2007 Stormwater Needs Assessment Program

Mason Creek
Subwatershed Needs Assessment Report

Clark County Public Works Clean Water Program

May 2008

For other formats
Clark County ADA Office, **Voice** (360) 397-2000
Relay (800) 833-6384, **E-mail** ADA@clark.wa.gov

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Responsible County Officials

Program Name:	Stormwater Needs Assessment Program
Project Code:	SNAP
Department:	Clark County Public Works Water Resources
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Reporting Category:	4420 000 531 534 245 011403
Client:	Earl Rowell, Clean Water Program manager
SNAP manager:	Rod Swanson, Senior Planner Contact: 360-397-6118 x4581 rod.swanson@clark.wa.gov
Subwatershed Lead:	John Tyler, Environmental Policy Analyst Contact: 360-397-2022, x4945 john.tyler@clark.wa.gov

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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
EIA	Effective Impervious Area
EDT	Ecosystem Diagnostic and Treatment model
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
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 Scores
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
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 Areas
UIC	Underground Injection Control
USFWS	U.S. Department Fish and Wildlife Services
VBLM	Vacant Buildable Lands Model
WAC	Washington Administrative Code
WRIA	Water Resource Inventory Area
WSDOT	Washington Department of Transportation

Executive Summary

Study Area

This Stormwater Needs Assessment report focuses on Mason Creek, tributary to the East Fork Lewis River. The entire subwatershed is in 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 Resources 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 following table summarizes conditions in Mason Creek subwatershed, including water quality, biological health, habitat, hydrology, and the stormwater system.

Ongoing Projects and Involvement

Mason Creek is well known as part of ongoing work to protect and restore fish habitat within the East Fork Lewis River watershed.

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

Category	Status
Water Quality	
Overall	• Fair
Fecal coliform bacteria	• TMDL required
Temperature	• TMDL required and often does not meet salmon habitat criteria
Sediment	• No data
Biological	
Benthic macroinvertebrates	• Moderate biological integrity
Anadramous fish	• Coho and winter steelhead use. High regional recovery priority
Habitat	
NOAA Fisheries criteria	• Forest cover and road density fall into the Non-Functioning category. • Stream crossing density and estimated effective impervious area fall into the Properly Functioning category
Riparian	• Forest cover is about 40 percent and is found in stream valleys and some upland areas. • Large woody debris has low recruitment potential in the upper basin and good in the lower stream reaches.
Wetland	• Primarily limited to riparian areas
Hydrology and Geomorphology	
Overall hydrology	• No hydrologic data is available but likely typical for a partly forested rural watershed
Future condition	• Projected impervious area should remain at levels that do not alter hydrology if forest cover is retained or expanded.
Stormwater (Unincorporated areas)	
System description	• Primarily field drains and road-side ditches. • No public stormwater facilities exist
Inventory status	• Largely complete
System adequacy	• Adequate treatment is probably provided by vegetation in ditches. • No flow control other than infiltration in ditches. • No outfall screening was performed.
System condition	• Largely undocumented but presumed functional

Opportunities

Few projects were identified by the assessment due to the absence of public land to site them. The main project needs appeared to be for riparian and wetland habitat restoration, undersized culvert replacement, and fish passage barrier removal.

Examples of opportunities for stormwater-related watershed improvement include:

- Focused stormwater outreach and education to streamside landowners in the headwaters areas.
- Focused monitoring to determine if fecal coliform sources are present.
- Potential retrofits to roadside ditches for enhanced stormwater control or treatment.
- Repair of any erosion problems in county road ditches.
- Promotion of riparian enhancement projects, particularly in the upper watershed.

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 Mason Creek subwatershed include:

- The Lower Columbia Fish Recovery Board is planning a project to identify restoration projects in the East Fork Lewis River floodplain. While there is little of Mason Creek within the East Fork Lewis River floodplain, there may be opportunity to coordinate actions.
- TMDL development coordination for bacteria and temperature will include Clark County.
- For new construction, emphasize stormwater management practices that focus on reduction of runoff and diffuse infiltration.
- Erosion control BMPs are an important measure to protect streams from land disturbing activities. Ensure that all regulated land disturbing activities have adequate erosion control.
- Examine the use of small projects to improve stormwater retention and treatment in roadside ditches.
- While no specific wetland or habitat restoration projects are proposed by the SNAP due to the absence of public land to place projects, restoring headwater wetlands should be a priority to improve hydrologic functions.
- Restoring riparian functions to improve fish habitat is a priority in Mason Creek.
- Consider fish barrier removal projects in the upper watershed as existing roads and culverts are upgraded or replaced.

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

Introduction

This report is a Stormwater Needs Assessment for Mason Creek subwatershed. 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, most cost effective mix of actions to protect, restore, or improve beneficial uses consistent with NPDES permit objectives and the goals identified by the state Growth Management Act (GMA), ESA recovery plan implementation, Total Maximum Daily Load (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 initiating wetland banking systems, 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 protection and salmon recovery planning under the state GMA and the federal 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 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.

Assessment Approach

Priorities for Needs Assessment in Mason 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, the Mason Creek subwatershed falls into the "Rural Residential with No UGA" category. Subwatersheds in this category are generally not heavily forested and not a high priority for stormwater management planning due to the lack of urbanization. However, these areas may take on a higher priority for management activities to protect and restore stream habitat and address salmon recovery goals. Accordingly, this effort is largely limited to summarizing existing information to identify potential restoration projects.

Assessment Tools Applied in Mason Creek

The SNAP utilizes a standardized set of tools for subwatershed assessment; including desktop mapping analyses, 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 with an asterisk (*) had new data or analyses for this needs assessment. The remaining tools were assessed based solely on pre-existing information or were not included in the assessment.

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	

Assessment Actions

Outreach Activities

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

- July 2007 -- press release to local media.
- August 2007 – article in "Planning Stormwater Projects" flyer distributed at Clark County fair and other public events.
- September 2007 – article in Clean Water Program E-Newsletter.
- Clean Water Program web pages updated to include the SNAP and SCIP.
- March 31 of each year, a description of the SNAP is included Clark County's stormwater management program plan submitted to Ecology.

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

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. The list was reviewed in early 2007 and general communications were planned. Coordination took the form of phone conversations, meetings, or electronic correspondence, and was 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 the Analysis of Potential Projects Section for 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 during the course of the Mason Creek needs assessment:

- Clark County Endangered Species Act program
- Lower Columbia Fish Recovery Board
- Lower Columbia Fish Enhancement Program
- Fish First
- Washington Department of Ecology

County personnel contacted Richard Dyrland of Fish First and Tony Meyer of the Lower Columbia Fish Enhancement Group to discuss projects in Mason Creek subwatershed. Both mentioned the ongoing issue of slope instability at a site on Mason Creek, but the remedy is not readily apparent. No other current or potential projects were identified by Fish First or LCFEG for the Mason Creek subwatershed.

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
- CC LISP/SCMP/Project Data
- CC Volunteer Project Data
- Ecology 303(d)
- WRIA Limiting Factors Analysis
- CC Consproj GIS Layer (conservation projects)
- CC 6-Year and 20-Year TIP
- Ecology EIM Data
- CC Mitigation Opportunities Project
- CC 2005 Subwatershed Characterization and Classification
- CC 2004 Subwatershed Summary
- CC 2004 Stream Health Report

Broad-Scale GIS Characterization and Metrics

Purpose

The broad-scale characterization is a GIS-based exercise providing an overview of the geographic and likely habitat setting for each subwatershed, background information for use in implementing other SNAP tools, and identification of potential acquisition or project sites.

Methods

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 is generally used as a tool to complete the Needs Assessment report and is 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.

Many of these characteristics are described in greater detail in later sections. For example geology and soils form the cornerstone of the Geomorphology and Hydrology section.

The characterization includes three components:

- A set of three standard map products as large paper maps
- 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

Map Products

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

General Conditions and Subwatershed Metrics

General Geography

Mason Creek is a tributary to the East Fork of the Lewis River located in northwest Clark County (Figure 1). It has moderately steep terrain, as part of low foothills between the Willamette Valley and Cascade Mountains. The Mason Creek subwatershed covers 10.9 square miles and receives on average 61.5 inches of rain a year. This subwatershed does not include any cities, towns or rural centers. Average parcel size is 8.5 acres. Development patterns in this area are not anticipated to change under the county's recently revised 20-Year Growth Management Plan.

