

2008 Stormwater Needs Assessment Program

Breeze Creek/Jenny Creek Subwatershed Needs Assessment Report

Clark County Public Works Clean Water Program

April 2009





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Acronyms and Abbreviations

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

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

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

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Executive Summary

Study Area

This Stormwater Needs Assessment report includes the Brezee Creek and Jenny Creek subwatersheds in the lower East Fork Lewis River watershed. The assessment focused on those portions of the study area that are within unincorporated Clark County.

Intent

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

Findings

Watershed Conditions

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

Ongoing projects and involvement

Current projects sponsored by Lower Columbia Fish Recovery Board (Lower East Fork Lewis River Restoration Plan) include channel restoration, riparian and stream bank revegetation, and aquatic habitat enhancement and restoration. The Clark County Legacy Lands Program and Clark County Clean Water Program are participating in project selection and development for this effort.

The Washington Department of Ecology is developing Total Maximum Daily Load (TMDL) for bacteria and temperature in the East Fork Lewis River watershed including both Brezee Creek and Jenny Creek.

There are no stormwater projects in Brezee Creek or Jenny Creek subwatersheds under the 2009 through 2014 Stormwater Capital Improvement Program.

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Category	Status
Water Quality Overall Fecal coliform bacteria Temperature	<ul style="list-style-type: none"> • Poor (Brezee Creek) to Good (Jenny Creek) • Significant increasing trend in turbidity (Brezee Creek) • Both fail state standards; Brezee Creek by a large margin. • All are included in East Fork Lewis River fecal coliform TMDL • Both subwatersheds fail temperature standard • Streams are included in East Fork Lewis River temperature TMDL
Biological Benthic macro-invertebrates Anadromous fish	<ul style="list-style-type: none"> • Low to moderate biological integrity for Brezee Creek and moderate to high biological integrity for Jenny Creek • Known Coho and Winter Steelhead (Brezee Creek and Jenny Creek) Presumed Fall Chum and Summer Steelhead (Brezee Creek) • Low to high regional recovery priority; Brezee Creek as a Tier 1 and Jenny Creek as a Tier 4 (mouth to full barrier falls)
Habitat NOAA Fisheries criteria Riparian Wetland	<ul style="list-style-type: none"> • Forest percentage and road density (Brezee Creek and Jenny Creek) and total impervious area (Brezee Creek) fall into the Non-Functioning category • Projected effective impervious area falls into the Potentially Unstable category • Stream crossing density falls in the Functioning category • Overall riparian conditions rated as marginal or impaired • Overall shade low to high in Brezee Creek; minimal for Jenny Creek • Large woody debris recruitment varies from none to moderate • Potential wetland areas associated with stream channel floodplains and tributary headwaters
Hydrology and Geomorphology Overall hydrology Channel stability	<ul style="list-style-type: none"> • Streams are generally higher gradient and have limited floodplain • Mixed rural land use suggests higher storm flows than forested areas • Projected unstable to very unstable
Future condition	<ul style="list-style-type: none"> • Projected impervious area in the Brezee Creek and Jenny Creek subwatersheds places them in the "Potentially Unstable" category
Stormwater (Unincorp areas) System description Inventory System adequacy System condition	<ul style="list-style-type: none"> • Primarily road-side ditches • No public stormwater facilities; one private facility • Complete • Assumed adequate treatment; inadequate flow control • 271 outfalls screened for illicit discharges; all were in compliance • Two outfalls draining to critical areas in compliance

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Opportunities

Projects listed in the SNAP report represent only a small part of those required to protect and restore streams within the study area. Opportunities for stormwater-related watershed improvement projects include the following:

- Focused stormwater outreach and education to streamside landowners in headwaters areas.
- Focused monitoring to determine if fecal coliform sources are present.
- Inspection of one potentially at-risk earthen dam.
- Inspection of one culvert causing localized backwater conditions.
- Potential purchase or protection of four parcels suitable for large-scale wetland restoration.
- Exclusion of livestock from stream in multiple locations.
- Investigation of three potential illicit discharges.
- Evaluation of several potential fish barriers, and removal of several known barriers in Brezee Creek and tributaries.
- Promotion of riparian enhancement projects, particularly in the upper and lower portions of 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 the study area include:

- Pursue future collaborative stormwater activities with the City of La Center in the Brezee Creek subwatershed.
- Continue to leverage projects with the Lower Columbia Fish Recovery Board through the Lower East Fork Lewis River Aquatic Habitat Restoration Plan.
- Continue active participation in Ecology's bacteria and temperature TMDL development for the East Fork Lewis River watershed.
- Replace deteriorated stream name signs at road crossings.
- Perform targeted monitoring or screening to identify fecal coliform sources.
- Develop technical assistance to aid rural property owners to effectively follow recently adopted runoff reduction practices for construction projects
- Develop a system to provide education about appropriate ditch maintenance practices to rural landowners.
- Examine the use of small projects to improve stormwater retention and treatment in roadside ditches.
- Consider fish barrier removal projects as existing roads and culverts are upgraded or replaced.

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- Develop literature and distribute to landowners educating about the water quality impacts and other potential hazards of on-line and off-line ponds.
- Increase education and technical support regarding the removal of invasive plants, and provide a list of suggested plants for stream revegetation and local nurseries that stock them for distribution to landowners.

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Introduction

This Stormwater Needs Assessment includes the Brezee Creek and Jenny Creek subwatersheds. The Clean Water Program (CWP) is gathering and assembling information to support capital improvement project (CIP) planning and other management actions related to protecting water bodies from stormwater runoff.

Purpose

The Stormwater Needs Assessment Program (SNAP), initiated in 2007, creates a system for the CWP to focus activities, coordinate efforts, pool resources, and ensure the use of consistent assessment 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 improvement actions to protect, restore, or enhance beneficial uses consistent with NPDES objectives and 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, this report contains

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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.

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Assessment Approach

Priorities for Needs Assessment in the Brezee Creek and Jenny 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 Brezee Creek subwatershed is categorized as “Rural Residential Including City-Serviced Fringes of UGA”. Subwatersheds in this category typically include rural areas bordering cities. These subwatersheds often score a high priority for stormwater management overall, but are a lower priority for Clark County due to the rural nature of the unincorporated portions. Stormwater management needs tend to be limited in these areas.

The Jenny Creek subwatershed is categorized as “Rural Residential Areas Outside of UGAs”. Rural residential subwatersheds outside of UGAs that are not heavily forested do not score highly as a priority for stormwater basin planning due to a lack of urbanization. However, these areas may take on a higher priority for watershed management oriented activities to protect and restore better quality stream habitat and salmon recovery priorities. Stormwater management actions for this classification type focus on mapping and evaluating the area draining to county outfalls, TMDL compliance, and possible habitat protection projects to mitigate for development in other parts of a watershed.

Assessment Tools Applied in Brezee Creek and Jenny Creek

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

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

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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	

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Assessment Actions

Outreach Activities

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

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

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

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

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

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Coordination with Other Programs

Purpose

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

Coordination is a two-way relationship; in addition to bringing information into the needs assessment process, coordinating agencies may use needs assessment results to plan projects and refine resource management options.

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 materially contribute to identifying potential projects and compiling information to complete the needs assessment.

Results

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

The following list includes departments, agencies, and groups contacted for potential coordination in the Brezee Creek and Jenny Creek needs assessment area:

- Clark County Endangered Species Act Program
- Lower Columbia Fish Recovery Board
- Lower Columbia Fish Enhancement Program
- Clark County Transportation Improvement Program
- Clark County Legacy Lands Program
- Vancouver/Clark Parks and Recreation
- Washington Department of Ecology
- Washington Department of Transportation

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Review of Existing Data

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

- LCFRB Habitat Assessments (Cramer report)
- LCFRB Workplan
- LCFRB Lower East Fork Lewis River Aquatic Habitat Restoration Plan (Draft)
- Ecology 303(d)
- WRIA Limiting Factors Analysis
- Ecology EIM Data
- Clark County Volunteer Project Data
- Clark County 6-year TIP
- Clark County 2007 Stormwater Needs Assessment Program
- Clark County 2006 Prioritizing Areas for Stormwater Basin Planning
- Clark County 2005 Subwatershed Characterization and Classification
- Clark County 2004 Subwatershed Summary
- Clark County 2004 Stream Health Report
- Clark County 2003 Long-Term Index Site Monitoring Project: 2002 Physical Habitat Characterization
- 2001 Clark County Long-Term Index Site Monitoring Project: Data Summary
- City of La Center Master Parks Plan (draft)

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Broad-Scale GIS Characterization and Metrics

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

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

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

The characterization includes three components:

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

Map Products

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

General Conditions and Subwatershed Metrics

General Geography

The study area comprises two very similar subwatersheds, Jenny Creek and Brezee Creek, in the lower East Fork Lewis River. The area is at the transition from the Willamette Valley floor to low foothills to the Cascade Mountains in northeastern Clark County (Figure 1). The land use is mainly rural residential and smaller forest tracts; however, the city of La Center occupies a significant part of the lowermost Brezee Creek subwatershed. The area is largely in private lands with areas of public open space where streams enter the East Fork Lewis River floodplain.

Topography

Breezee Creek and Jenny Creek headwater in rolling hills between 500 and 800 feet above sea level, then flow through relatively deep canyons down to the East Fork Lewis River floodplain near sea level. On Brezee Creek, a floodplain forms below the confluence of the three main stream branches. Jenny Creek develops a

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floodplain below about 300 foot elevation, but the lowermost part below Pacific Highway is confined to a rock canyon.

Geology and Soils

Older volcanic rocks are exposed in lowermost Jenny Creek and in limited areas along the main channel. Sedimentary rocks deposited by the ancestral Columbia and local streams underlie most of the area and include fine grained mudstone and gravel deposits. Ice Age gravel terraces formed along the East Fork are present in the lowermost Brezee Creek subwatershed. Gravelly rocks underlying the area provide significant amounts of gravel to streams.

Soils formed on the sedimentary rocks are generally clayey Hesson and Olequa series.

Hydrology

Geology and topography play the main role in determining study area hydrologic framework. Mountain foothill streams are generally higher gradient and have limited floodplain. Depending on geologic substrate, much of the precipitation may leave the basin as rainfall runoff or shallow interflow, leaving streams with low flows in summer months. Both creeks are largely underlain by sedimentary rocks that can provide better summer base flow than do denser volcanic rocks or fine-grained sediment.

Land cover is typical for rural areas. Generally, flatter hilltops are cleared for pastures and home sites, while steeper valleys walls are forested. Overall, about 40 percent of Brezee Creek and Jenny Creek subwatersheds are forested. Cleared uplands and relatively steep gradient streams can lead to somewhat flashy streams. This is also suggested by Clean Water Program observations of channel morphology in lower Brezee Creek.

A stream gauge has been operated on Brezee Creek by the Clean Water Program since water year 2004 and monitoring data is available.

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 both functioning and non-functioning stream habitat conditions (Table 2).

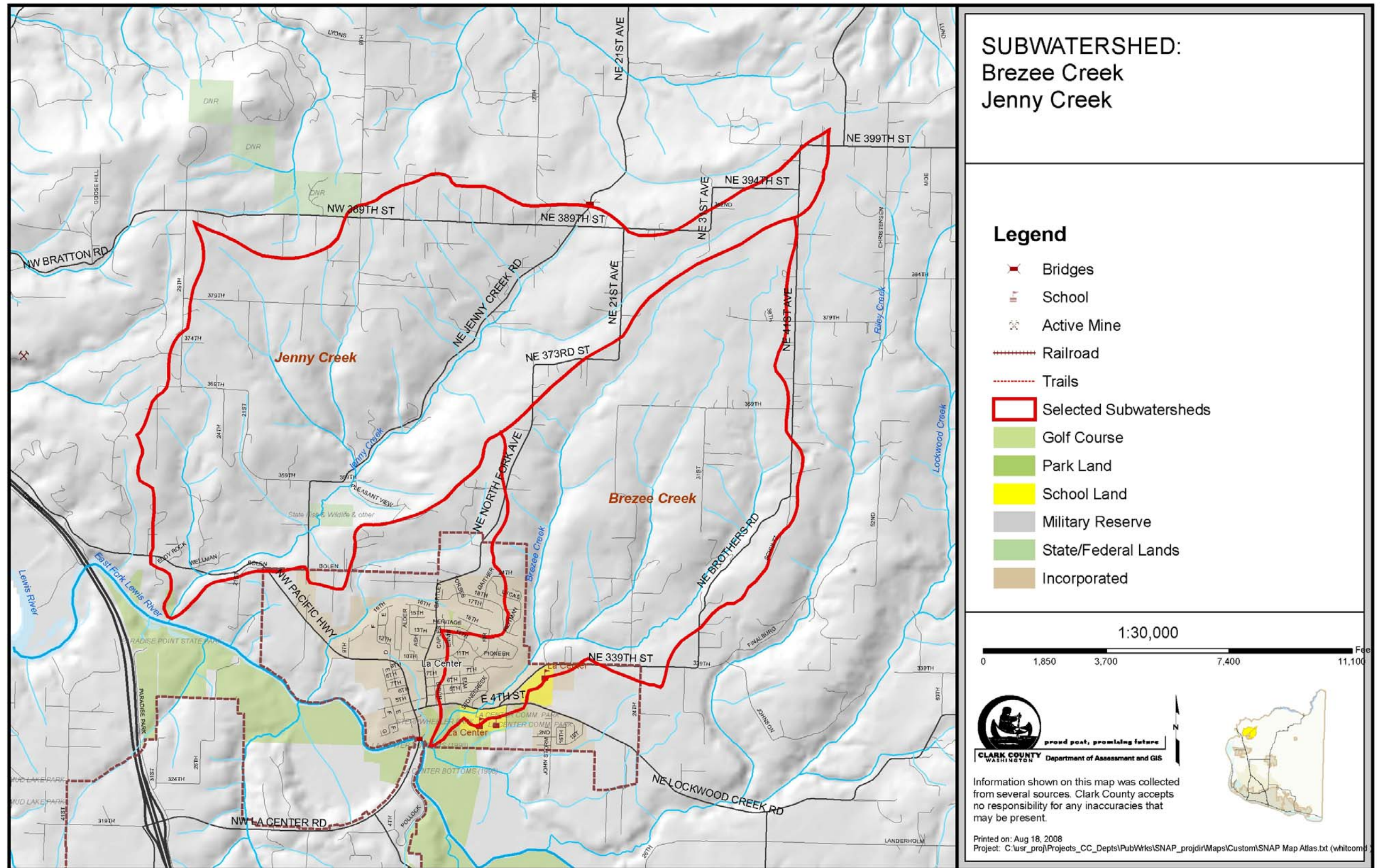


Figure 1: Subwatershed Map: Brezee Creek and Jenny Creek Subwatersheds

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Table 2: Watershed Scale Metrics				
Metric	Breeze Creek	Jenny Creek	Functioning	Non-functioning
Percent Forested (2000 Landsat)	38	40	> 65 %	< 50 %
Percent TIA (2000 Landsat)	16	12	< 5 %	> 15 %
Road Density 2007 data (miles/mile ²)	5.7	6.7	< 2	> 3
Stream Crossing Density (crossings per stream mile)	1.6	2.5	< 3.2/mile	> 6.4/mile
Percent EIA estimated from the Comprehensive Plan	5	3	< 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 study area's pattern of cleared hilltops and forested canyons is reflected in the amount of forest cover. Over time, forest cover could be increased if unused fields and tracts of grass on residential lots are converted to forest.

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 tend to be categorized as forested urban land cover.

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

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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 within the functioning category (<3.2 crossings/stream mile NOAA Fisheries criteria).

Future Effective Impervious Area

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

The 2008 Comprehensive Plan guides development for the next few years and when used to estimate effective impervious area it can provide a metric for potential hydrologic impacts due to expected development. Limited future EIA changes should be seen in Jenny Creek due to location outside the La Center Urban Growth Area. Within Brezee Creek subwatershed, there will be slightly higher effective impervious area due to the growth of La Center. Estimates are within the range of functional watersheds.

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 Jenny and Brezee Creek subwatersheds are potentially unstable based on limited forest cover and low EIA.

