East Fork Lewis River Alternative Restoration Plan

A strategy to achieve bacteria and temperature water quality standards

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For the **Water Quality Program**

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- Devan Rostorfer, June 2019: East Fork Lewis River watershed.

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Cross-referenced or relevant documents.
Publication 21-10-003: East Fork Lewis River Watershed Bacteria Monitoring and Nonpoint Source Identification
Publication 20-10-016: Quality Assurance Project Plan Monitoring Fecal Coliform Bacteria in Western Washington Water Bodies Appendix B3: Southwest Regional Office Sampling Site for 2019 and 2020
Publication 18-03-019: East Fork Lewis River Bacteria and Temperature Source Assessment Report
Publication 17-10-006: Quality Assurance Project Plan East Fork Lewis River Fecal Coliform Bacteria and Temperature Source Assessment
Publication 05-03-110: Quality Assurance Project Plan East Fork Lewis River Temperature and Fecal Coliform Bacteria Total Maximum Daily Load Study
Publication 09-03-002: Streamflow Summary for Gaging Stations on the East Fork Lewis River, 2005-06
Publication 09-03-037: Surface Water/Groundwater Exchange along the East Fork Lewis River (Clark County), 2005

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Department of Ecology's Regional Offices

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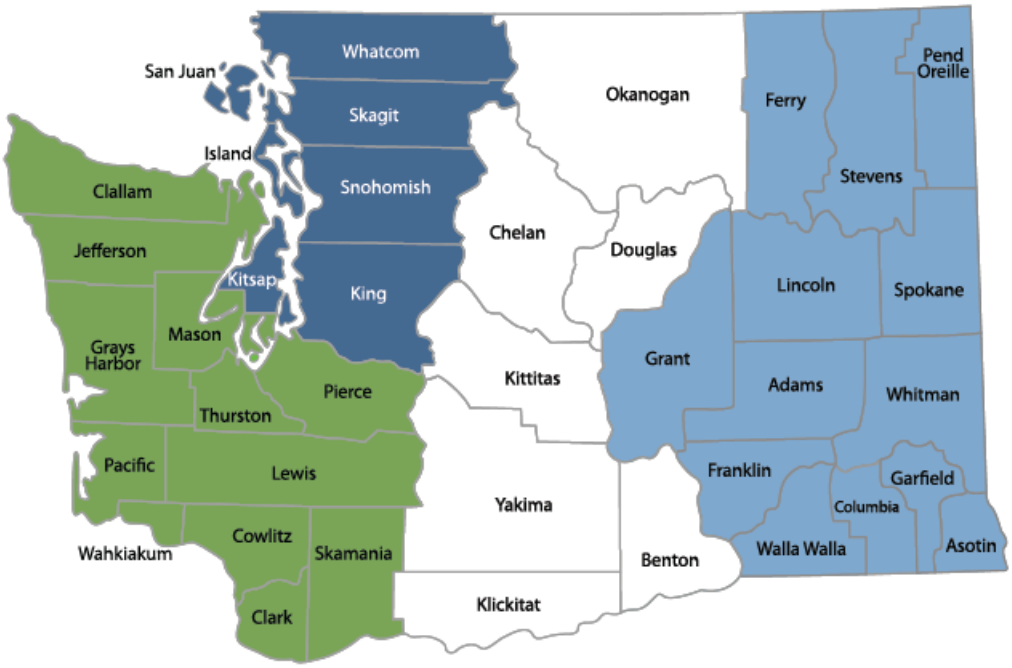

Southwest Region 360-407-6300 | Northwest Region 425-649-7000 | Central Region 509-575-2490 | Eastern Region 509-329-3400

Region	Counties served	Mailing Address	Phone
Southwest	Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Mason, Lewis, Pacific, Pierce, Skamania, Thurston, Wahkiakum	PO Box 47775 Olympia, WA 98504	360-407-6300
Northwest	Island, King, Kitsap, San Juan, Skagit, Snohomish, Whatcom	PO Box 330316 Shoreline, WA 98133	206-594-0000
Central	Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, Yakima	1250 W Alder St Union Gap, WA 98903	509-575-2490
Eastern	Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman	4601 N Monroe Spokane, WA 99205	509-329-3400
Headquarters	Across Washington	PO Box 46700 Olympia, WA 98504	360-407-6000

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Executive Summary

The East Fork Lewis River (EFLR) watershed is home to one of the fastest growing cities in Washington State, and five high priority populations of Endangered Species Act (ESA) listed salmon and steelhead. The watershed has seen a 47 percent increase in human population between 2000 and 2018, and provides recreation, timber, agriculture, and water resources for the rapidly growing southwest region of the State. At the same time, the watershed supports aquatic life and recreational uses and is key to the recovery of ESA-listed salmon and steelhead that rely on the mainstem and tributaries for critical spawning and rearing habitat. The diversity of functions the watershed supports has made the watershed a central focus of salmon recovery, water quality, water quantity management and planning in Southwest Washington. These planning efforts began in the early 2000's, but continue today as new partnerships have formed to support development of the East Fork Lewis River Alternative Restoration Plan.

TMDL Alternative Restoration Plans

Currently, the EFLR and its tributaries are on Washington State's impaired waters list (303d list) for warm water temperatures and bacteria pollution problem, which drives the need to develop a Total Maximum Daily Load (TMDL) as required by the Clean Water Act. Ecology has chosen to develop this TMDL Alternative Restoration Plan in advance of developing a TMDL in order to expedite the voluntary implementation of best management practices (BMPs) to improve water quality in the East Fork Lewis River. Keeping the watershed clean is important because high levels of bacteria increase risks to people swimming, wading, or fishing. High water temperatures also create poor conditions for fish and other wildlife.

The ultimate goal of this Alternative Restoration Plan is to outline a strategy to implement BMPs that will reduce pollution enough to meet water quality standards, in advance of a TMDL. The Plan identifies causes of water quality impairments and pollutant sources and estimates the pollution reductions needed to meet water quality standards. The Plan also describes the implementation needed to reduce sources of pollution. The plan outlines the technical and financial assistance needed, and develops an information and education component. An implementation schedule, criteria to measure progress, and a monitoring plan to evaluate effectiveness of implementation efforts is also included in the Plan.

Once the ARP is reviewed and accepted by EPA, category 5 impaired waters on the 3030d list will be changed to category 5-alt waters to recognize that an Alternative Restoration Plan has been developed for the watershed. If water quality standards are not achieved through implementation actions outlined in this Alternative Restoration Plan, a formal TMDL will be required for the watershed. Ecology has established criteria to measure progress, which are outlined in Chapter 11. Effectiveness monitoring, which is described in Chapter 12, will be the primary tool used to assess progress. Ecology's goal is to achieve bacteria water quality standards by 2035, and temperature water quality standards by 2055.

East Fork Lewis River Source Assessment

To support development of this Alternative Restoration Plan, Ecology published the *East Fork Lewis River Watershed Bacteria and Temperature Source Assessment*. The East Fork Lewis River Source Assessment is the first *Source Assessment* completed by Ecology in Southwest

Washington to analyze water quality data and identify critical areas for water quality improvement. Priority areas for bacteria and temperature improvement are located in the middle and lower sections of the watershed. No sites sampled in the EFLR met water quality standards (WQS) for temperature. The largest average shade deficit is located in the middle watershed, which is located between river miles 6 and 20. The middle watershed has an average shade deficit of 35 percent, with shade deficits of over 40 percent measured between river miles 9 to 13. These shade deficits are a high priority for riparian restoration to increase shade and help lower warm water temperatures. Priority areas to address bacteria are the Brezee and McCormick Creek tributaries, which are located in the lower watershed. To meet water quality standards, bacteria reductions of up to 86 to 96 percent are needed in Brezee and McCormick Creeks.

East Fork Lewis River Partnership

To implement recommendations from the *Source Assessment*, Ecology launched the East Fork Lewis River Partnership in May 2018 to work collaboratively with local, state, federal, and tribal governments, non-profits, watershed groups, and private landowners to develop and implement the *East Fork Lewis River Alternative Restoration Plan.* Since the partnership launched, over 50 different partners from 30 different organizations have engaged in EFLR Partnership activities, including private landowners.

The success of this water cleanup effort relies on establishing, maintaining, and leveraging partnerships, and increasing public awareness as principal tools to achieve improved water quality. Currently, multiple new projects and programs are being developed and implemented in the watershed including the new Poop Smart Clark Pollution Identification and Correction program, which will help address agricultural, septic, and stormwater resources of pollution. All of the new programs help achieve water quality and salmon recovery goals. Priorities for long-term implementation include addressing impacts from septic systems, stormwater, and agriculture, and enhancing riparian restoration, and streamflow restoration efforts in the watershed.

Chapter 1 - Introduction

The EFLR watershed is home to one of the fastest growing cities in Washington State, and five high priority populations of Endangered Species Act (ESA) listed salmonids. The watershed has seen a 47 percent increase in human population since 2000, and provides recreation, timber, agriculture, and water resources for this rapidly growing region of the State. At the same time, the watershed supports aquatic life and recreational uses and the watershed is key to the recovery of ESA-listed salmon and steelhead that rely on the mainstem and tributaries for critical spawning and rearing habitat. The social, economic, and environmental value of the watershed has made the EFLR watershed a central focus of salmon recovery, water quality, water quantity management, and planning in Southwest Washington. These planning efforts began in the early 2000's but continue today as implementation progresses and new partnerships have formed to support development of this Alternative Restoration Plan.

Watershed background

The EFLR watershed is located in the Lewis Water Resources Inventory Area (WRIA) 27 in Southwest Washington. The headwaters originate in the Cascade Mountain Range in the Gifford Pinchot National Forest draining 42 miles west to its confluence with the Nork Fork Lewis River, just west of the City of La Center and Interstate 5 (I-5). The 235 square mile watershed consists of a variety of land uses ranging from state, federal, and private timberlands in the upper and middle watershed, to bountiful agricultural lands in the middle and lower watershed. These agricultural lands are integral to sustaining Clark County's rural character and local economy. More developed and residential areas of the watershed are located in the towns of La Center, Ridgefield, Battle Ground, and Yacolt. In addition to supporting fish and municipal water resources, the EFLR provides significant recreational use for swimmers, hikers, anglers, and campers in the watershed. Rapid population growth, development, and urbanization have led to increased impervious surfaces, decreased forest cover, and water quality issues that affect the beneficial uses that the watershed provides for humans and aquatic species. The following table provides an overview of the EFLR watershed.

Table 1. East Fork Lewis River watershed overview.

Fact	Description
WRIA	27 – Lewis
Counties	Clark and Skamania
Population Increase	47 percent increase in human population since 2000.
Area	235 square miles.
River Length	42 miles total, 32.3 miles in study area.
Salmon Populations	5 primary populations of Endangered Species Act listed Salmonids.
Water Quality Impairments	State Impaired Waters List (303d) for bacteria and temperature.
Beneficial Uses	Aquatic Life and Recreational Uses
Jurisdictions	Clark County, City of Battle Ground, City of La Center, Yacolt, City of Ridgefield, Washington Department of Transportation
Permits	Phase I Municipal Stormwater, Phase II Municipal Stormwater, Construction Stormwater, Sand and Gravel, Municipal Wastewater

State's impaired waters list (303d)

The EFLR and its tributaries are on the Washington State's impaired waters list (303d list) for warm water temperatures and bacteria pollution problem, which drives the need to develop a Total Maximum Daily Load (TMDL), as required by the federal Clean Water Act. Ecology has chosen to develop this Alternative Restoration Plan (ARP) in advance of developing a TMDL, in order to expedite the voluntary implementation of best management practices (BMPs) to improve water quality in the East Fork Lewis River. Keeping the watershed clean is important because high levels of bacteria increase risks to people swimming, wading, or fishing. High water temperatures also create poor conditions for fish and other wildlife.

East Fork Lewis River Alternative Restoration Plan

How does it compare to a traditional TMDL?

This *Alternative Restoration Plan* provides a strategy to address sources of pollution in a watershed where pollutant challenges are mostly from nonpoint sources. One of the main questions Ecology tries to answer through an Alternative Restoration Plan is, "how much pollution needs to be reduced to meet water quality standards?" In order to answer this question there are four main steps to Ecology's Alternative Restoration Plan process. First, Ecology completes water quality assessment, monitoring and data collection. Second, Ecology completes a Source Assessment study to identify critical areas for water quality improvement and estimate the pollution reductions needed to meet water quality standards. Third, Ecology uses the results from a Source Assessment to develop an Alternative Restoration Plan, focused on implementation of BMPs to improve water quality. Finally, in step four, Ecology works with local partners to implement water quality BMPs necessary to achieve WQS.

Unlike a traditional TMDL study, this East Fork Lewis River Alternative Restoration Plan does not establish waste load allocations for point source dischargers or permitted facilities. Instead, the ARP identifies BMPs that need to be implemented to reduce nonpoint sources of pollution to meet water quality standards. These plans work best in watersheds where there is community support and active implementation happening on the ground. Effectiveness monitoring is the primary tool used to assess if progress is being made towards achieving water quality standards. If water quality standards are not achieved through implementation of the ARP, then a traditional TMDL, which establishes waste load allocations for point source dischargers, will be required in the watershed.

Today, much of the East Fork Lewis River watershed is made up of rural landscape and most of the water quality challenges are diffuse nonpoint sources. Therefore, a traditional TMDL is not the appropriate tool for achieving clean water. Currently, the East Fork Lewis River watershed is currently experiencing rapid growth and land use change. If land use change results in the presence of more point source dischargers and permitted facilities, than a traditional TMDL may be a more appropriate tool in the future if water quality standards are not attained by the target date.

TMDL Alternative Restoration Plan goals

The ultimate goal of this Alternative Restoration Plan is to outline a strategy to implement BMPs that will reduce pollution enough to meet water quality standards. The Plan identifies causes of water quality impairments and pollutant sources, estimates the pollution reductions needed to meet water quality standards, and describes the implementation needed to reduce sources of pollution. The plan also estimates the technical and financial assistance needed to support implementation, and develops an education and outreach strategy. An implementation schedule, criteria to measure progress, and an effectiveness monitoring strategy is also included in the ARP, as well as implementation cost estimates. Once the ARP is reviewed and accepted by EPA, category 5 impaired waters on the 3030d list will be changed to category 5-alt waters to recognize that an Alternative Restoration Plan has been developed for the watershed. If water quality standards are not achieved through implementation of this Alternative Restoration Plan, a formal TMDL study may be required for the watershed. Ecology has established important checkpoints and criteria to measure progress to evaluate if progress is being made towards improving water quality. Ecology will adaptively manage this ARP to determine if goals are being achieved, or if a TMDL will be necessary in the future. Alternative Restoration Plans rely on partnerships and collaboration to implement water quality projects. Establishing, maintaining, and leveraging partnerships and increasing public awareness are principal tools to improve water quality.

East Fork Lewis River Partnership

To achieve clean water, Ecology launched the EFLR Partnership in May 2018 to work collaboratively with local, state, federal, and tribal governments, non-profits, and private landowners to develop and implement the *East Fork Lewis River Alternative Restoration Plan.* Since the Partnership kicked off, over 50 different partners from 30 different organizations have engaged in EFLR Partnership activities, including private landowners. These activities have included multiple EFLR Partnership meetings, smaller bacteria and temperature workgroups, and a targeted meeting to discuss private landowner technical assistance needs in Clark County. Multiple Pollution Identification and Correction (PIC) program meetings have also been coordinated to develop a new program to find and fix sources of agricultural and septic system pollution and to support on-the-ground implementation. Ecology also hosted a grant project workshop to educate organizations on how to access grant funding for implementation. A water quality public town hall was also hosted to educate landowners on what they can do to restore clean water. In August 2020, Ecology hosted a public webinar to present the draft Alternative Restoration Plan. Ecology accepted public comments through September 2020 and published a Response to Comments Memo. Final comments were incorporated into the plan. Ecology has also worked with the Environmental Protection Agency (EPA) to incorporate EPA considerations into the final ARP.

EFLR Partnership implementation

Multiple new projects and programs are being developed and implemented in the watershed through the EFLR Partnership. All of these programs are in alignment with water quality and

salmon recovery goals. Priorities for long-term implementation in the EFLR watershed include addressing water quality impacts from septic systems, stormwater, and agriculture, and increasing riparian and streamflow restoration in the watershed. All information and meeting materials are available on the EFLR Partnership website. Multiple local, regional, state, and federal governments, tribes, nonprofits, and private landowners have been engaged in the EFLR Partnership. Many Ecology staff have also provided technical assistance and resources to support water quality improvement in the watershed. The EFLR is not only a priority for water quality recovery, but also for salmon recovery. EFLR stakeholders are summarized in Table 2.

Table 2. Tribes and stakeholders in the EFLR watershed.

Organization	Tribes and stakeholders
Tribal	Cowlitz Indian Tribe
Local and Regional	Clark County Public Works, Clark County Community Development, Clark County Public Health, City of La Center, City of Battle Ground, Yacolt, Clark Public Utilities, City of Vancouver, La Center Schools, Clark Conservation District, Clark Regional Wastewater District, Lower Columbia Fish Recovery Board, Southwest Washington Regional Transportation Council, and Lower Columbia Fish Enhancement Group.
State	Washington Department of Fish and Wildlife, Washington Department of Natural Resources, Washington Department of Transportation, Washington Department of Ecology, Washington State Conservation Commission, and Washington State University Clark County Extension
Federal	US Fish and Wildlife Service, US Forest Service, and US Department of Agriculture Natural Resources Conservation Service, USDA Farm Service Agency, Bonneville Power Administration, United States Environmental Protection Agency, NOAA Marine Fisheries Service.
Nonprofit	Lower Columbia Estuary Partnership, Columbia Land Trust, Watershed, Alliance of Southwest Washington, Friends of the East Fork, Friends of Clark County, Salmon Creek Fly Fishers, Clark-Skamania Fly Fishers, Trout Unlimited, Northwest Wild Fish Rescue, and the East Fork Community Coalition.
Private	Wapato Valley Mitigation and Conservation Bank, PC Trask & Associates, Interfluve, and Bonneville Power Administration.

