

2008 Stormwater Needs Assessment Program

Yacolt Creek/East Fork Lewis River (RM 21.40) Subwatershed Needs Assessment Report

Clark County Public Works Clean Water Program

April 2009





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2008 Stormwater Needs Assessment Program Table of Contents

	PAGE
Responsible County Officials.....	1
Acronyms and Abbreviations	5
Executive Summary.....	9
Study Area	9
Intent	9
Findings.....	9
Opportunities.....	11
Introduction.....	13
Assessment Approach.....	15
Priorities for Needs Assessment in Yacolt Creek and East Fork Lewis River (RM 21.40).....	15
Assessment Tools Applied in Yacolt Creek and East Fork Lewis River (RM 21.40)	15
Assessment Actions	17
Outreach Activities	17
Coordination with Other Programs.....	19
Review of Existing Data	21
Broad-Scale GIS Characterization and Metrics	23
Water Quality Assessment.....	29
Water Quality Assessment.....	31
Drainage System Inventory.....	37
Stormwater Facility Inspection	39
Illicit Discharge Detection and Elimination Screening.....	43
Stream Reconnaissance and Feature Inventory.....	45
Physical Habitat Assessment.....	47
Physical Habitat Assessment.....	47
Geomorphology and Hydrology Assessment.....	49
Riparian Assessment	51
Floodplain Assessment.....	57
Wetland Assessment	59

2008 Stormwater Needs Assessment Program

Table of Contents

Macroinvertebrate Assessment	65
Fish Use and Distribution	69
Hydrologic and Hydraulic Models	73
Analysis of Potential Projects.....	75
Summary of Conditions, Problems, and Opportunities.....	75
Recently Completed or Current Projects	78
Analysis Approach.....	78
Emergency or Immediate Actions.....	79
Potential Stormwater Capital Projects	81
Public Works and Clean Water Program Referrals	83
Projects for Referral to other County Departments, Agencies, or Groups	85
Non-Project Management Recommendations	87
References.....	89

Figures

Figure 1: Yacolt Creek and East Fork Lewis River (RM 21.40) Subwatershed Map	25
Figure 2: Channel Stability in Rural Areas (Booth, Hartley, and Jackson, June 2002)	29
Figure 3: Summary of 2008 Outfall Assessment Activities in East Fork Lewis River (RM 21.40) Subwatershed.....	41
Figure 4: Yacolt Creek and East Fork Lewis River (RM 21.40) LWD Recruitment Potential (adapted from S.P. Cramer and Associates, 2005.....	53
Figure 5: Yacolt Creek and East Fork Lewis River (RM 21.40) Shade Values (adapted from S.P. Cramer and Associates, 2005)	55
Figure 6: Yacolt Creek and East Fork Lewis River (RM 21.40) Potential Wetlands	61
Figure 7: Priorities for suitability of areas from protection and restoration from the hydrologic process (from Draft Watershed Characterization of Clark County (Ecology, 2007)	63

2008 Stormwater Needs Assessment Program

Table of Contents

Figure 8: Approximate range of B-IBI in Puget Lowland watersheds, showing progressive decline with increasing imperviousness in the upstream watershed.....	68
Figure 9: Yacolt Creek and East Fork Lewis River (RM 21.40) Fish Distribution and Barriers	70
Tables	
Table 1: Stormwater Needs Assessment Tools	16
Table 2: Watershed Scale Metrics	27
Table 3: Applicable Water Quality Criteria	31
Table 4: Data and Information Sources	32
Table 5: Likely Water Quality Concerns, Sources, and Solutions for East Fork Lewis River (RM 21.40) and Yacolt Creek Subwatersheds	35
Table 6: Drainage System Inventory Results, Yacolt Creek/East Fork Lewis River (RM 21.10)	37
Table 7: 2008 Outfall Assessment Project Activity Summary of East Fork Lewis River (RM 21.40) Subwatershed	42
Table 8: East Fork Lewis River (RM 21.40) Physical Habitat	48
Table 9: Station YAC005 and Station YAC030 Average Annual Macroinvertebrate Community Metrics and Total Scores from 2004 through 2008.....	67

2008 Stormwater Needs Assessment Program Table of Contents

2008 Stormwater Needs Assessment Program

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2008 Stormwater Needs Assessment Program

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2008 Stormwater Needs Assessment Program

2008 Stormwater Needs Assessment Program

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
GPS	Geographic Positioning System

2008 Stormwater Needs Assessment Program

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
SNAP	Stormwater Needs Assessment Program

2008 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

2008 Stormwater Needs Assessment Program

Executive Summary

Study Area

This Stormwater Needs Assessment report includes the Yacolt Creek and East Fork Lewis River (RM 21.40) subwatersheds in north-eastern Clark County. Assessment effort focused on the unincorporated areas.

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 study area's two subwatersheds, including water quality, biological health, habitat, hydrology, and the stormwater system.

Ongoing Projects and Involvement

This assessment did not identify any major projects in the study area sponsored by regional entities such as the Lower Columbia Fish Recovery Board, Clark County Legacy Lands, and Clark County Transportation Improvement Program.

There are no Clark County Clean Water Program stormwater projects in the assessment area under the 2009 through 2014 Stormwater Capital Improvement Program.

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

2008 Stormwater Needs Assessment Program

Category	Status
Water Quality Overall Fecal coliform bacteria Temperature	<ul style="list-style-type: none"> • Good • East Fork Lewis River (RM 21.40) meets standard year-round; Yacolt Creek does not meet standard during wet season • Both are included in the East Fork Lewis River fecal coliform TMDL • East Fork Lewis River (RM 21.40) fails standard; Yacolt Creek unknown • Both are included in the East Fork Lewis River temperature TMDL
Biological Benthic macro-invertebrates Anadromous fish	<ul style="list-style-type: none"> • Moderate to high biological integrity (Yacolt Creek); no data available for East Fork Lewis River (RM 21.40) • Known use by winter and summer steelhead (East Fork Lewis River (RM 21.40)); no anadromous use of Yacolt Creek • High regional recovery priority (East Fork Lewis River (RM 21.40)); Tier 1
Habitat NOAA Fisheries criteria Riparian Wetland	<ul style="list-style-type: none"> • Road density percentage falls into the Non-Functioning category • Percent total impervious area (both) and percent forested (Yacolt Creek) are marginally functioning • Percent forested (East Fork Lewis River (RM 21.40)), stream crossing density, and projected effective impervious area fall into the Properly Functioning category • Overall shade is low to moderate at 20% to 40% for both subwatersheds • Large woody debris recruitment potential is mostly high for East Fork Lewis River (RM 21.40); estimated as low to moderate for Yacolt Creek • Limited to riparian areas and stream channel floodplains • Suitable for wetland protection
Hydrology and Geomorphology Overall hydrology Future condition	<ul style="list-style-type: none"> • No detailed hydrologic assessment available • Measured flows in Yacolt Creek indicate low flashiness • Impervious area projected to remain at levels that do not alter hydrology if existing forest cover is retained or expanded
Stormwater (Unincorp. areas) System description Inventory status System adequacy System condition	<ul style="list-style-type: none"> • Primarily road-side ditches • No public or private stormwater facilities • Complete • Assumed adequate treatment • No flow control other than infiltration in ditches • No outfall screening was performed • Conditions largely undocumented but presumed functional

2008 Stormwater Needs Assessment Program

Opportunities

Specific project opportunities were limited to two stormwater outfalls causing erosion and streambank 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 to participate Ecology's TMDL development for fecal coliform and stream temperature
- Look for opportunities to coordinate stormwater management activities with the Town of Yacolt
- Examine the use of small projects to improve stormwater retention and treatment in roadside ditches
- Develop a system to provide education about appropriate ditch maintenance practices to rural landowners
- Replace missing or deteriorated stream name signs

2008 Stormwater Needs Assessment Program

Introduction

This Stormwater Needs Assessment includes the Yacolt Creek and East Fork Lewis River (RM 21.40) 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

2008 Stormwater Needs Assessment Program

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.

2008 Stormwater Needs Assessment Program

Assessment Approach

Priorities for Needs Assessment in Yacolt Creek and East Fork Lewis River (RM 21.40)

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, the Yacolt Creek subwatershed is categorized as “Rural Residential with No UGA”. Subwatersheds in this category are generally not heavily forested and not a high priority for basin planning due to the lack of urbanization. However, these areas may take on a higher priority for watershed management activities to protect better quality stream habitat and promote habitat restoration to meet salmon recovery priorities. Efforts for this subwatershed are largely limited to summarizing existing information.

The East Fork Lewis River (RM 21.40) subwatershed is 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 probably a limited need for stormwater management. Here 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 the watershed.

Assessment Tools Applied in Yacolt Creek and East Fork Lewis River (RM 21.40)

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 and chapters were completed based on pre-existing information.