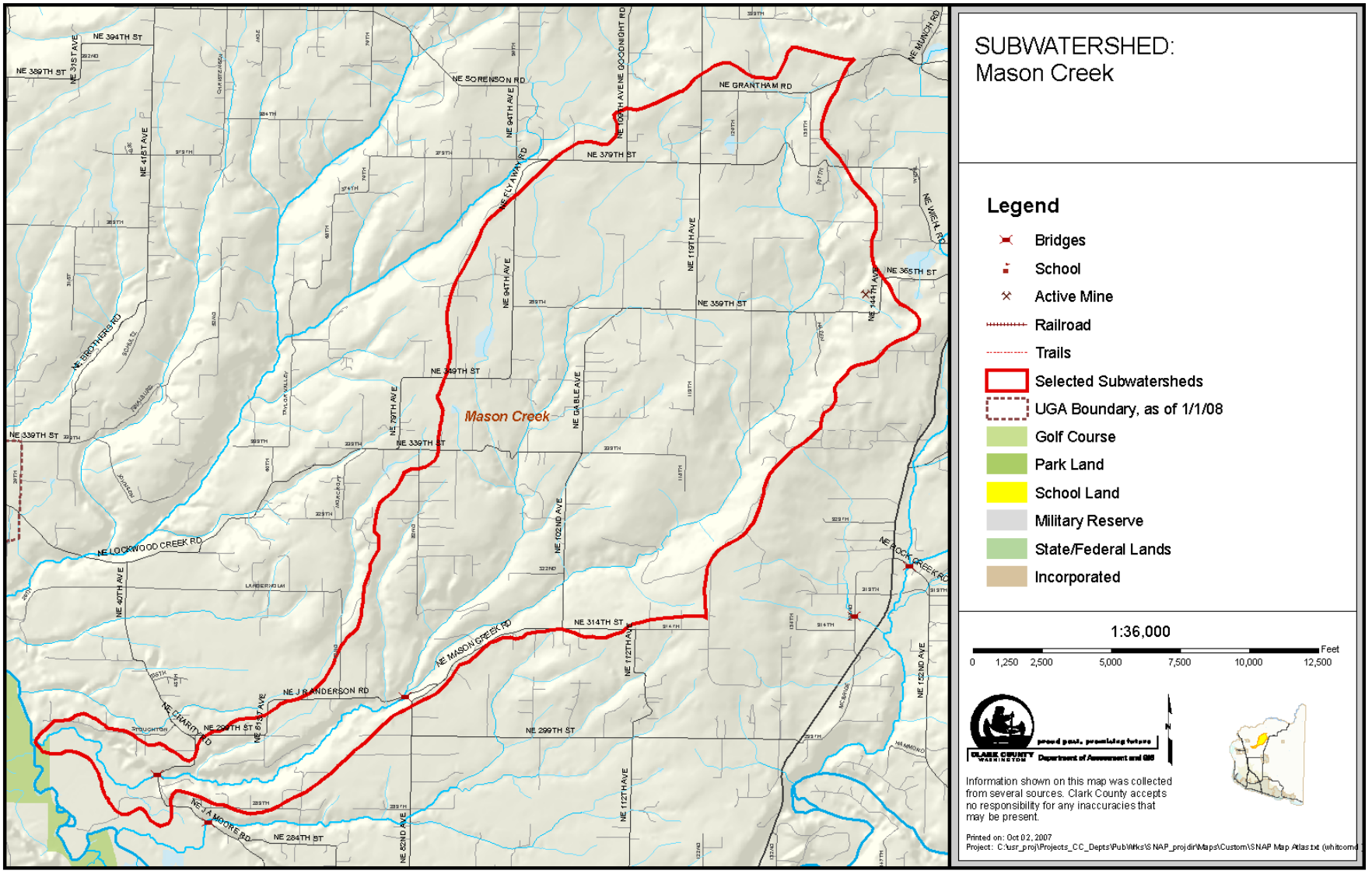

Figure 1: Mason Creek Subwatershed Area Map

Topography
The Mason Creek subwatershed has an elevated upland cut by relatively steep canyons leading up from the East Fork Lewis River. The upper elevations in Mason Creek subwatershed are 800 to 900 feet above sea level. There is also a relatively flat hilltop between 700 and 900 feet elevation cut by canyons below 800 to 700 feet. Mason creek drops to the East Fork Lewis River floodplain at an elevation of 30 feet.

Geology and Soils
Mason Creek watershed is underlain mainly by older semi-consolidated sandy gravel, commonly referred to as the Troutdale Formation or Troutdale gravels and glacial drift deposits. Ice Age river terraces, up to an elevation of about 250 feet are formed by material deposited by the East Fork Lewis River. Terraces have a thin mantle of fine-grained Cataclysmic Ice Age Flood Deposits. Alluvium along Mason Creek is reworked sand and gravel eroded from the Troutdale Formation and glacial till deposits. Lowermost Mason Creek crosses the sandy deposits of the East Fork Lewis River floodplain.

The Troutdale Formation is sandy ancestral Columbia River deposits and local stream deposits that at depth underlie the entire watershed. It is exposed as weathered reddish deposits on hills above about 400 feet altitude. Where streams have eroded into the Troutdale Formation, it forms steep valley walls and hard gravely substrate under stream channels.

Glacial drift is up to 90 feet thick (Howard, 2002) and mantles much of the subwatershed above 500 feet. The drift includes material ranging in size from clay particles to boulders.

Terrace deposits are largely sand and gravel derived from the East Fork Lewis River watershed. The mantling Cataclysmic Ice Age Flood Deposits are fine-grained sandy silt layers. These deposits are about 14,000 to 12,000 years old and were deposited by a succession of giant floods of the Columbia River caused by ice dam failures in the Missoula, Montana area.

Soils formed on the Troutdale Formation, glacial drift and fine-grained Cataclysmic Ice Age Flood Deposits tend to be fairly clayey. Much of the basin is underlain by Hydrologic Soil Group C soils but notable areas in uplands are underlain by Group B soils and low lying areas by Group D soils.

Hydrology
Mason Creek's drainage system is cutting into an upland area underlain by the Troutdale Formation. Headwater streams form in rolling, often cleared hilltop fields. Small, high gradient streams descend from the rolling hilltop into shallow valleys and deeper canyons downstream. After exiting its canyon, Mason Creek passes along the north side of the East Fork Lewis River floodplain to empty into the East Fork Lewis River.

Another notable feature of Mason Creek is the number of man-made ponds on headwater streams. Most of the ponds are also visible on the 1955 aerial photographs.

No significant stream flow data is available for Mason Creek. Hydrologic modeling conducted by Pacific Water Resources (2004) for the Lower Columbia Fish Recovery Board Clark County suggested that Mason Creek hydrology is compatible with stable steam channel conditions. The LCFRB Integrated Watershed Assessment (LCFRB 2008) rated Mason Creek as having impaired hydrology.

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 Mason Creek subwatershed does not completely meet standards due to lost forest and the amount of roads present. However, the stream crossing density and expected future EIA imply suitability for protection and restoration in Mason Creek.

Table 2: Mason Creek Metrics

Metric	Value	Functioning	Non-functioning
Percent Forested (2000 Landsat)	41	> 65 %	< 50 %
Percent TIA (2000 Landsat)	11	< 5 %	> 15 %
Road Density 2007 data (miles/mile2)	5.6	< 2	> 3
Stream Crossing Density (crossings per stream mile)	2.1	< 3.2/mile	> 6.4/mile
Percent EIA estimated from the Comprehensive Plan	3	< 10 %	> 10 %

Forest Cover

The proportion of a watershed in forest 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.

Mason Creek subwatershed has 41 percent forest cover, below the 50 percent NOAA fisheries threshold for non-functioning watershed processes. The forested areas are dispersed throughout the entire subwatershed, but much of the canopy cover remains along the riparian corridors. Presumably the level or mildly sloping areas in the Mason Creek subwatershed were cleared for agricultural activities early in the 20th century. A comparison of 1955 aerial photographs to present condition suggests that 1955 forest cover is very similar to present conditions.

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 area is 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 of less than five percent as fully functional and greater than 15 percent as non-functional habitat is a reasonable indicator of habitat quality. The estimated 11 percent TIA for Mason Creek subwatershed falls between the standards for fully functional at five percent and non-functioning at 15 percent. For comparison, Mason Creek has moderate biological integrity based on macroinvertebrate assemblages.

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, almost all of Clark County is non-functioning. Urban areas have road densities approaching 15 to 20 miles per square mile. Mason Creek subwatershed has 5.6 miles of road per square mile of land, characterized as a non-functioning watershed processes, but within the expected range for a rural area.

Stream Crossing Density
Stream crossing density is easily measured using available road and stream channel data. While the metric in Table 2 includes all road crossings, the salmon protection standard considers only larger fills over 60 feet wide, which would be approximately five to ten foot high road fill. According to the NOAA fisheries standard, Mason Creek is functional for salmon habitat.

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 the amount of total impervious area

(usually at lower intensity of development) to almost equal to TIA for high intensity development.

The 2008 Comprehensive Plan guides development for the next few years and when used to estimate effective impervious area provides a metric for expected hydrologic impacts due to development. The estimated EIA based on the Comprehensive Plan for Mason Creek is three percent, well within the 10 percent EIA NOAA Fisheries standard for functioning salmon habitat.

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 graphic (Figure 2). According to this figure, Mason Creek falls into the 'zone of uncertain channel stability' category. This indicates that through protection and restoration activities, it may be possible to increase forest cover and reduce the EIA as approaches to improve stream habitat. Conversely, increased land clearing could results in less stable channel conditions. Based on subwatershed scale conditions, Mason Creek is a good candidate for improving forest functions that could have a measurable impact on channel stability.