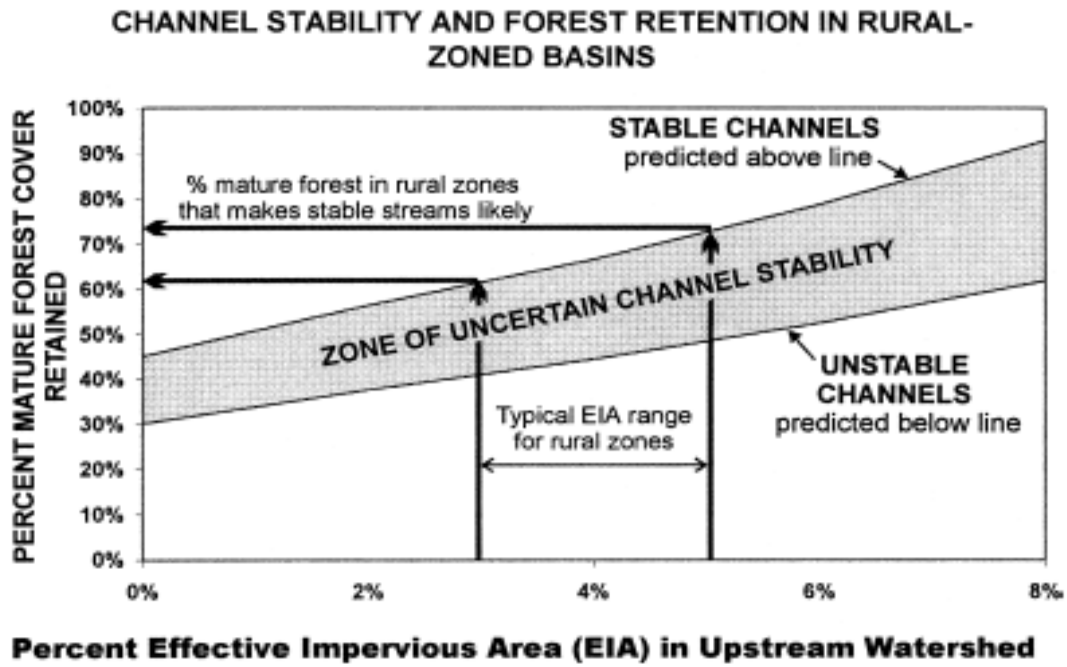


Figure 2: Channel stability in rural areas (Booth, Hartley, and Jackson, June 2002).

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Water Quality Assessment

The Water Quality Assessment summarizes and references available water quality data from the Breeze Creek and Jenny Creek 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 current Washington state water quality standards, Breeze Creek and Jenny Creek “are to be protected for the designated uses of: salmonid spawning, rearing, and migration; 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 602).

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

Table 3: Applicable Water Quality Criteria Brezee Creek and Jenny Creek Subwatersheds	
Characteristic	2006 Ecology criteria
Temperature	≤ 17.5 °C (63.5 °F)
Dissolved Oxygen	≥ 8.0 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>)

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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>

Both Brezee Creek and Jenny Creek are Category 5 listed (polluted waters that require a TMDL) for temperature and fecal coliform bacteria. 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 CWP compiled available data and produced the first county-wide assessment of general water quality.

Based on a limited available dataset including fecal coliform bacteria, general water chemistry (temperature, pH, and dissolved oxygen), and benthic macroinvertebrate scores, overall stream health in the Jenny Creek subwatershed scored in the good range. Brezee Creek scored in the poor range, largely because of elevated fecal coliform bacteria levels.

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 for the assessment area consists primarily of stream temperature and bacteria data collected by Ecology in 2005 and 2006 during TMDL development. Complete data and draft summaries for TMDL development may be viewed on the Ecology website at: <http://www.ecy.wa.gov/programs/wq/tmdl/EForkLewis/index.html>

General water quality data has also been collected by Clark County in Brezee Creek at La Center Bottoms from 2002 through 2007, and by Clark County volunteers in Jenny Creek during 2002 and 2003.

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

Table 4: Available Data	
Source	Data and/or Report
Clark County Clean Water Program	2002-2007 Long-term Index Site Project 2004 Stream Health Report 2002-2003 Volunteer Monitoring Program
Ecology	EF Lewis River TMDL technical study for temperature and bacteria

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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-BRZ-0.5 (Breeze Creek off 4th),
- 27-BRZ-0.07 (Breeze Creek @ mouth)
- 27-BRZ-SW1 (Stormwater Culvert near Cedar & 4th)
- 27-BRZ-SW2 (Stormwater Ditch to Breeze Creek Near mouth)
- 27-BRZ-14th (Tributary to Breeze Creek @ 14th)
- 27-JEN-0.35 (Jenny Creek @ Pacific Highway)

Continuous temperature data were collected from Station 27BRZ00.1 (Breeze Cr near mouth) and Station 27JEN00.3 (Jenny Creek at Pacific Highway) as part of the East Fork Lewis River temperature TMDL.

Clark County has one active monitoring station in the assessment area, on Breeze Creek at La Center Bottoms (Station BRZ010).

Oregon Water Quality Index (OWQI) Scores

The OWQI was developed by the Oregon Department of Environmental Quality (ODEQ) as a way to improve understanding of water quality issues by integrating multiple characteristics and generating a score that describes water quality status (Cude, 2001). It is intended to provide a simple and concise method for expressing ambient water quality.

The OWQI integrates eight water quality variables: temperature; dissolved oxygen; biochemical oxygen demand; pH; ammonia + nitrate nitrogen; total phosphorus; total solids; and fecal coliform. For each sampling event, individual sub-index scores and an overall index score are calculated. Overall index scores are aggregated into low flow (June through September) and high flow (October through May) seasons and a seasonal mean value is then calculated. The final annual OWQI score is reported as the lower of the two seasonal mean scores.

Index scores are categorized as follows:

very poor = 0 to 59; poor = 60 to 79; fair = 80 to 84; good = 85 to 89, and; excellent = 90 to 100.

Figure 3 shows seasonal mean and minimum OWQI scores for Station BRZ010 from 2002 through 2007. The overall score, based on the lower of the two seasonal averages (78), places the station in the poor category. Very low minimum scores indicate that under some conditions station BRZ010 had very poor water quality. However, these occurrences were uncommon and overall water quality was only a single point from reaching the fair category.

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Prior to 2007 data collection, during the 2002 through 2006 period, Station BRZ010 ranked eighth in overall water quality among 15 long-term monitoring stations county-wide (Hutton and Hoxeng, 2007).

Monthly OWQI values since 2002 ranged from very poor to excellent, although half of the monthly (32 out of 62 months sampled) OWQI values were in the Fair or Good category. Monthly values in the Very Poor category did not follow a clear pattern, with two occurring in the dry season and four during the wet.

Monthly sub-index scores for total phosphorus were typically fair to good, while scores for inorganic nitrogen were typically poor to fair, and total solids varied widely. Fecal coliform scores were widely scattered, with poor and very poor values relatively common. Sub-index scores for water temperature, dissolved oxygen, and pH were consistently excellent.

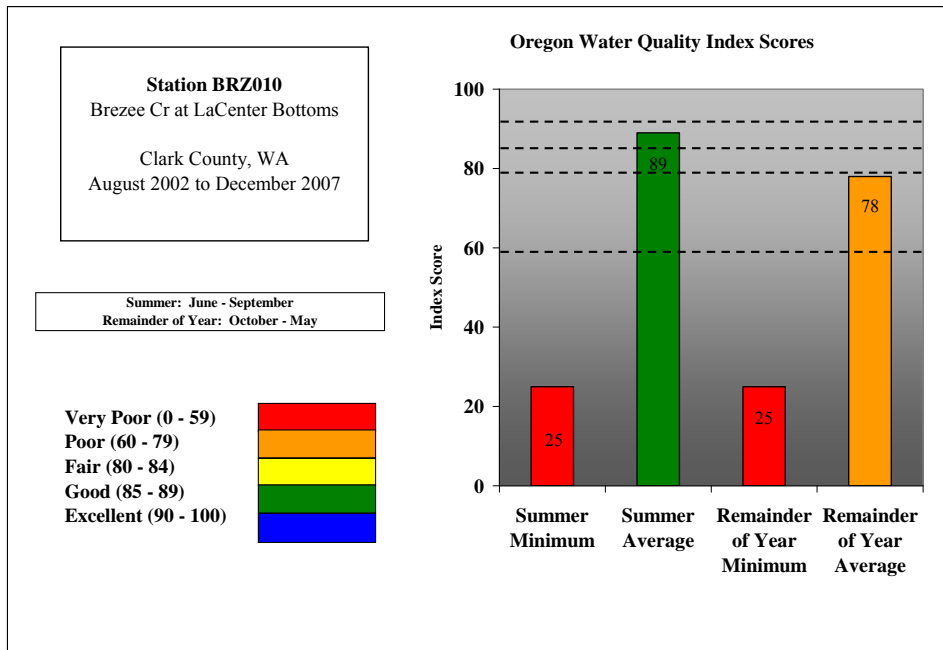


Figure 3: Average Water Quality, Brezee Creek Station BRZ010, 2002 through 2007, Oregon Water Quality Index

Trends

An analysis of potential statistical trends in OWQI scores based on the 2002 through 2006 dataset found one significant trend at Station BRZ010 (Hutton and Hoxeng, 2007).

An increasing trend (decreasing water quality) was evident in turbidity scores at the 95 percent confidence level. The magnitude of this trend was an increase of approximately 0.90 NTUs per year.

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In the 2007 analysis, only nine statistically significant trends were identified county-wide out of 45 potential trends evaluated (15 monitoring stations examined for potential trends in three parameters including overall OWQI, fecal coliform, and turbidity). The fact that one of these nine trends was located in Breeze Creek and that the trend indicated degrading water quality, suggests that Breeze Creek is at increased risk of immediate water quality degradation compared to most other monitored streams in Clark County.

Fecal Coliform Bacteria

Based on 30 to 32 samples at each station collected by Ecology in 2005 and 2006 (approximately evenly split between wet season and dry season), all of the Breeze Creek stations failed the 10 percent not-to-exceed portion of the standard in both seasons. Station BRZ-0.5 and Station BRZ-0.07 during the wet season, and Station BRZ-SW1 during both seasons, were the only stations to meet the geometric mean standard.

With the exception of the McCormick Creek subwatershed, the Breeze Creek subwatershed had the highest geometric means and 90th percentile values in the entire East Fork Lewis River watershed.

The Jenny Creek station failed the 10 percent not-to-exceed portion of the standard in both seasons, and failed the geometric mean standard during the dry season.

During a dry period sampled during 2005, Breeze Creek at Station 27-BRZ-0.07 carried approximately 20 percent of the total bacteria load measured in the East Fork Lewis River watershed, while the two stormwater stations and the Jenny Creek station carried approximately two percent each. During a rain event sampled in the same year, the approximate loads were much less than one percent for each of the stations.

Ecology results from the Breeze Creek subwatershed were consistent with longer-term results from Clark County at station BRZ010 (2002 through 2007). Overall fecal coliform bacteria values during the County sampling period failed the geometric mean portion of the standard during the dry season and failed the 10 percent not-to-exceed portion during both the wet and dry seasons.

Stream Temperature

In addition to routine monthly temperature readings which are incorporated into OWQI calculations, Clark County continuous temperature loggers recorded hourly temperature values at station BRZ010 between May and October during 2002 through 2008. Continuous readings provide a more complete picture of temperature dynamics than monthly grab samples.

Table 5 summarizes the continuous temperature data. The 7-Day average maximum value is the maximum of the 7-day moving average of daily maximum

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temperatures. The Ecology standards utilize this metric to determine temperature compliance (Breeze Creek criterion is 63.5 degrees F). Maximum daily ΔT is the maximum daily temperature fluctuation, and gives some indication of the susceptibility of the stream to changes in heat input.

Summer stream temperature at Station BRZ010 was relatively consistent and exceeded the 63.5 degrees F state criterion by two to five degrees F in each year monitored.

Ecology monitoring in 2005 also indicated that both temperature TMDL monitoring stations (Breeze Creek and Jenny Creek) exceeded the state criteria. Temperatures were very similar between Breeze Creek and Jenny Creek, and both fell near the midpoint of temperatures observed in the overall East Fork Lewis River watershed.

Table 5: Seasonal Maximum 7-day Moving Average and Maximum Daily Temperature Change at Breeze Creek station BRZ010, 2002 through 2008			
7-Day average		Maximum daily ΔT	
Date	Maximum	Date	Value
Station BRZ010:			
07/23/02	65.9	06/25/02	8.3
07/30/03	66.3	06/16/03	8.0
07/22/04	69.0	06/16/04	9.7
07/28/05	67.1	07/28/05	7.9
07/24/06	68.9	06/25/06	8.0
07/12/07	68.9	05/31/07	9.8
08/15/08	66.5	06/27/08	8.6

Due to the negative effects of chronic high temperatures on salmonids and other cold-water biota, the amount of time spent with elevated temperatures is also of interest. Figure 4 indicates the number of days on which the *daily* maximum temperature exceeded 64 degrees F at Station BRZ010. Sixty-four degrees was the Class A criterion prior to the November 2006 rule changes and is a threshold above which salmonids are known to suffer deleterious effects.

The number of days with temperatures exceeding 64 degrees F has ranged from 22 to 58 since 2002. Annual variations are likely attributable to differences in ambient air temperatures and stream flow. Regardless of variations between years and stations, the available Breeze Creek data indicates stream temperatures remain elevated over a substantial time period each summer.

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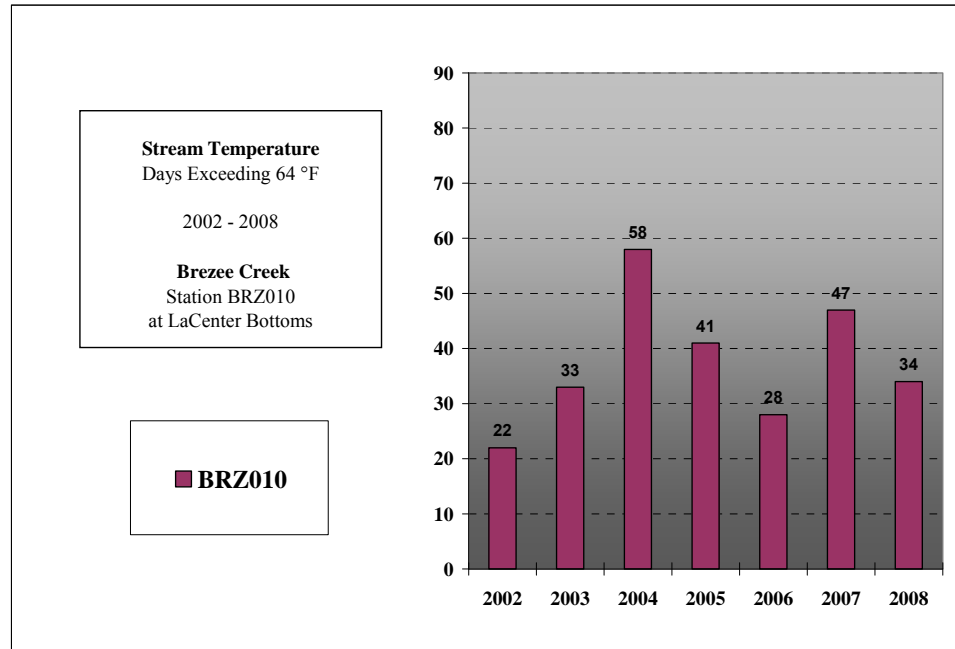


Figure 4: Days Exceeding 64° F, 2002 through 2008, Brezee Creek Station BRZ010

Nutrients

Nutrient criteria are not established for Washington streams. EPA suggests a total phosphorus criterion of 0.100 mg/L for most streams, and 0.050 mg/L for streams which enter lakes (EPA, 1986). EPA nitrate criteria are focused on drinking water standards and are not generally applicable to aquatic life issues.

Phosphorus and nitrogen in excess may contribute to elevated levels of algal or plant growth, especially in slower moving, low gradient streams, or in downstream water bodies.

Sixty-eight total phosphorus samples from Station BRZ010 between October 2001 and December 2007 ranged from 0.020 mg/L to 0.151 mg/L, and 93 percent of samples met the EPA criterion. Total phosphorus concentrations typically vary seasonally in many locations; seasonal median values in Brezee Creek are relatively similar, with slightly higher values during summer:

- Summer median = 0.061 mg/L
- FWS median = 0.041 mg/L

Turbidity

It is difficult to establish an exact background turbidity level for Brezee Creek because no data exists from a time when the creek was not impacted by human activities. However, based on data from the least-impacted streams monitored by CWP, we estimate that natural background turbidity in most Clark County streams would have been in the range of 0.5 to 2 NTU. Based on this estimate, the turbidity criterion for Brezee Creek is likely between 5.5 and 7 NTU.

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Since May 2002, the median of 68 turbidity samples at Station BRZ010 is 5.1 NTU, with individual samples ranging from 1.5 NTU to 65 NTU. Turbidity varies less seasonally than in many streams, with the FWS median less than twice the summer median:

- Summer median = 3.8 NTU
- FWS median = 5.8 NTU

Higher turbidity readings in the 20 to 40 NTU range are common in Clark County streams during storm events. Very high turbidity values (typically 100 or greater) often indicate a specific sediment source. Routine monthly monitoring at Station BRZ010 has not detected turbidity values over 65 NTU since 2002.

While the available data indicates relatively low turbidity currently, values have shown an increasing trend at Station BRZ010 since 2002 (see above).