East Fork Lewis River Source Assessment

To support development of this *Alternative Restoration Plan*, Ecology published an initial *Source Assessment Report.* The *East Fork Lewis River Watershed Bacteria and Temperature Source Assessment Report* was completed by the Department of Ecology in May 2018. This report analyzed water quality data (bacteria and temperature) from 2005-2006 and 2017 to develop general recommendations to improve water quality, achieve WQS, and support beneficial uses in the watershed. The completion of the *Source Assessment* characterized the watershed by gathering and analyzing data to create a watershed inventory, identifying issues of concern, estimating pollutant reductions needed to meet WQS, and identifying critical areas to implement water quality improvement projects. Water quality assessment completed by Department of Ecology and Clark County Clean Water Division enabled the development of this *Source Assessment.* This *Source Assessment* serves as the technical foundation for the East Fork *Lewis River Alternative Restoration Plan*. Together, *the Source Assessment* and the *Alternative*

Restoration Plan fulfill EPA's considerations for two different federal programs required by the Clean Water Act. This includes EPA's 319 requirements for watershed plans and considerations for Alternative Restoration Plans.

Function of Alternative Restoration Plan

Achieving EPA's considerations for ARPs

In 2015, the EPA shared a memo with states describing the information that Alternative Restoration Plans should include. According to EPA, "An alternative restoration approach is a near-term plan, or description of actions, with a schedule and milestones, that is more immediately beneficial or practicable to achieving water quality standards." Expectations for Alternative Restoration Plans are similar to, but not the same as, the Nine Minimum Elements of Watershed Planning required by the Section 319 program. Listed below are the components EPA looks for when reviewing Source Assessments Alternative Restoration Plans.

1. **Identification:** Identification of specific impaired water segments or waters addressed by the alternative restoration approach, and identification of all sources contributing to the impairment.
2. **Analysis:** Analysis to support why the State believes that the implementation of the alternative restoration approach is expected to achieve WQS
3. **Action plan or implementation plan**: An Action Plan or Implementation Plan to document the actions to address all sources of pollution and a schedule with clear milestones and dates, which includes interim milestones and target dates with clear deliverables.
4. **Available funding opportunities:** Identification of available funding opportunities to implement the alternative restoration plan.
5. **Identification of stakeholder and partners**: Identification of all parties committed, and additional parties needed
6. **Estimate of when WQS will be achieved**: An estimate or projection of the time when WQS will be met.
7. **Monitoring plan to evaluate effectiveness:** Plans for effectiveness monitoring to demonstrate progress made toward achieving WQS, including an adaptive management and evaluation process.
8. **Commitment to evaluate plan:** Commitment to periodically evaluate the alternative restoration approach to determine if it is on track to be more immediately beneficial or practicable in achieving WQS than pursuing the TMDL approach.

This *East Fork Lewis River Alternative Restoration Plan* has been submitted to EPA for review and acceptance, to verify that this Plan aligns with EPA's considerations for Alternative Restoration Plans. The *East Fork Lewis River Alternative Restoration Plan* is the first Alternative Restoration Plan submitted by Washington State, and the first plan submitted in EPA's Region 10 in the Pacific Northwest, which includes Alaska, Idaho, Washington, Oregon, and 271 Tribal Nations.

Achieving EPA's nine minimum elements for Section 319 watershed plans

The East Fork Lewis River Alternative Restoration Plans also serve the dual function of achieving EPA's nine minimum elements for successful watershed plans. These plans are required for projects that are developed and implemented with Section 319 funding. These plans inform planning, implementation, and funding decisions at the watershed level. Listed below are the nine minimum elements of watershed planning. The nine minimum elements are similar to, but not the same as, EPA's considerations for ARPs.

1. Identify causes of impairment and pollutant sources.
2. Estimate load reductions needed.
3. Describe nonpoint source implementation to achieve load reductions.
4. Estimate technical and financial assistance needed.
5. Develop information and education component.
6. Develop implementation schedule.
7. Develop milestones and targets.
8. Develop criteria to measure progress.
9. Monitor to evaluate effectiveness of implementation efforts.

Table 3. Achieving EPA's nine minimum elements through the EFLR Alternative Restoration Plan.

Element	Watershed Planning Step	EFLR Planning and Implementation Tool
1	Identify causes of impairment and pollutant sources.	East Fork Lewis River Source Assessment, Alternative Restoration Plan
2	Estimate load reductions needed.	East Fork Lewis River Source Assessment
3	Describe NPS implementation to achieve load reductions.	Alternative Restoration Plan
4	Estimate technical and financial assistance needed.	Alternative Restoration Plan
5	Develop information and education component.	Alternative Restoration Plan
6	Develop implementation schedule.	Alternative Restoration Plan
7	Develop milestones and targets.	Alternative Restoration Plan
8	Develop criteria to measure progress.	Alternative Restoration Plan
9	Monitor to evaluate effectiveness of implementation efforts.	Alternative Restoration Plan

Ecology's regulatory authority: Water Pollution Control Act (RCW 90.48)

Two primary statutes protect the quality of Washington's waters. These include the Federal Clean Water Act and the State Water Pollution Control Act (RCW 90.48), both implemented by the Department of Ecology. The State Water Pollution Control Act makes it unlawful for any person to, "cause, permit or suffer to be thrown, run, drained, allowed to seep or otherwise discharged any organic or inorganic matter that shall cause or tend to cause pollution of waters of the state" (RCW 90.48.080). Any person who violates or creates a substantial potential to violate any part of the Water Pollution Control Act, is subject to an enforcement order from Ecology pursuant to RCW 90.48.120. More information on Washington State's Regulatory Framework can be found in Chapter Two of Washington's Water Quality Management Plan to Control Nonpoint Sources of Pollution.

Ecology also has regulatory authority through the Forest Practices Act RCW 76.09 and WAC 222 to implement and enforce Forest Practices Rules and the Timber, Fish, and Wildlife agreement. Instream flow rules established through WAC 173-527 provide regulatory authority for enforcement related to water consumption and instream flows in the watershed. Authority through the Shorelands and Environmental Assistance program, which implements critical areas ordinances, shoreline management, and wetlands regulations, is also enforceable.

Table 4 outlines Washington State Department of Ecology's regulatory authority related to protecting water quality.

Table 4. Washington State Department of Ecology's regulatory authority.

Program	Action
Water Pollution Control Act	Enforce the Water Pollution Control Act (Ch. 90.48 RCW).
Nonpoint Source	Environmental Complaint Response for NPSs, including non-dairy agriculture complaints. Pursue enforcement action when necessary.
Municipal Permits	Develop and issue National Pollution Discharge Elimination System (NPDES) permits. Conduct inspections of stormwater sites and other permitted facilities. This includes the Municipal Stormwater Phase I and Phase II, Construction Stormwater, Sand and Gravel, and Industrial Stormwater General Permit.
Wastewater Treatment Plant Permits	Develop and issue Wastewater Treatment Plan Permits. Conduct inspections and oversee compliance with Wastewater Treatment Plant Permits.
Forestry	Oversee implementation of the Forest and Fish Program.
303(d)	Develop and issue Water Quality Assessment (305b) and publish the Impaired Waters (303d) list. Develop and Implement Alternative Restoration Plan (Alternative Restoration Plan) and TMDLs.
Combined Water Quality Funding	Provide funding opportunities through its competitive water quality grants and loan funding cycle, to projects addressing the objectives and BMPs identified in this Alternative Restoration Plan.

Technical and financial assistance

While many stakeholders in the EFLR are implementing good management practices to protect water quality and pose no threat to Washington State waters, others are affecting State waters. Ecology's goal is to work with stakeholders to achieve voluntary compliance with state law and WQS. This is often achieved through technical and financial assistance that promotes voluntary implementation of Best Management Practices (BMPs) necessary to protect water quality. Ecology invests heavily in technical and financial assistance and provides multiple opportunities and pathways for stakeholders to proactively address pollution problems before enforcement is pursued. Ecology uses regulatory authority as a backstop when technical and financial assistance efforts fail to address identified pollution problems.

Engaging private landowners for implementation

To improve water quality and achieve the goals of this *Alternative Restoration Plan*, landowners with a direct impact to surface water quality must implement BMPs on their property to reduce pollution. Priority stakeholders for targeted outreach and implementation include homeowners with septic systems, landowners with livestock and agriculture, streamside property owners with low riparian vegetation or shade, and landowners having impacts to streamflow. It is the goal of all participants in the water cleanup process to achieve clean water through cooperative efforts. Ecology believes that the actions outlined in this ARP will result in the attainment of water quality standards. If WQS are not achieved through implementation of this *Alternative Restoration Plan*, a traditional TMDL study may be required in the EFLR.

Chapter 2 – Water Quality Impairments and Pollutant Sources

Watershed summary

The *East Fork Lewis River Source Assessment* analyzed water quality data collected along 32.3 River Miles (RM) of the EFLR mainstem and tributaries. To support on-the-ground implementation and planning, the *Source Assessment* divided the EFLR into three sections to summarize water quality information. The three sections of the EFLR are the lower (RM 0 – 5.7), middle (RM 5.7 – 20.3), and upper (RM 20 - 32.3) watersheds. These three sections have different land uses, land cover, jurisdictions, permits, and different water quality monitoring stations.

Upper watershed

The Upper EFLR Watershed extends from RM 20 to RM 32.3, where the watershed crosses the boundary of Gifford Pinchot National Forest. A mix of public and private forestlands dominate the upper watershed, where active timber management and forest practices are implemented. Some residential and commercial development is present. The primary jurisdictions include the Town of Yacolt, unincorporated Clark County, Department of Natural Resources, and Gifford Pinchot National Forest. Significant tributaries in the upper watershed include King, Yacolt, Big Tree Creeks, and Rock Creek South.

Middle watershed

The Middle EFLR Watershed extends from RM 5.7 – 20.3. The land use is forest dominated and there are mixed agricultural, residential, and commercial land uses. The middle watershed has multiple parks including Lewisville and Daybreak Regional Parks, which are a part of the Clark County Legacy Lands Program. The primary jurisdictions include the City of Battle Ground, and unincorporated Clark County. Washington State Department of Transportation's (WSDOT) Highway 503 also bisects this portion of the watershed. There is some industrial development in the middle watershed, including sand and gravel mining operations. Significant tributaries in the middle water include Mason, Manley, Dean, Lockwood, Riley Creeks, and Rock Creek North.

Lower watershed

The Lower EFLR Watershed begins at the river's confluence with the North Fork Lewis River, just west of Paradise Point State Park and the Interstate 5 (I-5) Bridge. The lower watershed extends to RM 5.7, just east of the City of La Center. The land use is mixed, with some forestland, and significantly more commercial, residential, and agricultural land uses compared to the middle and upper watersheds. Although there is more development and urbanization in the lower watershed, there is significant riparian connectivity and public access due to the Clark County Legacy Lands Program, Paradise Point State Park, and City of La Center parks. The primary jurisdictions include the City of La Center, City of Ridgefield, and unincorporated Clark County. A portion of WSDOT's I-5 corridor also passes through the lower watershed. Significant tributaries include Brezee, Jenny, and McCormick Creeks.

Land use change assessment

In 2019, the Lower Columbia Fish Recovery Board (LCFRB) contracted with the consulting firm PC Trask and Associates to complete an extensive land use and land cover assessment of the EFLR to complete the *Lower Columbia Salmon Recovery Plan Partner Program Implementation Review: East Fork Lewis River Habitat Pilot Study (East Fork Lewis River Habitat Pilot Study)*. This assessment quantifies land use change and population growth in the EFLR since the early 2000s. According to the study, human population in the EFLR watershed has increased by approximately 47 percent between 2000 and 2018, from 24,159 to 35,593 residents. The City of Ridgefield has experienced the most significant population increase at 259 percent, followed by 124 percent growth in Battle Ground, 101 percent in La Center, and 69 percent in Yacolt.

With increased population, there has also been an increase in developed land cover. According to the National Land Cover Database (NLCD), around 500 acres of developed land cover was added to the EFLR watershed between 2001 and 2016. In 2001, there were 18,223 acres of development, and by 2016, the watershed had 18,731 acres of developed land cover. With increased development, the total acres of impervious land cover have also increased in the watershed. Between 2004 and 2018, Urban Growth Boundaries have increased by 160 percent in La Center, 84 percent in Battle Ground, 83 percent in Ridgefield, and 37 percent in Yacolt.

Research shows that watersheds with less than 10 percent impervious land cover are associated with better watershed health. According to the NLCD, in 2016 there were 12,585 acres of land with impervious surfaces at densities greater than 10 percent. In total, the watershed added 416 acres of impervious surfaces greater than 10 percent since 2001, resulting in an 8 percent total impervious surface level for the whole watershed.

Table 5. Summary of land use statistics in the EFLR watershed.

Category	Statistics
Population Change	47 percent increase in population in watershed between 2000 and 2018. Between 2000 and 2018, population has increased by 259% in Ridgefield, 124% in Battle Ground, 101% in La Center, 69% in Yacolt, and 34% in unincorporated Clark County.
Urban Growth Boundary	Between 2004 and 2018, Urban Growth Boundaries have increased by 160% in La Center, 84% in Battle Ground, 83% in Ridgefield and 37% in Yacolt.
Critical Areas Impacted	9,956 building footprints are located in 364 acres of critical areas.
Shoreline Areas Impacted	787 building footprints are located in 26 acres of shoreline areas
Septic System Permits	8,249 tax lots with septic system permits in 2018.
Wetlands	11,135 acres.
Forestlands	74,305 acres in 2016.
Harvested Forest	27,452 acres permitted for harvest from 2004 to 2018.
Developed Landcover	18,731 acres, of which 12,585 acres have impervious surface densities greater than 10% in 2016.
Non-Impervious Surfaces	132,366 acres in 2016.

Source: LCFRB and PC Trask & Associates, 2020.

Development patterns in the watershed can also be measured using building footprints and septic system records. Clark County building footprint data indicates that there are 9,956 building footprints in the EFLR watershed located in 364 acres of critical areas. Additionally, 787 building footprints are located within 26 acres of shoreline management areas. In 2018, there were 8,249 tax lots in the EFLR watershed with septic system permits. Commercial and multi-family residential land uses have increased in the watershed, while single-family residential, industrial, and agricultural lands have decreased.

Table 6. Land use changes in the EFLR watershed from 2004 to 2018.

Zone	Acres (2004)	Acres (2018)	Percent Change
Single-Family Residential	41,353	40,563	-2%
Multi-Family Residential	272	764	+181%
Commercial	621	1,075	+73%
Industrial	814	735	-10%
Agricultural	16,339	14,827	-9%

Source: PC Trask & Associates, 2020

From a natural resource perspective, the EFLR watershed had 82,787 acres of forestland in 2001, and 74,305 acres of forestland in 2016, indicating a loss of 8,482 acres of forested land cover. Between 2004 and 2018, the Washington Department of Natural Resources permitted approximately 27,452 acres of private and public forestlands for harvest. Although there has been an overall loss of forested land cover, it may not all be a permanent loss. The Washington State Forest Practices Rules require reforestation of harvested timberlands.

While the watershed has seen rapid growth, development, and land use change, there were 132,366 acres of non-impervious surfaces in the watershed as of 2016. Today, Clark County currently owns over 2,000 acres of public land in the EFLR watershed, and an additional 9,000 acres have been targeted for acquisition and preservation through the County's Legacy Lands program. A significant portion of this land is located in important forestlands, riparian, and shoreline management areas. Clark County's wetlands inventory documents 11,135 acres of wetlands in the EFLR watershed. Various project sponsors have implemented restoration projects in the watershed to protect, restore, and enhance natural resources to benefit water quality and salmon recovery. Much of this restoration work has been focused in the lower watershed, which is a priority for long-term implementation.

Water quality standards

The EFLR supports recreational uses and core summer habitat for aquatic life. The temperature water quality standard to protect aquatic life uses in the EFLR is 16° Celsius (C). Portions of the river have supplemental spawning and incubation criteria of 13° C from February 15 to June 15. The watershed also supports recreational uses, which includes swimming, wading, fishing, and other contact activities. In 2019, Ecology adopted an *E. coli* recreational water quality standard to protect public health and support primary recreational contact in Washington's waterways. Water quality criteria applicable in the EFLR watershed are shown in table 7.

Table 7. Water quality standards in the EFLR.

Beneficial Use	Parameter	Water Quality Standard
Core Summer Habitat, Aquatic Life	Temperature	16.0°C (60.8°F) 7-DADMax Supplemental spawning and incubation criteria of 13º C from February 15 to June 15
Primary Contact, Recreation	Bacteria (*E. coli*)	Geometric Mean: 100 cfu/100 ml 90th Percentile: 10% samples not to exceed 320 cfu/100 ml cfu = colony forming units

New *E. coli* bacteria standards for recreation.

The *East Fork Lewis River Source Assessment* identified bacteria impairments in the watershed using Fecal Coliform as an indicator for bacteria pollution. In January 2019, Ecology revised Surface WQS and adopted *E. coli* as the new freshwater indicator for bacteria and recreational uses. Generally, *E. coli* is a better indicator for assessing risks to public health. After December 2020, all water quality assessment completed in Washington State will be required to utilize *E. coli* as the primary indicator to demonstrate impairment or attainment of bacteria WQS for recreational use. It is possible that current listings outlined in this *Alternative Restoration Plan* and the *Source Assessment* may change due to new assessment methodologies and adoption of the new bacteria standard for recreation. To support this transition, all future bacteria monitoring should utilize *E. coli* as the primary indicator for water quality assessment. Ecology

collected *E. coli* data to support this new standard in 2020. Results from the assessment are reported in the *East Fork Lewis River Watershed Bacteria Monitoring and Nonpoint Source Identification* report.