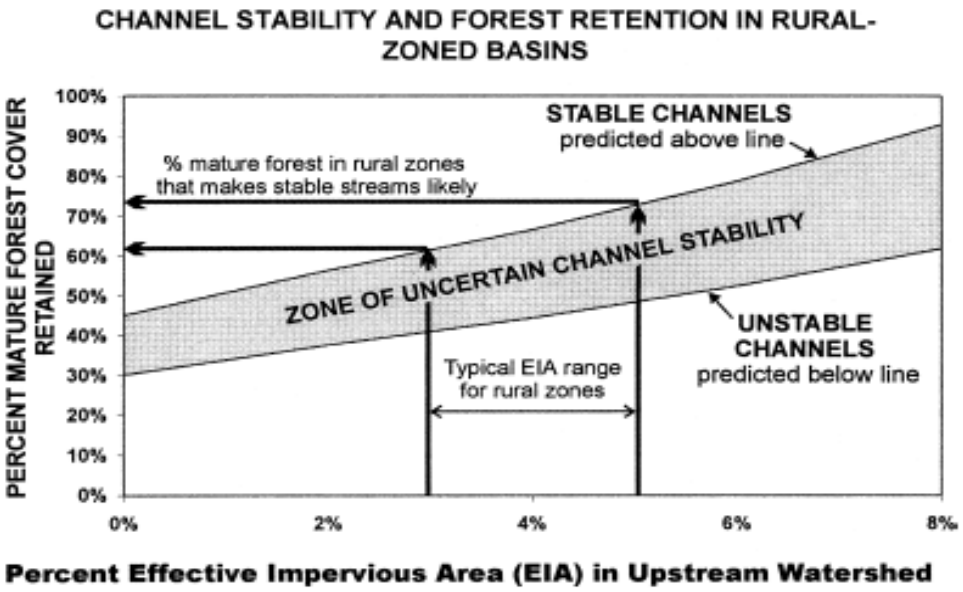

Figure 2: Channel Stability in Rural Areas (Booth, Hartley, and Jackson, June 2002)

Water Quality Assessment

Purpose

This section briefly summarizes and references available water quality data from the Mason Creek subwatershed. 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 Washington State water quality standards, Mason Creek is to be "protected for the designated uses of: core summer habitat; 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).

Table 3 summarizes currently applicable water quality criteria for Mason Creek.

Table 3: Applicable Water Quality Criteria for Mason Creek

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 100 colonies/100mL, and not more than 10% of samples exceeding 200 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)

303(d) Listed Impairments

The 2002/2004 303(d) list of impacted waters may be found on the Ecology website at:

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

Mason Creek is not listed on the 2002/2004 303(d) list. However, as a tributary to the East Fork Lewis River, Mason Creek is part of a fecal coliform and temperature TMDL in the East Fork Lewis River watershed.

Clark County Stream Health Report

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

Based on a limited historical dataset from the early 1990s including fecal coliform bacteria, general water chemistry (temperature, pH, and dissolved oxygen), and benthic macroinvertebrate scores, overall stream health in lower Mason Creek scored in the "fair" range. A simple land-use model predicted fair stream health in the remainder of the watershed.

The 2004 Stream Health Report may be viewed on the county website at http://www.clark.wa.gov/water-resources/stream.html.

Available Data

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

Fecal coliform bacteria and stream temperature have been the focus of the most recent monitoring in Mason Creek. Clark Public Utilities also collects monthly general water quality data; those data are available from CPU and are not summarized here.

TMDL data analysis and reporting by Ecology is ongoing, and draft reports for the fecal coliform TMDL monitoring will be available in 2008 or 2009. Data tables and project status may be reviewed at:

http://www.ecy.wa.gov/programs/wq/tmdl/e_fork_lewis

Table 4: Data and Information Sources	
Source	**Data and/or Report**
Clark County Clean Water Program	2004 Stream Health Report and draft reports Station MAS020
Ecology	303(d) List of Impaired Waterbodies Station 27-MAS-0.25 Station 27MAS 00.8 Station 27MAS-1.23 Station 27MAS-3.19 Station 27MAS-4.57 TMDL study overviews

Water Quality Summary

Clark County has one monitoring station (MAS020 at J.A. Moore Road) in the subwatershed, utilized for stream temperature and macroinvertebrate monitoring (see Macroinvertebrate section). Figure 3 shows the location of station MAS020.

Ecology TMDL monitoring for fecal coliform included four stations on Mason Creek (see Table Y for location descriptions). Preliminary Ecology data analysis provided in a PowerPoint overview at the web site above indicates the following with regard to Mason Creek:

- All four stations met the geometric mean criterion
- Three of the four stations failed to meet the 90th percentile criterion (MAS-1.23 met the criterion)
- Dry season fecal coliform values tended to be higher than wet season values for all four stations

Ecology monitoring for stream temperature included one station on Mason Creek (MAS 00.8). Preliminary Ecology data analysis provided in a PowerPoint overview at the web site above indicates the following with regard to Mason Creek:

- 7-DAD-Max during 2005 was approximately 18 degrees C, around two degrees above the state criterion (16 degrees C).
- Mason Creek was among the cooler monitoring stations throughout the 2005 monitoring period.
- During August 2005, Mason Creek had the coolest measured temperatures in the East Fork Lewis River watershed.

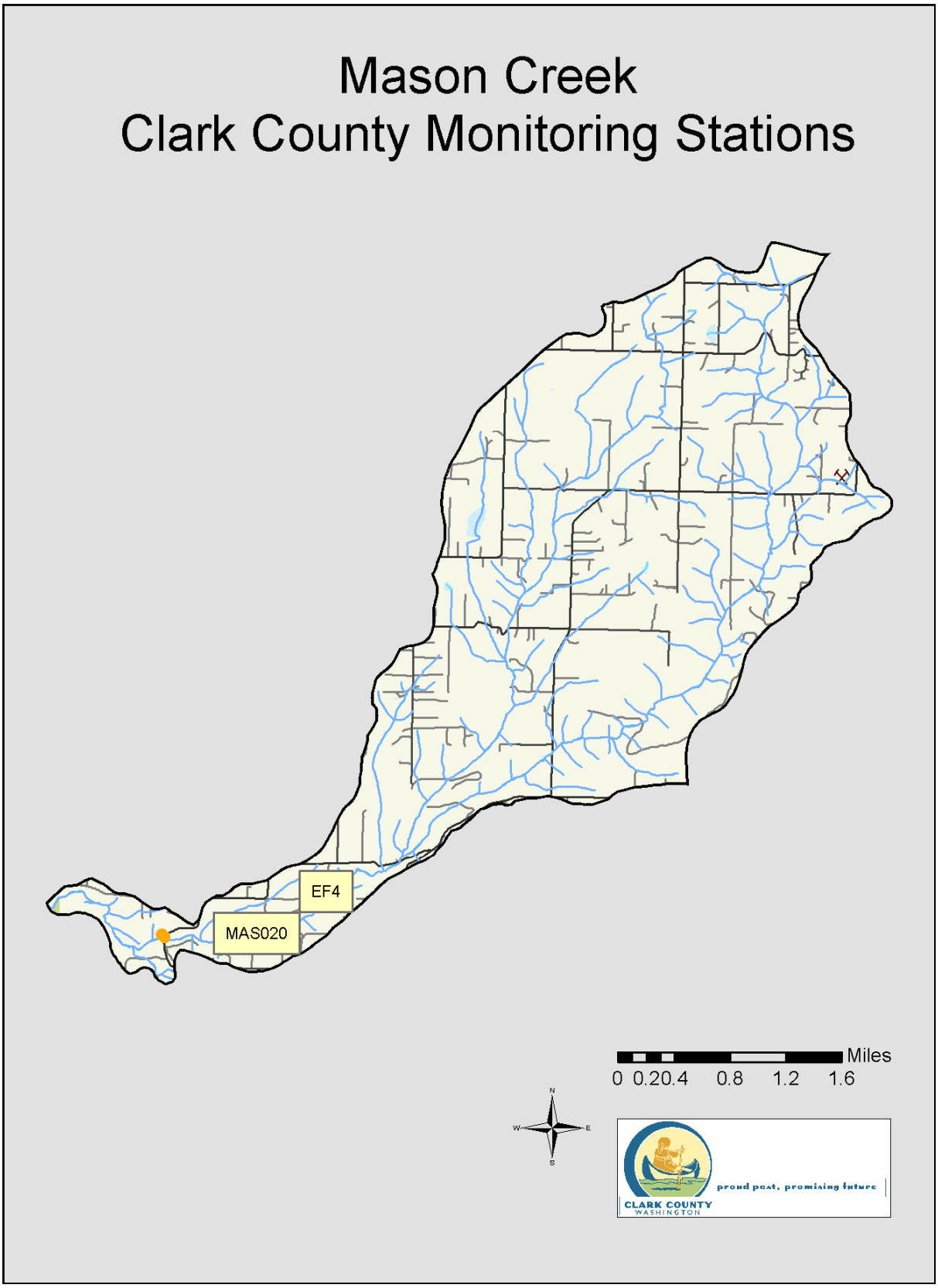

Figure 3: Clark County Mason Creek Monitoring Stations

The CWP also collected continuous stream temperature data at station MAS020 during summer 2004 as part of the LCFRB Habitat Characterization. Results included:

- 7-DAD-Max during 2004 was approximately 21.7 degrees C, nearly six degrees above the state criterion (16 degrees C).
- Daily maximum temperatures exceeded 18 degrees C on 68 days, and exceeded 21 degrees C on 15 days.