2008 Stormwater Needs Assessment Program

Table 1: Stormwater Needs Assessment Tools	
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	

2008 Stormwater Needs Assessment Program

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.

2008 Stormwater Needs Assessment Program

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, municipalities, and groups contacted for potential coordination in the Yacolt Creek and East Fork Lewis River (RM 21.40) needs assessment area:

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

2008 Stormwater Needs Assessment Program

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
- CPU Volunteer Project Data
- Ecology 303D (list)
- Ecology EIM Data
- Clark County 6-year TIP
- Clark County Mitigation Opportunities Project
- Clark County 2005 Subwatershed Characterization
- Clark County 2004 Stream Health Report

2008 Stormwater Needs Assessment Program

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 assessment area is in the Cascade Mountains foothills in north central Clark County (Figure 1). The land use is predominantly forest, with some rural residential, agriculture, and the Town of Yacolt. Much of the study area is forested except for areas cleared for agriculture in Yacolt Valley and the Town of Yacolt. Overall, the area is largely in private lands north of the East Fork Lewis River and a mix of state and private forest lands south of the East Fork Lewis River.

Topography

Yacolt Valley is perched at about 620 to 720 feet above sea level between mountain ridges that reach about 1,700 feet elevation to the west and about 1,600 feet on the east. The East Fork Lewis River cuts through a northwest-southeast trending ridge between Rock Creek (South) on the east to Lucia Falls on the west. The ridge elevation is roughly 1,100 to 1,400 feet with a high point of 2,275 feet at Bells Mountain.

2008 Stormwater Needs Assessment Program

Geology and Soils

Older volcanic rocks underlie the entire area and are exposed at the surface except where mantled by much younger Ice Age drift or in valleys where thin sediment occurs. Ice Age glaciers formed the topography in upper Yacolt Creek subwatershed and covered much of the area north of the East Fork Lewis River with 10 to 40 feet of dense glacial till. Sandy deposits fill Yacolt Valley, forming a southward sloping plain. Narrow Ice Age terraces occur along the East Fork Lewis River and there is almost no floodplain alluvium along the East Fork Lewis River.

Soils formed on the volcanic andesite lavas and glacial deposits are generally well-drained mountain soils belonging to the Cinebar and Yacolt Series north of the East Fork and Kinney Series and Olympic Series south of the East Fork Lewis River.

Hydrology

Geology and topography play the main role in determining the study area hydrologic framework. 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.

Yacolt Creek has its headwaters in low hills west of the Town of Yacolt. The stream is fairly low gradient, about 0.6 percent, once it enters Yacolt Valley. The stream bed is generally fine sandy material. Other creeks in the study area drain low mountains underlain by volcanic rock.

Clark Public Utilities recently placed a flow gauge on lower Yacolt Creek upstream of where it descends over rocky cascades into the East Fork Lewis River. Daily flow shows that summer low flows are about 1 to 2 cfs and annual peak flows were between 95 and 300 cfs. Three years of average daily flow data provides a TQmean of 33 percent, meaning that only a third of the daily flows are above the daily mean flow of 20 cfs.

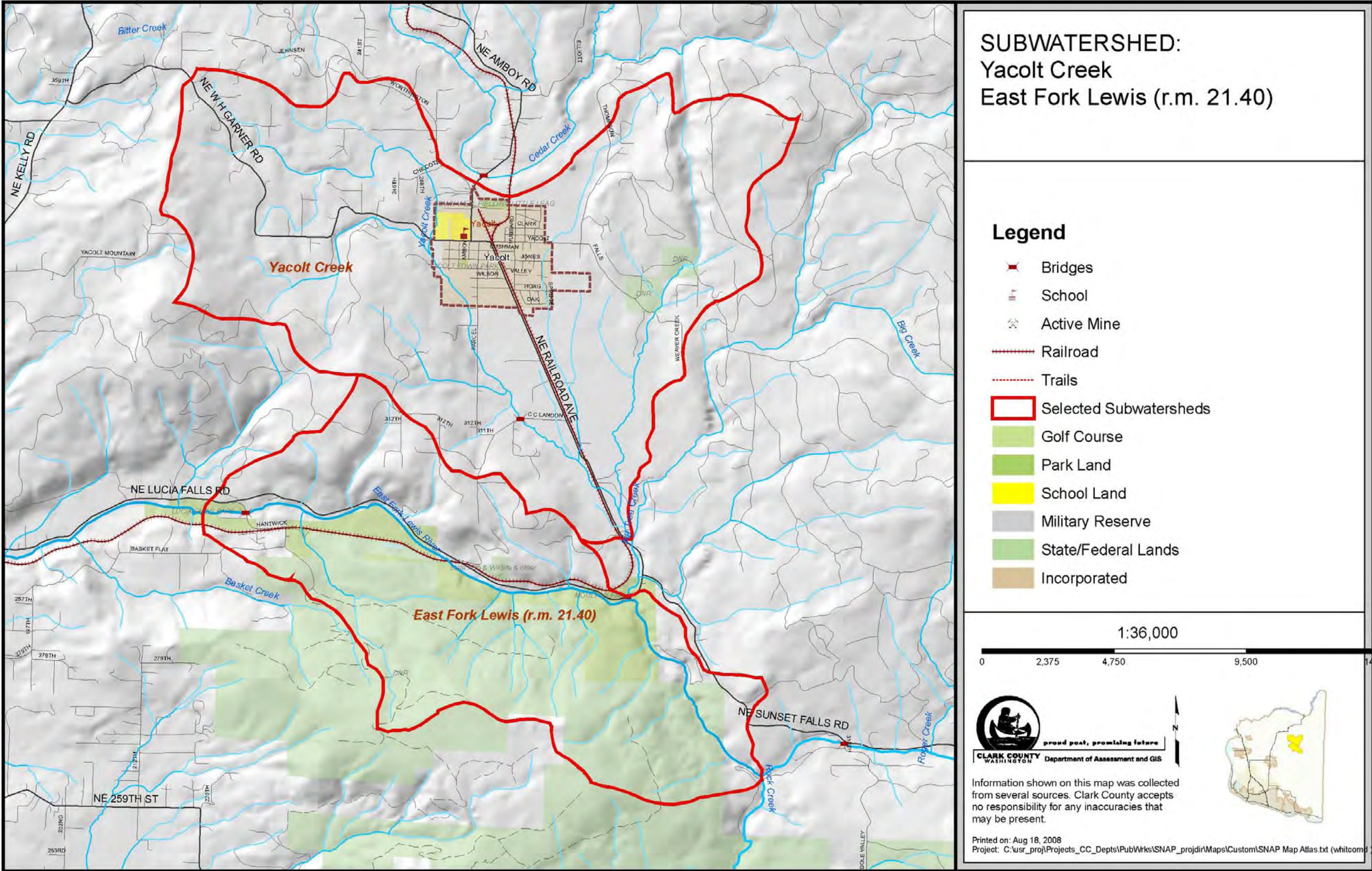


Figure 1: Subwatershed Map: Yacolt Creek and East Fork Lewis River (RM 21.40)

2008 Stormwater Needs Assessment Program

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 functioning or partially functioning stream habitat (Table 2).

Table 2: Watershed Scale Metrics				
Metric	Yacolt Creek	East Fork Lewis River (RM 21.40)	Functioning	Non-functioning
Percent Forested (2000 Landsat)	52	76	> 65 %	< 50 %
Percent TIA (2000 Landsat)	8	6	< 5 %	> 15 %
Road Density 2007 data (miles/mile ²)	6.3	4.6	< 2	> 3
Stream Crossing Density (crossings per stream mile)	2.6	1.4	< 3.2/mile	> 6.4/mile
Percent EIA estimated from the Comprehensive Plan	4	<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 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 East Fork Lewis River (RM 21.40) subwatershed is largely forest tracts in various stages of growth that range from recently cleared to mature forest. Very little area is cleared for pasture or residential use.

The Yacolt Creek subwatershed contains the municipality of Yacolt and significant amounts of rural residential and agricultural land uses. This is reflected in the much lower percentage of remaining forested area in comparison to the East Fork Lewis River (RM 21.40) subwatershed.

2008 Stormwater Needs Assessment Program

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 incorrectly be categorized as forested urban land cover. This tendency is reflected in the percent TIA in the East Fork Lewis River (RM 21.40) subwatershed, where there are several recent clear cuts.

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 are well into the non-functioning (>3 road miles/mi²) 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 both have stream crossing densities in the functioning category (<3.2 crossings/stream mile NOAA Fisheries criteria).

Future Effective Impervious Area (EIA)

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 East Fork Lewis River (RM 21.40) area due to forest zoning, and its location well outside current Urban Growth Area boundaries.

EIA is projected around four percent for the Yacolt Creek drainage, primarily due to potential future development in and around the town of Yacolt. Continued rural residential large-lot development is also likely. Overall, however, projected EIA for this area is well within the functioning category.