Impacts to Beneficial Uses and Potential Sources

General water quality in Brezee Creek is poor according to the overall OWQI and other measures discussed above. Jenny Creek has generally good water quality. Listed beneficial uses in both streams appear to be impacted primarily by fecal coliform bacteria and stream temperature. While overall turbidity levels are low, there is an apparent increasing trend in turbidity in Brezee Creek.

Observed levels of these characteristics may have negative impacts on the listed beneficial uses of: salmonid rearing, habitat and primary contact recreation. Table 6 at the conclusion of this section summarizes the primary water quality impacts to beneficial uses in the Brezee Creek/Jenny Creek assessment area, and probable sources of the observed impact.

Fecal Coliform Bacteria

Neither creek has developed swimming or wading areas, but it is possible that some local residents, particularly children, utilize the creeks for recreation. 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.

Geometric mean and 90th percentile values from 2002 through 2008 Clark County monitoring and 2005 Ecology monitoring were consistently higher during the summer season than during the remainder of the year in both Brezee Creek and Jenny Creek. This suggests that when exceedences do occur they are likely during the period of highest stream use.

Water Temperature

Water temperature may be an impediment to salmonid use in both subwatersheds. In particular, elevated temperatures have a detrimental impact on salmonid rearing. Migration and spawning tend to occur during cooler times of the year, but juveniles are exposed to elevated summer temperatures during rearing.

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Temperature-related impacts to salmonids typically include: decreased or lack of metabolic energy for feeding, growth or reproductive behavior; increased exposure to pathogens; decreased food supply; and increased competition from warm-water tolerant species (ODEQ, 2004 draft).

Breeze Creek is midway between the warmest and coolest streams monitored by the CWP, with summer temperatures regularly exceeding 64 degrees F and exceeding the current 63.5 degrees F state criterion by two to five degrees each year. Jenny Creek temperatures from Ecology's 2005 monitoring are very similar to Breeze Creek.

Turbidity

Breeze Creek exhibits relatively low routine turbidity levels based on county-wide monitoring data, but is susceptible to high short-term turbidity during rain events. The increasing trend in turbidity values in recent years is a concern.

The primary sources of turbidity in Breeze Creek are probably soil and bank erosion related. Both off-site erosion (development, agriculture, recreational vehicle use) and in-stream erosion (bank scour, slumping, and re-suspension of sediments during high flows) likely contribute significantly to the elevated turbidity during rain events.

Implications for Stormwater Management

Table 6 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.

Among the CWP activities most likely to have a positive impact on water quality are:

- Effective stormwater system designs, retrofitting, and maintenance;
- Source detection and removal projects; and
- Public education programs.

Stormwater system design, retrofitting, and maintenance include a range of activities that can address specific pollutants of concern. Source detection and removal projects help eliminate specific contributions of pollutants. Education programs are a critical element in modifying behavior and promoting better public stewardship of water resources.

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Table 6. Known Water Quality Concerns, Sources, and Solutions for Brezee Creek and Jenny 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 or sanitary sewer systems	groundwater seeps roadside ditches	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
		livestock, pets, wildlife	overland runoff roadside ditches direct access	
Water temperature	salmonid rearing 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 Decreased water withdrawals
		ponds	direct solar radiation stagnation	
		low summer flows	decreased resistance to thermal inputs	
Turbidity	Salmonid spawning, rearing, and migration; Aesthetic enjoyment	erosion (<i>development projects; land clearing; cropland; channel erosion</i>)	overland runoff roadside ditches channel dynamics	Erosion control regulations Storm sewer system cleaning and maintenance Storm water facility designs/retrofits to optimize settling and removal of suspended silt/clay Agricultural Best Management Practices Stream bank stabilization/rehabilitation Storm water outfall/facility retrofits to reduce flow-induced channel erosion

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Drainage System Inventory

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

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

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

The work effort during 2008 in the Brezee Creek and Jenny Creek subwatersheds focused on identifying and mapping previously unmapped discharge points and stormwater conveyance. Table 7 indicates the number of features previously inventoried in StormwaterClk prior to 2008 SNAP work, and the number of features added to the database as a result of 2008 SNAP and mapping project implementation.

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

Table 7: Drainage System Inventory Results, Brezee Creek/Jenny Creek		
Database Feature Category	Previously Inventoried	Added to Database during 2008
Inlet	0	2
Discharge Point (outfall)	2	272
Flow Control	0	2
Storage/Treatment	4	6
Manhole	0	1
Filter System	0	0
Channel	22	848
Gravity Main	8	358
Facilities	1	0

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Stormwater Facility Inspection

The stormwater facility inspection process includes two components:

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

Component 1: Public Stormwater Facility Inspection

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

Component 2: Offsite Assessment

Purpose

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

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

Methods

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

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

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

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

Results

Based on the county's StormwaterClk database, as of October 2008, there were no mapped public stormwater facilities in the Jenny Creek and Brezee Creek subwatersheds.

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Jenny Creek subwatershed contained two mapped outfalls that discharged into critical areas. Notable outfall assessment activities are summarized in Figure 5, including general outfall locations in the Jenny Creek subwatershed. There were no mapped outfalls in Brezee Creek subwatershed that discharged into critical areas

As summarized in Table 8, two outfalls that discharged into critical areas were assessed. Both outfalls were found to be in compliance. However, erosion and potential bank instability was observed during the assessment process along a portion of public roadway. Although not a water quality issue, this observation was reported to maintenance and operations

Potential Projects

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

Metric	Number
# of outfalls assessed	2
# of outfalls compliant	2
# of noncompliant outfalls	0
# of referrals initiated	0
# of referrals ongoing	0
# of outfalls fixed	0

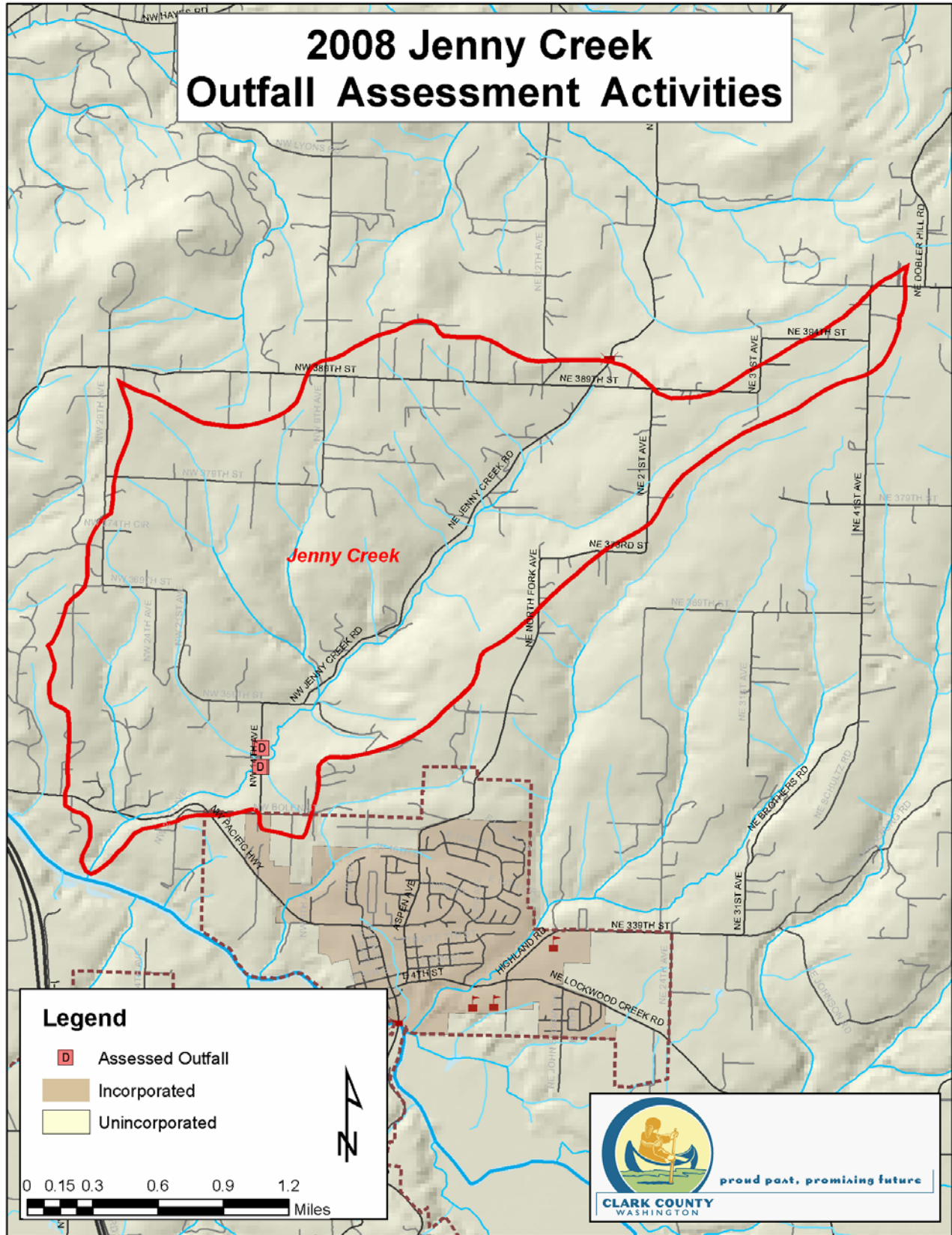


Figure 5: Summary of 2008 Outfall Assessment Activities in Jenny Creek Subwatershed

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Illicit Discharge Detection and Elimination Screening

Purpose

The purpose of the IDDE Screening project is to detect, isolate, and eliminate illicit connections and illicit discharges to Clark County's municipal separate storm sewer system (MS4).

The IDDE screening project is designed to meet the requirements of Clark County's 2007 NPDES permit, which requires identifying and removing illicit connections to the county's MS4.

Methods

IDDE screening includes checking every stormwater outfall for potential illicit discharges, conducting follow-up investigations to track down suspected discharges or connections, and referrals to the proper agencies for termination. Field work is primarily conducted during the dry summer season.

IDDE Screening activities were completed in the Brezee Creek and Jenny Creek subwatersheds during 2008.

Results

Based on the county's StormwaterCLK database, as of September 2008, there were 277 mapped stormwater outfalls in the Brezee Creek and Jenny Creek subwatersheds, consisting primarily of pipe outfalls and roadside ditches.

Figure 6 summarizes notable screening activities including general outfall locations, outfalls where water samples were collected, follow-up investigations performed, referrals made, and sources removed for Brezee Creek and Jenny Creek subwatersheds.

As summarized in Table 9, 271 outfalls were screened and no samples were collected at the outfalls. Six mapped outfalls were either not accessible or were mapped incorrectly. Because no measurable flow was found in the two subwatersheds no samples were taken or investigations initiated.

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Table 9: IDDE Screening Project Activity Summary of Brezee Creek and Jenny Creek Subwatersheds as of December 2008	
Metric	Number
# of outfalls screened	271
# of outfalls with sufficient flow to collect water samples	0
# of suspected illicit discharges	0
# of suspected illicit connections	0
# of investigations initiated	0
# of illicit discharge sources located	0
# of illicit connections identified	0
# of outfalls to be re-visited in 2009	0
# of referrals	0
# of illicit discharges removed	0
# of investigations and referrals ongoing	0
# of illicit connections terminated	0
# of cases closed without resolution	0

2008 Brezee Creek & Jenny Creek Screening Activities

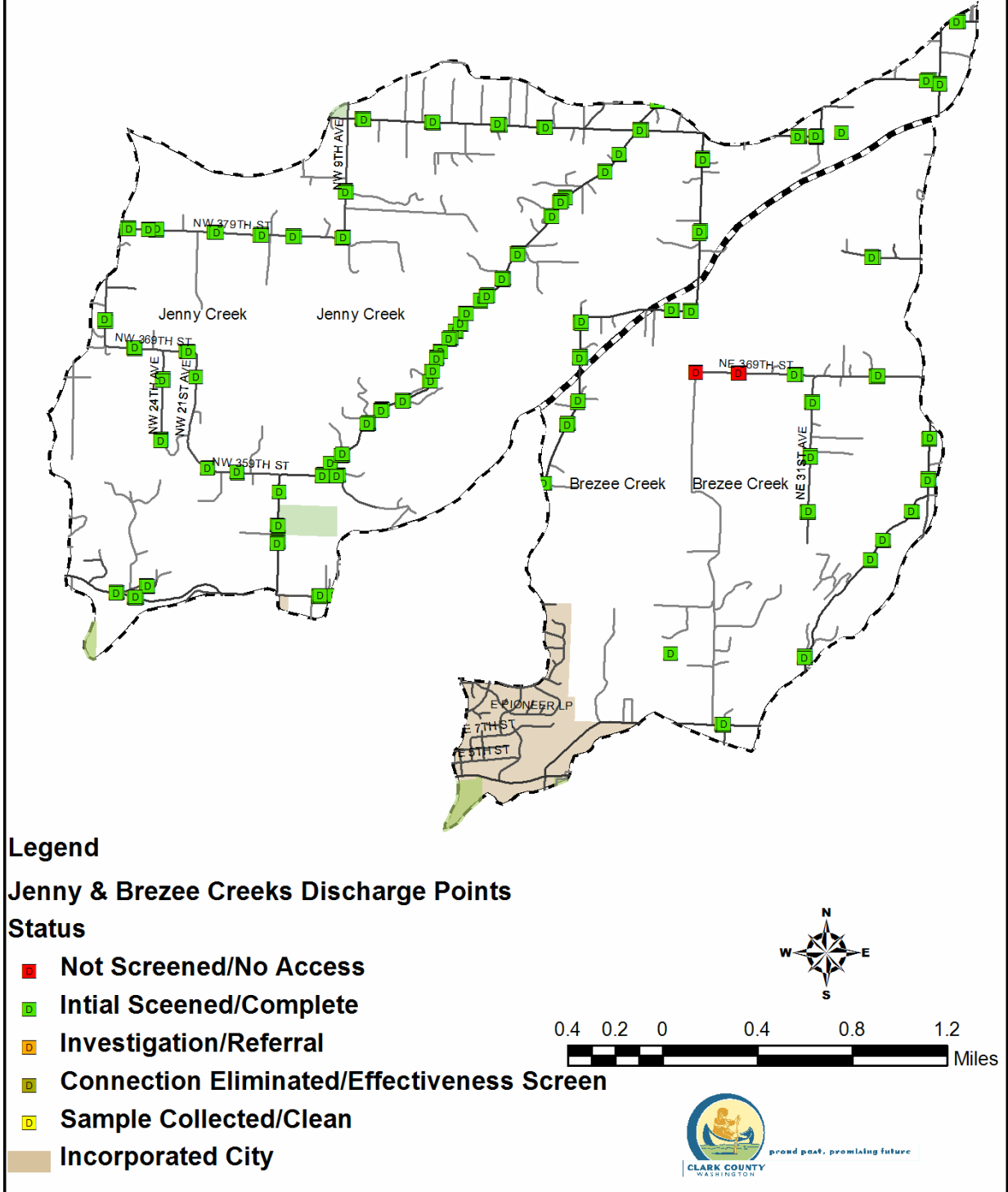


Figure 6: 2008 IDDE Screening Project in Brezee Creek and Jenny Creek Subwatersheds

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Stream Reconnaissance and Feature Inventory

Purpose

The Feature Inventory records the type and location of significant stream impairments, potential environmental and safety hazards, and project opportunities in selected stream reaches. Feature Inventory results are used primarily to document conditions and identify potential improvement projects or management actions for implementation by the CWP or other agencies.

Methods/Limitations

Geographic scope of the Feature Inventory was established by the County with input from Herrera Environmental Consultants, taking into consideration projected TIA, DNR water types, stream gradient, zoning, Clark County development permitting authority, and land ownership.

The Feature Inventory recorded significant conditions in the stream corridor relevant to SNAP components. Feature types are listed in Table 10.

The in-stream assessment approach allowed investigators to observe stream corridor features that are not always identifiable through other desk methods such as analysis of existing aerial photographs and GIS data.

A GPS position, one or more digital photos, and relevant attribute information were collected for each logged feature. All data and linked photos are stored in the Feature Inventory Geodatabase located on the Clark County server at: W:\PROJECT\011403, Needs Assessment Planning and Reports\GIS\Data\Geodatabase. Feature data includes field observations, estimated measurements, and/or notes describing important feature characteristics or potential projects.

The Feature Inventory project is not intended to be an exhaustive inventory of all human alterations to the stream corridor. Rather, the project seeks to identify the most significant features pertaining to stormwater management and potential stormwater mitigation projects.

Feature dimensions and other attribute data are estimates, and should not be used for quantitative calculations.

For additional information pertaining to the Feature Inventory SNAP tool, see Volume 1 of the SNAP.

Study Area

The extent of the completed Feature Inventory in Brezee Creek subwatershed is shown in Figure 7. Approximately 2.1 miles of the stream corridor was assessed in the subwatershed. Of the proposed survey extents, only one short reach was not accessible due to private property concerns.