Impacts to Beneficial Uses and Potential Sources

Observed levels of fecal coliform bacteria and stream temperature may have negative impacts on the listed beneficial use of primary contact recreation and core summer habitat. Table Z summarizes the primary water quality impacts to beneficial uses in Mason Creek and probable sources of the observed impact.

Fecal Coliform Bacteria

Primary contact recreation is impacted by elevated counts of fecal coliform bacteria, which indicates the possible presence of pathogens. Although water contact may take place year-round, elevated bacteria counts are of particular concern during the summer months when the majority of water contact recreation occurs. It is possible that some local residents, particularly children, utilize the creek for recreation and there may be a risk of illness associated with bacterial contamination.

Further analysis and reporting by Ecology will likely suggest specific areas and activities that may reduce fecal coliform pollution.

Stream Temperature

Stream temperature data is limited and somewhat inconclusive. Monitoring in 2005 indicated relatively good temperature conditions, while 2004 monitoring indicated significant exceedences of state criteria and an extended time period with temperatures exceeding the threshold for negative impacts to salmonids. Variation between these data sets may be due to antecedent weather conditions, temperature logger placement, or other factors.

Overall, the available data suggest that Mason Creek likely has elevated water temperatures at least periodically, and is not currently meeting the state criteria for its designation as core summer habitat.

Implications for Stormwater Management

Table 5 lists the primary known water quality concerns 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.

Table 5: Known Water Quality Concerns, Sources, and Solutions for Mason Creek				
Characteristic	**Beneficial Use Affected**	**Potential Sources**	**Mechanism**	**Solutions (bold indicates direct Clean Water Program involvement)**
Fecal coliform bacteria	Primary contact recreation	failing septic systems	groundwater seeps storm sewers	**Storm sewer screening for source identification and removal** **Education programs** **Storm water facility designs/retrofits to optimize bacteria reduction (see Schueler, 1999)** Agricultural Best Management Practices Septic and sanitary sewer system inspection and maintenance
		sanitary sewer leaks	groundwater seeps storm sewers	
		livestock, pets, wildlife	overland runoff storm sewers direct access	
Water temperature	Core summer salmonid habitat	vegetation removal	direct solar radiation	**Stormwater infiltration to increase baseflow** **Streamside planting/vegetation enhancement/riparian preservation through acquisition** **Education programs** Pond removal or limitation
		ponds	direct solar radiation stagnation	
		low summer flows	decreased resistance to thermal inputs	

Drainage System Inventory

Purpose

The drainage system inventory describes the types and number of drainage features, and the completeness of the inventory process.

Results

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 through the Digital Atlas located at:

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

The drainage system inventory is an ongoing CWP programmatic element focused on populating and updating the StormwaterClk database to include all existing stormwater drainage infrastructure.

Priority effort in the 2007 SNAP was directed toward identifying and mapping previously unmapped discharge points and stormwater facility polygons to support the Illicit Discharge Detection and Elimination Screening project (IDDE). Mason Creek was a lower priority for mapping due to the limited amount of stormwater infrastructure and the fact that IDDE screening activities were not scheduled for this subwatershed. Table 6 indicates the number of features previously inventoried in StormwaterClk prior to 2007 SNAP work, and the number of features added to the database as a result of 2007 SNAP implementation.

Table 6: Drainage System inventory Results, Mason Creek

Database Feature Category	Previously Inventoried	Added to Database during 2007 SNAP
Inlet	7	0
Discharge Point	1	7
Flow Control	0	0
Storage/Treatment	0	12
Manhole	0	0
Filter System	0	0
Channel	200	17
Gravity Main	76	22
Facilities	0	1

The drainage system inventory for the Mason Creek subwatershed remained incomplete at the conclusion of 2007 SNAP implementation. CWP resources were insufficient to complete mapping in all 2007 SNAP subwatersheds. Inventory completion is ongoing in 2008 and 2009 as part of a county-wide inventory update.

Stormwater Facility Inspection

No county owned or operated stormwater treatment or flow control facilities exist within the Mason Creek subwatershed.

Illicit Discharge Detection and Elimination Screening

No illicit discharge screening was conducted in Mason Creek during the current investigation. This work will likely be conducted as part of future bacteria TMDL monitoring.

Stream Reconnaissance and Feature Inventory

A rapid stream reconnaissance and feature inventory was not conducted in Mason Creek during this assessment.

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 scale.

Methods

No physical habitat survey information is available for Mason Creek.

Results

No results are available for Mason Creek

Geomorphology and Hydrology Assessment

The geomorphology and hydrology assessment was completed as a stand-alone report after the bulk of this document was finalized. When available, this report will be attached as Appendix A.

Riparian Assessment

Purpose

The riparian assessment characterizes existing conditions using available information to identify riparian restoration needs and areas for potential rehabilitation projects.

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 typically referred to agencies such as LCFRB, Lower Columbia Fish Enhancement Group (LCFEG), Clark Public Utilities and the Clark Conservation District for possible implementation.

This section focuses on opportunities likely to be considered by the CWP SCIP. These 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 2004 Watershed Characterization and Habitat Assessment reports prepared for the Lower Columbia Fish Recovery Board (R2, 2004 and SP Cramer, 2004). These reports apply primarily to salmon-bearing stream reaches; and therefore, do not provide information for many smaller streams. These projects used aerial photo interpretation following Washington Forest Practices Board methods for large woody debris (LWD) delivery and channel shade estimates.

In streams where no data exists from the 2004 LCFRB characterization, an examination of current orthophotographs is used to make a general assessment of riparian condition.

The 2004 LCFRB Habitat Assessment reports are also reviewed for site specific or general project recommendations within each subwatershed.

Results

The Mason Creek assessment uses results of the 2004 LCFRB habitat assessment. The full characterization reports are available on the Clark County website at:

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

At the subwatershed scale, the LCFRB rated Mason Creek riparian conditions as moderately impaired (LCFRB 2008).

Large Woody Debris Delivery
Figure 4 summarizes the LWD delivery potential for Mason Creek from the 2004 LCFRB assessment. Figure 5 shows that significant parts of Mason Creek lack or have very limited potential for woody debris recruitment.

Shade
Figure 5 illustrates shade conditions for Mason Creek from the 2004 LCFRB Habitat Assessment. The overall shade rating for Mason creek is between 40 to 70 percent. These ratings are consistent throughout the stream, except for the lowest reach between the mouth and the crossing of Lockwood Creek Road, which is rated as 0 to 20 percent.

Riparian vegetation in unassessed tributaries and headwater streams follows a pattern similar to the assessed mainstem. Riparian vegetation is most mature in deeper valleys lower in the basin, and less developed reaches in the upper reaches.

Potential Projects and Management Recommendations
No specific projects for the Mason Creek subwatershed are listed in the SP Cramer (2004) report.

There are no public lands suitable for riparian restoration projects in Mason Creek subwatershed.

Over the long-term, planting projects should be considered along lowermost Mason Creek and upper watershed tributaries that lack riparian forest.

