, extending to the confluence of King Creek and its unnamed left bank tributary.

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The East Fork of the Lewis River is mapped on SalmonScape as having known winter steelhead distribution ending at Horseshoe Falls, which is located just upstream of the confluence of the East Fork and King Creek.

The LCFRB 2004 Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan identifies the East Fork Lewis River as Tier 1 reaches (highest priority), and its tributary, Copper Creek, as a Tier 4 tributary. King Creek is also a Tier 4 reach.

The Big Tree Creek subwatershed does not have any reaches with anadromous fish use; therefore, the reaches are not ranked by priority (reach tiers) for recovery.

## King, Big Tree and East Fork Lewis (26.30) Winter Steelhead Distribution

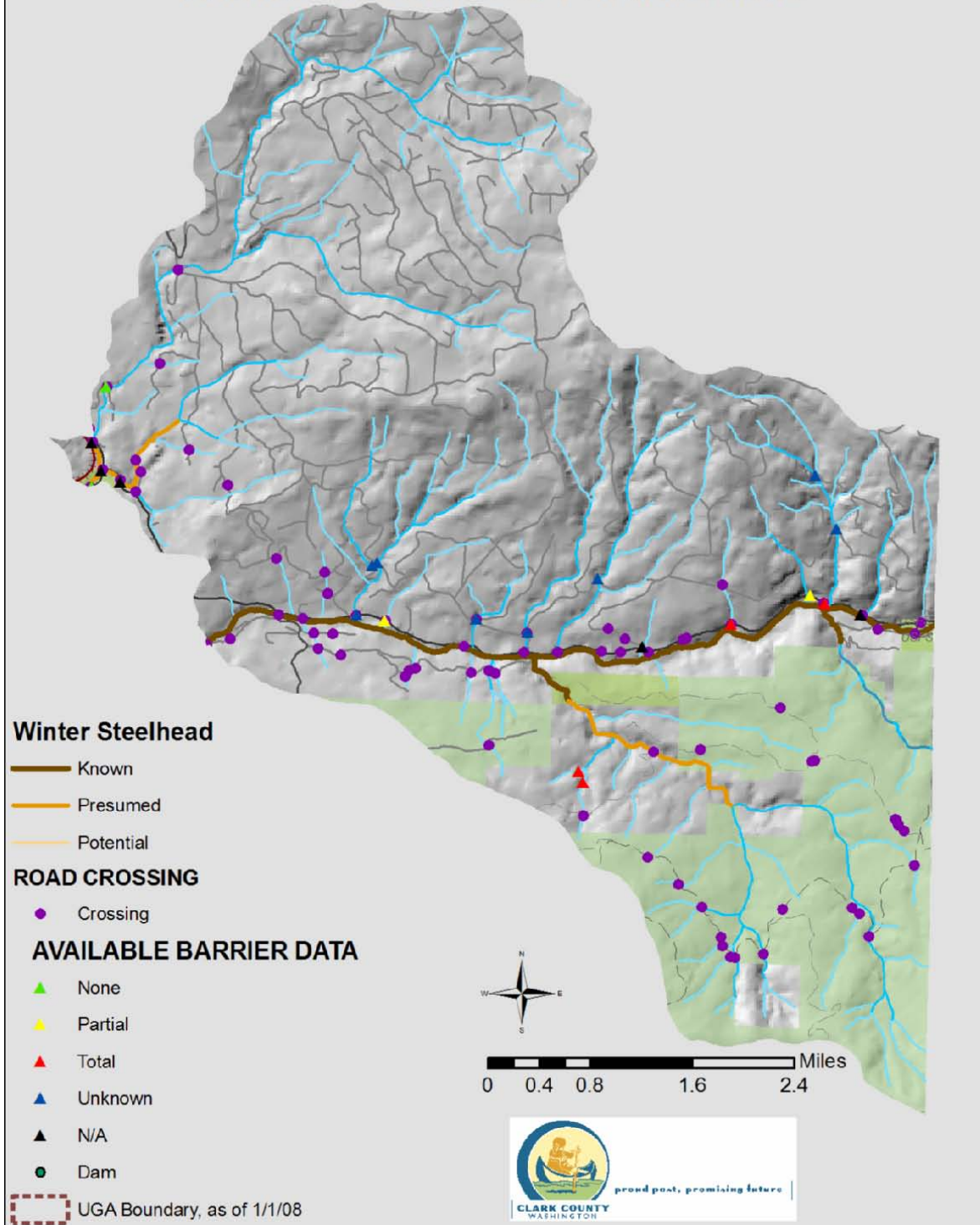


Figure 9: Big Tree Creek, East Fork Lewis River (RM 26.30), and King Creek Fish Distribution and Barriers