Estimated Channel Stability Based on Forest 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 the East Fork Lewis River (RM 21.40) should have stable

2008 Stormwater Needs Assessment Program

channels. Yacolt Creek subwatershed falls into the zone of uncertain channel stability due to a higher projected EIA and significantly lower percentage of intact forest cover.

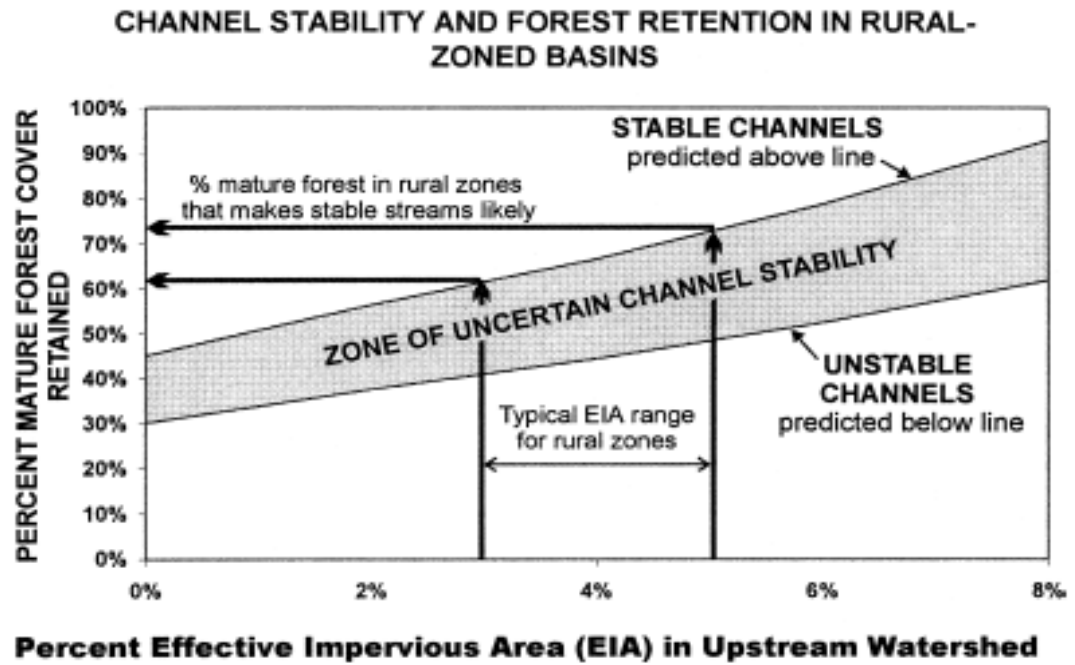


Figure 2: Channel stability in rural areas (Booth, Hartley, and Jackson, June 2002).

2008 Stormwater Needs Assessment Program

Water Quality Assessment

The Water Quality Assessment summarizes and references available water quality data for the Yacolt Creek and East Fork Lewis River (RM 21.40) subwatersheds. 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, Yacolt Creek and the East Fork Lewis River above Moulton Falls (RM 24.60) are to be protected for the designated uses of: core summer habitat; *extraordinary* primary contact recreation; domestic, industrial, and agricultural water supply; stock watering; wildlife habitat; harvesting; commerce and navigation; boating; and aesthetic values. Below Moulton Falls (RM 24.6), the designation of the East Fork Lewis River changes to primary contact recreation (WAC 173-201A-600 and Table 602).

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

Table 3: Applicable Water Quality Criteria	
Characteristic	Criteria
Temperature	≤ 16.0°C (60.8 °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. For waters designated primary contact recreation (not extraordinary), the criteria are 100 colonies/100mL and 200 colonies/100mL, respectively.
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

303(d) Listed Impairments

The 2008 303(d) list of impaired waters may be found on the Ecology website at:

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

Yacolt Creek is Category 5 listed (polluted waters that require a TMDL) for fecal coliform bacteria on the 2008 303(d) list. The East Fork Lewis River in the assessment subwatershed is Category 5 listed for temperature. Both subwatersheds are included in ongoing TMDL development for both temperature and fecal coliform in the East Fork Lewis River.

Clark County Stream Health Report

In 2004, the Clean Water Program compiled available data and produced the first county-wide assessment of general water quality. Based on limited available datasets for general water quality, fecal coliform bacteria, and benthic macroinvertebrates, Yacolt Creek and the East Fork Lewis River (RM 21.40) were both rated as having 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

Recent water quality data are somewhat limited for these subwatersheds, consisting 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 have also been collected intermittently in Yacolt Creek by Clark Public Utilities; however these data have not been analyzed and were not included in this assessment.

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

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

Water Quality Summary

Ecology collected instream flow and fecal coliform data from the following stations during data collection for the East Fork Lewis River fecal coliform TMDL:

- 27-EFL-24.6 (East Fork Lewis River above Big Tree Creek)
- 27-YAC-0.90 (Yacolt Creek at Railroad Avenue)
- 27-YAC-3.60 (Yacolt Creek at Chilcote Drive)

2008 Stormwater Needs Assessment Program

Continuous temperature data were collected from Station 27EFL24.6 (East Fork Lewis River above Moulton Falls) as part of the East Fork Lewis River temperature TMDL.

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

Fecal Coliform Bacteria

Based on 32 samples (16 wet season and 16 dry season), the mainstem East Fork Lewis River at Station 27-EFL-24.6 met the state standard in both seasons. The Yacolt Creek stations met the geometric mean standard for both seasons, but failed the 10 percent not-to-exceed portion of the standard during the wet season.

During a dry period sampled during 2005, Yacolt Creek at Station 27-YAC-0.90 carried less than one percent of the bacteria load measured in the East Fork Lewis River (RM 21.40) watershed. During a rain event sampled in 2005, the approximate load was much less than one percent.

Water temperature

Temperature logging (2005) indicated that station 27EFL24.6 had a 7-DADMax temperature of approximately 19 degrees C, exceeding the state criterion by three degrees.

Stream Health

Despite exceedence of the temperature criterion, the mainstem East Fork Lewis River had good overall stream health according to the 2004 Stream Health Report. Yacolt Creek also ranked in the good category, despite slightly exceeding the state criterion for fecal coliform bacteria.

Implications for Stormwater Management

Table 5 lists general water quality concerns in this 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 East Fork Lewis River (RM 21.40) and Yacolt Creek Subwatersheds

Characteristic	Beneficial Use Affected	Potential Sources	Mechanism	Solutions (bold indicates direct Clean Water Program involvement)
Fecal coliform bacteria	Primary contact recreation	failing septic systems or sanitary sewers	groundwater seeps	Storm sewer screening for source identification and removal Education programs Agricultural Best Management Practices Septic system inspection and maintenance
		livestock, wildlife, pets	overland runoff storm sewers/ditches direct access	
Water temperature	Core summer habitat	vegetation removal	direct solar radiation	Stormwater infiltration to increase baseflow Streamside planting/vegetation enhancement / riparian preservation through acquisition Education programs
		low summer flows	decreased resistance to thermal inputs	
		ponds	direct solar radiation	

2008 Stormwater Needs Assessment Program

2008 Stormwater Needs Assessment Program

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 Yacolt Creek and East Fork Lewis River (RM 21.40) subwatersheds 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 two subwatersheds is generally completed. Inventory is ongoing in 2009 as part of a county-wide inventory update.

Table 6: Drainage System Inventory Results, Yacolt Creek/East Fork Lewis River (RM 21.40)		
Database Feature Category	Previously Inventoried	Added to Database during 2008
Inlet	0	0
Discharge Point (outfall)	0	277
Flow Control	0	0
Storage/Treatment	0	0
Manhole	0	0
Filter System	0	0
Channel	0	788
Gravity Main	72	250
Facilities	0	0

2008 Stormwater Needs Assessment Program

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 Yacolt Creek and East Fork Lewis River (RM 21.40) subwatersheds.

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.

Results

Based on the County's StormwaterClk database, as of June 2008, there were no mapped outfalls in Yacolt Creek subwatershed that discharged into critical areas. There were 56 mapped outfalls in East Fork Lewis River (RM 21.40)

2008 Stormwater Needs Assessment Program

subwatershed that discharged into critical areas.

Figure 3 summarizes notable outfall assessment activities in East Fork Lewis River (RM 21.40) including general outfall locations.

As summarized in Table 7, 56 outfalls that discharged into critical areas were assessed. Fifty-four outfalls were found to be in compliance. Two unmapped outfalls were discovered during field activities and were not in compliance due to serious erosion and instability problems.

Potential Projects

The outfall assessment project initiated two referrals. Serious erosion problems were occurring at stormwater Outfall 2148 and at Outfall 2292. Repair of these outfalls is included in the Analysis of Potential Projects section.