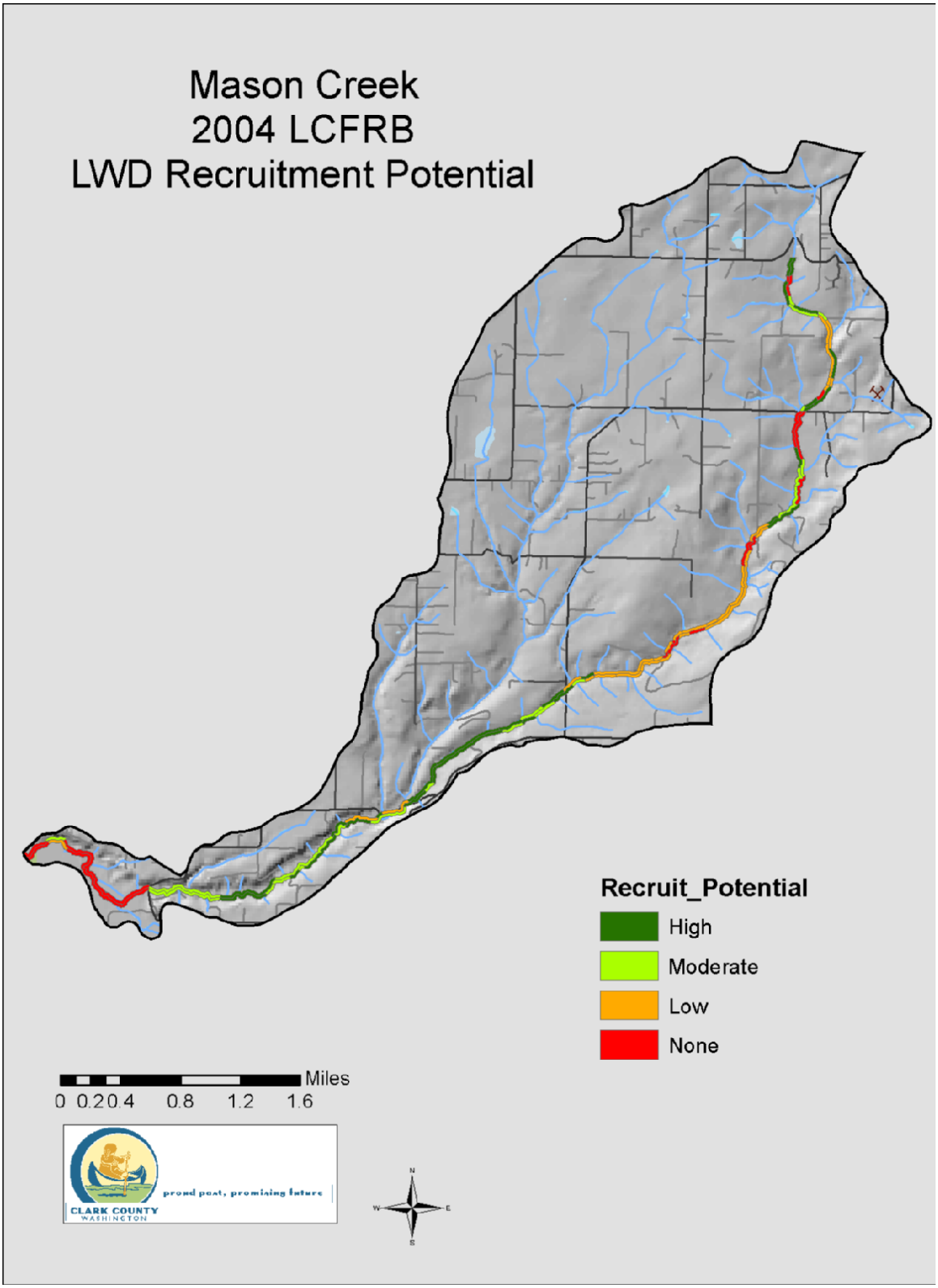

Figure 4: 2004 LCFRB LWD Recruitment Potential

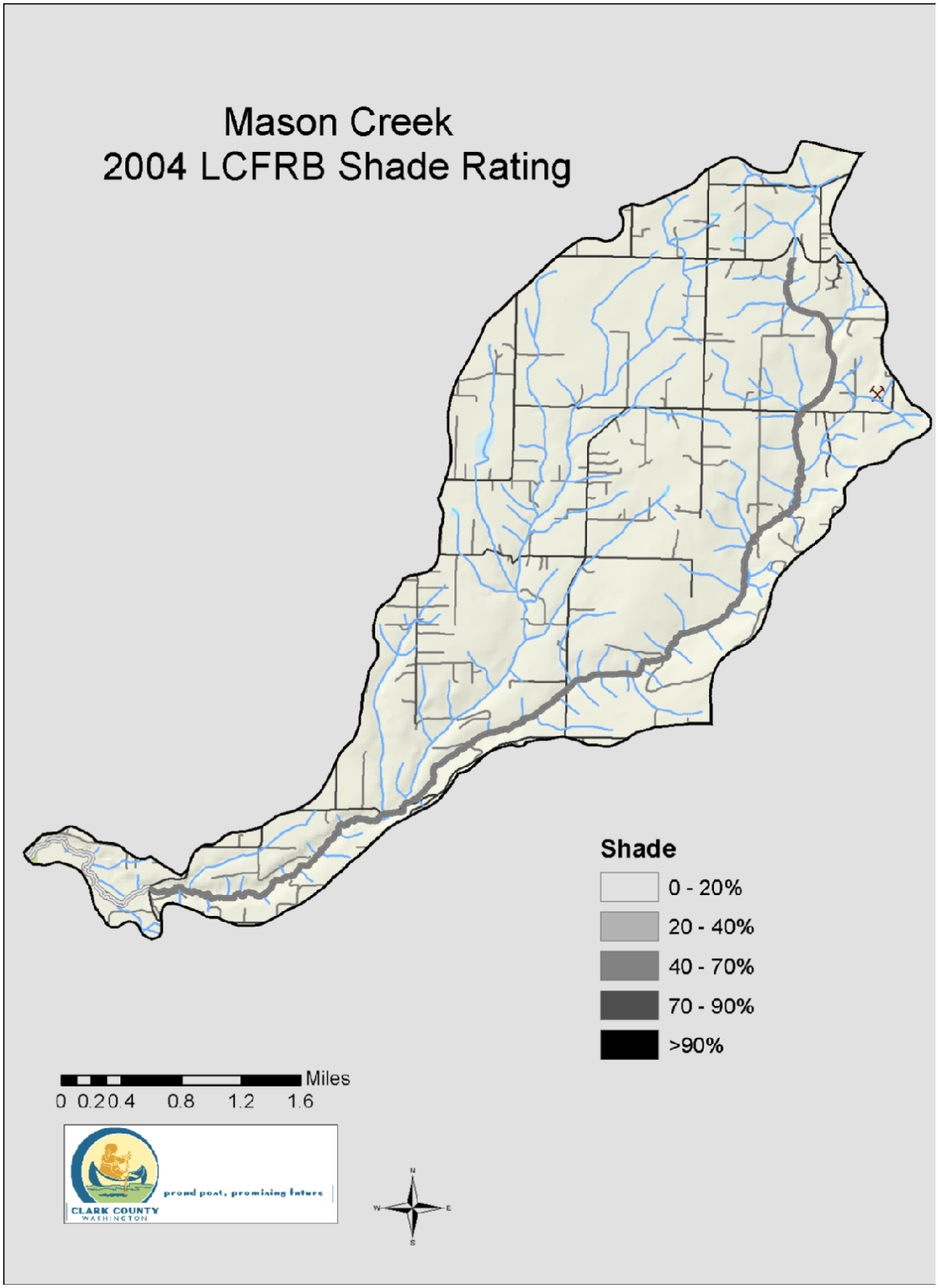

Figure 5: Mason Creek shade values (adapted from R2, 2004)

Floodplain Assessment

No floodplain assessment was completed for Mason Creek. Some discussion of floodplain conditions may be found in the Geomorphology and Hydrology section as Appendix A.

Wetland Assessment

Purpose

Wetlands perform important hydrologic, water quality and habitat functions. The primary reasons for the wetland 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.

The 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.

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. Detailed field evaluations and extensive review of existing data were not applied in the Mason Creek subwatershed.

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.

Geomorphology/Hydrology assessments may also discover potential wetland-related project opportunities.

Results

Figure 6 shows potential wetland areas within the Mason Creek watershed based on data from the county wetlands atlas, including the Clark County wetland model, National Wetlands Inventory, and high-quality wetlands layer.

Potential wetlands and related stormwater project opportunities are very limited within the Mason Creek subwatershed. A well-drained geologic setting combined with stream morphometry consisting of steep, narrow channels descending from upland benches limit wetland areas to narrow near-stream floodplains.

The Clark County Regional Wetland Inventory and Strategy Study did not recommend any mitigation opportunities within Mason Creek, and there are no

tax-exempt parcels in the subwatershed that overlap with potential wetlands from the Clark County wetlands model.