Source Assessment results

Temperature

No temperature monitoring sites in the EFLR met the temperature water quality standard in 2005-2006. Overall, water temperatures increase downstream from the upper watershed, to the lower watershed. The warmest water temperatures were measured in the middle and lower watershed. Warm water temperatures are associated with loss of riparian vegetation and high shade deficits. A shade deficit analysis identified priority river miles for riparian forest restoration. Opportunities for riparian restoration are outlined in Chapter 7. Other factors contributing to warm temperatures include climate change, decreased snowmelt, increased water withdrawal, decreased groundwater recharge, and increased impervious surfaces. Opportunities to restore vital streamflow and improve stream temperatures are also outlined in Chapter 8. The following tables summarize temperature priorities and temperature reductions needed to meet water quality standards. Results of a shade deficit analysis are also summarized. More detail related to BMPs to improve water temperatures is included in Chapters 7 and 8 of this plan. Overall, the middle and lower watershed are the highest priority for temperature reduction. More information can be obtained by reviewing the *East Fork Lewis River Source Assessment*.

Table 8. Temperature priorities in the EFLR.

Temperature priorities
• All monitoring sites on the EFLR exceeded temperature criteria. • The lower and middle watershed are priorities for addressing warm water temperatures. • Warmest temperature measured was 26.1 degrees Celsius at Dean Creek. • Largest average shade deficit is 35 percent in the middle watershed. • River miles with shade deficit over 40 percent are located between river miles 9 and 13. • Streamflow priorities are located from river miles 4.6 to 8, 10.1 to 13.2 and 26.9 to 29.

Table 9. Temperature reductions needed in East Fork Lewis River watershed.

Monitoring location	7-DADMax	Temperature Reduction Needed to achieve 16 degrees	Location in watershed (Lower, middle, upper
East Fork Lewis River mainstem RM 29	17.2	1.2 degrees	Upper watershed
King Creek RM 0	17	1 degree	Upper watershed
East Fork Lewis River mainstem RM 26.9	18.4	2.4 degrees	Upper watershed
Rock Creek South RM3.9	17.4	1.4 degrees	Upper watershed
East Fork Lewis River mainstem RM 24.6	19	3 degrees	Upper watershed
Big Tree Creek RM 0	17.6	1.6 degrees	Upper watershed
East Fork Lewis River mainstem RM 20.3	20	4 degrees	Upper watershed
Rock Creek North RM 5	20.9	4.9 degrees	Middle watershed
Rock Creek North RM 0.6	23.4	7.4 degrees	Middle watershed
East Fork Lewis River mainstem RM 14.7	22.7	6.7 degrees	Middle watershed
East Fork Lewis River mainstem RM 13.2	23.2	7.2 degrees	Middle watershed
East Fork Lewis River mainstem RM 10.1	23.4	7.4 degrees	Middle watershed
Manley Creek	21.9	5.9 degrees	Middle watershed
East Fork Lewis River mainstem RM 8.1	23.5	7.5 degrees	Middle watershed
Dean Creek RM 0.8	23	7 degrees	Middle watershed
Dean Creek RM 0	26.1	10.1 degrees	Middle watershed
East Fork Lewis River mainstem RM 7.3	23.3	7.3 degrees	Middle watershed
Mason Creek RM 0.8	18.1	2.1 degrees	Middle watershed
Lockwood Creek RM 0	22.4	6.4 degrees	Middle watershed
Brezee Creek	19.5	3.5 degrees	Lower watershed
Brezee Creek RM 0.1	19.5	3.5 degrees	Lower watershed
Jenny Creek RM 0.3	20	4 degrees	Lower watershed

Table 10. Summary of average shade deficits in East Fork Lewis River watershed.

River Mile	Average Potential Shade (%)	Average Effective Shade (%)	Average Shade Deficit (%)
1-2	24	13	9
2-3	32	7	25
3-4	39	9	28
4-5	37	3	34
5-6	42	8	36
6-7	47	15	31
7-8	42	5	36
8-9	42	12	30
9-10	54	15	40
10-11	65	21	40
11-12	55	13	45
12-13	67	16	49
13-14	72	39	37
14-15	70	43	29
15-16	69	40	25
16-17	71	36	38
17-18	71	41	28
18-19	74	46	27
19-20	80	47	34
20-21	73	40	32
21-22	69	36	34
22-23	73	50	25
23-24	82	59	22
24-25	78	54	25
25-26	82	62	21
26-27	82	52	27
27-28	87	55	34
28-29	85	59	26
29-30	87	57	30
30-31	89	61	30
31-32	91	72	21
32-33	94	80	13

Bacteria

The highest bacteria concentrations measured in the EFLR watershed are in the lower watershed, specifically in McCormick and Brezee Creeks. Brezee and McCormick Creeks are top priorities for bacteria reduction based on high bacteria concentrations in the wet and dry seasons. These subwatersheds also have the highest recommended load reductions needed to achieve bacteria WQS. Brezee and McCormick Creeks need estimated bacteria reductions of up to 86 to 96 percent to achieve WQS. The following tables summarize bacteria priorities and reductions needed in the watershed. More information is included in chapters 4 through 6 of this plan.

Table 11. Bacteria priorities in the EFLR.

Bacteria priorities

• Lower and middle watershed are priorities for bacteria reduction.
• Priority 1 is addressing bacteria in Brezee and McCormick Creeks.
• Priority 2 is addressing bacteria in Jenny, Rock Creek North, Riley Creek, and Lockwood Creek
• Priority 3 is addressing bacteria in Mason and Yacolt Creeks.
• Bacteria Reductions needed
  • Wet Season
  • 91-96% McCormick Creek Sites
  • 90-91% Brezee Creek Sites
  • 57% Rock Creek North
  • Dry Season
  ▪ 86-87% Brezee Creek Sites
  ▪ 86% McCormick Creek
  ▪ 83% Lockwood Creek
  ▪ 60% Mason Creek
  ▪ 52% Jenny Creek
  ▪ 51% Riley Creek

Table 12. Wet season bacteria reductions needed in watershed.

Monitoring Site	**Fecal Coliform Reduction Needed in Wet Season**	**Location in watershed (Lower, middle, upper)**
McCormick Creek RM 3.4	96%	Lower Watershed
Brezee Creek Stormwater Outfall 2	91%	Lower Watershed
Brezee Creek Stormwater Outfall 1	90%	Lower Watershed
McCormick Creek RM 2	81%	Lower Watershed
Rock Creek North RM 0.65	57%	Middle Watershed
Mason Creek RM 1.23	16%	Middle Watershed
East Fork Lewis River Mainstem RM 3.15	21%	Lower Watershed
Yacolt Creek RM 0.9	5%	Upper Watershed

Table 13. Dry season bacteria reductions needed in watershed.

Monitoring Site	Fecal Coliform Reduction Needed in Dry Season	Location in watershed (Lower, middle, upper)
Brezee Creek RM 0.5	87%	Lower Watershed
Brezee Creek at 14th Street	86%	Lower Watershed
Brezee Creek RM 0.007	86%	Lower Watershed
McCormick Creek RM 1.18	86%	Lower Watershed
Lockwood Creek RM 3.15	83%	Middle Watershed
Mason Creek RM 0.25	60%	Middle Watershed
Jenny Creek RM 0.35	52%	Lower Watershed
Riley Creek RM 0.95	51%	Middle Watershed
Rock Creek North RM 2.8	44%	Middle Watershed
Lockwood Creek RM 0.1	25%	Middle Watershed

Table 14. Non-seasonal bacteria reductions needed in watershed.

Monitoring Site	Fecal Coliform Reduction Needed Annually (Non-seasonal)	Location in watershed (Lower, middle, upper)
Mason Creek RM 3.19	38%	Middle Watershed
Mason Creek RM 4.57	36%	Middle Watershed
Lockwood Creek RM 1.25	35%	Middle Watershed
East Fork Lewis River Mainstem RM 0.75	17%	Lower Watershed

Other important creeks for bacteria reduction include Jenny, Riley, Lockwood, Mason, Rock Creek North, and Yacolt Creeks. In total, there are 257 priority river miles for water quality improvement due to bacteria impairments. On these priority tributaries there are an estimated 3,138 parcels within 100 feet of water that should be targeted for outreach, investigation, and implementation of BMPs. Some potential sources of bacteria pollution include poorly functioning septic systems, agriculture and farming practices that do not control contaminated runoff, direct livestock access, wildlife, and dogs. More information on BMPs to improve bacteria conditions are outlined in chapters 4, 5, and 6 of this plan.

Additional water quality information and details are available in *the East Fork Lewis River Watershed Bacteria and Temperature Source Assessment*.

Table 15. Priority river miles for addressing bacteria pollution.

Subwatershed	Miles of River	Estimated number of Parcels within 100 feet of water
Brezee Creek	18	262
McCormick Creek	22.4	283
Jenny Creek	27.3	289
Riley and Lockwood Creek	51.6	580
Rock Creek North	61.5	805
Mason Creek	51	614
Yacolt Creek	25.5	305
TOTAL	~257 miles	3,138 parcels

Other publications supporting this *East Fork Lewis River Alternative Restoration Plan* are listed below. All of these publications are available online and are referenced throughout this plan.

- East Fork Lewis River Watershed Bacteria Monitoring and Nonpoint Source Identification
- Quality Assurance Project Plan Monitoring Fecal Coliform Bacteria in Western Washington Water Bodies Appendix B3: Southwest Regional Office Sampling Site for 2019 and 2020
- East Fork Lewis River Bacteria and Temperature Source Assessment Report
- Quality Assurance Project Plan East Fork Lewis River Fecal Coliform Bacteria and Temperature Source Assessment
- Quality Assurance Project Plan East Fork Lewis River Temperature and Fecal Coliform Bacteria Total Maximum Daily Load Study
- Streamflow Summary for Gaging Stations on the East Fork Lewis River, 2005-06
- Surface Water/Groundwater Exchange Along the East Fork Lewis River (Clark County), 2005

Meeting water quality standards and delisting

The goal of this Alternative Restoration Plan is to identify strategies and BMPs to improve water quality of category 5 impaired waters on Washington State's impaired waters list (303d list). With the development of this ARP, all category 5 listings in the East Fork Lewis River will be changed to a new 'category 5-alt' listing in Washington State's Water Quality Assessment and in the Environmental Protection Agency's ATTAINS (Assessment, Total Maximum Daily load (TMDL) Tracking and Implementation systems) database. This new listing indicates that an Alternative Restoration Plan has been developed by Ecology and accepted by EPA, and that there is a plan in place to improve water quality in the watershed. Ecology believes that implementing the actions outlined in this ARP will result in the achievement of bacteria and temperature water quality standards. Effectiveness monitoring will be the primary tool used to assess progress towards meeting water quality standards. Temperature monitoring and *E. coli* monitoring are the main parameters that will be used to evaluate progress.

Ecology's goal is to address 100 percent of agricultural challenges in priority watersheds by 2033 through technical and financial assistance, and 100 percent of the noncompliant septic systems in the watershed by 2035 through septic system inspections, maintenance, and repair. The goal is to implement riparian restoration on 100 percent of the mainstem and tributaries by 2035, with the goal to achieve system potential tree height by 2055 to 2065. Additionally, Ecology will work with stormwater permittees to implement necessary stormwater activities by 2030, with the plan to implement stormwater BMPs on 10 percent of the total impervious surfaces in the watershed by 2065. More information on these activities are outlined in Chapter 5 through 8 of this plan. Cost estimates are detailed in Chapter 10, and criteria to measure progress is included in Chapter 11.

Once all of the agricultural and septic activities are completed between 2033 and 2035, Ecology will use annual reporting and effectiveness monitoring information to determine if bacteria standards are being met, and to reevaluate if a traditional TMDL is needed in the watershed for bacteria. In 2055, Ecology will reassess if temperature water quality standards are being met, and determine if a traditional TMDL is needed for temperature. Land use and landcover information will also be considered during this determination to understand how land use change may have resulted in changes in pollution sources. Ecology will also consider if new permits have been issued in the watershed when deciding if a traditional TMDL is necessary.

If water quality standards are not achieved through implementation actions outlined in this ARP, than a formal TMDL will be required in the watershed to comply with the Clean Water Act. The timeline for making this determination will be different for bacteria and temperature impairments. There is greater potential to address bacteria pollution in the near-term through the new Poop Smart Clark Pollution Identification and Correction Program and through stormwater activities being implemented in Brezee Creek by the City of La Center. However, improving temperatures in the watershed will require a much longer-term investment. When WQS are met, the Department of Ecology will delist 'category 5-alt' waters in accordance with Ecology's Policy 1-11. Effectiveness monitoring using temperature and *E. coli* will be the main tool to support delisting. The following table summarizes the Assessment Unit ID's that will be addressed by this ARP.

Category 5 waterbodies addressed in ARP

Table 16. Waterbody assessment unit IDs addressed in EFLR ARP.

Listing ID (Link)	Assessment Unit ID	Waterbody Name	Pollutant
21996	17080002000314	Brezee Creek	Temperature
48646	17080002000055	Rock Creek	Temperature
72861	17080002000823	Manley Creek	Temperature
7822	17080002000341	McCormick Creek	Bacteria
48639	17080002000334	King Creek	Temperature
46204	17080002000362	Rock Creek	Bacteria
45556	17080002000742	Riley Creek	Bacteria
48662	17080002000793	Dean Creek	Temperature
48659	17080002000362	Rock Creek	Temperature
48679	17080002000063	E.F. Lewis River	Temperature
7819	17080002000336	Lockwood Creek	Bacteria
48678	17080002000060	E.F. Lewis River	Temperature
7815	17080002000027	E.F. Lewis River	Bacteria
46264	17080002000342	McCormick Creek	Bacteria
45557	17080002000728	Jenny Creek	Bacteria
48670	17080002000025	E.F. Lewis River	Temperature
48664	17080002000075	Mason Creek	Temperature
37821	17080002000321	Copper Creek	Temperature
48647	17080002000309	Big Tree Creek	Temperature
48675	17080002000042	E.F. Lewis River	Temperature
45605	17080002004027	Unnamed Creek	Bacteria
48668	17080002000728	Jenny Creek	Temperature
6588	17080002000040	E.F. Lewis River	Temperature
48672	17080002000038	E.F. Lewis River	Temperature
48671	17080002000029	E.F. Lewis River	Temperature
46205	17080002000076	Mason Creek	Bacteria
72859	17080002012742	Unnamed Creek	Temperature
46224	17080002000338	Lockwood Creek	Bacteria
48677	17080002000059	E.F. Lewis River	Temperature
37824	17080002005610	E.F. Lewis River	Temperature
7826	17080002000797	Yacolt Creek	Bacteria
7820	17080002000336	Lockwood Creek	Temperature
48926	17080002000032	E.F. Lewis River	Temperature
37831	17080002000067	E.F. Lewis River	Temperature
45311	17080002000751	Brezee Creek	Bacteria
7825	17080002000055	Rock Creek	Bacteria
48676	17080002000048	E.F. Lewis River	Temperature
21999	17080002000363	Rock Creek	Temperature

Chapter 3 – Implementation Priorities

To achieve clean water in the EFLR, there are five implementation priorities. These include addressing water quality impacts from septic systems, agriculture, and stormwater, and increasing riparian restoration, and streamflow restoration in the watershed. Addressing nonpoint source impacts from septic systems, agriculture, and stormwater will help ensure waterbodies are incompliance with bacteria water quality standards. Efforts to increase riparian restoration and streamflow restoration will help make progress towards achieving temperature water quality standards. If water quality standards are not achieved through implementation actions outlined in this Alternative Restoration Plan, a traditional TMDL will required for the watershed. Ecology's goal is to achieve bacteria water quality standards by 2035, and temperature water quality standards by 2055. The following is a summary of pollution sources in the watershed.

Pollution sources

Septic systems

The first priority implementation area is to address and eliminate the water quality impacts from septic systems. To make progress on improving septic systems, additional outreach to septic system owners is needed to increase septic system inspections, maintenance, repair, and replacement; and to promote sewer connection where feasible. While septic system inspections are required in Washington State, there are opportunities to increase enforcement of septic system inspections and maintenance in Clark County. Increased enforcement for inspections and maintenance would help increase inspection frequency, and provide information on the location, condition, and criticality of septic systems in the EFLR watershed. This would also help connect financial assistance resources to homeowner in need of septic repair or replacement. One opportunity is to develop and implement a new septic system inspection and maintenance rebate program to provide financial assistance for septic inspections and maintenance, and help increase septic inspection rates in Clark County. Pollution identification and correction programs provide a framework to identify priority areas that need septic system assistance.

Agriculture

Eliminating water quality impacts from agriculture is also a priority in the watershed. Efforts to increase outreach, NPS investigation, and complete site visits to agricultural properties are necessary. Conservation planning to identify the BMPs needed to improve water quality is also needed, as well as additional technical assistance targeted towards water quality improvement. Financial assistance for agricultural landowners to implement water quality BMPs can help address temperature and bacteria challenges in the watershed.

Stormwater

Stormwater management is also a priority in the EFLR, especially in the lower watershed. The second highest bacteria concentrations entering the watershed are from a stormwater outfall in Brezee Creek, which drains a significant portion of the City of La Center's urban area. Efforts

to complete stormwater source tracing, illicit discharge detection and elimination, and bacteria source control are needed in the watershed. Some progress has been made to eliminate illicit cross connections in La Center's stormwater drainage, but more work is needed. Comprehensive stormwater planning and adoption of the Stormwater Management Manual for Western Washington for development standards and operations can also help support long-term water quality protection in the EFLR, specifically in Brezee Creek in City of La Center's jurisdiction, and in McCormick Creek in the City of Ridgefield's jurisdiction.

Riparian and streamflow restoration

The final clean water priorities for the EFLR are increasing riparian restoration and streamflow restoration. Currently, there are over 2,000 acres of publicly owned land in the EFLR due to Clark County's Legacy Lands Program and Columbia Land Trust's conservation and preservation efforts. Additional acreage has been targeted for acquisition. Efforts to implement projects that increase riparian tree canopy and restore streamflow are needed to lower water temperatures. Other cold-water enhancement projects such as wetland restoration, floodplain reconnection, streamflow restoration, cold-water refuge enhancement, and water conservation are also important.

Achieving clean water in the EFLR will require long-term cooperation, coordination, and collaboration across organizations and jurisdictions. While significant progress has been made in the watershed, continued implementation of water quality BMPs is needed to achieve clean water, meet water quality standards, and support beneficial uses for people, fish, and wildlife.