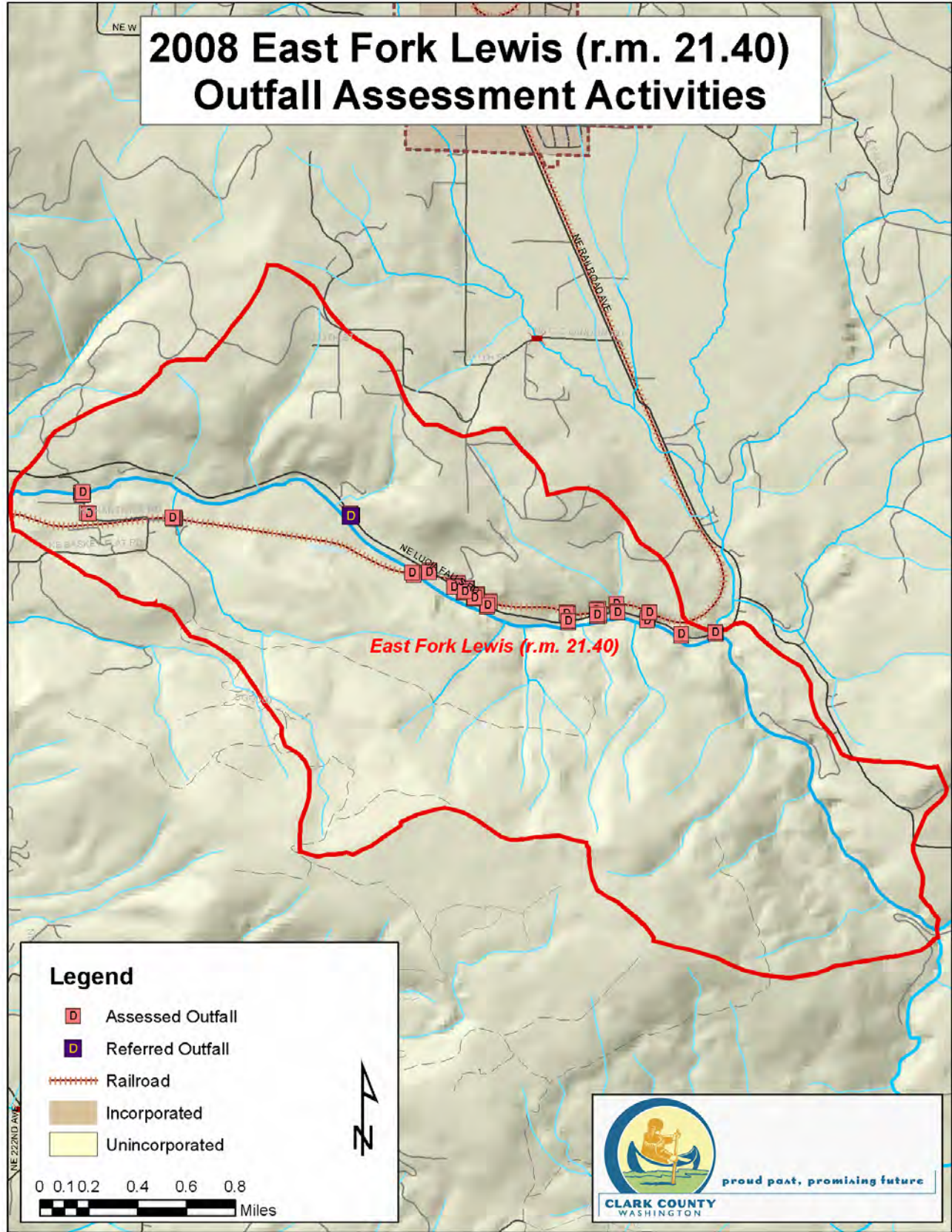


Figure 3: Summary of 2008 Outfall Assessment Activities in East Fork Lewis River (RM 21.40) Subwatershed.

2008 Stormwater Needs Assessment Program

Table 7: 2008 Outfall Assessment Project Activity Summary of East Fork Lewis River (RM 21.40) Subwatershed	
Metric	Number
# of outfalls assessed	56
# of outfalls compliant	54
# of noncompliant outfalls	2
# of referrals initiated	2
# of referrals ongoing	2
# of outfalls fixed	0

2008 Stormwater Needs Assessment Program

Illicit Discharge Detection and Elimination Screening

There were no mapped stormwater outfalls in Yacolt Creek or East Fork Lewis River (RM 21.40) at the time of the IDDE field screening.

Subsequent mapping of the area identified 277 stormwater outfalls (see Drainage System Inventory), almost exclusively from road ditches. IDDE screening may be conducted in these subwatersheds in response to data that suggests potential dry season discharges.

Illicit connections and discharges are expected to be rare in these subwatersheds.

2008 Stormwater Needs Assessment Program

Stream Reconnaissance and Feature Inventory

A rapid stream reconnaissance and feature inventory was not conducted.

2008 Stormwater Needs Assessment Program

Physical Habitat Assessment

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 portions of the mainstem within the East Fork Lewis River (RM 21.40) subwatershed (survey reaches #11 and #13 from RM 23.40 to RM 26.30 with the upper extent of the survey at the confluence with Rock Creek South) by S.P. Cramer (January 2005) for the Lower Columbia Fish Recovery Board. The project followed modified USFS Level II protocols. Comparable stream habitat information is not available for Yacolt 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 two surveyed East Fork Lewis River reaches are confined in many places by bedrock walls or steep valley walls. They have moderate gradient and their habitat types consist of an estimated 37 percent to 52 percent pool, 20 percent to 45 percent riffle, 17 percent to 26 percent glide, and one to two percent pool tailout.

Information in the S.P. Cramer report noted that while the relative proportion of substrate material for the pools and riffles differed for the lower reach, it was similar for the upper reach. In general, substrate composition was dominated by gravel, cobble, and bedrock, with relatively less sand. The streambed for both reaches was rated low for embeddedness (0 percent to 25 percent).

Table 8 summarizes habitat evaluations based on Washington Conservation Commission and NOAA Fisheries Properly Functioning Condition standards (Cramer, 2005, p. 217).

2008 Stormwater Needs Assessment Program

Table 8: East Fork Lewis River (RM 21.40) Physical Habitat				
	East Fork Lewis River (RM 21.40) Lower Reach		East Fork Lewis River (RM 21.40) Upper Reach	
Parameter	WCC¹	PFC²	WCC¹	PFC²
% Pool by Surface Area	Good		Fair	
Pool Frequency		Not Properly Functioning		Not Properly Functioning
Pool Quality		Properly Functioning		Properly Functioning
LWD		Not Properly Functioning		Not Properly Functioning
Substrate		At Risk		At Risk
Streambank Stability	Good	Properly Functioning	Good	Properly Functioning
Barriers	Good	Properly Functioning	Good	Properly Functioning

¹ Available Rating: Good; Fair; Poor

² Available Ratings: Properly Functioning; At Risk; Not Properly Functioning

2008 Stormwater Needs Assessment Program

Geomorphology and Hydrology Assessment

A geomorphology and hydrology assessment was not conducted.

Generally, mountain streams are high gradient having little to no floodplains and low summer flows. CPU has been monitoring Yacolt Creek flow for several years. Generally, while it displays little flashiness, Yacolt Creek flows range between one to two cfs during the summer to peak winter flows varying from 95 to 300 cfs.

2008 Stormwater Needs Assessment Program

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 that 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, and therefore 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 assessment, an examination of current orthophotographs is used to make a general assessment of riparian condition and identify areas where restoration or preservation projects may be appropriate.

Many riparian project opportunities are discovered through other SNAP activities. 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

Results

Results are based primarily on the 2005 LCFRB Habitat Assessment for the East Fork Lewis River (RM 21.40). Yacolt Creek subwatershed was not included in the LCFRB assessment because it is not accessible to salmon. 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 (Yacolt Creek) 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 the East Fork Lewis River (RM 21.40) as moderately impaired and Yacolt Creek as impaired.

Riparian (Large Woody Debris (LWD) Delivery)

Figure 4 shows Yacolt Creek and East Fork Lewis River (RM 21.40) subwatersheds' LWD delivery potential. Within the East Fork Lewis River (RM 21.40) subwatershed, the survey included the mainstem of the East Fork Lewis River. The majority of the mainstem of the East Fork Lewis River has high LWD recruitment potential along the approximate four mile distance surveyed.

The Yacolt Creek subwatershed was not formally surveyed because salmon and steelhead access is blocked by waterfalls near the mouth, but based on orthophotography estimates LWD delivery potential appears to be low to moderate for the mainstem and tributaries of Yacolt Creek.