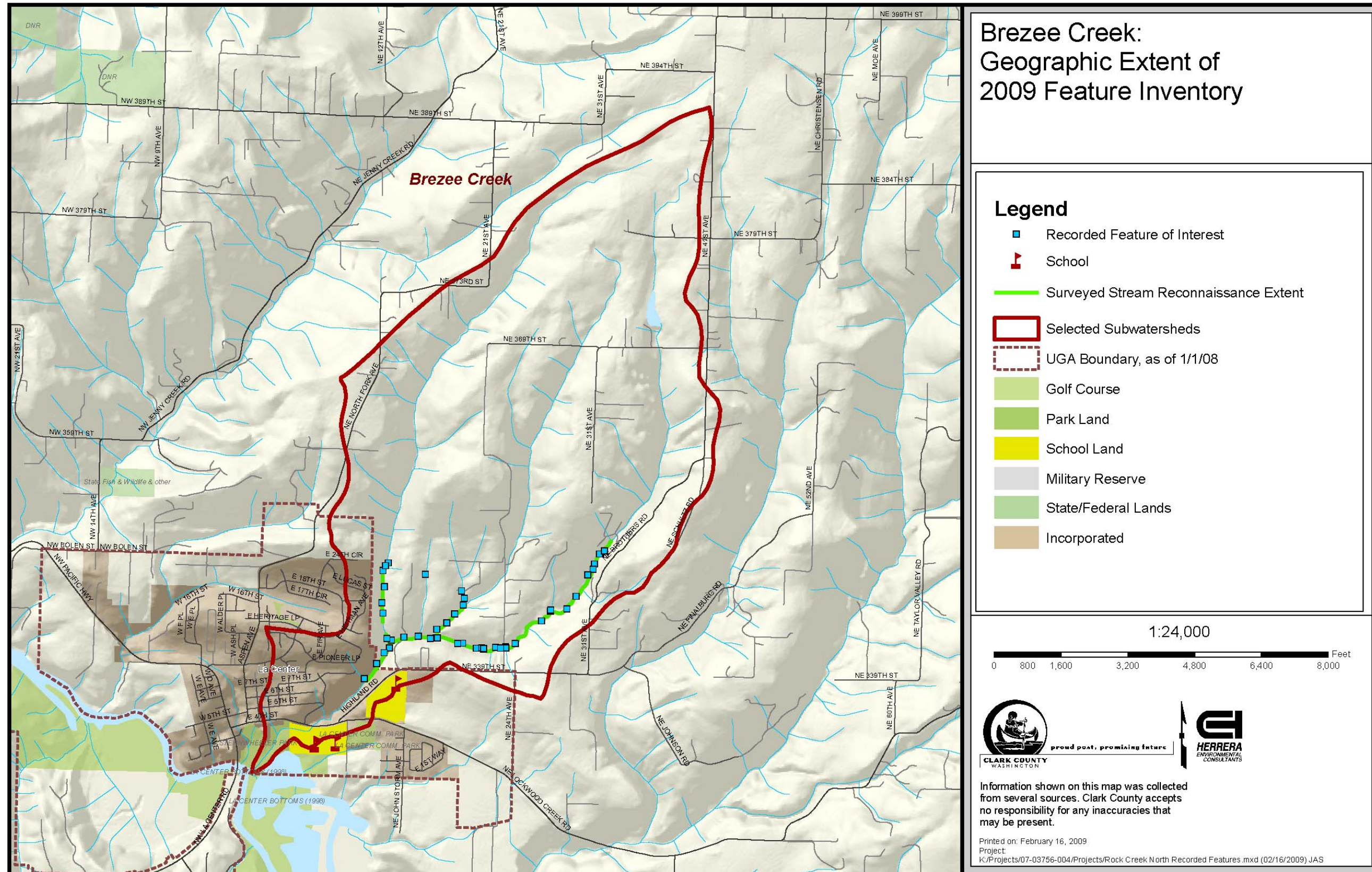


Figure 7: Brezee Creek Geographic Extent of 2009 Feature Inventory

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Results/Findings

A total of 43 features were identified in the Brezee Creek subwatershed. A breakdown of recorded features by type is presented in Table 10. Impacted stream buffers were the most prevalent feature type identified, followed by miscellaneous feature points and severe erosion points.

Table 10: Summary of Features recorded in the Brezee Creek Subwatershed	
Feature Type	Number Recorded
AGR - Aggradation	0
AP – Access point	2
CM – Channel modification	1
ER – Severe erosion	4
IB – Impacted stream buffer	13
IW – Impacted wetland	0
MB – Miscellaneous barrier	1
MI – Miscellaneous point	10
OT – Stormwater outfall	3
RR – Road Reconnaissance feature	0
SCB – Stream crossing, bridge	0
SCC – Stream crossing, culvert	3
SCF – Stream crossing, ford	1
TR – Trash and debris	3
UT – Utility impact	0
WQ – Water quality impact	2
Total	43

The following subsections contain general descriptions of the Brezee Creek subwatershed conditions. The descriptions include observations, trends, and issues that were identified either during the field work or during subsequent review of collected information.

Stormwater Infrastructure

Existing stormwater infrastructure is minimal in the surveyed reaches of the Brezee Creek subwatershed. This is due to the prevalence of agricultural land use in the subwatershed and the isolation of the surveyed streams in steep valleys or ravines. These valleys vary in size and width between 150 and 600 feet wide and create a natural buffer, limiting development.

Flow in the subwatershed is predominately northeast to southwest. The predominant source of stormwater in the surveyed areas of the subwatershed is overland runoff from agricultural land. These agricultural sources are primarily located in the upper reaches of the subwatershed. There is also some stormwater input associated with the rural, residential development along the west side of the mainstem of Brezee Creek. However, clear outfall points to the channel were not

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identified due to the wide nature of the valley in that area and the significant distance between the development and the stream channel.

Riparian Vegetation

The majority of the surveyed reaches have established riparian forest canopy along a riparian corridor confined within the steep valley walls. There are occasional breaks in riparian forest canopy where individual landowners have cleared trees down to the stream. Most of the clearing is located in areas where steep topography does not isolate the stream. Undergrowth in the majority of the riparian corridor is a mix of native and invasive plant species. Invasive plant species are widespread. Blackberry and nightshade are the most prevalent invasive plant species. Dense concentrations are intermittent in the upstream ends of the surveyed reaches, but become much denser farther downstream. In particular, the reach from feature IB-217 to SCC-148 has extremely heavy infestations of nightshade and blackberry that are, in many places, choking the channel.

Additional Results

Features of interest, particularly water quality impacts associated with agricultural land use, were discovered when field crews surveyed small tributary channels outside of the main area defined by the geographic scope of work. When located, these features were recorded in the same manner as other features. The discovery of numerous features of interest on small tributary channels in this and other subwatersheds indicates that significant stream impairments, potential environmental and safety hazards, and potential project opportunities may exist outside of the geographic scope of this Feature Inventory.

Some of the best channel conditions that were observed during the 2008-2009 Feature Inventory were associated with the large beaver complex on the mainstem of Brezee Creek near features MI-48 and MI-49. The beaver dams are halting the extreme incision that characterizes the reaches immediately downstream, promoting high floodplain connectivity, and creating diverse in channel habitat. These beaver ponds also provide flood attenuation and create significant areas of riparian wetland habitat not present in other areas of this subwatershed. This, combined with other observed instances of large woody debris accumulations reducing channel incision, should be considered when developing projects that are intended to improve channel and floodplain conditions. Brezee Creek and many other streams in Clark County are located in valleys and ravines that have all but eliminated development within the floodplain. As a result, there is little or no risk associated with promoting beaver activity and large woody debris accumulation to aggrade incised channels and improve floodplain connectivity in many areas.

Stormwater management may require a different approach in these reaches because the stream is isolated from most development by steep valleys or ravines that create a natural buffer to development between 150 and 600-feet wide. This

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is a favorable situation, but the degraded channel conditions that were observed indicate that the isolation of the stream channel is not enough to eliminate the effects of land use change on hydrology.

Potential Project Opportunities

Listed opportunities represent potential projects or project areas. They are not fully developed projects, and therefore require additional evaluation and development by Clark County or consultant staff prior to submittal to the SCIP process. Identifying them as potential projects in this document is the first step in the process of developing SCIP projects.

Potential project opportunities were identified based on the results of the Feature Inventory conducted in the Brezee Creek subwatershed. The CWP will evaluate the potential projects for further development or referral to the appropriate organization. Each potential project is listed in Tables 12 through 14, including the basis for the project and a description of the potential project. The location of each potential project is shown in Figures 8 and 9. Potential project opportunities were categorized into six groups based on the nature of the potential work. A total of 23 potential projects were identified. A summary of identified project opportunities by potential project category is shown in Table 11.

Table 11. Breakdown of Potential Project Opportunities by Category	
Potential Project Category	Potential Projects Identified
Emergency/Immediate Actions	2
Stormwater Facility Capital Improvement Projects	0
Stormwater Infrastructure Maintenance Projects	0
Habitat Restoration/Enhancement Projects	2
Property Acquisition for Stormwater Mitigation	0
Referral Projects for other Agencies	23

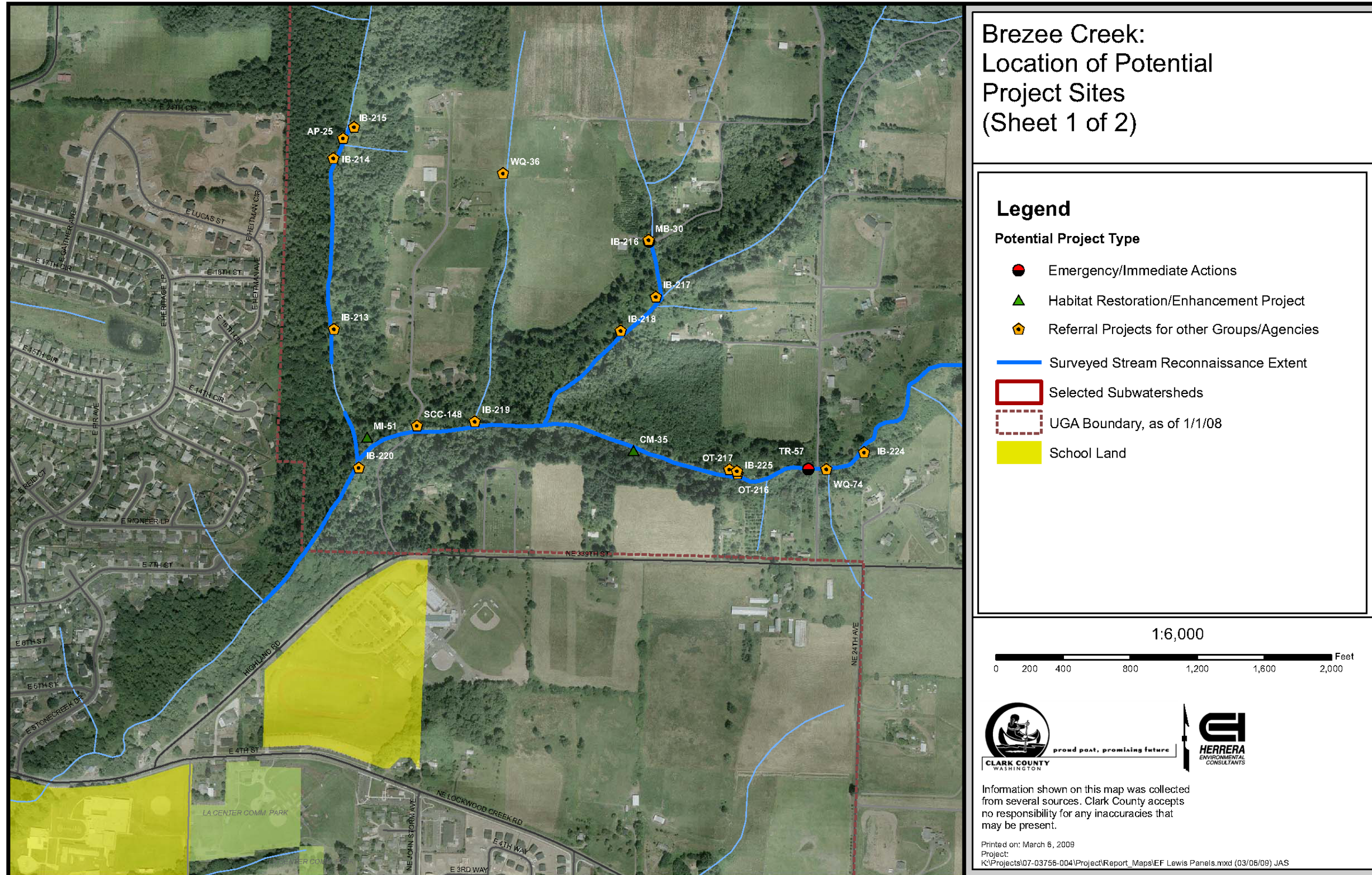


Figure 8: Brezee Creek Location of Potential Project Sites

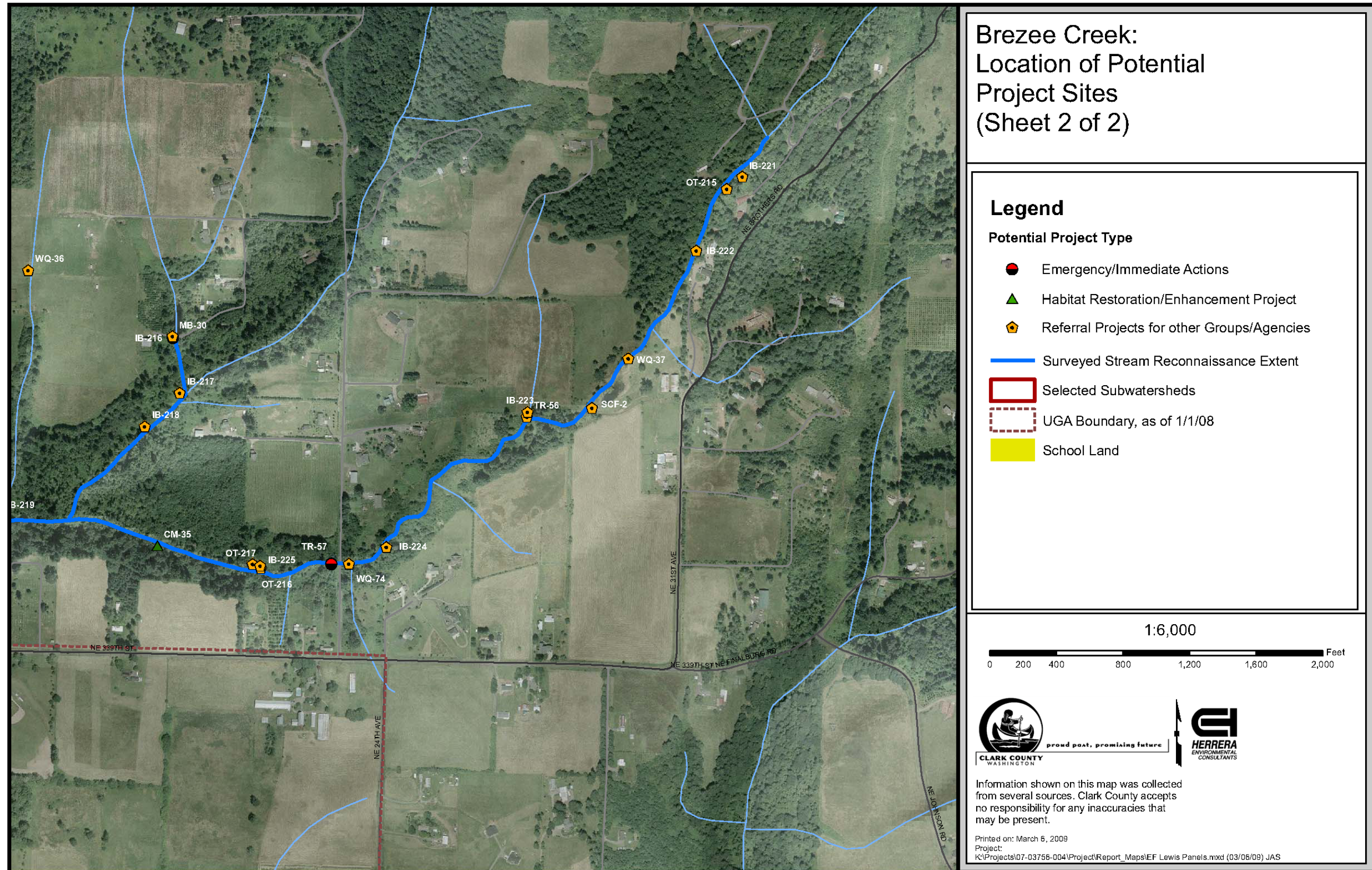


Figure 9: Brezee Creek Location of Potential Project Sites

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Emergency/Immediate Actions

Emergency/Immediate Actions require an immediate site response project to address a potential or imminent threat to public health, safety, or the environment. Emergency/Immediate Actions identified based on the results of the Feature Inventory are described in Table 12.