Nonpoint source pollution

Nonpoint source pollution is the primary source of water quality impairment in the East Fork Lewis River watershed causing increased bacteria levels and warm water temperatures. The priority subwatersheds for pollution reduction are Brezee, Jenny, and McCormick Creeks and Rock Creek North. These subwatersheds are not meeting water quality standards for bacteria and have the most significant water quality exceedances. All of these subwatersheds had significant bacteria exceedances measured in 2005-2006 and in 2017.

In addition to not meeting bacteria standards, increasing riparian restoration in the East Fork Lewis River tributaries will help make progress towards reducing warm water temperatures. There are an estimated 20 to 30 river miles of riparian restoration needed in East Fork Lewis River tributaries. The following is a summary of the expected nonpoint source challenges in each of the priority subwatersheds. More information about priority implementation areas is documented throughout this Plan, specifically in chapters 4 through 8.

Brezee Creek

Brezee Creek is located in the lower East Fork Lewis River watershed, entering the mainstem East Fork Lewis River at approximately river mile 3. Brezee Creek has an estimated 18 miles of tributaries, with approximately 262 parcels located within 100 feet of water. The primary jurisdictions in Brezee Creek are the City of La Center and Clark County. In the *East Fork Lewis*

River Source Assessment, Brezee Creek was identified as a high priority for bacteria reduction. Wet season bacteria reductions of 90-91 percent were recommended for stormwater outfalls in Brezee Creek. Ecology is working closely with the City of La Center in partnership with Clark County to investigate, identify, and eliminate stormwater sources of bacteria pollution in Brezee Creek. Dry season bacteria reductions of 86-87% were recommended at other monitoring sites in the Brezee Creek subwatershed. In 2017, bacteria sampling confirmed annual bacteria exceedances of up to 378 cfu/100 ml with 81 percent of samples exceeding criteria. Additionally, bacteria concentrations of 238 cfu/100ml were measured in the wet season with 63 percent exceeding criteria, and concentrations of 599 cfu/100 ml were measured in the dry season with 100 percent of samples exceeding criteria. Temperatures measured in Brezee Creek were 19.5 degrees Celsius. A temperature reduction of 3.5 degrees is needed to meet the temperature water quality standard of 16 degrees Celsius.

Nonpoint source pollution from stormwater, agriculture, septic systems, and lack of riparian vegetation are the suspected sources of pollution in Brezee Creek. In the Brezee Creek subwatershed, there are an estimated 166 parcels with septic systems. Approximately 67 of these are out of compliance with inspection and maintenance requirements for septic systems, and 50 of the noncompliant systems are located within 200 feet of the stream. Some of these septic systems may be eligible to connect to sewer services provided by the City of La Center.

Furthermore, the subwatershed has 156 parcels with agriculture. An estimated 129 agricultural parcels are located within 200 feet of stream. A 2010 landcover assessment of Brezee Creek estimated that the subwatershed was 16 percent impervious. An estimated 38 percent of the subwatershed is forested. Brezee Creek is experiencing significant urbanization and development; therefore, impervious surfaces have likely increased in the subwatershed.

McCormick Creek

McCormick Creek is located in the lower East Fork Lewis River watershed, entering the mainstem East Fork Lewis River between approximately river miles 2 and 3. McCormick Creek has an estimated 22.4 miles of tributaries, with approximately 283 parcels located within 100 feet of water. The primary jurisdictions in McCormick Creek are the City of Ridgefield and Clark County. In the *East Fork Lewis River Source Assessment*, McCormick Creek was identified as the highest priority for bacteria reduction. Wet season bacteria reductions of 96 percent were recommended for river mile 3.4 of McCormick Creek. In 2017, bacteria sampling confirmed annual bacteria exceedances of 547 cfu/100 ml, wet season exceedances if 663 cfu/100ml, and dry season exceedances of 481 cfu/100 ml with 100 percent of the samples exceeding criteria in all seasons.. Dry season bacteria reductions of 86% were recommended in McCormick Creek. Ecology worked with the City of Ridgefield and the Department of Agriculture to decommission and eliminate a manure lagoon, which was a major source of bacteria impacting this site Temperatures were not measured on McCormick creek, but the mainstem East Fork River at river mile 0.8, which is just downstream of the confluence with McCormick Creek, was 23 degrees Celsius. A temperature reduction of 7 degrees is needed to meet the temperature water quality standards.

Nonpoint source pollution from agriculture, septic systems, stormwater, and lack of riparian vegetation are the suspected sources in McCormick Creek. In the full subwatershed, there are 309 parcels with septic systems. Approximately 88 of these are out of compliance with inspection and maintenance requirements for septic systems, and 66 of the noncompliant systems are located within 200 feet of the stream. Some of these septic systems may be eligible to connect to sewer services provided by Clark Regional Wastewater District. Furthermore, the subwatershed has 170 parcels with agriculture. An estimated 140 agricultural parcels are located within 200 feet of stream. A landcover assessment of McCormick Creek completed in 2010 estimated that the subwatershed was 19 percent impervious surfaces, which is the most densely impervious subwatershed in the lower East Fork Lewis River. An estimated 20 percent of the subwatershed is forested, which is the least forested subwatershed in the full East Fork Lewis River.

Jenny Creek

Jenny Creek is located in the lower East Fork Lewis River watershed, entering the mainstem just upstream of river mile 1. Jenny Creek has an estimated 27.3 miles of tributaries, with approximately 289 parcels located within 100 feet of water. The primary jurisdiction in Jenny Creek is Clark County. In the *East Fork Lewis River Source Assessment*, Jenny Creek was identified as a high priority for bacteria reduction. Dry season bacteria reductions of 52 percent were recommended for Jenny Creek. In 2017, bacteria sampling confirmed annual bacteria exceedances of 105 cfu/100 ml with 50 percent of samples exceeding criteria, and dry season exceedances of 172 cfu/100 ml with 67 percent of samples exceeding criteria. Temperatures of 20 degrees Celsius were measured on Jenny Creek, indicating a reduction of 4 degrees is needed to meet the temperature water quality standard of 16 degrees Celsius.

Nonpoint source pollution from agriculture, septic systems, and lack of riparian vegetation are the suspected sources in Jenny Creek. In the full subwatershed, there are 351 parcels with septic systems. Approximately 114 of these are out of compliance with inspection and maintenance requirements for septic systems, and 94 of the noncompliant systems are located within 200 feet of the stream. Furthermore, the subwatershed has 201 parcels with agriculture. An estimated 167 agricultural parcels are located within 200 feet of stream. A landcover assessment of Jenny Creek completed in 2010 estimated that the subwatershed had 12 percent impervious surfaces. An estimated 40 percent of the subwatershed is forested.

Rock Creek North

Rock Creek North is located in the Middle East Fork Lewis River, entering the mainstem East Fork Lewis River around river mile 16. Rock Creek North has an estimated 61.5-mile tributaries, with approximately 805 parcels located within 100 feet of water. The primary jurisdiction in Rock Creek North is Clark County, with some contribution from WSDOT. Rock Creek North is located in a portion of Clark County where more urbanized land uses transition into more rural landscapes. In the *East Fork Lewis River Source Assessment*, Rock Creek North was identified as a high priority for bacteria reduction. Wet season bacteria reductions of 57 percent were recommended for Rock Creek North, with dry season reductions of 44 percent needed to meet

standards. In 2017, bacteria sampling confirmed bacteria exceedances of 173 cfu/100 ml in the dry season with 63 percent of samples exceeding criteria. Temperatures of up to 23.4 degrees Celsius were measured on Rock Creek North, indicating a reduction of 7.4 degrees is needed to meet the temperature water quality standards.

In the full subwatershed, there are 972 parcels with septic systems. Approximately 581 of these are out of compliance with inspection and maintenance requirements for septic systems, and 449 of the noncompliant systems are located within 200 feet of the stream. Furthermore, the subwatershed has 328 parcels with agriculture. An estimated 253 agricultural parcels are located within 200 feet of stream. Overall, Rock Creek North has the highest quantity of septic systems and agricultural parcels compared to other subwatersheds. A landcover assessment of Rock Creek North completed in 2010 estimated that the subwatershed had 10 percent impervious surfaces. An estimated 54 percent of the subwatershed is forested.

Other subwatersheds

In addition to the priority subwatersheds, Lockwood Creek, Riley Creek, and the East Fork Lewis River mainstem at river mile 0.75 also had dry season bacteria exceedances measured in 2017. Riley Creek enters into Lockwood Creek, which ultimately drains into the East Fork Lewis River between river miles 4 and 5. Dry season bacteria reductions of 51 percent are recommended for Riley Creek and dry season reductions of 25 percent are recommended for Lockwood Creek. An annual bacteria reduction of 35 percent is recommended for Lockwood Creek. A 17 percent annual reduction of bacteria was recommended for the East Fork Lewis River mainstem at river mile 0.75. Lockwood Creek has an estimated 10 percent impervious landcover and is 45 percent forested. Overall, the lower watershed is the highest priority for bacteria reduction, with the exception of Rock Creek North, which is located in the middle watershed. Riley and Lockwood Creek will be important to investigate for potential sources of nonpoint source pollution, but these subwatersheds are generally a lower priority for nonpoint source implementation compared to Rock Creek North, Brezee, Jenny, and McCormick Creeks.

Point source pollution and permitted facilities

Most of the pollution sources in the East Fork Lewis River that are contributing to high bacteria levels and warm water temperatures are from nonpoint sources of pollution. However, there are also point sources of pollution in the watershed with the potential to impact water quality. At this time, Ecology is not recommending any waste load allocations for point sources or additional effluent limits for permitted facilities. Instead, this plan focuses on addressing nonpoint sources of pollution, which are the major suspected source of water quality impairment in the watershed.

If point sources of pollution and permitted facilities increase in the watershed, a traditional TMDL may become necessary to meet water quality standards. Ecology will consider any new permitted facilities and point sources of pollution in the watershed when evaluating and measuring progress, completing effectiveness monitoring, and adaptively managing this

Alternative Restoration Plan. More information on Ecology's criteria to measure progress is included in Chapter 11 of this plan.

The following table is a summary of the point source pollution and permitted facilities in the East Fork Lewis River watershed as of 2017. These permits are administered by the Department of Ecology and are subject to the agency's regulatory authority. More information related to point source permits are summarized in this section and throughout chapters 4 through 8 of this plan.

Table 17. Point source permits in East Fork Lewis River watershed regulated by Department of Ecology.

Facility	Permit Number	Type of Discharge
La Center Sewage Treatment Plant	WA0023230	Municipal Wastewater Individual Permit
Larch Correction Center	WA0038687	Municipal Wastewater Individual Permit
Phase I Stormwater Permit (Clark County)	WA0042111	Municipal Separate Storm Sewer Systems (MS4) Individual Permit
Transportation, WSDOT	WAR043000	Municipal Separate Storm Sewer Systems (MS4) Individual Permit
Phase II Stormwater Permit (Battle Ground)		Municipal Separate Storm Sewer Systems (MS4) Individual Permit
Sand and Gravel (4)		Sand and Gravel Operations Process and Stormwater General Permit
Construction Stormwater		Construction Stormwater General Permit

Wastewater Treatment Plants

To reduce bacteria loading from human sources, most of the recommendations in this plan are focused on septic systems. Inspecting, maintaining, and repairing failing septic systems and connecting eligible septic systems to sewer are activities that are not required by Wastewater Treatment Plan permits. Instead, Wastewater Treatment Plant permits are more focused on water quality treatment at sewage plants, and reporting any unauthorized discharges or overflows of sewage. Wastewater Treatment permits are most often considered in TMDLs when a watershed is not meeting dissolved oxygen standards. As of 2021, dissolved oxygen is not an impairment in the East Fork Lewis River. Therefore, addressing impacts from wastewater treatment plants is not a focus of this TMDL Alternative Restoration Plan.

The only Wastewater Treatment Plant located near areas with bacteria exceedances is the City of La Center's Wastewater Treatment Plant. During the original Source Assessment study, water quality monitoring was completed near the wastewater outfall, which determined that the water quality near the facility's discharge point was meeting water quality standards. This facility is required to submit discharge-monitoring reports to the Department of Ecology to document that the facility is meeting the effluent limits outlined in its permit. Any exceedances, unauthorized discharges, or overflows of sewage are required to be reported to the Department of Ecology. This particular facility has not had a history of unauthorized discharges or water quality exceedances. The other Wastewater Treatment plant in the watershed is at

Larch Corrections Facility, which is located in the upper watershed. The segment of water that the Larch Corrections Facility discharges to is not on the State's polluted waters list for bacteria, and is therefore not a high priority in this Alternative Restoration Plan. Recommendations related to septic systems and managing bacteria sources from humans are outlined in Chapter 4 of this plan.

Stormwater permits

Stormwater recommendations in this plan are focused on bacteria source control, source tracing and investigative monitoring, and illicit discharge detection and elimination activities. These actions are a high priority in the Brezee Creek subwatershed in the City of La Center, which currently does not have a stormwater permit due to the city having a population under 10,000 residents. Reaching a population of 10,000 residents is the threshold, which triggers stormwater permit issuance. Additionally, McCormick Creek is also a priority for stormwater management activities; however, most of the McCormick Creek subwatershed is located in the City of Ridgefield's jurisdiction. The City of Ridgefield also does not meet the population threshold to trigger stormwater permit issuance. Other stormwater permittees in the watershed include Clark County and the Washington Department of Transportation (WSDOT), however, stormwater is not the suspected source of bacteria in the areas where Clark County and WSDOT have jurisdiction. Therefore, Ecology is not recommending any waste load allocations or effluent limits for stormwater permits at this time. Recommendations related to stormwater management are outlined in Chapter 6 of this plan.

Agricultural permits

For agriculture, there is only one small permitted dairy in the watershed, which is managed by the Washington State Department of Agriculture's (WSDA) Dairy Nutrient Management Program. There is also one egg laying facility in the watershed, which is managed by WSDA's Food Safety Program. The permit programs for the dairy and egg laying facility are outside of Ecology's regulatory authority. There are no Concentrated Animal Feeding Operation (CAFO) permits in the watershed. Recommendations included in this Alternative Restoration Plan for addressing nonpoint source pollution from agriculture are focused on addressing nonpoint source impacts from livestock by implementing agricultural best management practices (BMPs). These BMPs include livestock exclusion fencing, manure management BMPs, and pasture and heavy use area improvements. Agriculture implementation actions are outlined in Chapter 5.

Other permits

Other point source permits in the watershed include sand and gravel facilities and construction stormwater permits. As of 2017, there were eighteen construction stormwater permits, and four sand and gravel facilities. These permits do not regulate the discharge of bacteria or temperature. The construction stormwater and sand and gravel permits are more focused on erosion and sedimentation control, proper storage of materials, avoiding illicit discharges, and regulating the discharge of total suspended solids and pH levels. One of the sand and gravel facilities in the watershed does have a Habitat Conservation Plan (HCP) agreement with US Fish and Wild Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA) to

comply with requirements outlined by the Endangered Species Act. Requirements related to this HCP were not established by the Department of Ecology and compliance with the HCP is not regulated by Ecology. Progress on implementing the HCP is reported to NOAA and USFWS, which are the agencies responsible for monitoring, regulating, and inspecting the facility for compliance with the HCP.

Report outline

This *Alternative Restoration Plan* focuses on priority projects and program areas for water quality implementation in the EFLR, to address bacteria and temperature pollution challenges from nonpoint source pollution. The top priorities in the EFLR are addressing NPS pollution from septic systems and agriculture, increasing riparian and streamflow restoration efforts, and improving stormwater management efforts in the watershed. For each of these clean water priorities, the following information is provided.

1. Background information.
2. Implementation goals.
3. Implementation actions.
4. Milestones, targets, and timelines (Chapter 11)
5. Criteria to measure progress. (Chapter 11)
6. Funding and partnerships.
7. Cost estimates for implementation (Chapter 10)
8. Effectiveness monitoring and adaptive management (Chapter 12)

For each implementation priority, there are goal statements established for achieving clean water in the EFLR. To achieve clean water goals, there are actions that need to be implemented in priority areas. A unique identifier is provided for each implementation action. Organizations seeking Ecology funding to implement specific actions in this *Alternative Restoration Plan*, should reference the unique identifiers in funding applications. Cost estimates for implementation are outlined in Chapter 10 and criteria to measure progress are detailed in Chapter 11.

Where appropriate and feasible, this *Alternative Restoration Plan* seeks to align with salmon recovery planning, local government priorities, and relevant permit programs that are in the watershed. This *Alternative Restoration Plan* also recognizes the historical and ongoing work of multiple salmon recovery and water quality partners that have worked in the EFLR, long before Ecology conducted its initial water quality assessment. Water quality improvement in the EFLR will require long-term, coordinated implementation, and collaboration amongst many partners. The following a summary of the implementation goals in the East Fork Lewis River watershed.

Implementation goals

Overarching goal

- Achieve clean water, meet water quality standards, and support all beneficial uses in the East Fork Lewis River.

Septic systems goal

- Eliminate septic system impacts on water quality in the East Fork Lewis River.

Agriculture goal

- Eliminate impacts of agriculture on water quality in the East Fork Lewis River

Stormwater management

- Achieve a high level of stormwater management in the watershed.

Riparian restoration

- Achieve system potential riparian vegetation, of 85 percent tree canopy cover, in the East Fork Lewis River.

Streamflow restoration

- Achieve and sustain instream flow conditions that support aquatic life, water quality, and salmon recovery goals in the East Fork Lewis River.

Chapter 4 – Septic Systems

Introduction

Septic systems are one source of bacteria in the EFLR watershed. In 2020, there were an estimated 6,161 septic systems in the watershed, and 32 percent, or approximately 1,995 septic systems were considered noncompliant and needed inspections. An estimated 1,328 noncompliant septic systems are located within 200 feet of a stream. Septic system inspections are important to determine septic system age, condition, and maintenance needs, and to ensure septic systems are not failing and impacting water quality. The following table summarizes septic systems in the EFLR watershed.

Table 18. Septic system priorities in EFLR watershed.