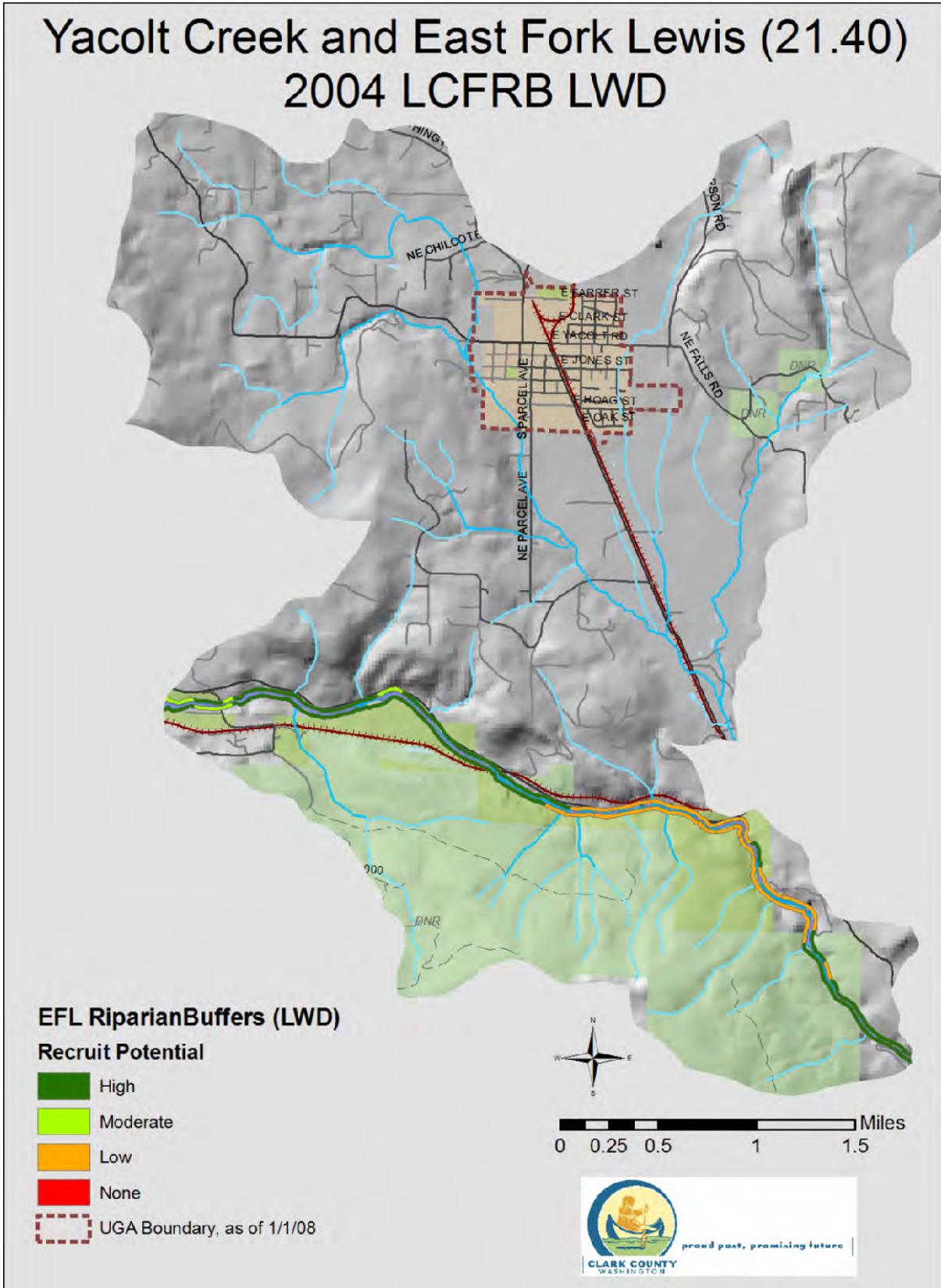


Figure 4: Yacolt Creek and East Fork Lewis River (RM 21.40) LWD Recruitment Potential (adapted from S.P. Cramer and Associates, 2005)

2008 Stormwater Needs Assessment Program

Shade

Figure 5 includes the East Fork Lewis River (RM 21.40) subwatersheds' shade ratings from the 2005 LCFRB Habitat Assessment. Overall, shade levels along the entire East Fork of the Lewis River mainstem within the East Fork Lewis River (RM 21.40) subwatershed ranged between 20 and 70 percent.

Shade levels within the Yacolt Creek subwatershed (mainstem and tributaries of Yacolt Creek) were estimated from 2007 orthophotography to be in the range of 20 to 70 percent. Lower shade ratings were found in areas impacted by agricultural and residential development.

Management Recommendations

Overall recommended management activities for the Yacolt Creek and East Fork Lewis River (RM 21.40) subwatersheds include riparian forest restoration in areas impacted by logging/forest roads or residential use, and invasive species removal. Also recommended is the acquisition of existing undeveloped forest land along the East Fork of the Lewis River for protection of streams and watersheds from future agricultural and residential development.

Potential Projects

The S.P. Cramer report recommended restoration projects in the East Fork Lewis River (RM 21.40) subwatershed include riparian forest restoration on private residential land along the south bank of the East Fork of the Lewis River, and restoration for highway and forest/logging road impacts within riparian areas on the north bank.

Riparian restoration projects in the Yacolt Creek subwatershed are not considered high priority due to the lack of anadromous species; however, restoration of areas impacted by residential and agricultural land uses would provide important benefits for resident fish and wildlife, and some associated downstream benefits to anadromous fish species.

Specific priority project areas listed in the S.P. Cramer and Associates (2005) report are the areas of private residence along the north bank of the East Fork of the Lewis River downstream of NE Hantwick Road. Orthophotography review did not identify any further areas for potential restoration.

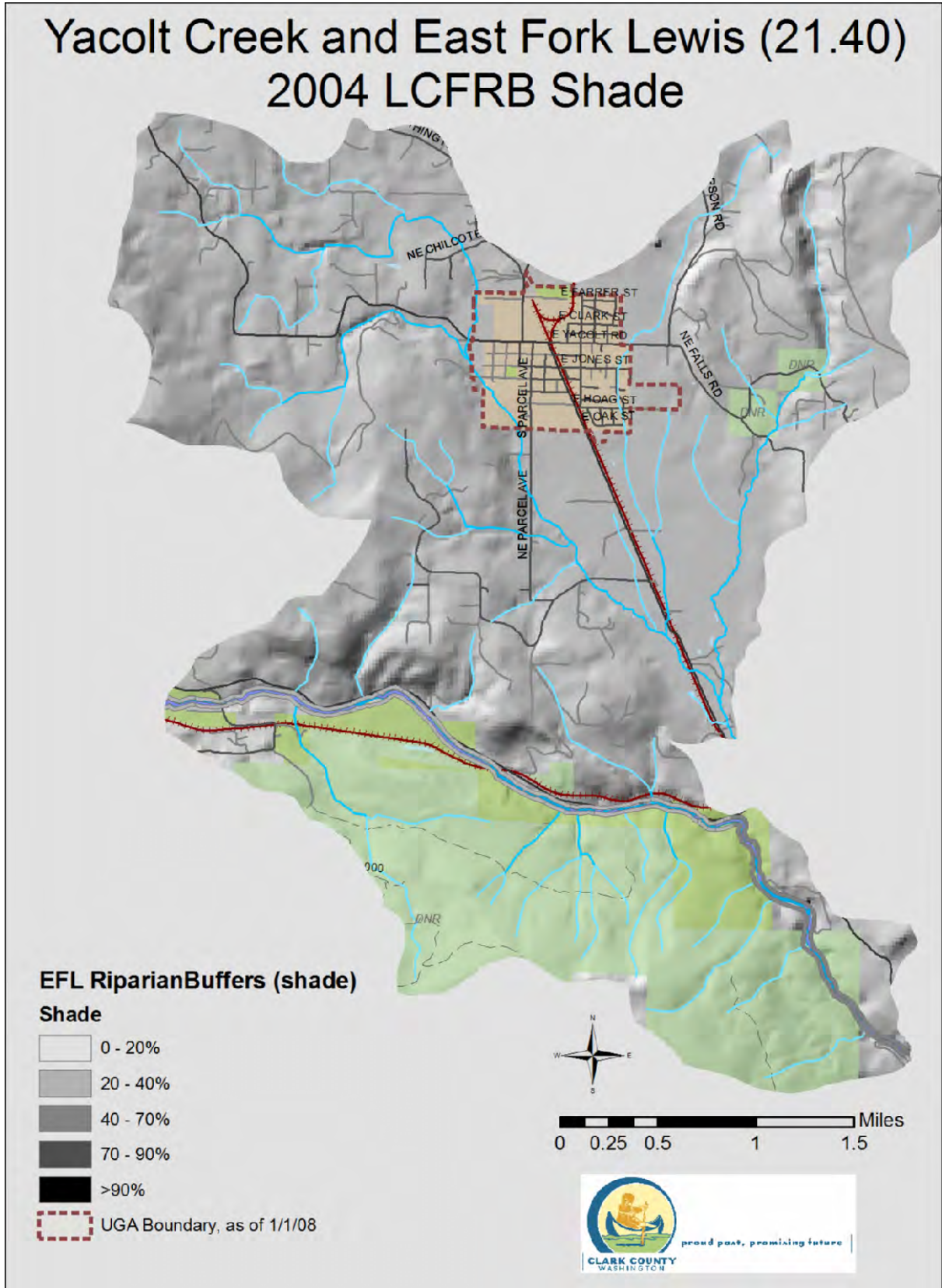


Figure 5: Yacolt Creek and East Fork Lewis River (RM 21.40) Shade Values (adapted from S.P Cramer and Associates, 2005)

2008 Stormwater Needs Assessment Program

Floodplain Assessment

A floodplain assessment was not conducted.