Table 12: Description of Potential Project Opportunities		
ID	Basis for Project	Project Description
MB-30	Large earthen dam creating a farm pond at the head of a short, steep, ephemeral, tributary drainage. The dam is approximately 20-feet high with undersized outlet works, no emergency spillway, and a failing downstream embankment being protected by plastic tarps. The outlet pipe at the base of the dam is not functioning and there is water seeping from the toe of the dam slope. There is potential for catastrophic failure.	Immediate site inspection by engineering staff to determine structural integrity of the dam and outlet works. May warrant removal of dam and restoration of tributary stream. At minimum, project should address failing outlet structures, stabilize the embankment, and appropriately mitigate for thermal and sedimentation impacts of the dam.
TR-57	Accumulation of potentially hazardous debris. Gas cylinders, PVC pipe, and a 55-gallon drum.	Confirm if debris is hazardous. Remove debris immediately.

Stormwater Facility Capital Improvement Projects

Stormwater Facility Capital Improvement Projects are projects that create new or retrofit existing stormwater flow control or treatment facilities. Facility retrofits include projects that will increase an existing facility's ability to control or treat stormwater in excess of the original facility's design goals.

No projects of this type were identified in surveyed reaches of the Brezee Creek subwatershed.

Stormwater Infrastructure Maintenance Projects

Stormwater Infrastructure Maintenance Projects include potential projects which address and repair maintenance defects affecting existing stormwater infrastructure. Infrastructure maintenance projects are required by the County NPDES municipal stormwater permit. Projects addressing simpler maintenance defects are referred directly to the County Public Works Operations and Maintenance staff.

No projects of this type were identified in surveyed reaches of the Brezee Creek subwatershed.

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Habitat Restoration/Enhancement Projects

Habitat Restoration/Enhancement Projects include potential projects which result in the restoration or enhancement of wetlands, upland forest, or riparian habitat. In-stream channel habitat and bank protection projects do not fall within the scope of Clark County's CWP, and are placed under the category of Referral Projects for other Groups/Agencies. Habitat Restoration/Enhancement Projects identified based on the results of the Feature Inventory are described in Table 13.

Table 13: Description of Potential Project Opportunities		
ID	Basis for Project	Project Description
MI-51	Large woody debris in the channel is holding grade in the tributary that enters from the east. The mainstem of Brezee Creek enters from the north and is severely incised to bedrock and clay layers. Loss of grade control on the tributary would result in significant headcutting and additional channel incision on the tributary from the east.	Place additional LWD structures to aggrade and hold grade in the Brezee Creek channel with the objective of improving habitat and reducing the chance of further incision up the east tributary.
CM-35	30-feet of asphalt bank armoring protecting a 6-foot-diameter concrete structure.	Investigate purpose of protecting the concrete structure. Consider replacing the asphalt bank armoring with a more natural, bioengineered bank stabilization treatment.

Property Acquisition for Stormwater Mitigation

Property Acquisition for Stormwater Mitigation Projects includes potential acquisitions of properties for any purpose that meets permit requirements to mitigate for stormwater impacts. This includes preservation or restoration of upland forest and riparian habitat zones.

No projects of this type were identified in surveyed reaches of the Brezee Creek subwatershed.

Referral Projects for other Groups/Agencies

Referral Projects for other Groups/Agencies includes potential projects that do not fall within the defined scope of Clark County's CWP. This includes, but is not limited to, in-channel restoration, agricultural BMPs, fish-passage barrier removals, and invasive plant management. It also includes referrals for projects such as trash removal, stream culvert repairs/maintenance, and drainage projects. Referral projects for other groups/agencies identified based on the results of the Feature Inventory are described in Table 14.

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Table 14: Description of Potential Project Opportunities		
ID	Basis for Project	Project Description
SCC-148	Undersized, 48-inch-diameter CMP culvert crossing under NE 14 th Avenue. Causes backwater and significant deposition on the floodplain during bankfull flow events. Downstream plunge pool and expansion scour with a 2-foot drop at the perched outlet. Channel incised to white clay layers 150-feet downstream of the crossing, but becomes gravel and cobble bed downstream of that.	Conduct additional barrier analysis and geomorphic investigation and replace the culvert crossing.
WQ-36	Significant agricultural and water quality impacts to headwaters of first order tributary. Issues include runoff from a tree farm, livestock access to the stream and riparian area, pasture runoff, channel erosion and instability, and invasive plant species. Invasive plant species are predominantly reed canary grass and blackberry in the areas that are not grazed.	Work with landowners to improve agricultural practices and reduce impacts to water quality and channel stability. Fence the riparian and wetland corridor and restore riparian vegetation. Apply source control and/or construct appropriate facilities to enhance water quality (new stormwater facility to detain and treat runoff or agricultural water quality BMP).
OT-215	2-inch-diameter flexible hose enters creek from the right bank. There is a strainer on the end of the hose. This could either be an illicit discharge point or a pump intake.	Call/meet with landowner to confirm the purpose of the hose. Conduct IDDE investigation if necessary. Confirm water rights if it is a withdrawal point.
WQ-37	Diversion of flows into an off-channel pond used for irrigation water. Return flow from the pond enters the stream near SCF-2, 350-feet downstream. Area around pond has been cleared of woody riparian vegetation.	Confirm water rights. Look into potential water quality impacts of the off-channel pond and educate landowner on ways to reduce the negative impacts of water withdrawals and irrigation return flows. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
WQ-74	Water withdrawal point. Pump house on right bank.	Confirm water rights. Look into ways to improve irrigation efficiency to reduce water withdrawals.
SCF-2	Stream ford actively used by horses to cross the channel. Potential source of sediment and nutrient loading.	Investigate the extent of water quality impacts from this livestock crossing. Work with landowner to develop alternative means for horses to cross the stream to minimize impact to riparian areas.

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Table 14: Description of Potential Project Opportunities		
ID	Basis for Project	Project Description
IB-215	Widespread invasive plant species in riparian area and floodplain. Predominantly reed canary grass.	Eradicate reed canary grass. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
IB-214	Widespread invasive plant species in riparian area and floodplain. Predominantly blackberry.	Eradicate blackberry. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
IB-213	Widespread invasive plant species in riparian area and floodplain. Predominantly blackberry.	Eradicate blackberry. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
IB-220	Widespread invasive plant species in riparian area, floodplain, and up the valley walls. Predominantly blackberry and nightshade.	Eradicate blackberry and nightshade. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
IB-216	Widespread invasive plant species in riparian area, floodplain, and up the valley walls. Predominantly blackberry and nightshade.	Eradicate blackberry and nightshade. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
IB-217	Widespread invasive plant species in riparian area, floodplain, up the valley walls, and clogging the channel. Predominantly blackberry and nightshade.	Eradicate blackberry and nightshade. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
IB-218	Widespread invasive plant species in riparian area, floodplain, up the valley walls, and clogging the channel. Predominantly blackberry and nightshade.	Eradicate blackberry and nightshade. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
IB-221	Widespread invasive plant species in riparian area, and floodplain. Predominantly blackberry.	Eradicate blackberry. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.

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Table 14: Description of Potential Project Opportunities		
ID	Basis for Project	Project Description
IB-222	Widespread invasive plant species in riparian area, and floodplain. Predominantly blackberry.	Eradicate blackberry. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
IB-223	Widespread invasive plant species in riparian area, and floodplain. Predominantly blackberry.	Eradicate blackberry. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
IB-224	Widespread invasive plant species in riparian area, and floodplain. Predominantly blackberry.	Eradicate blackberry. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
IB-225	Widespread invasive plant species in riparian area, and floodplain. Predominantly blackberry.	Eradicate blackberry. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
IB-219	Widespread invasive plant species in riparian area, of small tributary stream entering on right bank. Predominantly blackberry and nightshade.	Eradicate blackberry and nightshade. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
OT-216	Three, 2-inch-diameter PVC pipes draining from the direction of a house on the right bank. Source is likely a footing drain or a sump.	Confirm source of flow. Conduct IDDE investigation and develop a project to retain and treat runoff if necessary.
OT-217	6-inch-diameter PVC pipe discharging water after 40 hours without precipitation. Source is likely a septic tank or hillslope retaining wall.	Confirm source of flow. Conduct IDDE investigation and develop a project to retain and treat runoff if necessary.
AP-25	Deck on stream bank and fire pit within the active channel.	This landowner is very interested in stewardship and stream corridor health. Discuss moving the fire pit into a contained ring outside of the active channel. The deck is a minor disturbance within the riparian area.
TR-56	Two railroad ties spanning the channel that probably used to be the beams of a bridge. Potential source of creosote to the stream.	Contact landowner about removing the structure if it is believed to be a significant water quality hazard.

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Stormwater Management Recommendations

A number of general stormwater management measures should be implemented throughout the Brezee Creek subwatershed:

- Due to the agricultural nature of the subwatershed, stormwater management recommendations should be closely coordinated with agricultural extension services, soil and water conservation districts, and other agencies that regularly work with farms and ranches. These agencies may already have educational and financial assistance programs available.
- Educate private landowners concerning importance of invasive plant removal, and suggest removal techniques.
- Educate private landowners on importance of native riparian vegetation for shading streams.
- Educate landowners to discourage disposal of yard debris in streams or other receiving waters.
- Provide a list of suggested plants for stream revegetation and local nurseries that stock them for distribution to landowners
- Post stream identification signs where roads cross streams. Repair or replace deteriorated signs if necessary.
- Manmade ponds and withdrawal points are fairly common. Verify water rights of pond owners and those with pump stations. Develop literature and distribute to landowners educating about the WQ impacts and other potential hazards of on-line and off-line ponds and the effects of dewatering during summer low flows.
- A larger than usual proportion of the potential projects in this subwatershed is blackberry eradication and replanting. Consideration should be given to treating these as a single, larger program rather than isolated projects.

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Physical Habitat Assessment

Purpose

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

Methods

Minimal physical habitat information is available for Jenny Creek. Lack of habitat information on Jenny Creek may be attributed to a natural waterfall barrier that blocks fish passage at RM 00.13.

Quantitative habitat assessments were conducted at Brezee Creek by the Clean Water Program in 2002, using the methods described in the USEPA's Environmental Monitoring and Assessment Program (EMAP) Western Pilot Study: Field Operations Manual for Wadeable Streams (Peck et al., eds. 2001). Standard procedures used for field data collection are also described in the county's Standard Procedures for Monitoring Activities: Clark County Water Resources Section (2002). These protocols are designed to rate and assess general physical habitat attributes important in influencing stream ecology.

Results

No results are available for Jenny Creek.

The Long-Term Site Monitoring Project: 2002 Physical Habitat Characterization (Schnabel 2003) includes a narrative summary of the habitat survey results on Brezee Creek, including figures and tables, some of which are presented here.

Overall habitat quality is generally rated as fair (Table 15). Habitat was classified within this survey reach as beaver ponds or pools with low occurrence of riffles. Within the riffles surveyed, substrate was mostly coarse gravel and sand or fines. Mean embeddedness was estimated at 37 percent.

The survey reach was within a steep-sided canyon with intact riparian forest. Nearby upland areas were largely cleared or open. Stream banks were somewhat unstable and displayed high erosion potential and obvious undercutting, which suggests the flow regime in Brezee Creek has been impacted. Stream bank vegetative protection was marginal, with patches of bare soil and a moderate amount of non-native vegetation, especially in the lower end of the reach. A large woody debris (LWD) tally indicated a density of approximately 50 pieces/km, placing the reach in the "Not properly functioning" category under NOAA Fisheries guidelines (1996).

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Table 15: Summary of Brezee Creek Habitat Feature Ratings According to EMAP Physical Habitat Protocols

Habitat Category	Index	Result	Characterization
Overall habitat quality	Habitat quality index (HQI)	79	Score is relative to a DEQ grade-C reference condition scoring 100 on a normalized scale
Overall riparian quality	QR index	0.70	Good
	RCOND index	0.67	Good
Hydrologic flashiness	Mean of Flashrt1, Flashrt2, and Flashrt3 indices	3.95	Signs of hydrologic impact
	Individual Metric		
Channel morphology	Pool percentage (PCT_POOL)	29%	Does not meet recommended pool area
	Riffle percentage (as PCT_FAST)	36%	Does not meet recommended riffle area
Residual pools	Residual pool volume (TOTPVOL)	13.8m ³	n/a
Substrate composition	Dominate substrate	77%	Coarse gravel and larger particles
	Mean embeddedness (XEMBED)	37%	“Not properly functioning”
	Substrate sand and fines (PCT_SAFN)	19%	“At risk” (4% fines <0.6mm, 15% sand (0.6-2mm))
	D ₅₀ (median particle size, mm)	12	n/a
Bed substrate stability	Bed stability index (LRBS_BW4)	-0.42	Streambed relatively stable
Fish cover	Natural fish cover by area (XFC_NAT)	0.25	Fish cover minimal
Large woody debris	Total LWD density (C1W)	137/mile	“Not properly functioning” (low density and few large pieces)
Riparian vegetation cover	Stream shading mid-channel (XC DENMID)	91%	Well-shaded
Human Disturbance	Riparian human disturbance index (W1_HALL)	0.26	n/a
Invasive plant species	Overall invasive plant proportion (ip_score) (individual species proportion)	1.64	Invasive plants common (English Ivy = 0.64, Him Black = 0.82, Reed Canary = 0.18)

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Geomorphology and Hydrology Assessment

A geomorphology and hydrology assessment was not conducted. The Clean Water Program has operated a stream gauge on lower Brezee Creek at the LISP site since 2003.

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Riparian Assessment

Purpose

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

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

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

Method

Where possible, the assessment is based on GIS data from existing reports, primarily the Habitat Assessment report prepared for the Lower Columbia Fish Recovery Board (S.P. Cramer and Associates, 2005). This report applies primarily to salmon-bearing stream reaches 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 characterization, an examination of current orthophotographs is used to make a general assessment of riparian condition.

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

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

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In areas not surveyed by S.P. Cramer, orthophotographs were reviewed to assess overall riparian conditions and identify areas where restoration or preservation projects may be appropriate.

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.

Results

The results include both the Brezee Creek and Jenny Creek subwatersheds. The Brezee Creek subwatershed assessment uses results of the 2005 LCFRB Habitat Assessment for analysis. The full characterization report is available on the Clark County website at:

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

The Jenny Creek subwatershed was not included in the 2005 LCFRB Habitat Assessment, so the 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 Brezee Creek subwatershed as impaired.

Riparian (Large Woody Debris (LWD) Delivery)

The Brezee Creek subwatershed LWD delivery potential is summarized on Figure 10. According to the LCFRB survey, Brezee Creek was assessed as having ‘moderate’ LWD recruitment potential overall, as the majority of the riparian zone was densely vegetated with small trees. However, there are areas identified in the lower and uppermost reaches that are shown as having ‘low to none’ LWD recruitment potential. The unnamed tributaries associated with Brezee Creek were not addressed in the LCFRB survey, but appear to have similar LWD recruitment potential as the mainstem of Brezee Creek.

The LCFRB survey did not assess the LWD delivery potential for Jenny Creek, therefore, LWD potential was visually estimated from 2007 orthophotography. With the exception of the area from the mouth to one-mile upstream (at the N.W. 14th Avenue road crossing) the majority of the four-mile long riparian zone associated with Jenny Creek appeared to have very little forest cover. Cleared areas appeared to primarily be a result of residential and agricultural development adjacent to major roads, such as Jenny Creek Road. The observations made from the orthophotography overview indicate that LWD recruitment potential could be low to moderate.