Priority Subwatersheds	Number of Parcels with Septic Systems	Number of parcels with noncompliant septic systems	Number of parcels with noncompliant septic systems within 200 feet of a stream
Jenny Creek	351	114	94
Brezee Creek	166	67	50
McCormick Creek	309	88	66
Rock Creek North	972	312	239
Total septic systems in priority subwatersheds	1798	581	449
Total septic systems in watershed	6,161	1995 (approx. 32%)	1328

Clark County Public Health (CCPH) has jurisdiction and regulatory authority over septic systems in the EFLR Watershed. CCPH regulates septic systems under Washington State Administrative Code 246-272A and Clark County Code 24.17, which requires all homeowners who are not connected to municipal sewer to have an approved, and correctly functioning septic system to manage household sanitary waste.

Efforts to inspect and maintain septic systems are critical to keep septic systems functioning, and to protect public and environmental health. Septic tanks that need maintenance or are in disrepair are one source of bacteria that can affect surface water and groundwater quality. In Clark County, 98 percent of drinking water comes from groundwater sources. Failing or poorly maintained septic systems can cause risks to drinking water quality, especially in zones of contribution to aquifer recharge areas. Addressing septic system sources of bacteria in the EFLR will help achieve clean water for people, fish, and wildlife. The following table describes key septic system facts in the EFLR.

Table 19. Septic system facts in the EFLR watershed.

Septic system facts
• 69 percent of unincorporated tax lots in watershed have septic systems. • 6,161 septic systems in EFLR watershed. • 32 percent have not been inspected. • Around 1,995 septic systems need inspections in the watershed. • $130 dollars is the average inspection cost. • Every 3 years is when septic should be inspected. • The average cost to failing septic systems is $8,000 to $15,000 dollars.

Septic system inspection and maintenance

Washington State Department of Health requires that septic system inspections be completed every 3 years to ensure systems are maintained and functioning properly. While State Law requires inspections, there are opportunities to increase septic related outreach, implementation, and enforcement in Clark County. Efforts to require and enforce septic system inspections and maintenance is the first step to improve water quality. Completing inspection provides greater water quality protection and assurance.

To teach homeowners how to care for their septic systems, multiple public education and outreach efforts have been implemented in Clark County. Most notably, Well and Septic Workshops are provided by Washington State University Extension to encourage septic system inspections and maintenance.

Washington State University Well and Septic Workshops

Through a partnership between Clark County Public Works, Clark County Public Health, and Washington State University Extension, Well and Septic Workshops are hosted to teach private homeowners how to self-inspect their own septic systems. After attending a workshop, septic system owners are able to self-inspect their system every 6 years. Between self-inspections, septic system owners must hire a certified septic system inspector.

Table 20. Recommended septic system inspection frequency.

Year	Inspection frequency
Year 1	Attend Well and Septic Workshop to self-inspect.
Year 3	Hire certified inspector.
Year 6	Attend Well and Septic Workshop to self-inspect.
Year 9	Hire certified inspector.

While these workshops have been successful and well attended, there is often more demand for workshops than capacity. From 2012 to 2018, Washington State University hosted 21 well and septic workshops, which were attended by around 671 septic system owners. Today, Clark County has 34,500 septic systems countywide, and 10,350 have not been inspected. Around 1,995 of these uninspected septic systems are in the EFLR watershed. More workshops are needed educate septic system owners and promote inspections. Some outcomes from workshops held from 2012 to 2018 are listed below.

- 21 Well and Septic workshops hosted.
- 671 attendees.
- 33 percent responded to workshop survey.
- 384 survey respondents installed septic BMPs.
- 63 survey respondents inspected systems.

In addition to hosting more workshops, there are other education and outreach options to increase septic system inspection rates. One option is to provide septic system inspection and maintenance training online. Online training would provide easier and broader access to septic system education. The first online Well and Septic workshop was held in 2020.

Another option is to proactively send letters to septic system owners that need inspections or maintenance. In 2015, only 49 percent of septic system owners had completed septic inspections countywide. CCPH worked to proactively send out Past Due Operation and Maintenance Notification Letters to septic system owners. This lettering effort resulted in an almost 20 percent increase in septic system inspections in Clark County from 2015 to 2018, achieving a 70 percent septic inspection rate countywide. Direct door-to-door outreach is another option to provide septic system owners with education and technical assistance. Ecology's NPS staff have started door-to-door outreach to septic owners in the lower EFLR watershed, but more outreach is needed.

Septic system assistance

On average, it costs around $130 dollars to complete a septic system inspection. Investing in septic system inspections will provide more information about septic system age, design, and condition, and any maintenance, repair, or replacement needs in the watershed. This information can help implementing organization prioritize and target the most critical septic systems for technical and financial assistance.

New septic systems can cost around $21,000 dollars to replace and public sewer connection can cost around $19,000 dollars. Staying up to date on septic inspections, operations, and maintenance needs can extend the lifecycle use of septic system infrastructure, and offset future costly repair associated with poor maintenance, septic failure, and septic replacement. More information about septic related cost estimates is outlined in Chapter 10.

Septic system inspection and maintenance program

To provide septic system owners with financial assistance, organizations in Clark County are developing a new septic system inspection rebate program. This program provides reimbursements to property owners in the EFLR that complete certified septic system

inspections. Developing a rebate program for septic system maintenance and tank pumping provides financial assistance for essential septic system services. Opportunities to establish public-private agreements with septic system companies to complete inspections and maintenance should be explored.

Craft3 loan program for septic repairs or replacement

Property owners needing replacement or significant repair of their septic system may qualify for financial assistance through different funding sources. Clark County collaborates with Craft3, a nonprofit lender in Oregon and Washington, to offer homeowners an affordable loan to repair or replace failing septic systems. The loan covers the full costs of designing, permitting, installing, and maintaining a septic system, or completing public sewer connection. Owner and non-owner occupied properties, including commercial, secondary, rental, and vacation properties are eligible to apply for Craft3 assistance. Low interest rates and deferred payment options may be available for homeowners with lower incomes. The program was launched in Clark County in 2016, and has assisted at least 300 septic system owners in Clark County since its inception.

Clark County Community Services Single-Family Housing Rehabilitation Program

Another financial assistance option for septic owners is the Clark County Housing Rehabilitation Program, which is available to low-to-moderate income homeowners who live in Clark County. Funding for the program is through the U.S. Department of Housing and Urban Development (HUD) Community Development Block Grant (CDBG) Program under Title 1 of the Housing and Community Development Act of 1974.

United States Department of Agriculture (USDA)

The USDA offers rural residents with properties outside city limits and urban growth boundaries with two types of loans that can support septic system improvements. Single Family Housing Direct Home Loans (Section 502 Direct Loan Program) and Single Family Housing Repair Loans and Grants (Section 504 Home Repair Program) assist low and very low-income applicants with septic related repair and replacement.

Connecting to Sewer

In urbanized areas, some homeowners may have the option to connect to municipal sewer, rather than maintaining, repairing, or replacing septic systems. To help septic system owners connect to public sewer, some public wastewater treatment entities have financing options available to help connect properties with septic systems to public sewer. In Clark County, Clark Regional Wastewater District and the City of Vancouver have programs that support and incentivize septic owners to connect to sewer. The estimated cost to connect to sewer is $19,000 dollars. In the EFLR, there are two Wastewater Treatment Plants. One is at the City of La Center, and the other is at Larch Corrections Facility. Clark Regional Wastewater District also provides sewer services within the watershed. The City of La Center should consider developing financial resources to help septic system owners connect to sanitary sewer services.

One option is to develop a utility local improvement district to generate local funding needed to connect septic system owners to sewer services. Septic systems in Brezee, Jenny, and McCormick Creeks may eventually be eligible for sewer connection. Updating local codes and ordinances to require septic system owners to connect to sewer can help address water quality challenges associated with septic systems.

La Center's Wastewater Collection System

The City of La Center has made significant financial and technological investments in its wastewater treatment plant. With significant population growth and residential development in the community, La Center has made significant investments in its wastewater system. Currently, La Center has an approved design capacity of 0.69 million gallons per day (MGD) MGD with a pre-approval to expand to 1.04 MGD in the future. La Center's treatment plant utilizes advanced Membrane Bioreactor (MBR) technology with an anoxic zone to maximize the facility's performance and maximize its ability to remove nitrate, which is a common nutrient of concern. La Center is regulated through the Department of Ecology's State Waste Discharge Permit, which requires the city to submit daily monitoring reports on water quality from the treatment plant's discharge. Some monitoring was completed in the EFLR near the wastewater treatment plant's discharge point in 2005 and 2006 through past TMDL efforts. WQS for bacteria were generally met near the facility's discharge. Potential temperature impacts from the wastewater treatment plant are unknown.

Today, there are homeowners that still rely on septic systems within the City of La Center's sewer service area. La Center should pursue opportunities to connect remaining septic system owners to municipal sewer within the city's urban growth area.

Pollution Identification and Correction

Pollution Identification and Correction (PIC) Programs provide a comprehensive framework to find and remove sources of bacteria in watersheds. PIC programs often include monitoring, NPS investigation, financial and technical assistance, public education and outreach, and implementation of water quality BMPS for source correction. Priorities for PIC programs include finding and fixing septic and agricultural sources of pollution and assisting landowners with implementation of septic and agricultural BMPs. The Washington State Department of Ecology and Department of Health have developed guidance for PIC program development and implementation. Entities wishing to develop a new PIC program or seeking funding for PIC program implementation should reference DOH and Ecology guidance.

How to establish a PIC program in Clark County

Multiple organizations in Clark County have expressed interest in developing a new, pilot PIC program in the lower and middle EFLR watershed. The new Poop Smart Clark PIC program was recently awarded funding in 2021. PIC efforts in the EFLR should target implementation in subwatersheds with known bacteria issues. In the EFLR, McCormick and Brezee Creeks are the highest priority subwatersheds for bacteria reduction due to consistently high, dry season bacteria concentrations. Jenny, Lockwood, Mason, Riley, and Yacolt Creeks, Rock Creek North, and the EFLR mainstem near Paradise Point, are also priorities for PIC efforts.

To begin implementing a new PIC program, it is important to establish an interlocal agreement or memorandum of understanding, which outlines how partner organizations will work together to administer, manage, and implement the PIC program. In addition, it is important to establish responsibility for PIC program coordination, communication, and oversight. One opportunity is to establish a PIC Coordinator, PIC Advisory Group, charter, governance structure, or framework, which outlines how partners will coordinate on PIC program planning and implementation. In addition to developing an Interlocal Agreement, it is critical to establish a PIC Program Flowchart, which defines a chain-of-command and details the different authority and responsibility of organizations, as well as enforcement tools and a regulatory backstop.

Defining how site visits and property inspections will be completed and how public education, technical assistance, and financial assistance will be provided to landowners is also important. Having a clear enforcement process and regulatory backstop for addressing bacteria pollution is essential. Without an enforcement mechanism, it is difficult to implement a PIC program that relies solely on voluntary compliance, education, and technical assistance. Listed below are some of the foundational elements of a successful PIC program.

- Establish a PIC program interlocal agreement.
- Establish a PIC program coordinator, advisory group, charter, or governance structure.
- Establish a PIC program flowchart and chain-of-command.
- Develop protocols for site visits and property inspections.
- Outline how technical and financial assistance will be provided.
- Develop an enforcement process and regulatory backstop.

Within PIC program development, various definitions and protocols need to be developed. For example, implementing organizations will need a Quality Assurance Project Plan (QAPP) to support PIC monitoring efforts. Any monitoring efforts implemented in the watershed must incorporate the new *E. coli* standard for bacteria. In addition to utilizing this new bacteria indicator, it will be important for the monitoring team to determine thresholds for how to confirm a bacteria hot spot, and complete investigative sampling. Additionally, having established protocols for completing sanitary surveys and dye tests, site visits, shoreline surveys, and property investigations can support field staff that visit properties of concern. Listed below are some of the monitoring actions needed to establish a successful PIC program.

- Develop a Quality Assurance Project Plan (QAPP), which incorporates the new *E. coli* standard for bacteria.
- Select initial monitoring locations.
- Determine thresholds for confirming bacteria hotspots and a threshold for resampling.
- Develop an investigative sampling and source tracing process.
- Establish protocols for sanitary surveys and dye tests.
- Develop protocols for site visits, NPS surveys, illicit discharge detection and elimination, and property investigations.

PIC programs should focus on the most critical drainages for water quality improvement. To prioritize properties for initial investigation, land use analysis and mapping should be completed to identify parcels that may be contributing bacteria sources. Watershed evaluation

and windshield surveys may help support property prioritization. Prioritizing properties within 200 feet of a river should be considered. Completing a septic system record assessment can also support PIC program efforts. Having clear criteria for how properties will be prioritized for investigation, follow-up, and corrective action will also support targeted implementation. In addition to addressing bacteria from septic systems, developing strategies for addressing other bacteria sources, from agriculture, stormwater, pet waste, and wildlife should also be incorporated into PIC implementation. Having a clear strategy for how to communicate with landowners and provide technical and financial assistance for BMP implementation is also needed. Action items for assessment and mapping are listed below.

- Complete land use analysis and mapping.
- Establish geographic prioritization and project scope.
- Complete watershed evaluation and windshield surveys.
- Complete septic system record assessment.
- Establish clear criteria for how properties will be prioritized for investigation, outreach, and implementation.

Successful PIC program not only find and fix sources of bacteria, but also foster public awareness to prevent bacteria pollution in the future. Developing a strong public education and outreach plan is one element of PIC program establishment, as well as developing criteria to measure progress, and establishing an evaluation process, which includes long-term effectiveness monitoring. Some of the action items related to PIC program education and outreach are listed below.

- Develop a communication, education, and outreach strategy.
- Develop implementation targets and criteria to measure progress.
- Develop an evaluation process to measure success.
- Develop a long-term effectiveness-monitoring plan.

Poop Smart Clark septic systems

Clark Conservation District, Clark County Public Works, Clark County Public Health, Washington State University Extension, and Watershed Alliance of Southwest Washington have developed a new Pollution Identification and Correction Program in Clark County called Poop Smart Clark. This collaborative program was awarded funding to implement a pilot PIC program to address multiple sources of bacteria in the EFLR watershed including livestock, human, and canine sources.

Work within this program will include monitoring, source identification, technical assistance, outreach, education, and implementation of livestock and septic BMPs, as well as a canine for clean water component. Tasks associated with the PIC program include completing water quality monitoring, a land use assessment, and septic system records assessment. Door-to-door outreach and education efforts will help promote implementation of septic and agricultural projects. To support septic system correction, a new septic system inspection and maintenance rebate program will be developed, as well as additional resources to support septic system

repair and replacement. More workshops on septic system maintenance will also be hosted along with works on livestock technical assistance and BMP implementation.

To support to development of a PIC program, Clark Conservation District and Watershed Alliance of Southwest Washington issued a survey to find landowners who could benefit from water quality improvement projects in the EFLR. Some landowners have already expressed interest in implementing water quality BMPs on their properties, but more outreach to landowners is needed.

To achieve outreach, Poop Smart Clark is developing a new website called "poopsmartclark.org" which is a social marketing, public education and outreach tool to raise public awareness about what individuals can do to reduce bacteria pollution in Clark County watersheds. This Poop Smart framework was initially developed and implemented in Skagit County and has had significant, measurable success, including generating more willing landowners to implement voluntary BMPs for water quality. Additional details related to this program are provided in the Agriculture Chapter of the *Alternative Restoration Plan*.

Septic system enforcement

Ecology's goal is to work with stakeholders to achieve voluntary compliance with state law and the WQS. Ecology invests heavily in technical and financial assistance and provides multiple opportunities and pathways for stakeholders to proactively address pollution problems before enforcement is pursued. Ecology uses regulatory authority as a backstop when technical and financial assistance efforts fail to address identified pollution problems. Any person who violates or creates a substantial potential to violate any part of the Water Pollution Control Act, is subject to an enforcement order from Ecology pursuant to RCW 90.48.120

If the bacteria WQS applicable to the waterbodies included in this *Alternative Restoration Plan* are not achieved through implementation of BMPs for septic systems outlined in this *Alternative Restoration Plan*, a traditional TMDL study will be required to comply with the Clean Water Act.

Septic system implementation

To achieve clean water in the EFLR, meet WQS for bacteria, and support recreational uses, it is necessary to address and eliminate water quality impacts from septic systems. Significant progress has been made to develop a new, comprehensive Pollution Identification and Correction program in Clark County called Poop Smart Clark, but more work and coordination is needed to launch this program into the future. The following implementation tables outline septic system implementation goals, and additional septic system actions needed to achieve clean water in the EFLR. The long-term goal is to eliminate septic system impacts on water quality, and to achieve 100 percent septic system inspection and maintenance compliance, and correct and replace any failing septic systems. To achieve this goal, local organizations should prioritize septic system implementation efforts in the lower and middle watersheds where known bacteria problems exist.

Table 21. Septic system implementation goals.

Implementation Goals
• Eliminate septic system impacts on water quality in the EFLR. • Achieve 100 percent septic system inspection and maintenance compliance. Prioritize septic system inspection and maintenance in the lower and middle watershed where known bacteria problems exist. Initial efforts should be targeted to McCormick and Brezee Creek, followed by Lockwood, Riley, Jenny, Rock Creek North, Mason, and Yacolt Creeks. • Prioritize septic system outreach and implementation in the lower and middle watershed (river miles 0 to 20 – specifically McCormick, Brezee, Lockwood, Riley, Jenny, Mason, Yacolt, and Rock Creek North) where known bacteria problems exist. • Develop and implement a Pollution Identification and Correction program that supports long-term identification and correction of septic system issues contributing to bacteria pollution in surface waters.

Implementation actions – septic systems

Table 22. Septic system implementation actions.