2008 Stormwater Needs Assessment Program

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 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 6 shows potential wetland areas within the Yacolt Creek and East Fork Lewis River (RM 21.40) subwatersheds based on data from the county wetlands atlas, including the Clark County wetland model, National Wetlands Inventory, and high-quality wetlands layer.

The East Fork Lewis River (RM 21.40) subwatershed has large expanses of potential wetland areas associated with the East Fork of the Lewis River riparian corridor and floodplain.

2008 Stormwater Needs Assessment Program

In the Yacolt Creek subwatershed, pockets of potential wetlands are primarily associated with stream channel floodplains of Yacolt Creek and its tributaries.

Although there were many areas of potential wetlands within the subwatersheds reviewed, the 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.

2008 Stormwater Needs Assessment Program

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>

Results pertaining to the Yacolt Creek and East Fork Lewis River (RM 21.40) subwatersheds are summarized below.

The East Fork Lewis River (RM 21.40) subwatershed is part of the rain-on-snow and snow-dominated mountainous hydrogeologic unit which is characterized by rain-dominated precipitation, shallow and deep groundwater flow patterns, glacial till over consolidated formations, as well as more permeable sedimentary formations (i.e., river alluvium and Troutdale formation) and moderate to steep topography (Ecology, 2007).

The Yacolt Creek subwatershed is part of the rain-dominated mountainous unit. This unit is characterized by rain-dominated precipitation, shallow and deep patterns of groundwater flow patterns, glacial till over consolidated formations, as well as more permeable alluvium, and moderate to steep topography.

Figure 7 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.

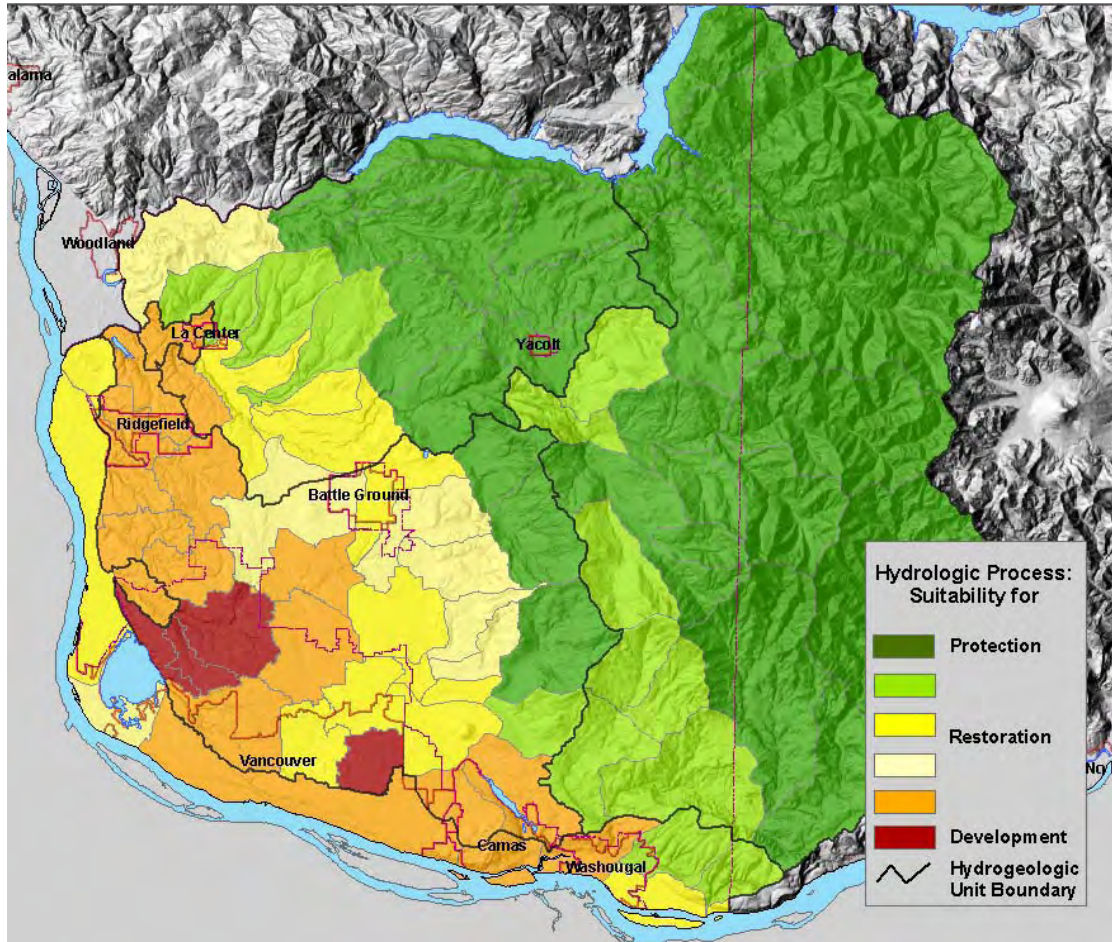


Figure 7: Priorities for suitability of areas for protection and restoration for the hydrologic process (from Draft Watershed Characterization of Clark County (Ecology, 2007)).

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 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 Yacolt Creek and East Fork Lewis River (RM 21.40) subwatersheds. According to the Draft Watershed Characterization, protection within these subwatersheds suggests consideration of measures to protect watershed hydrologic processes by maintaining forest cover. Additionally, restoration projects should also be undertaken because they should have higher levels of potential success relative to other more highly altered units in the county (Ecology, 2007).

2008 Stormwater Needs Assessment Program

Potential Projects

This assessment did not discover any specific potential projects to improve wetland hydrology within the Yacolt Creek and East Fork Lewis River (RM 21.40) subwatersheds.

2008 Stormwater Needs Assessment Program

Macroinvertebrate Assessment

Purpose

The Benthic Macroinvertebrate Index of Biological Integrity or B-IBI (Karr, 1998) is a widely used measurement of stream biological integrity or health based on macroinvertebrate populations. Macroinvertebrates spend most of their lives in the stream substrate before emerging as adults. While in the stream, they are subject to impacts from continuous and intermittent pollutant sources, hydrology and habitat changes, and high summer water temperatures.

The B-IBI score is an index of ten metrics describing characteristics of stream biology, including: tolerance and intolerance to pollution, taxonomic richness, feeding ecology, reproductive strategy, and population structure. Each metric was selected because it has a predictable response to stream degradation. For example, stonefly species are often the most sensitive and the first to disappear as human-caused disturbances increase, resulting in lower values for the metric “Number of Stonefly taxa”.

In addition to the overall B-IBI scores, examining individual metric scores gives insight into stream conditions and better explains differences in the overall score.

Methods

All field and laboratory work followed CWP protocols for macroinvertebrate sampling and analyses (Clark County, June 2003). Samples are collected during late summer, preserved, and delivered to a contracted lab for organism identification, enumeration, and calculation of B-IBI metrics.

Raw data values for each metric are converted to a score of one, three, or five, and the ten individual metrics are added to produce an overall B-IBI score ranging from 10 to 50. Scores from 10 to 24 indicate low biological integrity, from 25 to 39 indicate moderate integrity, and greater than 39 indicate high biological integrity.

Results are influenced by both cumulative impacts of upstream land use and reach-specific conditions at or upstream of sampling sites. Thus, samples from a reach integrate local and upstream influences. Many of the B-IBI metrics are also influenced by naturally occurring factors in a watershed; for example, the absence of gravel substrate can lower scores.

Macroinvertebrate monitoring data are available for the Yacolt Creek subwatershed but not for the East Fork Lewis River (RM 21.40) subwatershed. The Yacolt Creek macroinvertebrate samples were collected by volunteers and Clark Public Utilities (CPU) in 2004, 2006, and 2008 as well as by Clark County Clean Water Program (CWP) staff in 2007 (Clark County, unpublished data). Samples were collected from two different Yacolt Creek locations about one-half mile apart; with the CPU Station YAC030 just downstream from where Railroad

2008 Stormwater Needs Assessment Program

Avenue crosses the creek and the CWP Station YAC005 located about 0.25 miles upstream from the mouth of Yacolt Creek, just north of Moulton Falls Park.