## King, Big Tree and East Fork Lewis (26.30) Summer Steelhead Distribution

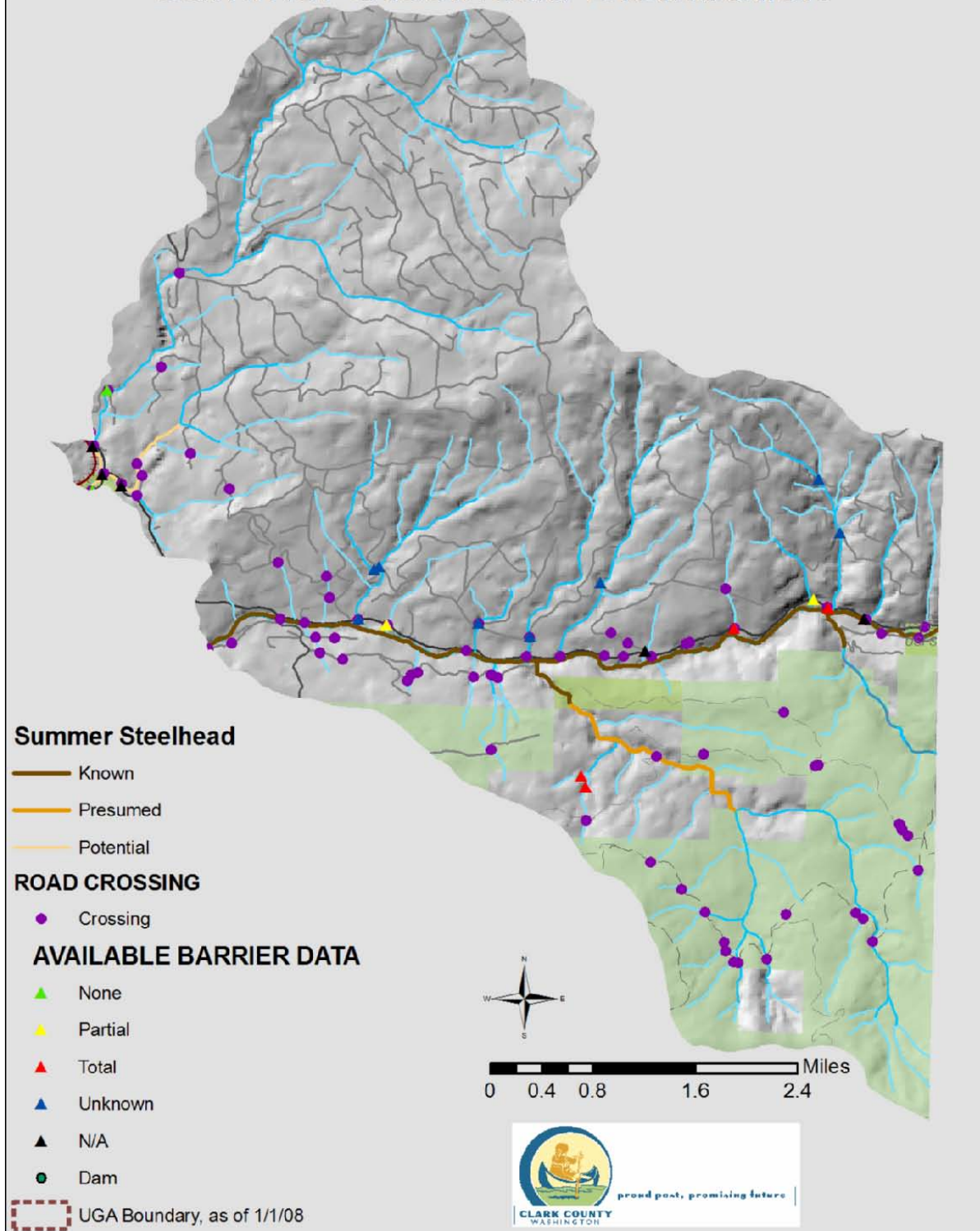


Figure 10: Big Tree Creek, East Fork Lewis River (RM 26.30), and King Creek Fish Distribution and Barriers

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### Barriers

The WDFW barrier database and the 2007 LCFRB Regional Culvert Inventory provide the most complete assessment of barriers (Figures 9 and 10).