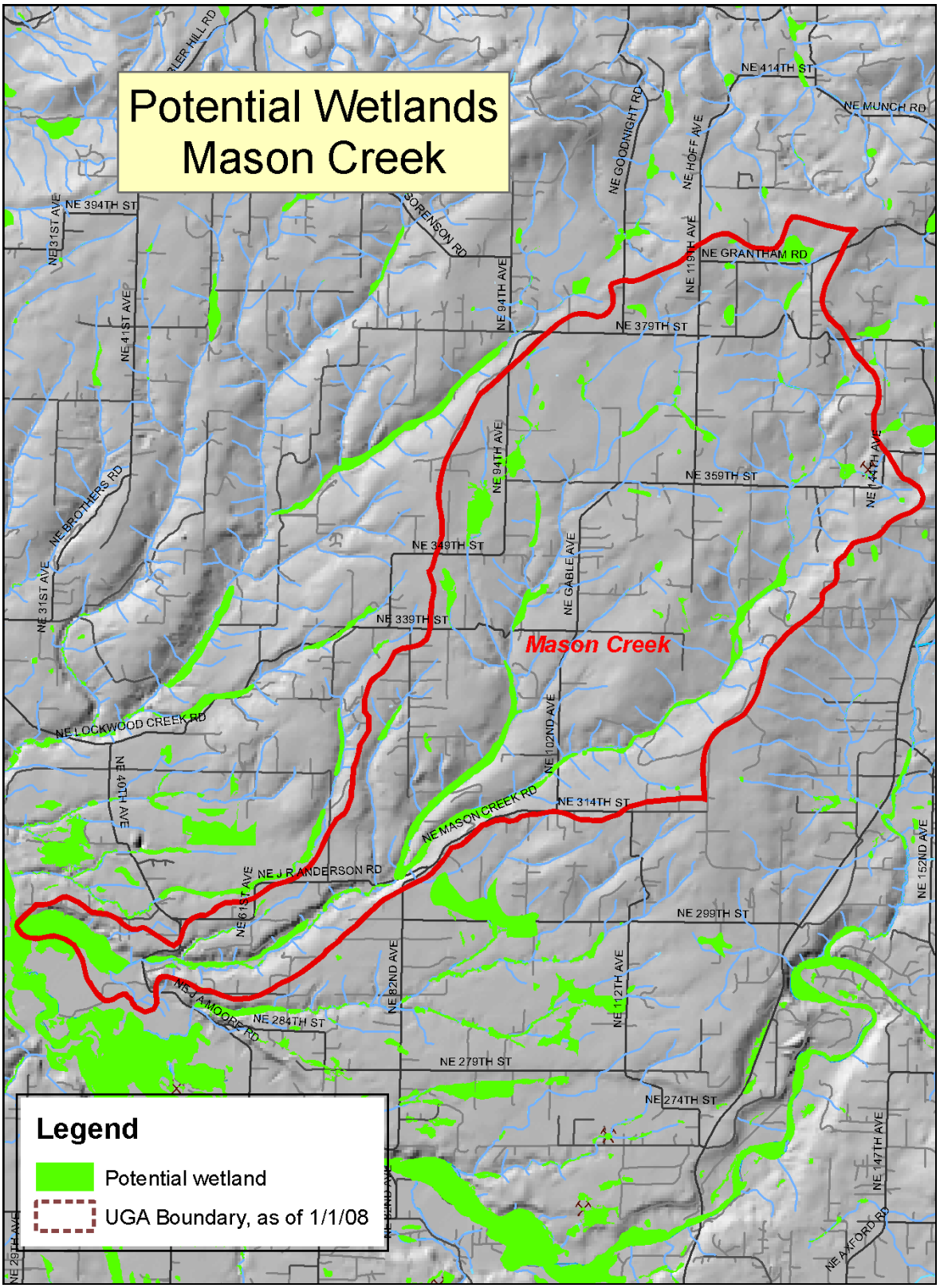

Figure 6: Potential Wetlands in Mason Creek Subwatershed

Draft Watershed Characterization
The Draft Watershed Characterization may be found on the Clark County website at http://www.clark.wa.gov/mitigation/watershed.html. Results pertaining to the Mason Creek subwatershed are summarized below.

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.

In general, green areas have higher levels of importance for watershed processes and limited alteration, indicating they should be managed 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)

The Mason Creek subwatershed is shown as suitable for preservation and restoration (light green) due to its relatively high level of importance for watershed processes and relatively lower level of alteration. Suggested measures include maintaining watershed processes primarily through preservation of existing forest cover (Ecology, 2007).

Potential Projects
This assessment did not discover any high priority stormwater CIP projects related to wetlands within the Mason Creek subwatershed.

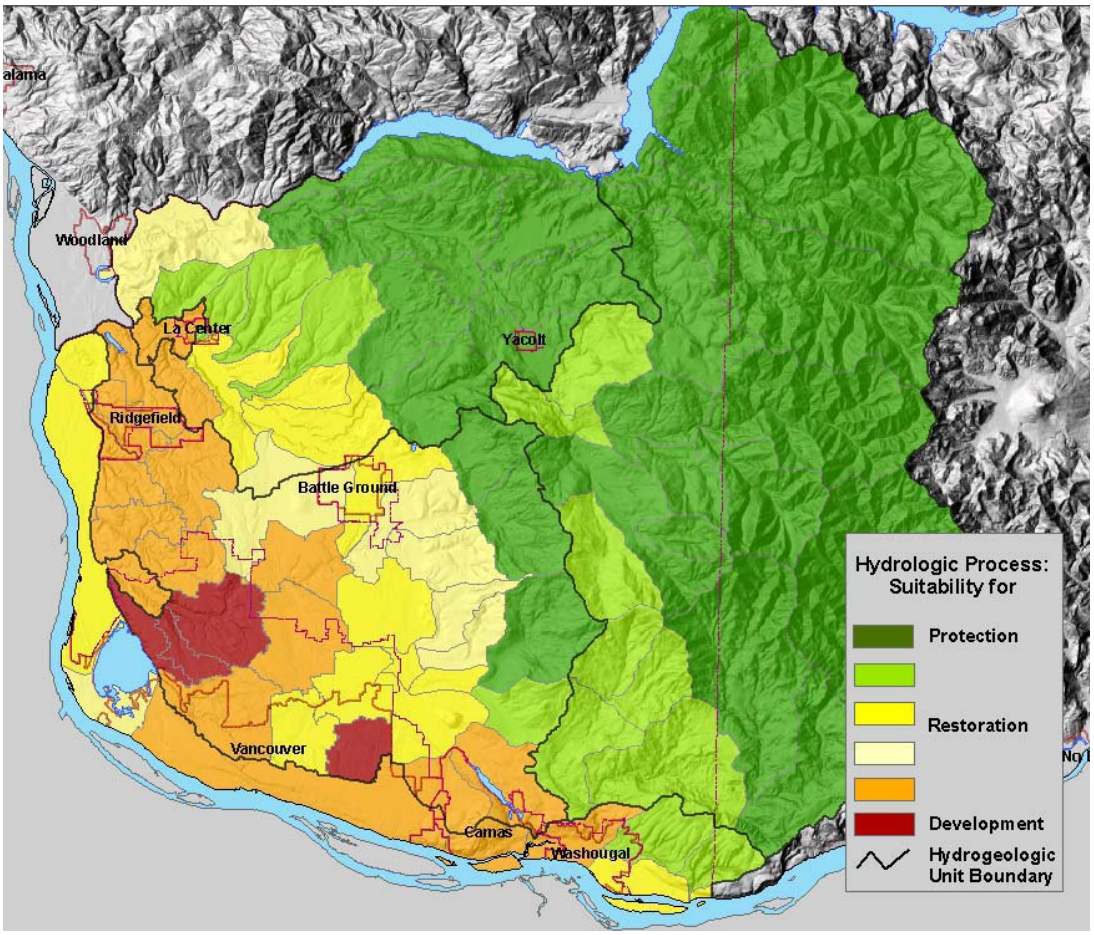

Figure 7: Priorities for suitability of areas for protection and restoration for the hydrologic process (from Draft Watershed Characterization of Clark County (Ecology, 2007)).

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 chronic and acute 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 provides 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 (June 2003). For example, to maximize the comparability of samples, macroinvertebrate collection is from four riffles within a single reach. 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 indicates high biological integrity.

Results are influenced by both cumulative impacts of upstream land use and reach-specific conditions near 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.

The Mason Creek macroinvertebrate sample was collected by the CWP in 2004 (Clark County, 2005). Samples were from station MAS020, located near J. A. Moore Road and approximately two miles southeast of La Center.

Results

The B-IBI score was 32 (Table 7), which falls close to the middle of the moderate biological integrity category.

Table 7: MAS020 Annual Macroinvertebrate Community Metrics and Total Score From 2004

B-IBI Metrics	MAS020		
	Value	Score	Category
Total number of taxa	33	3	moderate
Number of Mayfly taxa	11	5	high
Number of Stonefly taxa	4	3	moderate
Number of Caddisfly taxa	5	3	moderate
Number of long-lived taxa	6	5	high
Number of intolerant taxa	0	1	low
Percent tolerant taxa	8	5	high
Percent predator taxa	7	1	low
Number of clinger taxa	17	3	moderate
Percent dominance (3 taxa)	72	3	moderate
Total B-IBI score		32	**moderate**

The ten individual metric results are classified as two low, five moderate, and three high. In particular, the low scoring metric for intolerant taxa suggest signs of degraded water and habitat quality since they are among the first organisms to disappear as human disturbances increase (Fore, 1999). Also, the sites' low scores for percent predators could reflect decreasing diversity in prey items.

Booth et. al. (2004) found a 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 MAS020 station's 2004 B-IBI score falls in the middle portion of the range of expected scores (estimated 2000 Total Impervious Area from Wierenga, 2005).