Results

Station YAC005's 2007 B-IBI score of 42 indicates high biological integrity whereas Station YAC030's three year average of 33 falls in the moderate category. Station YAC030's B-IBI results differed by 12 points from 2004 to 2006 and by eight points from 2006 to 2008. These values are somewhat more variable than the typical year to year variation of less than five points observed for Puget Sound streams (Karr 1998 and Law 1994).

Table 9 shows one low, three moderate, and six high scores among the average results for individual metrics at station YAC005. Station YAC030 had two low, five moderate, and three high scores. A low score for the "intolerant taxa" metric at station YAC030 suggests degraded habitat quality since these taxa are typically the first to disappear as human disturbance increases (Fore, 1999). Low scores for the percent predators metric at both stations could reflect decreasing diversity in prey species.

Booth et al. (2004) found that there is a wide but well defined range of B-IBI scores for most levels of development, but observed overall that B-IBI scores decline consistently with increasing watershed total impervious area (TIA). Figure 8 shows that the B-IBI score for Station YAC005 falls in the upper third while the three scores for Station YAC030 fall in the middle portion of the range of expected scores (estimated 2000 Total Impervious Area from Wierenga, 2005).

By comparing Yacolt Creek to the likely range of conditions for watersheds with similar amounts of development, measured as total impervious area, it is possible to make some general statements about the potential benefits from improving stream habitat.

2008 Stormwater Needs Assessment Program

Table 9: Station YAC005 and Station YAC030 Average Annual Macroinvertebrate Community Metrics and Total Scores from 2004 through 2008.						
BIBI Metrics	YAC005 1-Yr 2007 Averages			YAC030 & CPUYAC Site 3-Yr 2004, 2006, 2008 Averages		
	Value	Score	Category	Value	Score	Category
Total number of taxa	50.0	5	high	52.30	5	high
Number of Mayfly taxa	9.0	5	high	7.0	3	moderate
Number of Stonefly taxa	8.0	5	high	6.3	3	moderate
Number of Caddisfly taxa	8.0	3	moderate	6.7	3	moderate
Number of long-lived taxa	5.0	5	high	3.0	3	moderate
Number of intolerant taxa	3.0	3	moderate	1.3	1	low
Percent tolerant taxa	12.8	5	high	15.0	5	high
Percent predator taxa	6.0	1	low	9.8	1	low
Number of clinger taxa	20.0	3	moderate	23.7	5	high
Percent dominance (3 taxa)	45.3	5	high	49.7	3	moderate
Summary of avg. metric scores		40	high		32	moderate
Multi-year average B-IBI Score						
		42	high		33	moderate

2008 Stormwater Needs Assessment Program

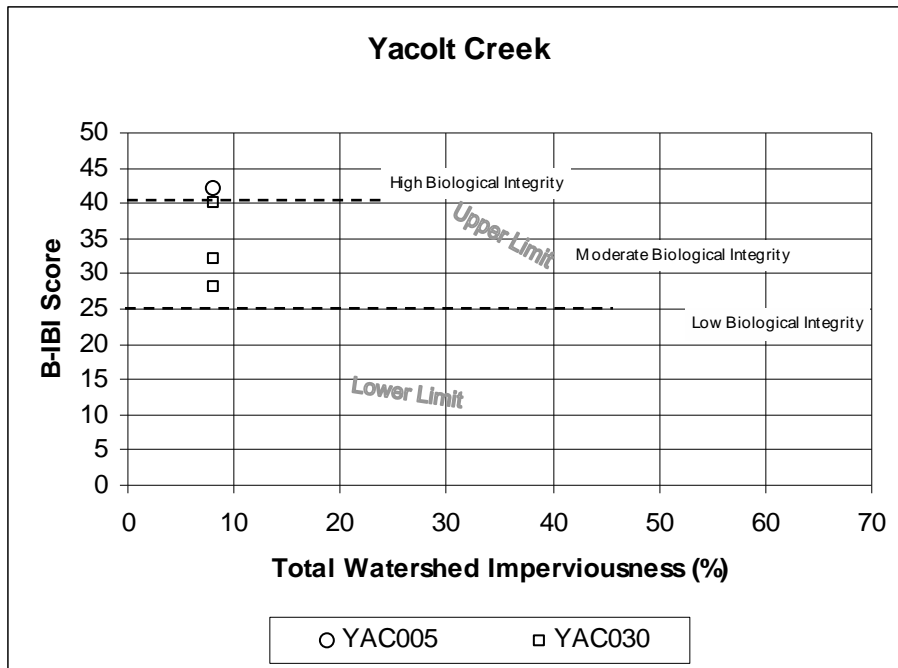


Figure 8: Approximate range of B-IBI in Puget Lowland watersheds, showing progressive decline with increasing imperviousness in the upstream watershed. Adapted from Booth et al., 2004. Markers indicate Total BIBI scores at Station YAC005 and Station YAC030 for particular years versus estimated 2000 subwatershed TIA.

Yacolt Creek B-IBI scores fall in the middle to upper third of the expected range for a watershed with eight percent impervious area. The results suggest only limited room for improvement at the YAC005 station, with greater improvement possible at the YAC030 station upstream. Protection and rehabilitation of habitat are important for maintaining or improving biological integrity.

2008 Stormwater Needs Assessment Program

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 for the Yacolt Creek and East Fork Lewis River (RM 21.40) subwatersheds 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 (Figure E) is similar to the fish distribution data originating from the SalmonScape database for the Yacolt Creek and East Fork Lewis River (RM 21.40) subwatersheds.

The available evidence suggests that anadromous fish use within the Yacolt Creek and East Fork Lewis River (RM 21.40) subwatersheds includes winter and summer steelhead (Figure 9).

The LCFRB 2004 Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan identifies the reaches of East Fork of the Lewis River in the East Fork Lewis River (RM 21.40) subwatershed as predominately Tier 1 reaches (highest priority). The Yacolt Creek subwatershed does not have any reaches with anadromous fish use, and is therefore not ranked by priority (reach tiers) for recovery.