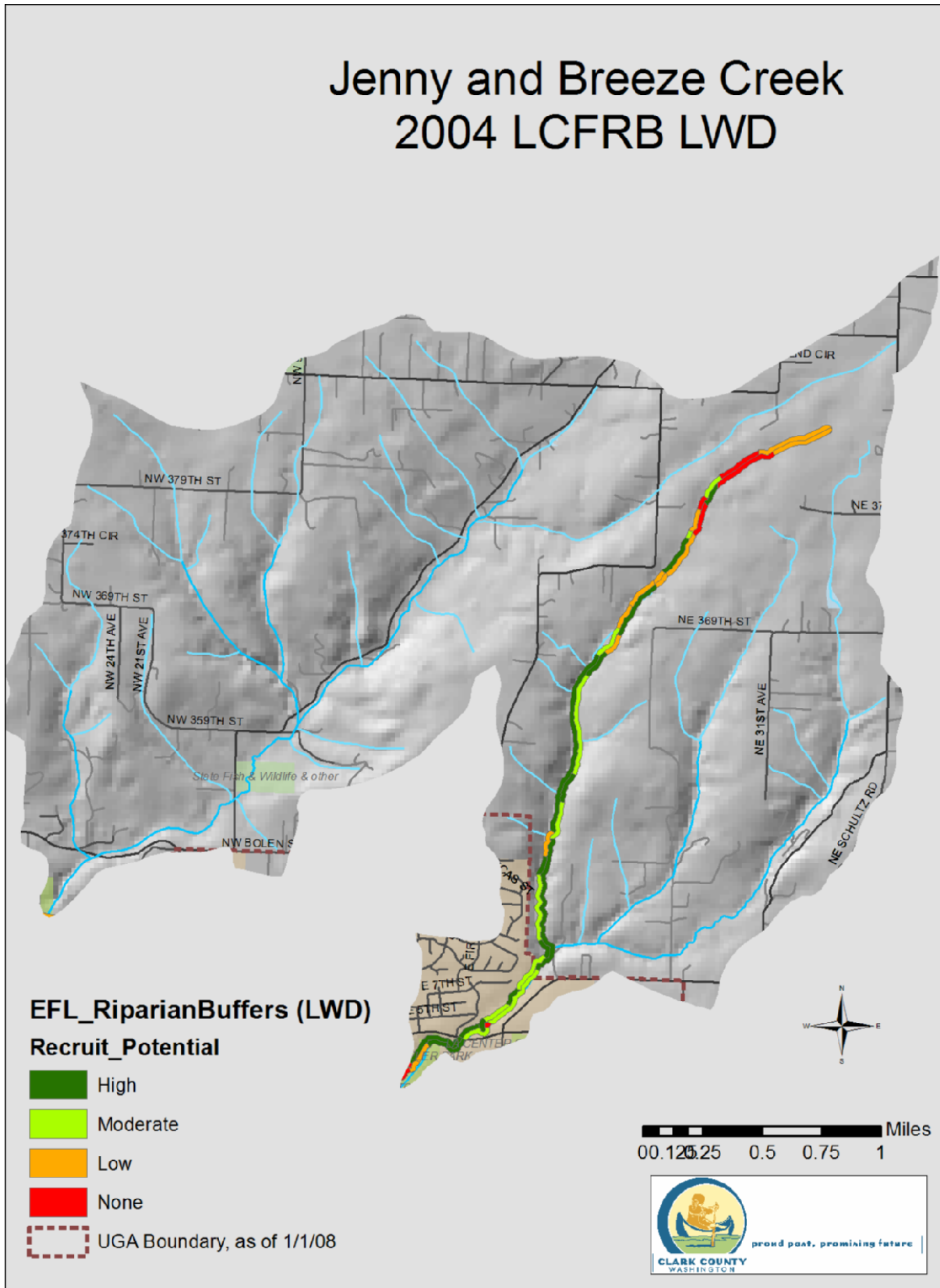


Figure 10: Breeze Creek and Jenny Creek LWD Recruitment Potential (adapted from S.P. Cramer and Associates, 2005)

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Shade

Breeze Creek subwatershed shade conditions are illustrated on Figure 11. The LCFRB survey assessed Breeze Creek as having shade levels in the range of 70 to 90 percent, due to the forest stands and some degree of riparian vegetation throughout the majority of the stream reach. The unnamed tributaries that are associated with Breeze Creek were not addressed in the LCFRB survey, but based on orthophotography review; appear to have similar shade ratings as the Breeze Creek mainstem.

Shade ratings for Jenny Creek were visually estimated from 2007 orthophotography. The majority of the four mile long riparian zone of Jenny Creek appeared to have very little forest cover. As a result, the riparian zone has minimal shading except for only a few feet of shading across the channel width from grasses and weedy forbs.

Management Recommendations

Overall recommended management activities include fencing livestock out of riparian areas, establishing riparian buffers, and acquisition of land for future protection of streams and watersheds.

Potential Projects

Potential riparian restoration projects for Breeze and Jenny Creek subwatersheds were identified from a review of the S.P. Cramer and Associates (2005) report and orthophotography analysis in areas that were not formally surveyed. Although general restoration recommendations were only discussed for the Breeze Creek subwatershed within the LCFRB survey, the general recommendations would also apply for the Jenny Creek subwatershed. General recommendations for restoration projects include riparian forest restoration in areas that have been cleared for residential, agricultural, and recreational use.

According to the Draft East Fork Lewis River Community Habitat Restoration Plan and Project Design Technical Memorandum 1 (LCFRB, 2008) the highest priority projects or areas (Tier 1) were located within the lowermost reach of Jenny Creek (from the mouth to 0.13 miles upstream), and the segment of Breeze Creek immediately upstream of the East 4th Street/Lockwood Creek Road culvert crossing.

Although there were no specific areas listed for riparian restoration with the Breeze or Jenny Creek subwatersheds in the S.P. Cramer and Associates (2005) report, a review of 2007 orthophotography identified areas that were potentially in need of riparian restoration. Potential projects that are located on publicly owned lands are identified within Table 16 below.

The majority of the riparian zone of Breeze Creek and its main tributaries consists of forested areas, with areas of agricultural or residential clearing located primarily in the uppermost reaches. However, there is an area near the mouth of

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Breeze Creek that could benefit from riparian restoration. This area is owned by Clark County and is associated with the La Center Bottoms Stewardship Site. Although there are areas in the upper reaches of Breeze Creek that have low LWD recruitment potential, the vegetation in the riparian zone is still providing some measure of shading, as represented by the 70 and 90 percent shade rating.

Within the Jenny Creek subwatershed, the majority of the riparian zone of Jenny Creek could benefit from some level of riparian reforestation. However, there were two areas that appeared to have sustained the greatest impact from clearing within the riparian zone, and could benefit substantially from reforestation.

The main tributaries to Jenny Creek appear to be well vegetated with small trees and shrubs, based on orthophotography review, and should not need additional reforestation.

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Table 16: Description of Potential Project Opportunities		
ID	Basis for Project	Project Description
IB1- JC	Increasing native understory vegetation to reduce erosion and improve bank stabilization on Jenny Creek, within a 400 foot area downstream of the GPS point and a 100 foot area immediate upstream of the south property boundary. Replant any of the formerly planted areas that have failed along the right bank downstream of the GPS point. Remove widespread invasive species within riparian areas. Invasive species consists primarily of Himalayan blackberry.	Improve native undergrowth vegetation within riparian area surrounding Jenny Creek. Eradicate Himalayan Blackberry within riparian areas.
IB2- BZ	Increasing native understory vegetation to reduce erosion and improve bank stabilization on Brezee Creek, within a 1,100 foot area downstream of the GPS point. Remove widespread invasive species within riparian areas. Invasive species consists primarily of reed canary grass and Himalayan blackberry.	Improve native undergrowth vegetation within the riparian area surrounding Brezee Creek. Eradicate reed canary grass and Himalayan blackberry within riparian areas and remove trash within creek and surrounding areas.

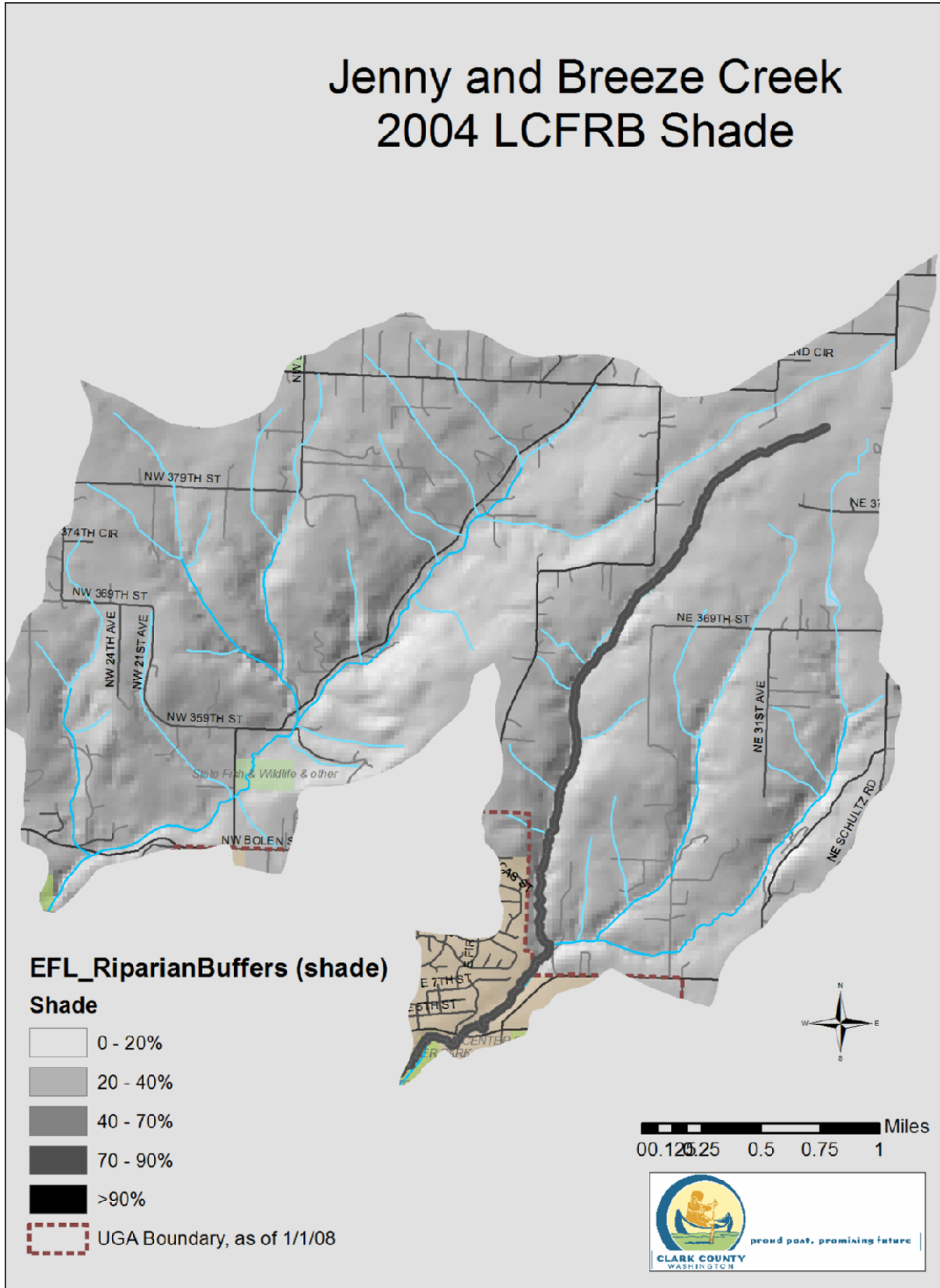


Figure 11: Breeze Creek and Jenny Creek Shade Values (adapted from S.P Cramer and Associates, 2005)

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Floodplain Assessment

A floodplain assessment was not conducted.

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Wetland Assessment

Purpose

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

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

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 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.

Potential project sites have been reviewed and verified through field reconnaissance and are detailed in the results section.

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 12 shows potential wetland areas within the Brezee Creek and Jenny Creek subwatersheds based on data from the county wetlands atlas, including the Clark County wetland model, National Wetlands Inventory, and high-quality wetlands layer.

Breeze Creek subwatershed has smaller pockets of potential wetland areas associated with stream channel floodplains. The wetland mapping shows a large potential wetland near the headwaters of the tributary to Brezee Creek located in the easternmost portion of the watershed. This potential wetland area is a permanently diked/impounded open water wetland associated with the tributary stream channel.

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Like the Brezee Creek subwatershed, Jenny Creek subwatershed also has smaller pockets of potential wetland areas associated with the stream channel floodplains of the mainstem of Jenny Creek. There are some small open water impoundments near the uppermost reaches of Jenny Creek, and a large potential forested wetland area that appears to be associated with the headwaters of Jenny Creek (located east of the Jenny Creek headwaters off of NE 389th Street).

Review of the wetland inventories and studies did not discover any high-priority mitigation opportunities within publicly held lands within Brezee Creek or Jenny Creek subwatersheds. Although there are several tax-exempt parcels in the Brezee Creek and Jenny Creek subwatersheds that overlap with potential wetlands from the Clark County wetlands model, for the most part these sites are already well vegetated and do not appear to have been significantly altered through ditching/clearing. The only exception would be the wetland located within the riparian zone of Jenny Creek, south of NW 359th Street and east of NW 14th Avenue, owned by Washington State and the La Center School District.

The tax-exempt parcels are primarily owned by the La Center School District, Washington State, and Clark County, and are located primarily in the lowermost reaches of Brezee Creek and Jenny Creek. These areas could be potential project sites which would warrant further investigation through an onsite field visit.

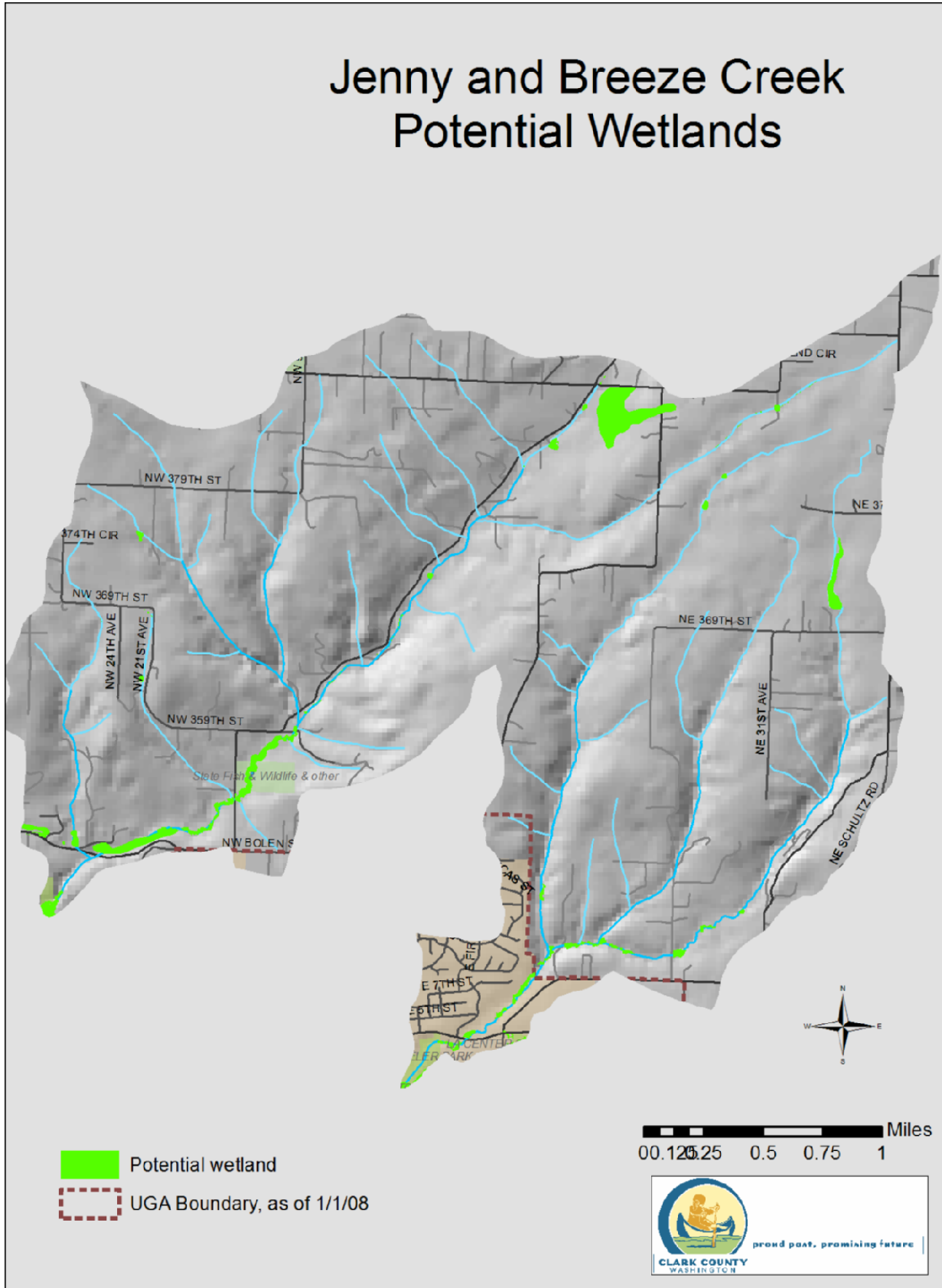


Figure 12: Breeze Creek and Jenny Creek Potential Wetlands

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Draft Watershed Characterization

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

Results pertaining to the Brezee Creek and Jenny Creek subwatersheds are summarized below.

The Brezee Creek and Jenny Creek subwatersheds are part of the Rain-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).

Figure 13 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.