There are several full and partial barriers mapped on tributaries to the East Fork Lewis River. These full and partial barriers are associated with road crossings on NE Sunset Falls Road, which are located along Anaconda Creek, Rogers Creek, and an unnamed tributary of the East Fork of the Lewis River. In the King Creek subwatershed, there are two full barriers located on an unnamed tributary to the lower reach. No mapped barriers were listed within the Big Tree Creek subwatershed.

### Recommendations

Although there are several full and partial barriers mapped within the East Fork Lewis River (RM 26.30) and King Creek subwatersheds, improvement or replacement of these barriers is not recommended as a priority at this time due to the lack of anadromous fish use and the associated low recovery priority ranking.



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### Hydrologic and Hydraulic Models

No modeling was performed for this assessment area.



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## Analysis of Potential Projects

The analysis of potential projects:

- Briefly summarizes stormwater conditions, problems and opportunities
- Notes recently completed or current projects within the study area that may be relevant to SNAP project selection
- Describes the analytical approach
- Lists recommended projects and activities for further evaluation

Projects or activities are placed in one of several categories.

## Summary of Conditions, Problems, and Opportunities

### Conditions and Problems

This section briefly summarizes important results from the assessment chapters and identifies overall stormwater-related problems.

### *Coordination with Other Programs*

The Washington Department of Ecology is developing TMDLs for bacteria and temperature in the East Fork Lewis River watershed.

### *Broad-Scale Characterization*

The study area's three mountainous subwatersheds, located near the Skamania County border, are drained by streams and rivers that often form canyons and are dominated throughout by commercial forest cover. These high gradient streams tend to have much lower summer flows than during the wetter winters. The only Clark County right-of-way in the area is along Sunset Falls Road.

Standard subwatershed scale metrics compared to NOAA fisheries standards suggest the streams in the study area generally have properly functioning habitat. Road density percentage and Percent forested (Big Tree Creek) fall into the Non-Functioning category, while Percent forested (EF 26.30 and King Creek), stream crossing density, and projected effective impervious area fall into the Properly Functioning category. Percent total impervious area is in the marginally functioning range. Land cover, zoning as commercial forest, and subwatershed metrics suggest that a protection and restoration approach is appropriate.

### *Water Quality Assessment*

Big Tree Creek and East Fork Lewis River (RM 26.30) are on the 2008 Washington State 303(d) list of impaired waters for water temperature, while King Creek has no 303(d) listings. State monitoring during 2005 and 2006 indicated that fecal coliform levels in Big Tree Creek did not meet standards, and portions of all three creeks exceeded the standard for water temperature. The three subwatersheds are included in the fecal coliform and temperature TMDLs currently under development by Ecology.

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## *Drainage System Inventory*

The drainage system inventory is generally complete for these three subwatersheds. Priority work in 2008 was identifying and mapping previously unmapped discharge points and stormwater conveyances.

## *Stormwater Facility Inspection*

As of October 2008, there were no public stormwater facilities in the study area. Seventeen outfalls that discharged into critical areas were assessed, one of which had a significant erosion problem.

## *Illicit Discharge Screening*

Illicit discharge screening was not conducted.

## *Physical Habitat Assessment*

Physical habitat measurements in 2004 indicated that the East Fork Lewis River (RM 26.30) mainstem had good habitat functionality. Pool surface area, pool quality, substrate, streambank stability, and fish barrier metrics indicated good or properly functioning conditions. Pool frequency and large woody debris metrics indicated poorly functioning conditions.

In lower King Creek, percent pool area was rated poor, while pool frequency, pool quality, and substrate conditions were rated fair or at-risk. Large woody debris conditions were not properly functioning. Streambank stability and fish barrier metrics indicated properly functioning conditions.

## *Geomorphology and Hydrology*

These tasks were not included in this assessment.

## *Riparian Assessment*

The most reliable riparian assessment data in Clark County is limited to the areas assessed during the 2004 LCFRB Habitat Assessment. King Creek and the East Fork Lewis River (RM 26.30) mainstem were included in this assessment but Big Tree Creek was not included but was assessed qualitatively through examination of orthophotos.

Generally, riparian conditions in all three subwatersheds were rated moderately impaired. Big Tree Creek and King Creek had low large woody debris recruitment potential while the majority of the East Fork Lewis River (26.30) mainstem had high. All three had moderate levels of riparian shade.