No. OSS1	Inspection and Maintenance
OSS1.1	Pilot a septic system inspection and maintenance, enforcement program in the EFLR watershed. Prioritize outreach, investigation, and enforcement to subwatersheds where there are known bacteria problems, and the highest density of septic systems that are past due for inspection. Prioritize past due septic systems for compliance related outreach. Complete outreach to past-due septic system owners. Achieve 100% septic system inspections to confirm system age and condition.
OSS1.2	Develop and implement a septic system rebate program for septic system inspections and maintenance.
OSS1.3	Develop and implement a pollution identification and correction program that supports long-term identification and correction of septic systems contributing to bacteria pollution in surface waters.
OSS1.4	Complete a septic system records assessment to identify and map septic systems that are past due for inspection. Create an inventory of parcels that are serviced by septic systems in priority subwatersheds. Utilize information from past inspection reports to evaluate likelihood of failure and prioritize subwatersheds for compliance actions.
OSS1.5	Implement a past due operation and maintenance lettering effort, with the goal to increase inspection rates.
OSS2	**Repair and Replacement**
OSS2.1	Develop a rebate, discount, coupon, reimbursement, or cost-share based program to for septic system repair and replacement.
OSS2.2	Continue Clark County's participation in the Craft3 Regional Loan Program for septic system repair and replacement.
OSS2.3	Develop mechanisms to expedite and streamline permitting for OSS repair and replacement.
OSS3	**Sewer Extension and Connection**
OSS3.1	Where feasible, extend sanitary sewer to critical sewage areas and connect septic system owners to sanitary sewer, focusing on Brezee, McCormick, and Jenny Creeks.
OSS3.2	Continue Clark Regional Wastewater District's (CCRWD) Septic Elimination Program (SEP) to facilitate sanitary sewer extensions to critical sewerage areas. Utilize CCRWD financial assistance programs to incentivize septic system owners to connect to sewer
OSS3.3	Replicate CCRWD's Connect to Sewer Program or the City of Vancouver's Sewer Connection Incentive Program in Brezee, McCormick, and Jenny Creeks to promote more septic system owners to connect to sanitary sewer services and provide financial assistance to facilitate sewer connections.

Table 23. Septic system implementation actions (cont.)

OSS4	Education and Outreach
OSS4.1	Promote more septic system inspections, maintenance, and repair by encouraging participation in Washington State University Extension's Well and Septic workshops. Increase promotion of the Craft 3 regional loan program, USDA funding, and other sources of funding for septic system repair and replacement. Where appropriate encourage septic system owners to connect to sewer.
OSS4.2	Host more Well and Septic Workshops, to increase the number of septic system owner's eligible to self-inspect their systems.
OSS4.3	Update septic system educational materials.
OSS4.4	Utilize Poop Smart Clark to educate on septic systems and connect landowners to resources
OSS4.5	Establish relationship with septic system professionals, and provide technical support, training, and continuing education opportunities for the septic system industry.
OSS5	**Other**
OSS5.1	Calculate expected bacteria load reductions from septic system improvement projects and report to Ecology and EPA.
OSS5.2	Update local codes, ordinances, and increase enforcement to ensure proper siting, and setbacks for septic systems to avoid water quality impacts.
OSS5.3	Utilize investigative monitoring, illicit discharge detection and elimination (IDDE) methods, including dye testing, source tracing, and smoke testing to identify sources of bacteria pollution.
OSS5.4	Track septic system implementation and complete effectiveness monitoring post implementation.

Milestones, targets, and timelines for septic systems

The short-term goal is to provide technical and financial assistance for septic system inspections and maintenance on the 1,328 noncompliant septic systems located within 200 feet of all streams in the East Fork Lewis River by 2030. This will cost approximately $836,640 dollars. To achieve this goal, 10 percent of these septic systems (approximately 133 septic systems) should have O&M completed by 2022, and 25 percent (332 septic systems) should be addressed by 2023.

Ecology is confident in the ability to achieve 25 percent implementation by 2023 due to the new Poop Smart Clark pollution identification and correction program, which will be implemented in the watershed starting in 2021-2022. This program includes funding for septic system inspections and maintenance in priority areas for water quality. The ultimate goal is to achieve 50 percent of septic system inspections and maintenance by 2025, and 75 percent by 2027, with 100 percent implementation on noncompliant septic systems within 200 feet of a stream by 2030. More detailed information on milestones, targets, and timelines is included in Chapter 11. Cost estimates for implementation are outlined in Chapter 10.

Criteria to measure progress on septic systems

Ecology's goal is to achieve 100 percent implementation of septic system inspections and maintenance on 1,328 noncompliant septic systems located within 200 feet of the stream by 2030. Remaining septic systems in the watershed will be addressed by 2032. An annual survey will be sent to implementing partners to track and measure progress. This survey will document the total number of septic systems in compliance with inspections and maintenance requirements, and the total number of septic systems that have received technical and financial assistance. Information collected from the annual survey will be used to develop an annual report.

Clark County completes routine monitoring in the watershed every five years. The last time the watershed was monitored was in 2020. The watershed will be monitored again in 2025, 2030, and 2035. The long-term goal for septic systems is to achieve bacteria water quality standards by 2035. Ecology will formally reassess the watershed in 2035 to determine if bacteria water quality standards are being met. *E. coli* will be the primary parameter used to measure effectiveness of implementation actions. If bacteria water quality standards are not achieved by 2035, Ecology will determine if a formal TMDL study is needed in the watershed to address bacteria. More detailed information on criteria to measure progress on septic system implementation is included in Chapter 11.

Funding and partnerships for septic systems

The Department of Ecology provides funding for septic system implementation through the Water Quality Combined Funding Program. The full list of eligible BMPs may be updated annually when new information or technology becomes available

Table 24. Ecology funding for septic system implementation.

Best Management Practice	Description
Onsite Sewage System	Septic System projects are eligible for both grants and loans. Eligible projects include: planning, design, and construction of community large onsite sewage systems; surveys of existing septic systems throughout watersheds; local government loan programs provided to homeowners and small commercial enterprises for the repair and replacement of failing septic system; and homeowner education and outreach on the topic of septic system operation and maintenance.

Information on BMP costing can be obtained by contacting Ecology's grant project managers and financial managers. The USDA Natural Resources Conservation Service also serves as a strong resource for BMP cost estimation. More information on estimated costs to address septic system sources of bacteria is outlined in Chapter 10.

To achieve WQS in the EFLR, significant financial investment is needed to address water quality impacts from septic systems. The following organizations are working to address septic system challenges in the watershed.

Table 25. Septic system implementing organizations and partners.

Implementation	Stakeholders
Primary organizations	Clark County Public Health, Clark County Public Works, Clark Regional Wastewater District (City of Battle Ground, and City of Ridgefield), City of La Center, Clark Conservation District, Watershed Alliance, and Washington State University Extension
Partners	Department of Ecology, Craft3 Regional Loan Program, Clark County Regional Wastewater District, Discovery Clean Water Alliance, United States Department of Agriculture, and Washington Department of Health.

Chapter 5 – Agriculture

Introduction

The EFLR is an urbanizing watershed that has strong rural and agricultural character. In 2018, the watershed had 14,827 acres of agricultural zoning, which consists of numerous equestrian properties, small acreage farms with livestock, orchards, vegetable farms, wineries, and rolling pastures. Between 2004 and 2018, zoning for agricultural lands decreased by 9 percent in the watershed, with a loss of 1,512 acres. Most of the remaining agricultural land uses are located in the middle and lower portion of the watershed where there are documented bacteria issues. However, there are some private forest owners with active silviculture practices in the upper watershed.

Agriculture is one source of bacteria pollution in the EFLR watershed. Agriculture can impact water quality through NPS runoff and stormwater, direct access of livestock to streams, or direct discharge of manure to surface water. Agriculture can also impact stream temperature if property owners have removed native trees and shrubs in stream buffer areas, affecting riparian shade

The extent of agricultural impacts in the EFLR watershed is currently under evaluation. The Department of Ecology and local organizations are working to understand the extent and severity of agricultural issues through Poop Smart Clark and NPS investigation. The lower and middle watershed, where known bacteria issues exist, are priority areas for investigation, site visits, conservation planning, technical and financial assistance. The *East Fork Lewis River Source Assessment* identified Brezee and McCormick Creeks as the top priority for bacteria reduction. Rock Creek North, Jenny, Riley, and Lockwood Creek are secondary priorities. Mason and Yacolt Creek are also priorities for bacteria reduction. The following table includes a summary of agricultural priorities in the EFLR watershed.

Table 26. Agriculture priorities in the EFLR watershed.

Priority Subwatersheds	Parcels with Agriculture	Parcels with agriculture within 200 feet of a stream
Jenny Creek	201	167
Brezee Creek	156	129
McCormick Creek	170	140
Rock Creek North	328	253
Total	855	689

Source: Clark Conservation District SFY 2022 Water Quality Combined Funding Application WQC-2022-ClarCD-00025

The properties listed in table 28 need field investigation, windshield surveys, watershed evaluation, mapping, and additional water quality monitoring to identify potential impacts to water quality from agriculture. Once source confirmation is complete, outreach to property owners to provide technical and financial assistance and encourage implementation of agricultural BMPs is needed. The following table includes a summary of agriculture in the EFLR.

Table 27. Agriculture facts in the EFLR watershed.

Agriculture facts.
• 14,827 acres of agricultural zoning. • Estimated 322 farms in watershed. • One small dairy with potential manure application. • One egg laying facility. • Zero Concentrated Animal Feeding Operations. • Mostly small acreage agriculture with livestock, horses, alpaca, and poultry; pasture, crops, and grassland. • 855 agricultural parcels in priority subwatersheds, 689 located within 200 feet of stream.

Livestock facilities in the East Fork Lewis River

Currently, there is only one small permitted dairy in the EFLR, which is regulated through the Washington State Department of Agriculture's (WSDA) Dairy Nutrient Management Program. This dairy is located in the Middle EFLR, in the headwaters of Mason Creek, with some potential manure application on fields in the Lockwood Creek drainage. In McCormick Creek, there is one active egg laying facility regulated by WSDA's Food Safety program. In the McCormick Creek subwatershed, there is also an active irrigation district withdrawing water from the mainstem EFLR for agricultural uses. There are no Concentrated Animal Feeding Operation (CAFO) permits or facilities. Most of the agricultural properties in the EFLR watershed are small acreage farms on residential properties. Equestrian use and alpaca farms are common.

Historically, the watershed had significantly more agriculture and portions of the watershed have legacy impacts from agricultural activities. Some of these areas with legacy impacts are now being improved and restored. For example, the lower McCormick Creek watershed used to have a dairy operation where cattle would graze in floodplain areas near the mainstem EFLR. This property is currently owned by the Clark County Legacy Lands program and is in the process of being restored to improve water quality and salmon habitat. Additionally, through NPS investigation and implementation, an abandoned manure lagoon from a historical dairy operation was identified and decommissioned in McCormick Creek, which removed a large source of bacteria from the watershed.

Although agriculture has significantly decreased in Clark County, there are still significant livestock impacts in watersheds. According to the USDA Agricultural Census completed in 2017, Clark County is number three in the State of Washington for the total number of farms, behind Yakima and Spokane counties. In total, the market value of agriculture in Clark County was $47.7 million dollars in 2017, with almost $28 million dollars related to livestock. According to USDA, Clark County has over 300,000 chickens, and over 15,000 cattle. Today, Clark County has an estimated 1,978 farms that are an average of 46 acres each. The total estimated agricultural lands in the county is 90,000 acres. Fifty eight percent of farms are associated with the production of livestock and poultry. Listed below is a summary of Clark County agriculture from the USDA Census.

Table 28. Livestock and agriculture in Clark County from USDA 2017 Agriculture Census.

Livestock in Clark County
• 1,978 farms, ~46 acres each. • 15,065 cattle on 730 farms. • 3,371 milk cows on 21 farms. • 12,445 other cattle on 332 farms. • 2,016 sheep & lambs on 139 farms. • 412 hogs & pigs on 67 farms. • 1,939 goats on 198 farms. • 2,687 horses on 491 farms. • 11,470 poultry on 505 farms. • 530 acres of orchards on 178 farms. • 20-30 wineries.

Nonpoint source implementation by Department of Ecology

To support bacteria reduction efforts in the EFLR, the Department of Ecology piloted a new, proactive NPS effort in the EFLR in 2018 to 2020. The goal of proactive NPS investigation was to use monitoring data, watershed evaluation, property inspections, and outreach as a mechanism to find and fix sources of bacteria.

Ecology started its NPS efforts in the headwaters of McCormick Creek, where the highest bacteria concentrations were measured in the Source Assessment. Agricultural properties were prioritized for site visits based on their proximity to surface water. A postcard was mailed to property owners before site visits were completed. Any property owners with natural resource concerns or water quality challenges were referred to Clark Conservation District. The Conservation District works with landowners to provide technical and financial assistance to implement BMPs for water quality. Additional properties with septic concerns were referred to CCPH for technical and financial assistance. Future NPS investigation and monitoring was targeted to Jenny, Riley, Brezee, Lockwood Creeks, and Rock Creek North.

In total, there are 855 agricultural parcels located in priority areas for water quality investigation and outreach. Along these river miles, there are 689 parcels within 200 feet of water. Surveying these areas and providing landowners with assistance will require coordination across multiple organizations. In 2019, Ecology visited 18 properties in McCormick Creek. NPS monitoring was one tool used to confirm, and further investigate bacteria sources. During site visits, Ecology documented any NPS pollution issues observed using a site visit form. Early success stories from NPS investigation are listed below.

- Identification and decommissioning of a large manure lagoon from an old dairy.
- Communication with a landowner who was historically dumping manure into the creek. After attending a WSU Extension workshop, the landowner has stopped dumping manure and has implemented manure management BMPs to correct the issues.
- Communication with an irrigation district in McCormick Creek.

- A site visit to a dog grooming facility that was directly discharging to the river. The owner was advised to eliminate the discharge.
- Sites with stormwater and erosion issues were identified and inspected.
- The identification of an industrial stormwater site operating without a permit, which resulted in permit issuance.

Manure lagoon decommissioning in McCormick Creek

Ecology's NPS investigation efforts in McCormick Creek resulted in the early identification and removal of a large manure lagoon from an old dairy in the City of Ridgefield. This manure lagoon was located on a property that was recently sold and was transitioning from agricultural land use, into residential land use. Liable parties were notified about their responsibility for manure lagoon decommissioning. Ecology worked with the City of Ridgefield, an engineering firm, and the construction contractor to provide technical assistance on how to decommission the manure lagoon appropriately using NRCS Manure Lagoon Decommissioning Guidelines (Code 360: Closure of Waste Impoundments). A map of properties with appropriate soils where the manure could be land applied was provided, as well as consultation on the appropriate agronomic rates and BMPs for manure application.

The Construction Stormwater Permit was the primary tool used to manage the manure lagoon decommissioning. Ecology required the liable party to develop a Stormwater Pollution Prevention Plan (SWPPP) specific for the lagoon to prevent bacteria discharge to McCormick Creek. Ecology also requested that a berm be constructed, and the site be stabilized for the wet weather season to prevent discharge. As of September 2019, the manure lagoon was fully decommissioned. Effectiveness monitoring in McCormick Creek will help determine if the major bacteria source located upstream from documented exceedances in McCormick Creek was removed, or if additional sources remain.

Nonpoint source monitoring

In 2020, Ecology implemented additional NPS monitoring and investigation to further identify sources of bacteria. This monitoring data was collected in collaboration with Clark County Clean Water Division and will be used to target outreach and implementation efforts through Poop Smart Clark. Priority areas for additional investigation were Brezee, Jenny, Bolen Creeks, and Rock Creek North. Results from this monitoring effort were published in the 2021 *East Fork Lewis River Watershed Bacteria Monitoring and Nonpoint Source Identification report*. More information on this study is summarized in Chapter 12.

Traditionally, Ecology utilizes two pathways for NPS implementation and compliance. One pathway is through environmental complaint response, and another pathway is through proactive investigation. Proactive investigation is the primary method being implemented in the EFLR Watershed; however, Ecology staff are also responding to complaints.

Environmental Report Tracking System (ERTS)

Environmental agencies rely on residents and landowners in watersheds to be the, "eyes and ears" for the environment. If the public observes pollution issues, they are encouraged to

submit an ERTS complaint online at ecology.wa.gov/ReportAnIssue. Environmental complaints are one important mechanism for Ecology to address water quality concerns. Ecology has routinely responded to ERTS complaints in the EFLR watershed.

When a NPS pollution issue is identified, site visits and property investigations are completed. If the problem is related to agriculture, a letter may be sent to the property owner, referring them to Clark Conservation District for assistance. Ecology communicates with the County and Conservation District regarding the property until compliance is achieved. Follow-up site visits are completed to confirm BMP implementation. The ultimate goal is voluntary compliance and implementation of BMPs necessary for water quality.

Voluntary Clean Water Guidance for Agriculture

The Voluntary Clean Water Guidance for Agriculture is a technical resource that is currently being developed for the agricultural community, restoration practitioners, and technical assistance organizations to support implementation. Compared to other agricultural guidance documents developed by USDA NRCS, this guidance focuses on BMPs that protect water quality and help meet the Washington State WQS. In the future, this guidance will inform Ecology's NPS funding program, and will inform Alternative Restoration Planning, technical assistance, education, and outreach efforts. Ecology recommends that farmers and conservation districts use the guidance during the farm and conservation planning process to identify the best BMPs for water quality. Conservation Districts may also use the guidance to provide technical assistance to landowners, and when developing water quality protection plans or projects. It can also serve as a tool for developing education and outreach materials.

This guidance is voluntary because agricultural landowners are not required to use these specific BMPs. However, to protect water quality and comply with WQS, Ecology recommends implementing BMPs from this guidance. If an agricultural landowner implements the recommended BMPs from the Voluntary Clean Water Guidance for Agriculture, Ecology will presume the operation is adequately protecting water quality and is in compliance.

Agricultural assistance

Clark County has agriculture and solid waste ordinances to protect water resources from the impacts of agriculture. Clark County Code Enforcement is responsible for implementing and enforcing these ordinances. Most often, agricultural issues in Clark County are identified through environmental complaints submitted by the public. These complaints are usually responded to with a combination of letters, phone calls, site visits, or by providing agricultural landowners with technical assistance to address the issue. Clark County provides some limited funding to Washington State University Extension and Clark Conservation District to provide public education, outreach, and assistance to landowners on agricultural BMPs.

Although there are some established programs to help agricultural landowners, there is often limited capacity and funding available to provide essential technical assistance, conservation planning, and financial assistance to landowners to help fix water quality issues and natural resource concerns. Historically, the County also has limited capacity and ability to issue corrective action or enforcement to agricultural landowners due to financial constraints, limited

staffing capacity, and lack of political support. Opportunities to update local agricultural codes, ordinances, and enforcement protocols should be pursued, as well as securing a local source of funding for essential Conservation District assistance. One important source of local funding for conservation districts is Rates and Charges, which has not been approved in Clark County. Securing Rates and Charges is important, as Conservation Districts are the key organization that assists Ecology, the County, and landowners in achieving environmental compliance.