By comparing Mason Creek to the likely range of conditions for watersheds with similar amounts of development, measured as impervious area, it is possible to make some general statements about the potential benefits from improving stream habitat. The Mason Creek B-IBI score, compared to the level of development in the subwatershed, suggests the potential to improve biological integrity by restoring forest cover and riparian habitat

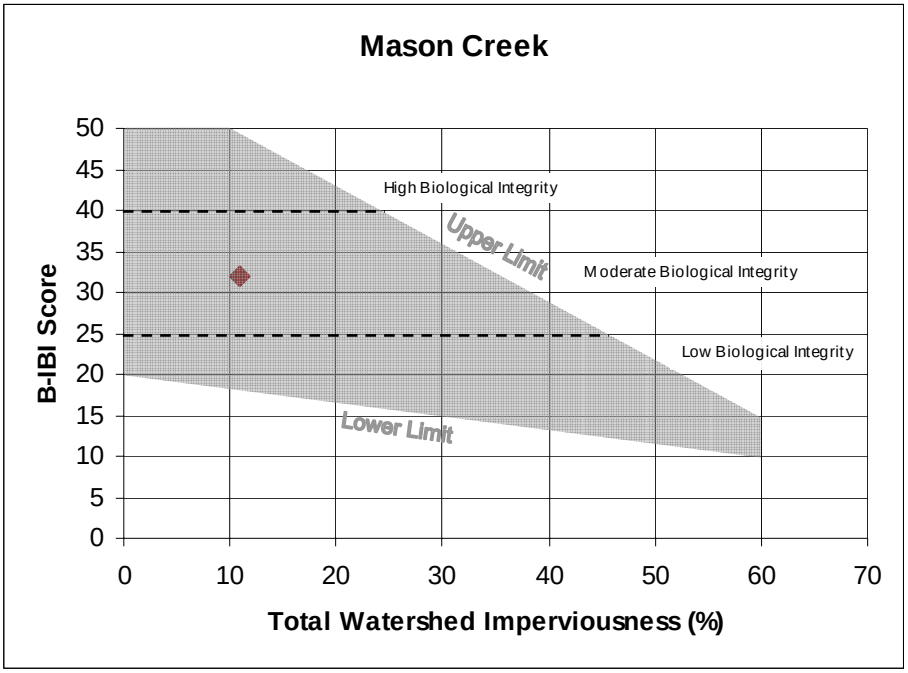

Figure 8: Approximate range of B-IBI in Puget Lowland watersheds, showing progressive decline with increasing imperviousness in the upstream watershed. Adapted from Booth et al., 2004. Markers indicate Total BIBI scores at MAS020 vs. estimated 2000 subwatershed TIA.

Physical Habitat Factors

No substantial stream habitat survey data exists for Mason Creek. Other field observations have noted that Mason Creek has a gravel bottomed channel that should provide adequate substrate for macroinvertebrates.

Hydrology

No stream gauge data exists for Mason Creek. Based on watershed characteristics such as forest cover, benthic macroinvertebrate populations probably are impacted by some alteration of stream hydrology due to forest clearing.

Water Quality

Water quality conditions at the Mason Creek site indicate that B-IBI scores are probably decreased due to water quality degradation. Findings include:

- In 2004, Clark County reported fair water quality for Mason Creek as part of a broad County-wide assessment (Clark County, 2004).
- Water temperature monitoring at MAS020 during the summer of 2004 indicated excessive heating over a prolonged period (Clark County, 2005).

Management Recommendations for Mason Creek

Improvements to habitat complexity and decreasing water temperatures, both in this reach and upstream, should help increase the biological diversity in Mason Creek. Increasing forest cover in the subwatershed could also improve habitat conditions.

Fish Use and Distribution

Purpose

Fish distribution refers to the geographic extent of 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 improvement projects.

Methods

Fish distribution is mapped from existing Clark County GIS information, which reflect 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
- Salmon Scape (http://wdfw.wa.gov/mapping/salmonscape/)
- Clark County 1997 passage barrier data
- LCFRB/Clark Conservation District passage barrier dataset (LCFRB Nov. 2007)

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 (roads.shp) with LiDAR-derived stream data from StrmCntr.shp.

Results/Summary

Distribution

All available evidence suggests that anadromous fish use of Mason Creek includes Coho (Figure 9) and winter steelhead (Figure 10). Mason Creek is defined as a Group D subwatershed for salmon restoration and/or preservation projects (LCFRB, 2004). More recent information in the 2008 6-Year Habitat Work Schedule (LCFRB, 2008) suggests that Mason Creek has a higher priority as a Group B subwatershed having several Tier 2 reaches. Lowermost Mason Creek is listed in the six year habitat plan (LCFRB 2008) as a Coho Tier 1 reach.

Barriers

The WDFW barrier database and the 2007 LCFRB Regional Culvert Survey provides the most complete assessment of barriers in the Mason Creek subwatershed. The data that supports these studies were collected at different times. As a result, there are inconsistencies between them. There are instances where one study has findings that are not reported by the other. This is the case in the Mason Creek subwatershed.