Public land is very limited within the subwatersheds; therefore, riparian projects would typically be on private land and require landowner cooperation.

## *Wetland Assessment*

Based on available wetlands data, potential wetlands are largely limited to riparian areas, stream channel floodplains, and a few upland areas. Ecology's

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draft wetland characterization of Clark County places all three subwatersheds in a category where the primary priority should be protection of wetland hydrology by maintaining forest cover followed by potential restoration at sites with high likelihood of success.

No specific wetland projects are proposed

### *Macroinvertebrate Assessment*

No benthic macroinvertebrate survey information is available for the study area

### *Fish Use and Distribution*

The LCFRB (2004) has identified the East Fork Lewis River (including RM 26.3) as the highest priority (Tier 1) for salmon recovery, with King Creek and the East Fork tributary of Copper Creek as lower priorities (Tier 4). King Creek and East Fork Lewis River (RM 26.30) have known use by winter and summer steelhead, whereas Big Tree Creek has no known anadromous fish use.

No high priority barrier removals were noted outside of existing inventories and assessments. Generally, barriers should be considered for removal as existing stream crossings are upgraded or replaced.

### Recently Completed or Current Projects

There are no stormwater projects planned for any of these three subwatersheds in the 2009-2013 SCIP or the 2008-2012 TIP.

### Analysis Approach

#### Purpose

The Analysis of Potential Projects narrows the initial list of possible projects to a manageable subset of higher priority opportunities. Listed opportunities in sections of the SNAP report represent sites requiring immediate follow-up, possible stormwater capital improvement projects, referrals to ongoing programs, and potential projects for referral to other county departments or outside agencies.

Stormwater capital improvement project opportunities are recommended for further evaluation by engineering staff, and potential development into projects for consideration through the SCIP process. Referrals to ongoing programs such as IDDE Screening or Operations and Maintenance are addressed within the program work plans and schedules. There are also referrals to other county departments, such as Public Health, or to outside agencies such as Clark Conservation District and Clark Public Utilities for actions outside the CWP scope.

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### Methods

The project review is qualitative and based on best professional judgment of CWP staff. An initial review is conducted for all potential projects identified during the stormwater needs assessment. Field notes, descriptions, field photos, and other associated information are reviewed. In some cases, additional field reconnaissance is performed.

In general, potential capital projects are evaluated considering problem severity, estimated cost and benefits, land availability, access, proximity and potential for grouping with other projects, and potential for leveraging resources.

Based on this review, lower priority opportunities are removed from the list. Higher priority projects are recommended for further consideration.

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### Emergency or Immediate Actions

Limited field work in the study area did not discover any situations that required immediate action.



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### Potential Stormwater Capital Projects

No stormwater capital projects were identified.



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### Public Works and Clean Water Program Referrals

One unmapped outfall to a critical area in the East Fork Lewis River (RM 26.30) subwatershed was referred to the CWP engineer due to erosion and instability problems.



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Projects for Referral to other County Departments, Agencies, or Groups  
No specific issues for referral were identified.



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## Non-Project Management Recommendations

Non-project stormwater management recommendations address areas where CWP programs or activities could be modified to better address NPDES permit components or promote more effective mitigation of stormwater problems. Information of this type contributes to adaptive management strategies and more effective stormwater management during the permit term.

Management and programmatic recommendations in the Big Tree Creek, King Creek, and East Fork Lewis River (RM 26.30) subwatersheds, by NPDES permit component, include:

### Mechanisms for public involvement

- Publish SNAP report on CWP web page.

### Development Regulations for Stormwater and Erosion Control

- EIA is not expected to increase to significant levels due to development envisioned by the Comprehensive Plan. For construction projects, emphasize stormwater management that focuses on reduction of runoff and diffuse infiltration close to the source.

### Stormwater Capital Improvements

- Examine the use of small projects to improve stormwater retention and treatment in roadside ditches.
- Consider fish barrier removal as existing roads and culverts are upgraded or replaced. Restoring access to fish habitat is not recommended as a priority at this time because existing known barriers are not located on high priority reaches or reaches with known salmonid use.

### Operation and Maintenance Actions

- None

### Education and Outreach to reduce behaviors that contribute pollution

- Develop a system to provide education about appropriate ditch maintenance practices to rural landowners.

### TMDL Compliance

- Encourage continued involvement in Ecology's ongoing TMDL development activities. There are no approved TMDLs in the assessment area.



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