Organizations providing agricultural assistance to landowners in Clark County and the EFLR are outlined in the following table.

Table 29. Agricultural assistance organizations.

Organization	Description of Programs
Clark Conservation District	Clark Conservation District provides technical assistance to landowners with natural resource, livestock, soil, and water issues. The CD is a non-regulatory agency that works directly with landowners to correct environmental issues, achieve voluntary compliance, and protect clean water.
Washington State University Extension – Clark County	The WSU Extension Small Acreage program provides educational workshops and other outreach to residents on mud and manure management, fencing and pasture management, and other water quality topics unique to rural properties.
USDA Natural Resource Conservation Service (NRCS)	NRCS has financial assistance programs available to assist agriculture producers, and private non-industrial forest landowners to implement conservation activities on their properties to address natural resource concerns. One example is the Environmental Quality Incentives Program (EQIP)
USDA Farm Service Agency (FSA)	The Conservation Reserve Enhancement Program (CREP) is a voluntary program implemented by the USDA Farm Service Agency to benefit both farms and fish by helping restore natural vegetation along salmon streams, and provide rental payments to property owners for riparian plantings on their property for 10-15 years.
Washington State Department of Ecology Water Quality Program	Staff work with property owners to improve water quality by identifying pollution issues and connecting landowners to local agricultural assistance organizations. Ecology can also provide strategic planning support and provides competitive funding opportunities to organizations that can work with private landowners to implement conservation projects.

Clark Conservation District

Clark Conservation District is a non-regulatory organization that works with private landowners to provide solutions to natural resource and water quality concerns. Clark Conservation District can support landowners by providing technical assistance, education and outreach, conservation planning services, and by providing financial assistance to implement water quality projects on private property. While Clark Conservation District provides an essential service to residents of Clark County, there is no sustainable funding source at the local level to support the District's programs. The District is 100 percent grant funded.

Securing a local source of funding is essential to supporting Clark County landowners with natural resource assistance ad helping landowners stay in compliance with environmental laws.

Multiple regulatory programs rely on Conservation Districts to provide landowners with technical and financial assistance as a pathway to achieve voluntary compliance with local, state, and federal pollution programs. Over the last two years, Department of Ecology has worked closely with Clark Conservation District, the Washington State Conservation Commission, and the USDA Natural Resource Conservation Service (NRCS) to develop solutions to increase the District's capacity.

Washington State University Extension

The Washington State University (WSU) Extension Small Acreage Program provides outreach and education to rural property owners, and hosts multiple educational workshops focused on best practices for natural resources and water quality on farms. Workshop topics include mud and manure management, fencing and pasture management, and other water quality topics unique to rural and agricultural landowners. Other annual events include the Living on the Land Education Series, Small Acreage Expo, a Small Acreage Recognition Program, and Best Management Practices Workshops. From 2012 to 2018, approximately 316 Clark County residents attended WSU's BMP workshops, and 74 percent of individuals surveyed implemented 198 BMPs. Additionally, 470 people graduated from the Living on the Land series since 2003. These individuals have implemented 752 BMPs on at least 2,473 acres, benefitting 1,795 non-poultry livestock in Clark County. WSU Extension primarily relies on grant funding to implement agricultural programs and has a small portion of funding from Clark County.

USDA Natural Resource Conservation Service (NRCS)

Currently, there is one USDA NRCS staff person providing support to agricultural producers in Clark County. Priority resource concerns established by the NRCS Southwest Washington Local Working Group are water quality issues from excess nutrients, sediments, and pesticides; inadequate fish and wildlife habitat, degraded plant and soil conditions, and challenges with water supply for irrigation. NRCS has grant opportunities available to help landowners implement agricultural BMPs. However, NRCS does not provide much funding support for essential technical assistance or conservation planning services, which are normally the first steps necessary to help landowners.

Conservation planning and implementation process

The traditional process to support agricultural landowners with implementation involves multiple steps. Normally, properties with water quality challenges are identified and landowners are contacted through a letter, site visit, or phone call. Once an initial site visit is completed, landowners may be provided technical assistance verbally or in a letter. If there are more significant issues, a conservation plan (or farm plan) targeted towards water quality BMP implementation may be developed. Once conservation planning and BMP design is complete, on-the-ground BMP implementation can occur using various levels of financial assistance. Private landowners may also choose to fix the problem on their own. BMP maintenance and monitoring is utilized to ensure BMPs are working and to measure BMP effectiveness. The conservation planning and implementation process is summarized in the following table.

Table 32. Process to support implementation on private properties.

Steps	Activity
1	Identification of Properties
2	Landowner Outreach
3	Site Visit
4	Technical Assistance
5	Conservation Planning
6	BMP Design
7	BMP Implementation
8	BMP Maintenance and Monitoring

Poop Smart Clark agriculture

Clark Conservation District, Clark County Public Works, Clark County Public Health, Washington State University Extension, and Watershed Alliance of Southwest Washington are developing a new Pollution Identification and Correction (PIC) Program in Clark County called *Poop Smart Clark*. PIC programs provide an overarching framework for organizations to work across jurisdictions, organizations, and programs to comprehensively address bacteria and other pollution problems in watersheds. PIC programs can help achieve long-term water quality goals for agriculture, while also addressing septic system issues, and stormwater sources. Additional details related to this program were provided in the Septic System Chapter of the *Alternative Restoration Plan*.

In 2019, Clark County applied for an NRCS Regional Conservation Partnership Program (RCPP) grant to implement a new PIC program in Clark County, focusing its initial efforts on the EFLR. In 2020, Clark County was awarded $1.4 million dollars to launch the Poop Smart Clark PIC Program. This program will utilize expertise from local agencies and nonprofits to reduce sediment, nutrient, and bacteria runoff in Clark County. Through pollution source identification, targeted outreach, education, and implementation of on-the-ground practices, Poop Smart Clark connects landowners with the tools they need to correct pollution, drive social change, and spur adoption of improved management practices. The funding award primarily supports implementation of agricultural BMPs. Additional funding is needed to support other elements of a comprehensive PIC program including outreach and technical assistance. The new program may begin implementation as early as 2021 through 2025.

PIC Partners issued a survey to find potential landowners who could benefit from water quality improvement projects in the EFLR. Some landowners have already expressed interest, but more outreach to landowners is needed. In the following table, specific tasks and agencies involved with PIC program implementation are detailed.

Table 30. Pollution identification and correction (PIC) program tasks in Clark County.

Tasks	Agency
Source Identification	
Quality Assurance Project Plan	Clark County Public Works Clean Water
Water Quality Data Assessment	Clark County Public Works Clean Water
Land Use Assessment	Clark County Public Works Clean Water
Septic System Records Assessment	Clark County Public Health
Monitoring and Microbial Source Tracking	Clark County Public Works Clean Water
Outreach	
Poop Smart Clark Development	Clark Conservation District
Door-to-door Outreach	Clark Conservation District / Watershed Alliance of Southwest Washington
Septic Systems	
Septic System Compliance Prioritization	Clark County Public Health
Septic Inspection and Maintenance Rebate Program	Watershed Alliance of Southwest Washington
Septic System Inspection & Maintenance Workshops	Washington State University Extension
Septic System Repair and Replacement	Clark Conservation District and Watershed Alliance of Southwest Washington
Livestock	
Livestock Technical Assistance	Clark Conservation District
Livestock BMP Installation	Clark Conservation District
Livestock BMP Workshops	Washington State University Extension

Agriculture enforcement

Ecology's goal is to work with stakeholders to achieve voluntary compliance with state law and WQS. Ecology invests heavily in technical and financial assistance and provides multiple opportunities and pathways for stakeholders to proactively address pollution problems before enforcement is pursued. Ecology uses regulatory authority as a backstop when technical and financial assistance efforts fail to address identified pollution problems. Any person who violates or creates a substantial potential to violate any part of the Water Pollution Control Act, is subject to an enforcement order from Ecology pursuant to RCW 90.48.120.

The Voluntary Clean Water Guidance for Agriculture is a technical resource that is under development for the agricultural community, restoration practitioners, and agricultural assistance organizations to utilize for implementation. Ecology recommends implementing BMPs from this guidance to comply with WQS. If bacteria and temperature WQS are not achieved through implementation of BMPs for agriculture outlined in this Alternative Restoration Plan, a traditional TMDL study will be required in the EFLR to comply with the Clean Water Act.

Agriculture implementation

To achieve clean water in the EFLR, meet WQS for bacteria, and support recreational uses, it is necessary to address water quality impacts from agriculture. The extent of agricultural impacts in the watershed is currently unknown, but areas with known bacteria issues have been identified and proactive NPS investigation and monitoring is underway. Additional watershed evaluation, mapping, and assessment is needed to target and identify bacteria sources. Since the EFLR Partnership was launched, significant progress has been made to build local capacity and form new partnerships to address agricultural issues and help landowners. However, more work, coordination, resources, and capacity are needed. The following implementation tables outline goals and actions for agricultural implementation in the EFLR. The long-term vision is to eliminate agricultural impacts on water quality. To achieve this goal, local organizations should prioritize agricultural implementation efforts in the lower and middle watersheds, where known bacteria problems exist.

Table 31. Agriculture implementation goals.

Agricultural goals
• Eliminate impacts of agriculture on water quality in the EFLR. • Implement agricultural BMPs necessary to protect water quality in the lower and middle watershed (river miles 0 to 20 – specifically McCormick, Brezee, Lockwood, Riley, Jenny, Mason, Yacolt, and Rock Creek North) where known bacteria problems exist. The *East Fork Lewis River Source Assessment* identified Brezee and McCormick Creeks as the top priority areas for bacteria reduction. Rock Creek North, Jenny, Riley, and Lockwood Creek are secondary priorities. Mason and Yacolt Creek are also priorities for bacteria reduction • Prioritize agricultural outreach and implementation in the lower and middle watershed (river miles 0 to 20 – specifically McCormick, Brezee, Lockwood, Riley, Jenny, Mason, Yacolt, and Rock Creek North) where known bacteria problems exist. • Develop and implement a Pollution Identification and Correction program that supports long-term identification and improvement of agricultural properties contributing to bacteria pollution in surface waters.

Table 32. Agriculture implementation actions.

AG1	**Proactive Nonpoint Source Investigation**
AG1.1	Proactively investigate and identify properties with NPS water quality concerns in the lower and middle EFLR watershed, where known bacteria issues exist. (River miles 0 to 20 – specifically McCormick, Brezee, Lockwood, Riley, Jenny, Mason, Yacolt, and Rock Creek North).
AG1.3	Complete watershed evaluation, windshield surveys and desktop analysis to develop a list of properties with NPS water quality issues that would benefit from a site visit, technical assistance, conservation planning, or implementation of BMPs. Send letters to property owners and refer to Clark Conservation District to address bacteria pollution.
AG2	**Site Visits**
AG2.1	Complete site visits at all properties in the EFLR watershed with NPS water quality concerns to assess and document water quality issues, provide technical assistance, and identify opportunities for water quality BMP implementation. Prioritize streamside agricultural landowners with livestock and no riparian vegetation for initial outreach efforts.
AG2.2	Work with the Washington State Department of Agriculture Dairy Nutrient Management Program and the Food Safety Program to inspect the dairy and egg-laying facility in the EFLR to identify potential sources of NPS pollution. Ensure manure management and any land application of manure or biosolids is occurring in a manner protective of water quality.
AG2.3	Complete site visits and inspections at all wineries in the EFLR to identify bacteria and temperature pollution problems. Identify opportunities to implement source control best practices for bacteria and temperature, including management of fruit waste and management of manure land applied as compost or fertilizer. Prioritize visiting wineries with large ponds attracting geese, which potentially contribute to bacteria pollution and thermal loading. If appropriate, encourage proper wastewater treatment practices and coverage by the Ecology winery general permit.
AG2.4	Complete site visits at all produce producers and orchards in the watershed to educate and encourage the implementation of source control measures.
AG3	**Technical Assistance**
AG3.1	Provide technical assistance for the planning, design, and implementation of eligible water quality BMPs and stream restoration activities to all property owners with NPS water quality challenges in the EFLR. Document technical assistance in a letter outlining necessary corrective action and implementation needed to address water quality concerns.
AG3.2	Identify water quality improvement projects that are eligible for Ecology, NRCS, Clark CD, RCO or other funding.
AG3.3	Provide technical assistance to support manure lagoon decommissioning and management in the watershed.

Table 33. Agriculture implementation actions (cont.)

AG4	Conservation Planning
AG4.1	Complete site-specific conservation plans targeted to water quality BMP implementation on all properties in the EFLR with NPS pollution concerns. Prioritize agricultural landowners with livestock for initial planning efforts.
AG4.2	Identify opportunities for off-stream watering, livestock feeding, waste management BMPs, livestock exclusion fencing, heavy use area protection, pasture management, and riparian restoration on farms.
AG5	**Implementation – Agricultural BMPs**
AG5.1	Implement appropriate livestock BMPs on properties in the EFLR with NPS water quality concerns. These include off-stream watering, livestock feeding, waste management BMPs, livestock exclusion fencing, and riparian restoration. Utilize the *Voluntary Clean Water for Agriculture Guidance* for implementation support.
AG5.2	Where appropriate, utilize Ecology funding, NRCS, RCO or Clark CD funding to implement BMPs on private property.
AG6	**Public Education and Outreach**
AG6.1	Implement agricultural education and outreach efforts in the EFLR. Focus on subwatersheds with known bacteria issues.
AG6.2	Connect NPS agricultural education to soil health, mud management, pasture health, erosion, flooding, protecting private property, restoring salmon habitat, and enhancing recreational opportunities in the EFLR.
AG6.3	Host more agricultural workshops and events. Prioritize hosting workshops in the watershed boundaries and target advertisements to residents living in the watershed to increase attendance.
AG6.4	Develop and host new agricultural workshops for Clark County including BMPs for equestrian owners, horse boarding facilities, alpaca farms, and small farmers with livestock in urban areas. Workshops targeted towards small acreage landowners are a priority.
AG6.5	Provide landowners renting the Conservation District's poultry processing unit, manure spreader equipment, and participating in the manure exchange program or annual native plant sale with education on water quality BMPs.
AG6.6	Update printed agricultural education materials. When appropriate, translate materials for other languages and make them accessible.
AG6.7	Provide education on best practices for water withdrawals, irrigation, water-use efficiency, off-stream watering facilities, and the negative impacts of constructed ponds for agriculture. Focus on how these efforts benefit water temperatures, streamflow restoration, and salmon recovery. Provide technical assistance to farmers with water resource challenges, including any irrigation districts in the watershed.
AG6.8	Develop new videos to educate the public on agricultural BMPs to improve water quality.
AG6.9	Create public private partnerships for agricultural education and outreach with local feed, agriculture supply stores, and real estate agencies specializing in agricultural and equestrian properties.

Table 34. Agriculture implementation actions (cont.)

AG6	Public Education and Outreach
AG6.10	Form relationships with Clark County Executive Horse Council, the Alpaca Association of Western Washington, Clark-Cowlitz County Farm Bureau, Pacific Northwest Poultry Association, the Northwest Livestock Commission, Washington Cattle Feeders Association, Future Farmers of America, 4H programs, the Center for Agriculture, Science, and Environmental Education, veterinarians, and others to promote education and outreach on agricultural BMPs for water quality
AG6.11	Provide educational information on agricultural BMPs at Clark County Fair and the Washington State Horse Expo.
AG6.12	Increase outreach to Clark County residents to raise awareness and utilization of Ecology's Environmental Incident Reporting system (ERTS) to report NPS pollution complaints.
AG7	**Pollution Identification and Correction**
AG7.1	To support PIC program administration, establish a PIC Program Interlocal Agreement or Memorandum of Understanding, PIC Program Coordinator, Advisory Group, Charter, or Governance Structure.
AG7.2	Establish a PIC Program Flowchart and Chain-of-Command, which describes an enforcement process and regulatory backstop.
AG7.3	Complete land use analysis and mapping. Establish geographic prioritization and project scope. Complete watershed evaluation and windshield surveys to support prioritization.
AG7.4	Develop protocols for site visits and property inspections and outline how technical and financial assistance will be provided. Establish clear criteria for how properties will be prioritized for investigation, outreach, and implementation.
AG7.5	Develop a Quality Assurance Project Plan (QAPP) for bacteria monitoring, which incorporates new *E. coli* standard. Select initial monitoring locations and determine thresholds for confirming bacteria hotspots and a threshold for resampling. Additionally, develop an investigative sampling and source tracing process.
AG7.6	Develop protocols for site visits, NPS surveys, illicit discharge detection and elimination, shoreline surveys, and property investigations.
AG7.7	Conduct outreach to agricultural landowners and stakeholders that have the potential to impact water quality. Provide technical assistance to agricultural landowners to design and construct BMPs necessary for water quality improvement. Administer funding for livestock BMP implementation. Conduct initial and follow-up site visits to ensure proper installation, use, and maintenance of water quality BMPs.
AG7.8	Develop a communication, education, and outreach strategy to support agricultural PIC efforts.
AG7.9	Develop an evaluation process to measure success. Develop implementation targets and criteria to measure progress, as well as a long-term effectiveness-monitoring plan.

Table 35. Agriculture implementation actions (cont.)

AG8	Other
AG8.1	Secure local funding from Clark County and municipalities to support Clark Conservation District and local agricultural assistance organizations.
AG8.2	Update mapping to identify where water quality improvement projects have been implemented and where landowners are spreading manure. Include soil suitability mapping for land application of bio solids (lagoon decommissioning drainage class soils).
AG8.2	Through the NRCS Southwest Local Working Group and Regional Conservation Partnership Program (RCPP), prioritize the EFLR for additional planning and implementation support. Work with the Washington State Conservation Commission to prioritize resources for Southwest Washington and Clark County to implement water quality activities.
AG8.3	Implement best practices from Ecology's Voluntary Clean Water Guidance for Agriculture.
AG8.4	Calculate expected load reductions from implementation of livestock BMPs and report to Ecology and EPA.
AG8.5	Track implementation and complete effectiveness monitoring to assess water quality improvement post-implementation.
AG8.6	Implement source control BMPs to reduce NPS agricultural runoff in stormwater.
AG8.7	Update local codes and ordinances to address agricultural discharges to water quality and manure management.