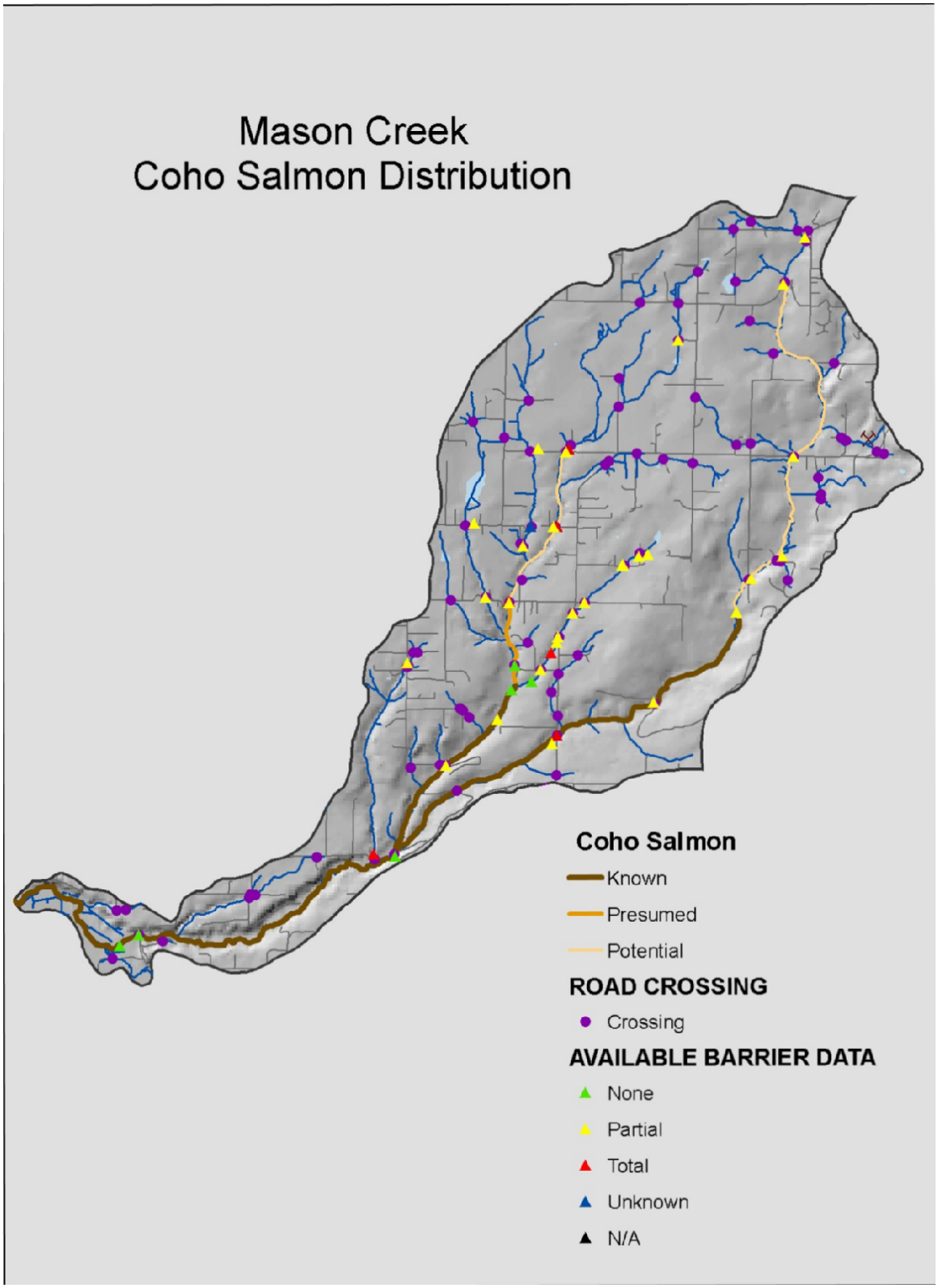

Figure 9: Coho Distribution and Barriers

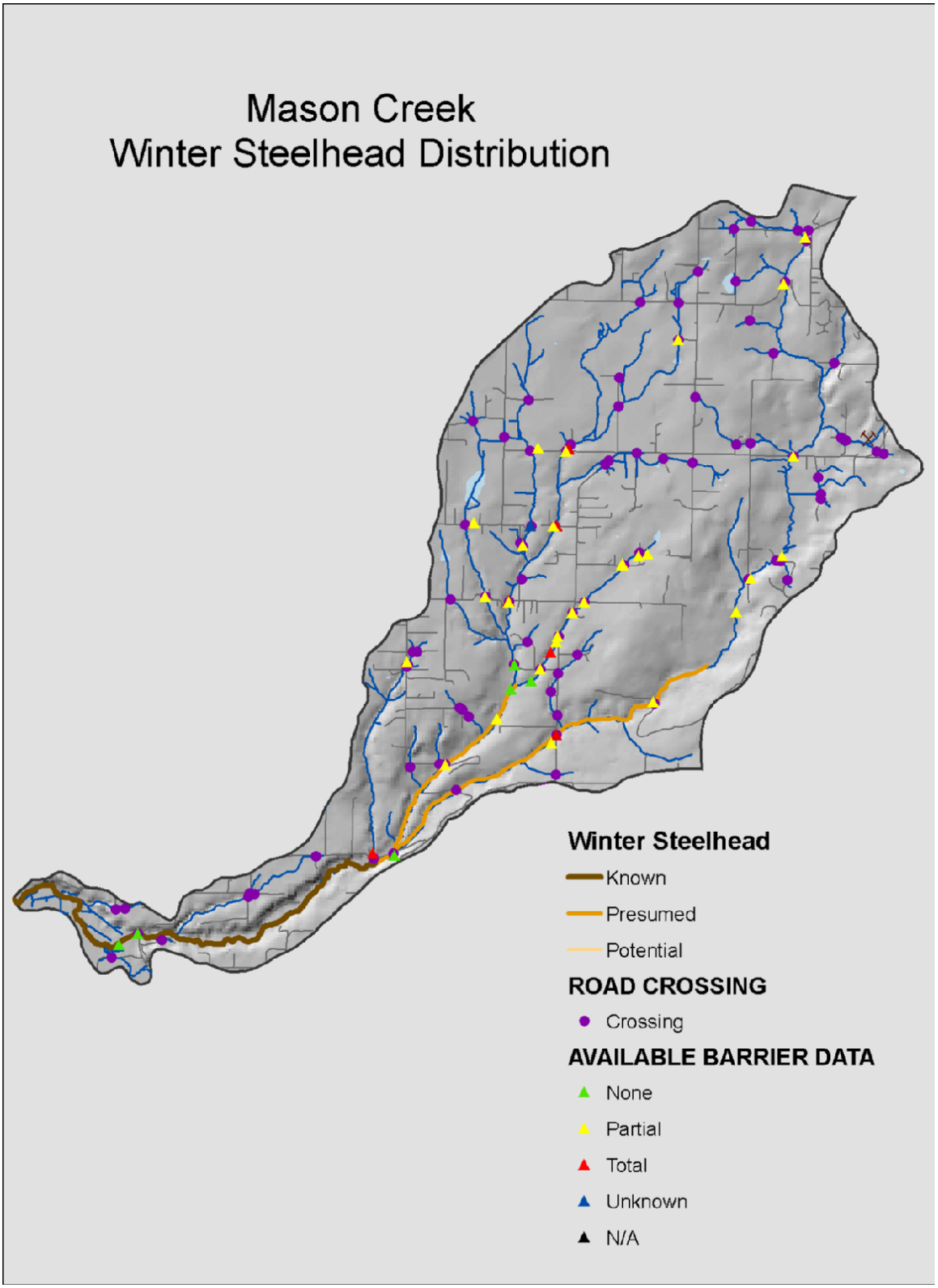

Figure 10: Winter Steelhead distribution and Barriers

There are six fish barriers identified in the portion of Mason Creek and tributaries that have "known" fish use by both Coho salmon and winter steelhead. A "total barrier" is located where NE 102nd Avenue crosses Mason Creek. The remaining barriers are partial.

Recommendations

This report does not include additional information to make specific recommendations for Mason Creek barrier removals separate from existing inventories and assessments. Generally, barriers should be considered for removal as existing stream crossings are upgraded or replaced.

Hydrologic and Hydraulic Models

No modeling projects were completed for the SNAP report. However, an HSPF model was completed by Pacific Water Resources (August 2004) for the East Fork Lewis River as part of WRIA planning for WRIA 27 and 28. It includes limited information for Mason Creek as a modeled subbasin.

Analysis of Potential Projects

The analysis of potential projects includes:

- a brief summary of stormwater 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 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:
Mason Creek soils tend to be fine-grained and are easily eroded. The subwatershed is well drained uplands cut by shallow to deep canyons. The entire area is rural, with no urban development.

Standard subwatershed scale metrics compared to NOAA fisheries standards suggests the Mason Creek habitat is degraded but still meets, or is near meeting, several standards for properly functioning. Non-functioning criteria include lack of forest cover and road density. Land cover, zoning, and subwatershed metrics suggest that a protect and restore approach is appropriate.

Water Quality Assessment:
Mason Creek is not 303(d) listed, but is part of the East Fork Lewis River fecal coliform and temperature TMDL project.

The limited water quality information for Mason Creek indicates Mason Creek has some concerns for bacteria contamination and water temperature. The Clark County Stream Health Report (2004) summarized Mason Creek stream health as fair.

Drainage System Inventory:
Drainage mapping is largely complete. Additional mapping will be completed in 2008 and 2009.

Stormwater Facility Inspection:
As of December 2007, there were no mapped public stormwater facilities in the Mason Creek subwatershed.

Illicit Discharge Screening:
Illicit discharge screening was not conducted in Mason Creek. Screening is anticipated as part of future bacteria TMDL work.

Geomorphology and Hydrology:
See Appendix A for results of these assessments.

Riparian assessment:
The most reliable riparian assessment data in Clark County is limited to the areas assessed during the 2004 LCFRB Habitat Assessment. Mason Creek was included in this assessment.

Generally, riparian conditions to support large woody debris recruitment are at good to acceptable levels along the mainstem downsteam of 102nd Avenue where the stream forms a wooded canyon. Outside of this area, the rating is poor to none.

Riparian shade is good for the length of the mainstem; however, the reaches in the upper mainstem and several tributaries lack significant wooded riparian zones.

Public land is very limited within the subwatershed; 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 and a few upland areas. Ecology's draft wetland characterization of Clark County places Mason Creek in a category where the priority should be protection and restoration of wetland hydrology.

No wetland projects are proposed because there is no public land included in potential wetland areas.

Macroinvertebrate Assessment:
Based on a single sample from lower Mason Creek, the creek displayed moderate biological integrity typical for a stream draining a rural area. The range of B-IBI scores for comparable areas includes both higher and lower integrity scores. Considering this, it is probable that biological integrity could be increased through improvements to upstream water quality conditions.

Fish Use and Distribution:
The LCFRB (2008) has identified Mason Creek as a relatively important stream for salmon recovery. There is known use by Coho salmon and winter steelhead in the basins lower reaches.

This report does not include additional information to make specific recommendations for Mason Creek barrier removals separate from 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 Mason Creek in the 2007 through 2011 SCIP.

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.

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 on the basis of 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.

Emergency or Immediate Actions

Limited field work in Mason Creek did not discover any situations that required immediate action.

Potential Stormwater Capital Projects

- None are identified at this point.

Stormwater Infrastructure Maintenance CIPs

West Consulting found two potential maintenance projects during field work:

- 379th Street and Mason Creek (SE Quarter Section 22 in T5N/R2E) – Sediment accumulation upstream of culvert and tires in stream above culvert.
- Unnamed tributary to Mason Creek at 339th Street (SW Quarter Section 21 in T5N/R2E) - Culvert outlet invert is perched due to excessive scour downstream of culvert outlet. Scour in channel is causing headcut up the roadside ditch. Sedimentation upstream of culvert resulting from culvert backwater.

Stormwater Class V Underground Injection Control Projects

- No county-owned Class V UIC wells are known in the Mason Creek subwatershed.

Habitat Rehabilitation/Enhancement Projects

- None are proposed due to the absence of public land.

Property Acquisition for Stormwater Mitigation

- No stormwater facilities or land acquisitions for facilities are proposed.

Public Works and Clean Water Program Referrals

- No CWP referrals were made.

Projects for Referral to other County Departments, Agencies, or Groups

- Livestock have direct access at several points along Mason Creek or its tributaries. Including near 359th Street, and 379th Street at 119th Avenue, and 379th Street at 109th Avenue. These sites should be referred to the Clark Conservation District.
- Fish passage barriers are well known to resource management agencies.

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 Mason Creek subwatershed, by permit component, include:

Storm Sewer Mapping and Inventory

- None, it is planned for completion in 2008-2009.

Coordination of Stormwater Activities

- The Lower Columbia Fish Recovery Board is planning a project to identify restoration projects in the East Fork Lewis River watershed below Lewisville Park. The Mason Creek SNAP report will be forwarded to that project for review.
- TMDL development for bacteria and temperature will include Clark County.

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.
- In a hilly subwatershed such as Mason Creek, effective erosion control measures for land disturbing activities are critical for protecting stream habitat.

Stormwater Capital Improvements

- Examine the use of small projects to improve stormwater retention and treatment in roadside ditches.

Operation and Maintenance Actions

- Restoring access to fish habitat is a priority in Mason Creek. Fish barrier removal projects in the upper watershed should be considered as existing roads and culverts are upgraded or replaced.
- Review county ditch maintenance practices for vegetation removal.

Education and Outreach to reduce behaviors that contribute pollution

Areas where increased outreach could improve stream conditions include:

- Stream crossings have missing or deteriorated stream name signs that should be replaced.
- Develop a system to provide education about appropriate ditch maintenance practices to rural landowners.

TMDL Compliance

- As Ecology and local stakeholders develop the East Fork bacteria and temperature TMDL, implementation measures will be identified.

Monitoring Stormwater Program Effectiveness

- Problems caused by stormwater are common and most severe on small tributary streams. Future Stormwater Needs Assessments may be most effective by focusing on smaller tributary streams.

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Appendices

Appendix A — Geomorphology and Hydrology Assessment