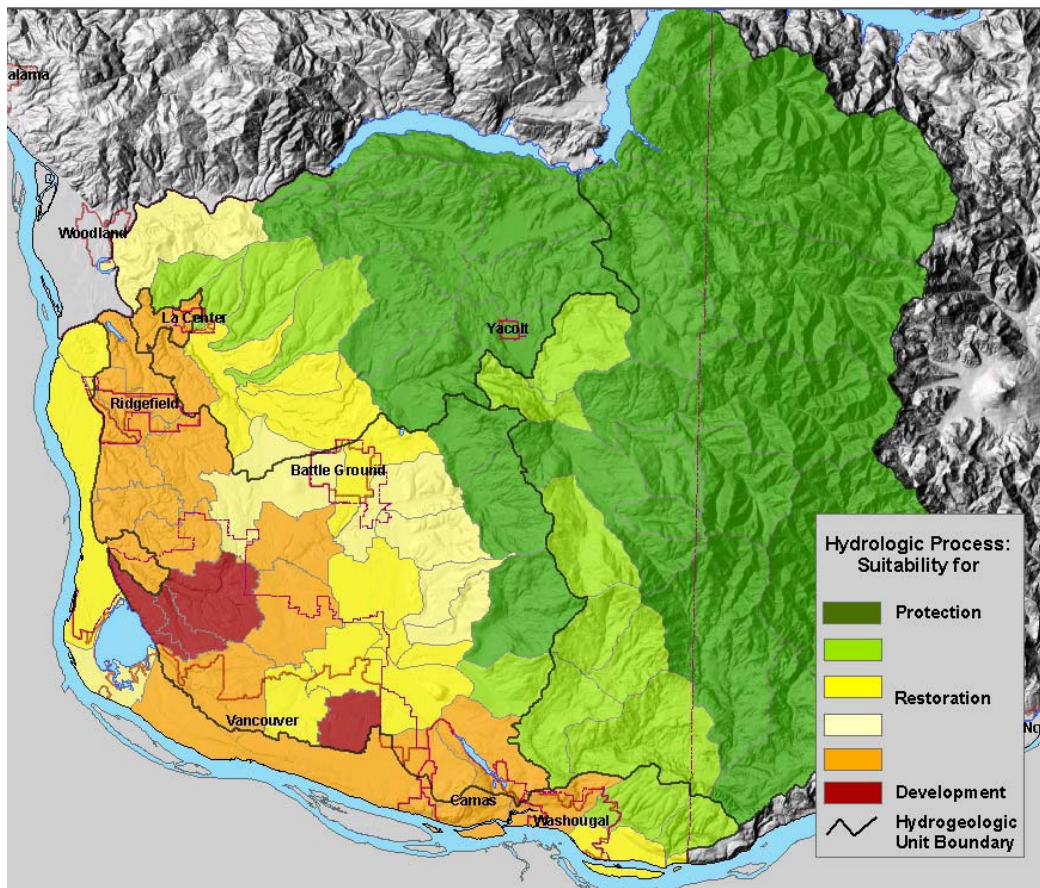


Figure 13: Priorities for suitability of areas for protection and restoration for the hydrologic process (from Draft Watershed Characterization of Clark County (Ecology, 2007)).

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In general, green areas have higher levels of importance for watershed 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).

The Brezee Creek and Jenny Creek subwatersheds are considered as suitable for preservation and restoration (light green) due to their relatively high level of importance for watershed processes and relatively lower level of alteration. Suggested measures of protection include maintaining watershed processes primarily through preservation of existing forest cover. Restoration projects should also be undertaken within these areas since they would have a higher level of potential success relative to other more highly altered units in the county (2007).

Potential Projects

Potential project locations for further exploration based on this wetland assessment include the following:

- Table 17 includes tax exempt parcels that overlap with potential wetlands from the Clark County wetlands model.

Table 17: Tax Exempt Parcels Overlapping Potential Wetlands				
ASSR_SN	ASSR_AC	OWNER	PT1DESC	Description
258694000	20.00	State of Washington	Game and wildlife preserves	Potential wetlands associated with Jenny Creek floodplain
258647000	17.00	La Center School District	Single family unit not sharing structure with other uses	Potential wetlands associated with Jenny Creek floodplain

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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 (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.

The Brezee Creek macroinvertebrate samples were collected by the CWP annually over seven years from 2001 through 2007. All samples were from Station BRZ010 located in lower Brezee Creek upstream from the La Center Bottoms Park. Jenny Creek samples were collected by volunteers in 2002 and CWP staff in 2007.

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Results

Station BRZ010's average B-IBI score over seven years was 31, placing it in the category of moderate biological integrity. The annual B-IBI scores ranged over 14 points from a minimum of 24 in 2005 to a maximum of 38 in 2001. However, the yearly variation was within the typical amount of less than five points observed for Puget Sound streams (Karr 1998 and Law 1994).

Table 18 shows two low, five moderate, and three high scores among the average results for individual metrics. A low score for the intolerant taxa metric suggests degraded water and habitat quality since these are among the first organisms to disappear as human disturbances increase (Fore, 1999). Also, the low score for percent predators could reflect decreasing diversity in prey items.

Table 18: BRZ010 Average Annual Macroinvertebrate Community Metrics and Total Score from 2001 through 2007			
B-IBI Metrics	BRZ010 7-Year Averages		
	Value	Score	Category
Total number of taxa	41.6	5	high
Number of Mayfly taxa	7.4	3	moderate
Number of Stonefly taxa	5.7	3	moderate
Number of Caddisfly taxa	6.6	3	moderate
Number of long-lived taxa	5.9	5	high
Number of intolerant taxa	1.3	1	low
Percent tolerant taxa	47.5	3	moderate
Percent predator taxa	8.9	1	low
Number of clinger taxa	23.1	5	high
Percent dominance (3 taxa)	54.2	3	moderate
Summary of avg. metric scores		32	moderate
Multi-year average B-IBI Score		31	moderate

For Jenny Creek, the B-IBI scores of 44 for Station JEN010 in 2002 and 38 for Station JEN005 in 2007 indicate high and moderate biological integrity, respectively.

Table 19 shows annual metric results for Station JEN005 and Station JEN010. Metric results for Station JEN005 in 2007 were classified as two lows, three moderates, and five highs; whereas for Station JEN010 in 2002 there were no lows, three moderates, and seven highs. The interpretation for Jenny Creek's two low scoring metrics would be similar to those described above for Brezee Creek.

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Table 19: Station JEN005 and Station JEN010 Average Annual Macroinvertebrate Community Metrics and Total Scores from 2002 through 2007.						
BIBI Metrics	JEN005 1-Yr 2007 Averages			JEN010 1-Yr 2002 Averages		
	Value	Score	Category	Value	Score	Category
Total number of taxa	48.0	5	high	47.0	5	high
Number of Mayfly taxa	7.0	3	moderate	8.0	3	moderate
Number of Stonefly taxa	8.0	5	high	6.0	3	moderate
Number of Caddisfly taxa	11.0	5	high	10.0	5	high
Number of long-lived taxa	5.0	5	high	7.0	5	high
Number of intolerant taxa	1.0	1	low	4.0	5	high
Percent tolerant taxa	33.5	3	moderate	12.0	5	high
Percent predator taxa	9.2	1	low	10.5	3	moderate
Number of clinger taxa	20.0	3	moderate	22.0	5	high
Percent dominance (3 taxa)	36.8	5	high	39.9	5	high
Summary of avg. metric scores		36	moderate		44	moderate
Multi-year average B-IBI Score		38	moderate		44	high

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 14 shows that BRZ010 station's 2001 through 2007 B-IBI scores fall in the middle of the range of expected scores (estimated 2000 Total Impervious Area from Wierenga, 2005). By comparing Brezee Creek and Jenny 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.

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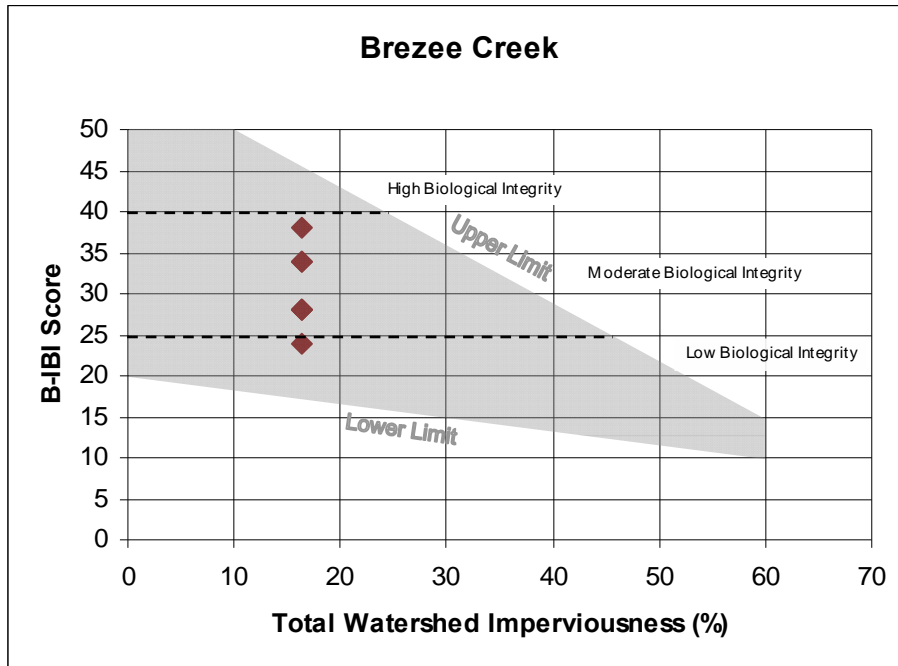


Figure 14: Approximate range of B-IBI in Puget Lowland watersheds, showing progressive decline with increasing imperviousness in the upstream watershed. Adapted from Booth et al., 2004. Markers indicate Total B-IBI scores at Station BRZ010 for particular years, vs. estimated 2000 subwatershed TIA.

Brezee Creek's B-IBI scores fall mostly in the middle of the expected range for its estimated 16 percent impervious area. This implies an opportunity to increase the level of biological integrity by improving habitat and stream conditions. Management strategies that limit further degradation and promote rehabilitation of stream health are important for maintaining or improving its biological integrity.

Figure 15 shows that Station JEN005 and Station JEN010 B-IBI scores fall in the upper portion of the range of expected scores (estimated 2000 Total Impervious Area from Wierenga, 2005).

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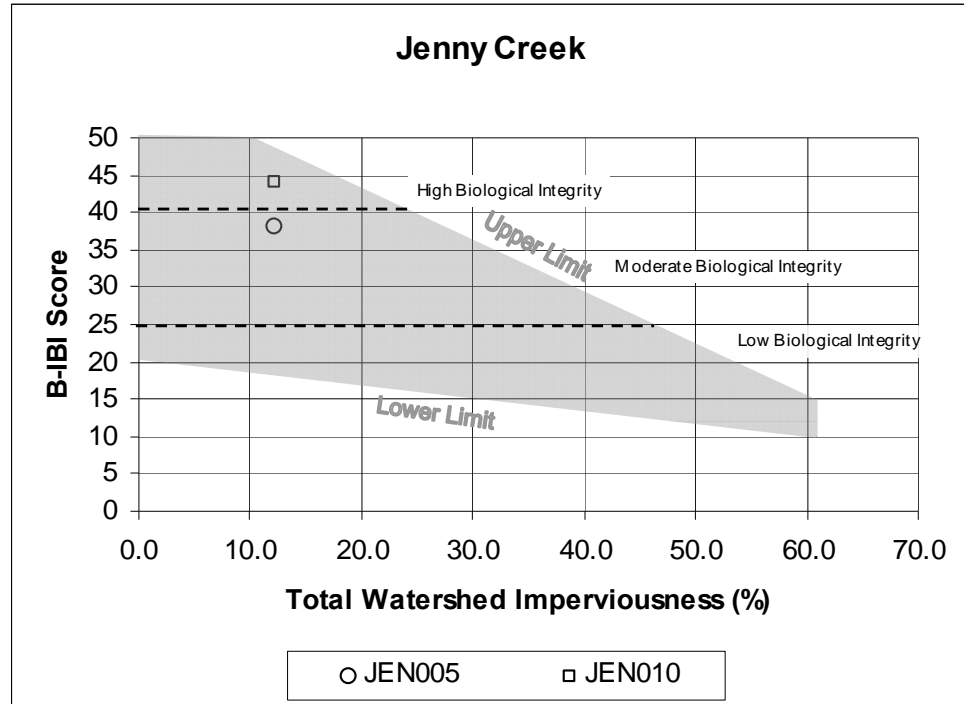


Figure 15: Approximate range of B-IBI in Puget Lowland watersheds, showing progressive decline with increasing imperviousness in the upstream watershed. Adapted from Booth et al., 2004. Markers indicate Total B-IBI scores at Station JEN005 and Station JEN010 for particular years, vs. estimated 2000 subwatershed TIA.

Jenny Creek B-IBI scores fall near the top of the expected range for a watershed with twelve percent impervious area, with only limited room for further improvement. Thus, management strategies to protect existing beneficial stream conditions are important for sustaining high biological integrity.

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Fish Use and Distribution

Purpose

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

Methods

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

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

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

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

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

Results/Summary

Distribution

The fish distribution mapped from Clark County GIS information (Figure E) varied slightly from fish distribution data originating from the SalmonScape database within the Brezee Creek subwatershed. This difference is identified within the individual subwatershed discussions below. For the purposes of this report, when the fish distribution mapping figures differ from SalmonScape fish distribution data, it is assumed that the SalmonScape distribution is a more accurate representation of the fish populations within the listed watersheds.

The available evidence suggests that anadromous fish use within the Brezee Creek subwatershed includes Coho salmon and winter steelhead (Figure 16). The SalmonScape fish distribution data also identified the additional presumed presence of fall chum and summer steelhead from the mouth of Brezee Creek upstream to the East 4th Street/Lockwood Creek Road crossing. Additionally,

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SalmonScape maps the documented distribution of Coho salmon further upstream, to the point where the tributaries join the mainstem of Brezee Creek.

The LCFRB 2004 Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan did not address Jenny Creek other than the short 0.13 mile segment located upstream from the mouth to the full barrier falls, which is listed as a Tier 1 reach. This reach is mapped as having documented Coho and Winter Steelhead distribution, which ends at the full barrier falls.

Brezee Creek was listed as a Tier 4 reach (lowest priority). The Brezee Creek subwatershed is also considered a Group D watershed, as it contains only Tier 4 reaches. Reaches are placed in Tiers (1-4), with Tier 1 reaches representing the areas where recovery measures would produce the greatest benefits towards accomplishing the Plan's biological objectives.

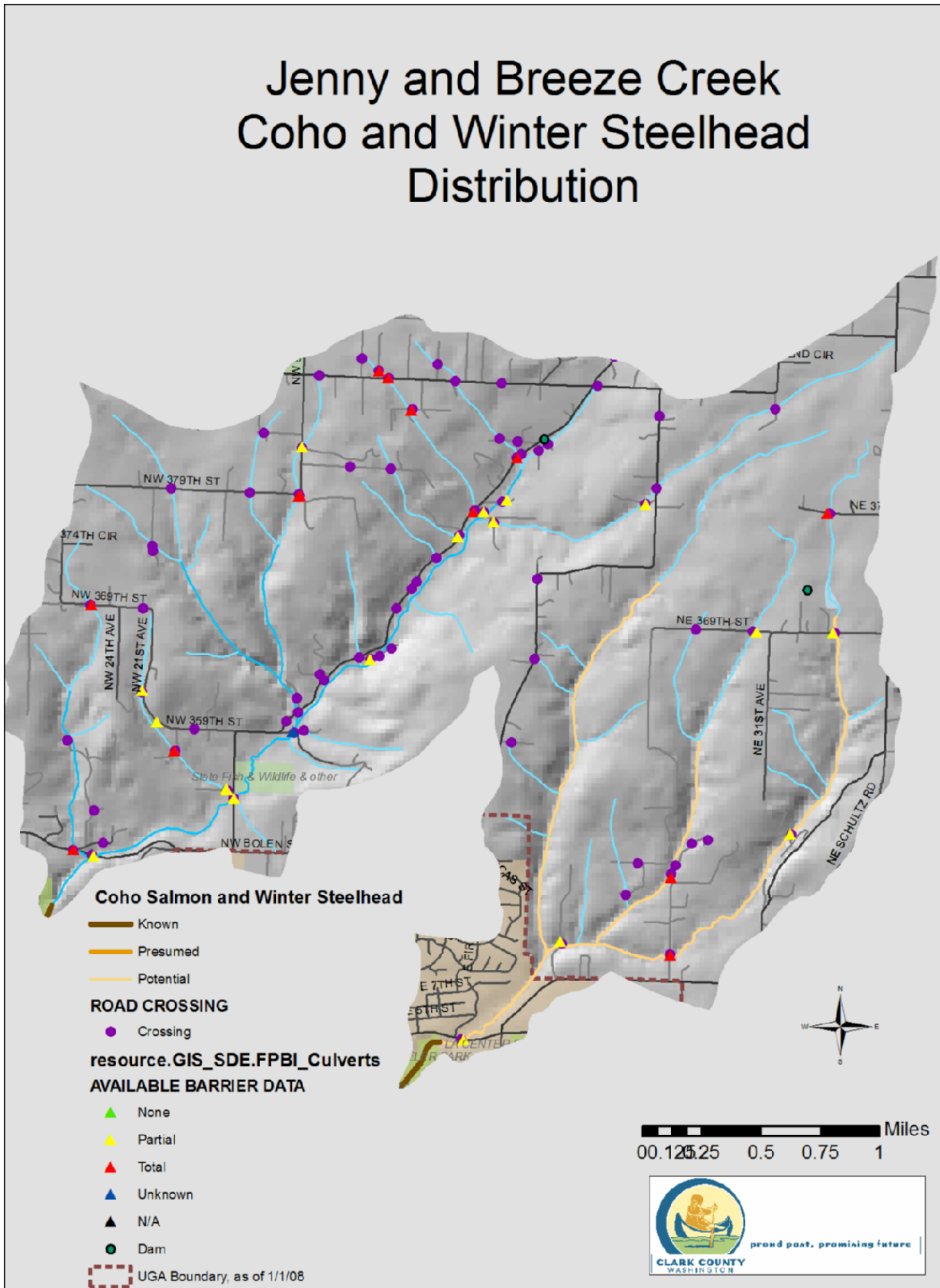


Figure 16: Breeze Creek and Jenny Creek Fish Distribution and Barriers

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Barriers

The WDFW barrier database and the 2007 LCFRB Regional Culvert Inventory provide the most complete assessment of barriers in the Brezee Creek and Jenny Creek subwatersheds (Figure E).