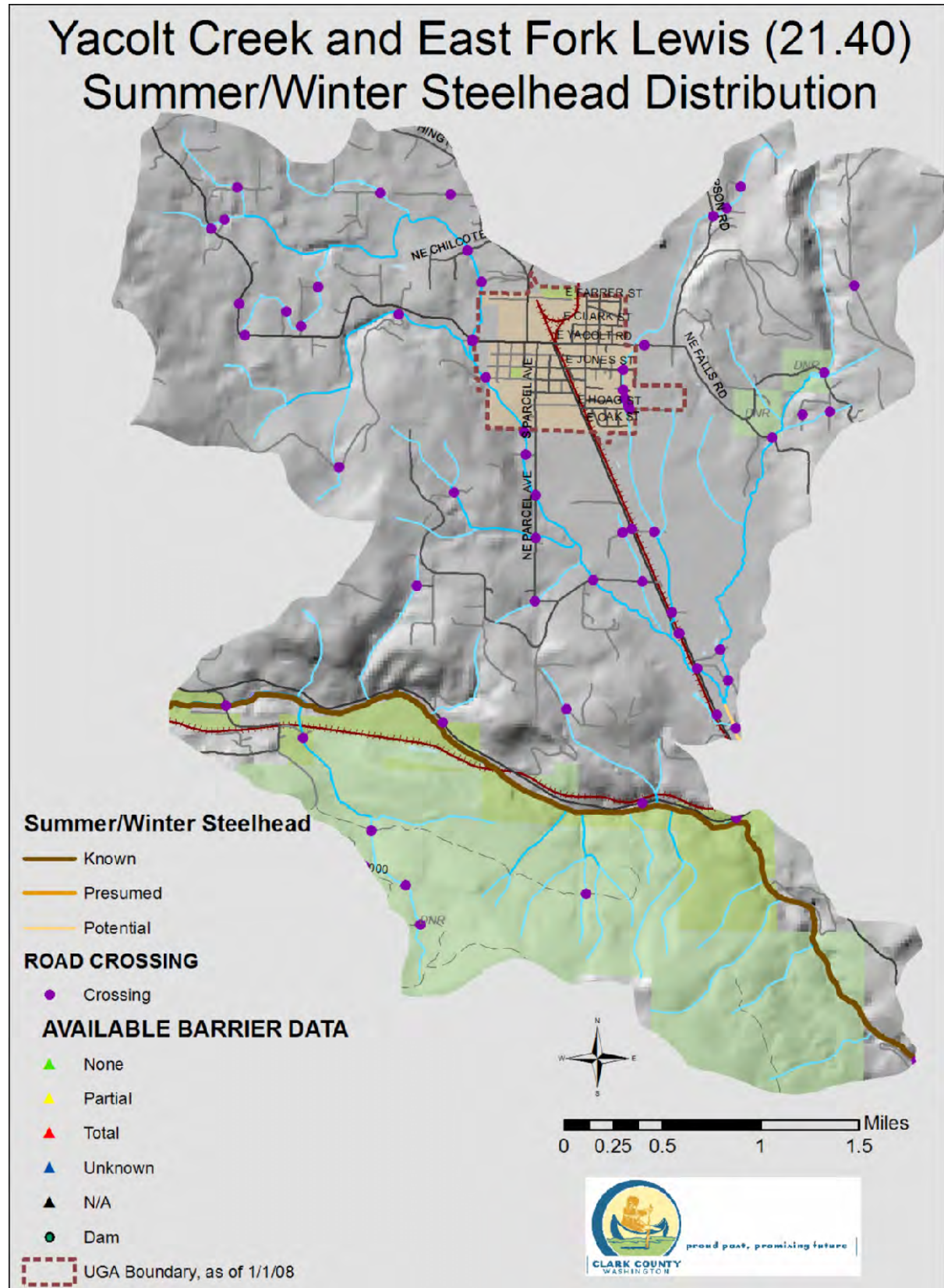


Figure 9: Yacolt Creek and East Fork Lewis River (RM 21.40) Fish Distribution and Barriers

2008 Stormwater Needs Assessment Program

Barriers

The WDFW barrier database and the 2007 LCFRB Regional Culvert Inventory provide the most complete assessment of barriers in the Yacolt Creek and East Fork Lewis River (RM 21.40) subwatersheds (Figure E).

There is a barrier in the Salmonscape database that is not shown in Figure E for the East Fork Lewis River at Moulton Falls, near the confluence of the East Fork of the Lewis River and Big Tree Creek. There are no other mapped barriers within the East Fork Lewis River (RM 21.40) subwatershed.

Within the Yacolt Creek subwatershed, there are no mapped barriers indicated on the mainstem of Yacolt Creek or its associated tributaries. Waterfalls near the mouth block salmon and steelhead access.

Recommendations

None.

2008 Stormwater Needs Assessment Program

Hydrologic and Hydraulic Models

No modeling was performed for this assessment area.

2008 Stormwater Needs Assessment Program

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; and
- 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 two subwatersheds, located in the Cascade Mountain foothills near the Town of Yacolt, are predominantly in state and private forest lands with some rural residential and agriculture land uses, especially in the Yacolt Valley. Yacolt Creek flows south through a relatively flat valley bottom dominated by well drained Ice Age glacial till and sand outwash. The East Fork Lewis River (RM 21.40) mainstem has almost no floodplain alluvium deposits along its shores as it cuts through ridges in the study area.

Standard subwatershed scale metrics compared to NOAA fisheries standards suggest the streams in the study area primarily have properly functioning habitat. Road density was the only metric indicating non-functioning conditions. Metrics for percent total impervious area for both subwatersheds and percent forested for Yacolt Creek fall in between the Functioning and Non-Functioning categories. Percent forested in EFLR (RM 21.40), and stream crossing density in the entire study area, are in the functioning category.

The study area is expected to change little in the near term based on the latest Clark County Comprehensive Plan. Land cover, zoning, and subwatershed metrics suggest that a protection and restoration approach is appropriate.

Water Quality Assessment

Both subwatersheds are listed on the 2008 Washington State 303(d) list of impaired waters, Yacolt Creek for fecal coliform and the East Fork Lewis River (RM 21.40) for water temperature. State monitoring indicated that Yacolt Creek exceeds the standard for fecal coliform and East Fork Lewis River (RM 21.40)

2008 Stormwater Needs Assessment Program

exceeds the water temperature standard. The streams in both subwatersheds are included in Ecology's ongoing fecal coliform and temperature TMDL development.

Drainage System Inventory

The drainage system inventory is complete for these two subwatersheds.

Stormwater Facility Inspection

As of October 2008 there were no public stormwater facilities in the study area. There were no outfalls discharging to critical areas in the Yacolt Creek subwatershed. Fifty-six outfalls were assessed for the East Fork Lewis River (RM 21.40). Two of these outfalls were not in compliance due to serious erosion and instability problems.

Illicit Discharge Screening

Illicit discharge screening was not conducted.

Physical Habitat Assessment

Physical habitat measurements were made in 2004 on portions of the East Fork Lewis River (RM 21.40) mainstem, but not on Yacolt Creek. Streambed embeddedness for both surveyed East Fork Lewis River (RM 21.40) reaches was generally low. Habitat parameters rated as not properly functioning for East Fork Lewis River (RM 21.40) were large woody debris and pool frequency. Substrate conditions were categorized as "at risk", while pool quality, streambed stability, and barriers were properly functioning.

Geomorphology and Hydrology

Detailed hydrology analyses were not performed for this assessment. Generally, mountain streams are high gradient having little to no floodplain and low summer flows. CPU has been monitoring Yacolt Creek flow for several years. Generally, the creek displays little "flashiness", and flows range between 1 to 2 cfs during the summer to peak winter flows varying from 95 to 300 cfs.

Riparian Assessment

Generally, riparian conditions in the East Fork Lewis River (RM 21.40) subwatershed were rated moderately impaired while those for Yacolt Creek were rated impaired. Large woody debris recruitment potential is high for the majority of the mainstem within East Fork Lewis River (RM 21.40), but appears to be low to moderate for Yacolt Creek. Riparian shade levels for both East Fork Lewis River (RM 21.40) and Yacolt Creek varied from low to moderate with lower levels adjacent to agricultural and residential areas.

Wetland Assessment

Potential wetlands are primarily limited to riparian areas and stream channel floodplains. Ecology's draft wetland characterization of Clark County places the assessment area in a category where the priority should be protection of wetland

2008 Stormwater Needs Assessment Program

hydrology by maintaining forest cover, followed by potential restoration at sites with high likelihood of success.

Macroinvertebrate Assessment

Several years of Yacolt Creek macroinvertebrate monitoring indicate moderate to high biological integrity. Based on expected values for streams with similar watershed impervious area, slight to moderate improvement in biological health could be expected with improved habitat conditions.

No macroinvertebrate monitoring data was available for the East Fork Lewis River (RM 21.40) subwatershed.

Fish Use and Distribution

The LCFRB (2004) has identified mainstem reaches of the East Fork Lewis River (RM 21.40) subwatershed as Tier 1 (highest priority) for anadromous fish use, with known use by winter and summer steelhead. Yacolt Creek was not ranked.

There are no known man-made barriers to fish passage in either subwatershed. Anadromous fish use of Yacolt Creek is blocked by natural waterfalls near the mouth.

2008 Stormwater Needs Assessment Program

Recently Completed or Current Projects

There are no proposed stormwater projects in the assessment area in the 2009-2014 SCIP or the 2008-2013 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, operations and maintenance, and source control outreach receive follow-up within the context and schedules of the individual program areas. Referrals to other county departments, such as Public Health, or to outside agencies such as Clark Conservation District and Clark Public Utilities may lead to additional activities outside the CWP scope.

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.

2008 Stormwater Needs Assessment Program

Emergency or Immediate Actions

The assessment did not discover any situations requiring immediate action.

2008 Stormwater Needs Assessment Program

Potential Stormwater Capital Projects

No stormwater capital projects were identified.

2008 Stormwater Needs Assessment Program

Public Works and Clean Water Program Referrals

Two unmapped outfalls to a critical area in the East Fork Lewis River (RM 21.40) subwatershed were referred to the CWP engineer due to erosion and instability problems.

2008 Stormwater Needs Assessment Program

Projects for Referral to other County Departments, Agencies, or Groups
Limited field work resulted in no referrals.

2008 Stormwater Needs Assessment Program

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 Yacolt Creek and East Fork Lewis River (RM 21.40) subwatersheds, by NPDES permit component, include:

Storm Sewer Mapping and Inventory

- None; inventory of existing infrastructure was completed in 2008.

Coordination of Stormwater Activities

- Look for opportunities to coordinate future stormwater management activities with the Town of Yacolt.
- Continue to participate in Ecology's TMDL development for fecal coliform and temperature.

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 under the existing 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.

Operation and Maintenance Actions

None.

Education and Outreach to Reduce Behaviors that Contribute Pollution

Areas where increased outreach could improve stream conditions include:

- Replace missing or deteriorated stream name signs.
- Develop a process to provide education about appropriate ditch maintenance practices to rural landowners.

TMDL Compliance

There are no approved TMDLs in this assessment area.

Monitoring Stormwater Program Effectiveness

None.

2008 Stormwater Needs Assessment Program

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