Known barriers within the Brezee Creek watershed includes a partial barrier on the mainstem of Brezee Creek, and two full and four partial barriers on a tributary to Brezee Creek. The partial barrier on the mainstem of Brezee Creek is the East 4th Street/Lockwood Creek Road culvert crossing. The full barrier on the tributary to Brezee Creek is located at NE 23rd Avenue, with partial barriers at the NE 14th Avenue, NE 351st Way and NE 369th Avenue crossings.

The known barriers for the Jenny Creek subwatershed are multiple partial barriers (Figure E). However, the most significant barrier to anadromous fish passage (not mapped) is the full barrier falls located approximately 600 feet upstream of the mouth of Jenny Creek. This barrier completely blocks anadromous fish passage, which limits fish upstream to resident fish species. Partial barriers on the mainstream of Jenny Creek are located at Pacific Highway, NE 14th Avenue, NE Pleasant View Drive and NE 378th Street.

Recommendations

Both Brezee Creek and Jenny Creek subwatersheds contain many full and partial fish barriers within their mainstem and tributary reaches. Although the majority of the reaches within the Brezee Creek subwatersheds are low priority (Tier 4), improvement or removal of these barriers would provide potential upstream habitat for a variety of anadromous fish species.

Jenny Creek subwatershed has several partial barriers on the mainstem, but because a natural barrier restricts anadromous fish use immediately above the mouth, improvement or replacement of these barriers is not recommended at this time.

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Hydrologic and Hydraulic Models

No modeling was performed for this assessment area.

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Analysis of Potential Projects

The analysis of potential projects:

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

Projects or activities are placed in one of several categories.

Summary of Conditions, Problems, and Opportunities

Conditions and Problems

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

Coordination with Other Programs

The Washington Department of Ecology is developing TMDLs for bacteria and temperature in the East Fork Lewis River watershed, which includes Brezee Creek and Jenny Creek. The CWP actively participates in TMDL development and implementation, and coordinates on an ongoing basis with the Lower Columbia Fish Recovery Board, Clark County Legacy Lands, and Vancouver-Clark Parks and Recreation.

Broad-Scale Characterization

The assessment area is almost entirely rural residential and smaller forest tracts; however, the City of La Center occupies a significant part of lowermost Brezee Creek subwatershed. The area is largely in private lands with areas of public open space where streams enter the East Fork Lewis River floodplain.

Standard subwatershed scale metrics compared to NOAA fisheries standards suggest this study area has both functioning and non-functioning stream habitat conditions. The only functioning metrics for the Jenny Creek subwatershed were stream crossing density and percent TIA. The only functioning metric for the Brezee Creek subwatershed was stream crossing density. Forest percentage, road density, and total impervious area metrics are in the non-functioning category. Additionally, both Brezee Creek and Jenny Creek subwatersheds are projected to see further increases in EIA under the 2008 Comprehensive Plan, placing both in the potentially unstable category.

Water Quality Assessment

A relatively large dataset is available for Brezee Creek where the CWP monitors water quality and streamflow. Volunteer monitors have also been active through Clark County. General water quality data collected by Clark County from 2002 through 2007 indicate that seasonal mean and minimum OWQI values for Brezee Creek place the creek in the poor category. In addition, an increasing trend

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(decreased water quality) was evident in turbidity scores which suggests Brezee Creek is at risk of increased water quality degradation.

Jenny Creek has generally good water quality. Both Brezee Creek and Jenny Creek are on the 2008 Ecology 303(d) list of impaired waters for both fecal coliform and water temperature. Both subwatersheds are included in the temperature and fecal coliform TMDLs being developed for the East Fork Lewis River. State monitoring during 2005 and 2006 indicated that both subwatersheds failed to meet fecal coliform bacteria standards.

Drainage System Inventory

The drainage system inventory is complete for both Brezee Creek and Jenny Creek subwatersheds. Storm drains in this area consist almost entirely of roadside ditches, with 272 associated outfalls to surface water.

Stormwater Facility Inspection

As of October 2008, there are no public stormwater facilities in the study area.

Off-site assessments conducted for two public stormwater outfalls discharging to critical areas were found to be in compliance.

Illicit Discharge Screening

Screening conducted at 271 known stormwater outfalls, primarily from roadside ditches, identified no illicit connections or discharges.

Stream Reconnaissance Feature Inventory

Approximately 2.1 miles of stream corridor were assessed in the Brezee Creek subwatershed. A total of 43 features were recorded, primarily impacted stream buffers and miscellaneous features of interest. Twenty-three potential projects were identified, with all but four being projects for referral to outside groups or agencies.

Physical Habitat Assessment

Physical habitat measurements made in 2002 on Brezee Creek indicated that overall habitat quality was fair. Pool and riffle percentages did not meet recommended levels. LWD density and mean embeddedness were characterized as "not properly functioning". The survey reach was in a steep-sided canyon with intact riparian forest providing adequate shade. Upland areas were characterized as cleared or open.

Data are not available for Jenny Creek.

Geomorphology and Hydrology

These tasks were not included in this assessment

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Riparian Assessment

The most reliable riparian assessment data in Clark County is limited to the areas assessed during the 2004 LCFRB Habitat Assessment. The major streams and some of their tributaries were included in the LCFRB assessment. Qualitative assessments were made from orthophotos for areas not included in the LCFRB assessment.

Generally, riparian conditions within Brezee Creek and Jenny Creek are impaired.

Overall, the mainstem of Brezee Creek was assessed as having 'moderate' LWD recruitment potential as the riparian zone is densely vegetated. The uppermost and lower reaches were assessed as having 'low to none' LWD recruitment potential. Orthophotography analysis of LWD recruitment potential for Jenny Creek was found to be in the low to moderate category.

Riparian shade levels for Brezee Creek range from 70 to 90 percent for the majority of the reach with low shade levels in the uppermost and lower reaches. Jenny Creek is estimated to have minimal shade levels due to riparian vegetation consisting of mainly grasses and weedy forbs.

Wetland Assessment

Large potential wetlands in Brezee Creek are associated with the headwaters of the tributary located in the easternmost portion of the subwatershed. Smaller pockets of potential wetland are associated with the stream channel floodplains of the mainstem of Brezee Creek. Jenny Creek also has pockets of potential wetland associated with the mainstem floodplains. This assessment did not discover any high priority stormwater-related capital projects in these areas.

Macroinvertebrate Assessment

Based on seven annual samples, biological integrity in Brezee Creek ranged from low to moderate.

Breezee Creek scores fall mostly in the middle of the expected range for its estimated TIA compared to the predicted range of B-IBI scores for areas with similar levels of total impervious area. This suggests that management strategies that limit further degradation and promote rehabilitation are important for at least maintaining its moderate biological integrity. It is likely that biological integrity could be improved through enhancements to habitat and stream conditions.

Based on two samples, biological integrity of Jenny Creek was high in 2002 and moderate in 2007. Jenny Creek scores fall mostly in the upper portions of the expected range for its estimated TIA, with only limited room for further improvement. Thus, management strategies to protect existing beneficial stream conditions are important for sustaining high biological integrity.

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Fish Use and Distribution

Regional fish recovery priority is moderate to high in this assessment area, consisting primarily of Tier 1 (Jenny Creek to RM 00.13) and Tier 4 reaches (Brezee Creek). The Brezee Creek subwatershed has known anadromous fish use which includes Coho and Winter Steelhead. It is also presumed that Fall Chum and Summer Steelhead are present in Brezee Creek. There has been documented use by Coho and Winter Steelhead within lower Jenny Creek (mouth to RM 00.13).

Multiple barriers exist on the mainstem of Brezee Creek and its tributaries, but as a Tier 4 subwatershed barrier removal is not a high priority.

Jenny Creek subwatershed has several partial barriers on the mainstem, but because a waterfall restricts anadromous fish use immediately above the mouth of the creek, improvement or replacement of these barriers is not recommended.

Recently Completed or Current Projects

There are no stormwater projects in the Brezee Creek and Jenny Creek subwatersheds under the 2009 - 2014 Stormwater Capital Improvement Program or the 2008-2013 Transportation Improvement Program.

The LCFRB Lower East Fork Lewis River Aquatic Habitat Restoration Plan (draft) identifies a number of habitat restoration projects to be considered along Brezee Creek and Jenny Creek. None are prioritized for immediate action.

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 include 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

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during the stormwater needs assessment. Field notes, descriptions, field photos, and other associated information are reviewed. In some cases, additional field reconnaissance is performed.

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

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

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Emergency or Immediate Actions

Identifier	Basis for Project	Project Description	Action
Brezee Creek Subwatershed			
MB-30	Large earthen dam creating a farm pond at the head of a short, steep, ephemeral, tributary drainage. The dam is approximately 20 feet high with undersized outlet works, no emergency spillway, and a failing downstream embankment being protected by plastic tarps. The outlet pipe at the base of the dam is not functioning and there is water seeping from the toe of the dam slope. There is potential for catastrophic failure.	Immediate site inspection by engineering staff to determine structural integrity of the dam and outlet works. May warrant removal of dam and restoration of tributary stream. At minimum, project should address failing outlet structures, stabilize the embankment, and appropriately mitigate for thermal and sedimentation impacts of the dam.	Refer to CWP engineering.
TR-57	Accumulation of potentially hazardous debris. Gas cylinders, PVC pipe, and a 55-gallon drum.	Confirm if debris is hazardous. Remove debris immediately.	Refer to Code Enforcement and CWP Outreach; contact landowner about BMPs.

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Potential Stormwater Capital Projects

Stormwater Capital Facility Improvement Projects

No projects of this type were identified.

Stormwater Infrastructure Maintenance CIPs

No projects of this type were identified.

Stormwater Class V Underground Injection Control (UIC) Projects

No county-owned Class V UIC wells are known in the three subwatersheds.

Habitat Restoration/Enhancement Projects

No specific projects for consideration by the SCIP were discovered.

Property Acquisition for Stormwater Mitigation

ID	Basis for Project	Project Description	Action
Breezee Creek Subwatershed			
OS-52	Potential riparian reforestation area on Breezee Creek within the East Fork Lewis River Greenway.	Investigate the feasibility of obtaining property and developing a large scale riparian reforestation habitat enhancement and water quality improvement.	Evaluate for 2009 SCIP
Jenny Creek Subwatershed			
OS-54	Potential wetlands associated with Jenny Creek floodplain	Investigate the feasibility of obtaining property and developing a large scale wetland complex for habitat enhancement and water quality improvement.	Evaluate for 2009 SCIP
OS-53	Potential wetlands associated with Jenny Creek floodplain	Investigate the feasibility of obtaining property and developing a large scale wetland complex for habitat enhancement and water quality improvement.	Evaluate for 2009 SCIP

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Public Works and Clean Water Program Referrals

Private Stormwater Facilities Maintenance

No projects of this type were identified.

Public Works stormwater infrastructure maintenance

No projects of this type were identified.

CWP Outreach/Technical Assistance

Identifier	Basis for Project	Project Description	Action
Breezee Creek Subwatershed			
WQ-36 SCF-2	Livestock access or crossing through stream. Likely source of sediment and nutrients.	Investigate alternative means for livestock to cross channel to minimize water quality impacts and reduce stream bank erosion.	Refer to CWP Outreach; contact landowner about BMPs, CCD assistance
WQ-37	Diversion of flows into an off-channel pond used for irrigation water. Return flow from the pond enters the stream near SCF-2, 350 feet downstream. Area around the pond has been cleared of woody riparian vegetation.	Confirm water rights. Look into potential water quality impacts of the off-channel pond and educate landowner on ways to reduce the negative impacts of water withdrawals and irrigation return flows. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.	Refer to CWP Outreach; contact landowner about BMPs, CCD assistance
AP-25	Deck on stream bank and fire pit within the active channel.	This landowner is very interested in stewardship and stream corridor health. Discuss moving the fire pit into a contained ring outside of the active channel. The deck is a minor disturbance within the riparian area.	Refer to CWP Outreach; contact landowner about BMPs, CCD assistance

CWP Illicit Discharge and Detection Elimination Screening

None

CWP Engineering Evaluation

None

CWP Infrastructure Inventory

None

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

Identifier	Basis for Project	Project Description	Action
Brezee Creek Subwatershed			
IB-215 IB-216 IB-217 IB-218 IB-219 IB-220 IB-221 IB-222 IB-223 IB-224 IB-225	Widespread invasive plant species in riparian area and floodplain. Predominantly blackberry.	Eradicate blackberry. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.	Refer to Clark Public Utilities
MI-51	Large woody debris in the channel is holding grade in the tributary that enters from the east. The mainstem of Brezee Creek enters from the north and is severely incised to bedrock and clay layers. Loss of grade control on the tributary would result in significant headcutting and additional channel incision on the tributary from the east.	Place additional LWD structures to aggrade and hold grade in the Brezee Creek channel with the objective of improving habitat and reducing the chance of further incision up the east tributary.	Refer to Clark Public Utilities
OS-61	Increasing native understory vegetation to reduce erosion and improve bank stabilization on Jenny Creek, within a 400 foot area downstream of the GPS point and a 100 foot area immediately upstream of the south property boundary. Replant any of the formerly planted areas that have failed along the right bank downstream of the GPS point. Remove widespread invasive species within riparian areas. Invasive species consists primarily of Himalayan blackberry.	Improve native undergrowth vegetation within the riparian area surrounding Jenny Creek. Eradicate Himalayan Blackberry within riparian areas.	Refer to Clark Public Utilities

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Non-Project Management Recommendations

Non-project stormwater management recommendations address areas where county 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 Brezee Creek and Jenny Creek subwatersheds, by NPDES permit component, include:

Storm Sewer Mapping and Inventory

None

Coordination of Stormwater Activities

- Pursue future collaborative stormwater activities with the City of La Center in the Brezee Creek and Jenny Creek subwatersheds.
- Continue to search for opportunities to coordinate or leverage projects with the Lower Columbia Fish Recovery Board through the Lower East Fork Lewis River Aquatic Habitat Restoration Plan.
- Continue active participation in Ecology's bacteria and temperature TMDL development for the East Fork Lewis River watershed.

Mechanisms for public involvement

- Publish SNAP reports on CWP web page.

Development Regulations for Stormwater and Erosion Control

- Develop technical assistance to aid rural property owners to effectively follow recently adopted runoff reduction practices for construction projects

Operation and Maintenance Actions to Reduce Pollutants

- Confirm that county ditch maintenance practices minimize vegetation removal whenever possible.

Education and Outreach to reduce behaviors that contribute stormwater pollution

- Increase education and technical support regarding the removal of invasive plants, and provide a list of suggested plants for stream revegetation and local nurseries that stock them for distribution to landowners. Eradication and/or control of invasive plants is beyond the resources of public agencies and requires actions by private landowners.
- Post stream identification signs where roads cross streams. Repair or replace deteriorated signs if necessary.
- Develop a process to provide education about appropriate ditch maintenance practices to rural landowners.
- Discuss current management practices with agricultural land users to promote practices to reduce sediment and nutrient loads to headwaters streams.

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- Educate landowners to discourage disposal of yard debris in streams or other receiving waters.
- Develop literature and distribute to landowners educating about the water quality impacts and other potential hazards of on-line and off-line ponds.

TMDL Compliance

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

Monitoring Stormwater Program Effectiveness

None.

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