Milestones, targets, and timelines for agriculture

The short-term goal is to provide technical and financial assistance to the 689 agricultural landowners located within 200 feet of a stream by 2031 to support implementation of agricultural BMPs. This will cost approximately $5.9 million dollars, which does not include the costs for design, engineering, planning, construction, or implementation of BMPs. To achieve this near-term goal, 10 percent of agricultural landowners should have technical assistance and conservation planning completed by 2023, and 25 percent should be addressed by 2025.

Ecology is confident in the ability to make progress on agricultural implementation due to the new Poop Smart Clark pollution identification and correction program, which will start in 2021-2022. This program includes funding for technical assistance, conservation planning, and BMP implementation in priority areas for water quality. The ultimate goal is to achieve 50 percent of agriculture implementation on parcels located within 200 feet of priority streams areas for by 2027, and 75 percent by 2029, with 100 percent implementation on agricultural properties within 200 feet of a stream by 2031. More information on milestones, targets, and timelines is included in Chapter 11 of this plan. Cost estimates for implementation are outlined in Chapter 10.

Criteria to measure progress on agriculture

Ecology's goal is to achieve 100 percent implementation on 689 agricultural parcels located within 200 feet of the stream by 2031. Remaining agriculture properties in the watershed will be addressed by 2033. An annual survey will be sent to implementing partners to track and measure progress. This survey will document the total number of site visits, technical assistance letters, conservation plans, and BMPs implemented in the watershed including the total dollars spent on technical and financial assistance. Information collected from the annual survey will be used to develop an annual report.

Clark County completes routine monitoring in the watershed every five years. The last time the watershed was monitored was in 2020. The watershed will be monitored again in 2025, 2030, and 2035. The long-term goal for agriculture is to achieve bacteria water quality standards by 2035. Ecology will formally reassess the watershed in 2035 to determine if bacteria water quality standards are being met. *E. coli* will be the primary parameter used to measure effectiveness of implementation actions. If bacteria water quality standards are not achieved by 2035, Ecology will determine if a formal TMDL study is needed in the watershed to address bacteria. More detailed information on criteria to measure progress on agriculture implementation is included in Chapter 11. The following criteria should be utilized to measure progress on agriculture implementation.

Funding and partnerships for agriculture

The Department of Ecology provides funding for agricultural BMPS through the Water Quality Combined Funding Program. The following agricultural BMPs are currently eligible for Ecology funding. The full list of eligible BMPs may be updated annually when new information or technology becomes available.

In addition to these BMPs, Ecology also funds implementation of riparian buffers that are beneficial for water quality. Additional guidance on agricultural BMPs should be referenced in the *Voluntary Clean Water Guidance for Agriculture*.

Table 36. Ecology funding for agriculture implementation.

Best Management Practice	Description
Livestock Exclusion Fencing	Livestock exclusion fencing protects riparian areas from impacts due to livestock activities in and around streams. In addition to fencing, recipients of this funding are required to plant the buffer between the stream and fencing setback with native trees and shrubs to provide a higher level of water quality improvement.
Livestock Off-stream Watering Facilities	A livestock owner uses off-stream watering to provide an alternative source of watering when fencing or other methods exclude livestock from streams in order to protect water quality. Recipients of this funding must also implement livestock exclusion fencing and riparian plantings in conjunction with off-stream watering facilities.
Livestock Feeding BMPs	Livestock feeding and waste management BMPs support the relocation of livestock activities that threaten water quality. Eligible livestock BMPs include heavy use area protection and associated fencing, waste storage facilities, and windbreaks. Grass filter strips are eligible as needed around heavy use areas, when located outside riparian areas. Livestock exclusion fencing and riparian restoration is a required prerequisite for projects that relocate livestock and must meet the minimum setback requirements.
Conservation-Based Tillage Systems	Conservation-based tillage systems that are consistent with Ecology's Voluntary Clean Water Guidance for Agriculture guidance are eligible for financial assistance.
Pollution Identification and Correction	Pollution Identification and Correction (PIC) programs work to protect and restore water quality by finding and fixing sources of bacteria, Eligible PIC program activities often include pollution source identification surveys and sampling, mapping, water quality monitoring, outreach, and BMP implementation.
Technical Assistance and Conservation Plans for Water Quality	Ecology may reimburse the costs associated with project-specific planning and technical assistance for planning, design, and implementation of eligible water quality BMPs or riparian restoration. In-depth planning or engineering designs on private property may require a landowner agreement prior to significant investment.

Information on BMP costing can be obtained by contacting Ecology's grant project managers and financial managers. The USDA NRCS also serves as a strong resource for BMP cost estimation. To achieve WQS in the EFLR, significant financial investment is needed to address water quality impacts from agriculture. More information on estimated costs to address agricultural sources of bacteria is outlined in Chapter 10. The following organizations are working to address agricultural challenges in the watershed.

Table 37. Agriculture implementing organizations and partners**.**

Implementation	Stakeholders
Primary organizations	Clark Conservation District and Washington State University Extension.
Partners	Watershed Alliance of Southwest Washington, Washington State University Extension, Washington State Conservation Commission, United State Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS), USDA Farm Service Agency, Clark County Public Works Code Enforcement, Clark County Public Health, Clark County Animal Control, Washington State Department of Agriculture, and Washington State Department of Ecology. .

Chapter 6 – Stormwater Management

Introduction

Stormwater is one of the primary sources of bacteria pollution in the EFLR watershed. In the *East Fork Lewis River Source Assessment*, the second highest bacteria concentrations measured in the watershed were discharging from a stormwater outfall in the City of La Center. This stormwater outfall drains La Center's downtown and urban growth area before discharging to Brezee Creek, near river mile four of the EFLR mainstem. Samples collected from this outfall have regularly exceeded WQS since 2005-2006. The bacteria concentrations measured at this outfall were almost six times higher than the applicable water quality standard, with 100 percent of dry season samples exceeding water quality criteria. Additionally, the highest bacteria levels measured in the watershed are located in McCormick Creek. The McCormick Creek subwatershed is experiencing rapid urbanization and development due to population growth in the City of Ridgefield.

Phase one priorities for stormwater management in the EFLR include bacteria source tracing, illicit discharge detection and elimination (IDDE) programming, bacteria source control activities, and comprehensive stormwater management planning. Adoption of the Stormwater Management Manual for Western Washington for development standards and stormwater operations is also a priority, in non-permitted areas. Focusing these efforts in the Brezee Creek and McCormick Creek subwatersheds where the highest bacteria concentrations have been measured, and where there are significantly more impervious surfaces and stormwater infrastructure, is a priority. The following table outlines stormwater impervious levels in the EFLR watershed. The secondary priority is to implement retrofits on approximately 1,810 acres of impervious surfaces, which is approximately 10 percent of the total imperviousness in the watershed, which is equivalent to the total amount of commercial and industrial land uses in the watershed. This target is also close to the total acres within the City of La Center's jurisdiction, which is approximately 1,677 acres.

Table 38. Stormwater impervious surfaces in the EFLR watershed.

Impervious Surface Type	Acres
100% industrial land uses	735
100% of commercial land use	1,075
100% of City of La Center	1,677
100% of commercial and industrial land uses	1,810
10% of total impervious surfaces	1,873
25% of total impervious surfaces	4,683
50% of total impervious surfaces	9,366
Acres with impervious densities greater than 10%	12,585
Total impervious surfaces	18,731

Addressing stormwater impacts in McCormick and Brezee Creeks will require close coordination with local jurisdictions, including the Cities of La Center and Ridgefield, which do not have Municipal Stormwater Permits or programs in place. Coordination with Clark County and the

Washington Department of Transportation is also necessary. The following list summarizes stormwater facts in the EFLR.

Table 39. Stormwater facts in the EFLR watershed.

Stormwater facts.
• Clark County has as Phase I Stormwater Permit. • City of Battle Ground has Phase II Stormwater Permit. • WSDOT has stormwater permit to implement Highway Runoff Manual. • Cities of Ridgefield, La Center, and Yacolt do not have stormwater permits. • 8% impervious land cover in watershed. • 18,731 acres of developed land cover in watershed. • 12,585 acres with impervious surfaces at densities greater than 10% • 96-acre increase in road impervious surfaces outside of urban growth areas between 2001 and 2016. • 4.9% increase in impervious surfaces (non-road) between 2001 and 2016. • 9,956 building footprints located in 364 acres of critical areas. • 787 building footprints located in 26 acres of shoreline management area. • 47% population increase in watershed since 2000. • Between 2000 and 2018, population has increased by 259% in Ridgefield, 124% in Battle Ground, 101% in La Center, and 69% in Yacolt. • Between 2004 and 2018 Urban Growth Boundaries have increased by 84% in Battle Ground, 83% in Ridgefield, 160% La Center, and 37% in Yacolt

Western Washington Municipal Stormwater Permit

The Western Washington Municipal Stormwater Permit requires local governments to manage and control stormwater runoff so that it does not pollute downstream waters. In the EFLR watershed, there are three municipal stormwater permittees. Clark County has a Phase I municipal stormwater permit, which regulates discharges in unincorporated counties with populations of 100,000 or more people in the 1990 census. The City of Battle Ground has a Phase II permit, which is implemented in jurisdictions with over 10,000 residents. The Washington Department of Transportation (WSDOT) also implements the Highway Runoff Manual on state roads. Other municipalities in the watershed that do not have stormwater permits are the City of Ridgefield, La Center, and Yacolt.

Stormwater jurisdictions and permits

City of La Center

The Brezee Creek subwatershed is a priority for stormwater implementation work in the EFLR watershed. Two jurisdictions have stormwater infrastructure in the Brezee Creek subwatershed.

These jurisdictions include unincorporated Clark County and the City of La Center. Unincorporated Clark County has a Phase I Municipal Stormwater Permit requiring the implementation of stormwater BMPs, including Illicit Discharge Detection and Elimination (IDDE) programming, stormwater outfall screening and mapping, and source control activities.

The City of La Center does not have a stormwater permit; therefore, all stormwater activities and programs implemented by the city are voluntary and proactive. La Center has expressed interest in completing more proactive stormwater work. For example, the City has recognized the value in developing a comprehensive stormwater management plan to support capital improvement and asset management programs, and to guide long-term investment in stormwater infrastructure. However, the City has yet to develop and implement a plan. To achieve stormwater goals, La Center adopted a stormwater utility in 2019 to generate a local source of revenue to fund future construction, operation, and maintenance needs. La Center is also interested in developing a private stormwater facility inspection and maintenance program, and an illicit discharge detection and elimination program. As of August 2020, the City of La Center has not adopted the Stormwater Management Manual for Western Washington stormwater standards or operations. The City is currently utilizing the 1992 Stormwater Management Manual for Puget Sound Basin for implementation and design standards.

Other jurisdictions with stormwater impacts in the EFLR include the City of Battle Ground, the Washington Department of Transportation (WSDOT), and the City of Ridgefield. The City of Battle Ground is under the Western Washington Phase II Municipal Stormwater Permit, which is implemented in portions of the Middle EFLR watershed. Since 2004, the urban growth boundary in the City of Battle Ground has increased by 84 percent. Priorities for long-term stormwater reimplementation in Battle Ground include bacteria source control, illicit discharge detection and elimination, and implementation of low impact development.

Washington Department of Transportation

The Washington State Department of Transportation (WSDOT) implements its Municipal Stormwater Permit in all Phase I and Phase II areas. WSDOT tracks permit implementation data including a features inventory, BMP type and location, outfalls, conveyance mapping, and IDDEs. This data is available upon request. WSDOT is also required to implement its Highway Runoff Manual statewide. In the Highway Runoff Manual, WSDOT has identified BMPs for waterbodies with TMDLs and category 5 listings. These best practices should be implemented in the EFLR watershed. Highways and state routes under WSDOT jurisdiction include Interstate-5 (I-5), which crosses the EFLR near Paradise Point State Park; state route 503 (SR-503) which bisects the middle watershed near Lewisville Park; and state route 502 (SR-502) which runs parallel to the river in the southern portion of the watershed. WSDOT's I-5 northbound EFLR Bridge Replacement project, at river mile 0.75 is set to begin in 2022. The project will eliminate direct stormwater discharge to the EFLR. WSDOT is exploring opportunities to implement water quality education at Paradise Point State park beneath the bridge. WSDOT has also established stormwater retrofit priorities in Clark County, including a location within the EFLR watershed along state route 502 at Mill Creek. While not yet funded, the retrofit will be funded in one of three ways as outlined in WSDOT's Stormwater Retrofit Management Plan. WSDOT has also identified two fish passage barriers along state route 503, which are not prioritized because

they are outside of the Puget Sound fish passage injunction area. However, these locations will be corrected as funding allows. WSDOT also has active wetland mitigation sites in the watershed that it monitors. These locations change overtime. WSDOT's TMDL Lead may be contacted to request data or to explore partnership opportunities.

City of Ridgefield

The City of Ridgefield also has stormwater impacts in the EFLR, specifically in the McCormick Creek subwatershed. Ridgefield does not have a municipal stormwater permit and has not adopted the Stormwater Management Manual for Western Washington. The implementation of stormwater BMPs within Ridgefield's jurisdiction would be beneficial to water quality in rapidly developing and urbanizing portions of the EFLR.

Clark County

The Clark County Stormwater Management Plan describes how stormwater and related water quality issues are managed. This plan is updated each year and describes many of the actions identified in the EFLR Alternative Restoration Plan in detail. The primary stormwater infrastructure owned by Clark County in the EFLR watershed are roads and ditches. Between 2001 and 2016, impervious surfaces from road infrastructure have increased by 96 acres in the watershed. Clark County plans to update its mapping and inventory of roads and ditches in the watershed in the next few years. In the past, Clark County has implemented stormwater needs assessment studies, water quality monitoring, and stream health reporting in the watershed. Clark County also has a Canine for Clean Water program, which provides education to dog owners about proper management and disposal of pet waste. According to the program, Clark County has over 110,000 dogs adding more than 13,000 tons of pet waste to Clark County watersheds each year through stormwater runoff. Pet waste is a major priority for stormwater source control activities in the EFLR. Implementation of pet waste facilities is one best management practice to reduce bacteria from Clark County's pets.

Stormwater source control

The Phase I and Phase II Municipal Stormwater permit requires the development, implementation, and management of source control programs to prevent and reduce the discharge of NPS pollutants to stormwater systems. Source Control programs often include the implementation of operational, structural, and treatment BMPs at pollution generating land use types, businesses, and activities. The Municipal Stormwater Permit requires implementation of source control BMPs. Structural and non-structural BMPs for bacteria and temperature source control are outlined in the Stormwater Management Manual for Western Washington. Inspections of pollutant generating land uses are required to ensure source control ordinances and BMPs are implemented.

Priority businesses for stormwater source control in the EFLR are businesses that have the potential to produce bacteria and increase water temperatures. These businesses include, but are not limited to, Animal Care Services, Food and Kindred Products, Commercial Composting, and Water and Sewer Districts and Departments.

Agricultural and residential land uses are a priority due to the potential for bacteria pollution from livestock and pets. The most important Source Control practices in the EFLR watershed are listed below.

- Correct illicit discharge to storm drains (IDDE).
- Address pet waste and goose waste.
- Prevent pollution from commercial animal handling areas, nurseries and greenhouses, commercial composting, and fertilizer applications.
- Implement preventative maintenance and good housekeeping.

Source Control implementation in the EFLR should be targeted to watersheds where known bacteria pollution exists. Field staff completing monitoring, NPS investigation, inspections, or pollution identification and correction activities should be trained to implement Stormwater Source Control programs. Some elements of source control programs relevant to the EFLR are as follows.

- Update and make source control ordinances or enforcement programs effective.
- Identify and inventory publicly and privately owned institutional, commercial, and industrial sites, which have the potential to generate pollutants to stormwater systems.
- Require the application of source control BMPs for pollutant generating sources associated with existing land uses and activities.
- Implement operational, structural, or treatment BMPs, to manage pollutant-generating sources.
- Implement an inspection program for sites identified. Inspect businesses or sites identified in the source control inventory to assess BMP effectiveness and compliance with source control requirements. Sites should be prioritized for inspection based on their land use category, potential for pollution generation, and proximity to receiving waters, or to address an identified pollution problem within a specific geographic area or sub-basin. All sites identified through credible complaints should be inspected.
- Implement a progressive enforcement policy to require sites to come into compliance with stormwater requirements within a reasonable time.
- Enforce source control ordinance.
- Provide education and technical assistance on source control programs.
- Train staff who are responsible for implementing the Source Control Program to conduct source control activities.
- Prioritize agricultural and residential land uses, and businesses that generate bacteria and temperature pollution for source control activities

Illicit discharge detection and elimination (IDDE)

The Phase I and Phase II Municipal Stormwater Permit requires the development, implementation, and management of Illicit Discharge Detection and Elimination (IDDE) programs to prevent, detect, characterize, trace, and eliminate illicit connections and illicit discharges into stormwater. IDDE implementation in the EFLR should be targeted to watersheds where known bacteria pollution exists and specifically for Brezee Creek. Field staff completing monitoring, NPS investigation, inspections, or pollution identification and correction activities

should be trained to implement IDDE programs. Training should include information on IDDE investigation methods such as dye testing, smoke testing, and stormwater televising. The development of surveys and protocols for shoreline and IDDE investigation is also needed. Some elements of IDDE programs are listed below.

- Implement an ordinance, appropriate policies or other regulatory mechanism to prohibit illicit discharges into the stormwater system, and an enforcement plan to ensure compliance.
- Implement an ongoing program designed to detect and identify non-stormwater discharges and illicit connections into stormwater systems, which includes procedures for conducting investigations.
- Maintain a storm-sewer system map showing the locations of all known storm drain outfalls and discharge points.
- Develop procedures for reporting and correcting or removing illicit connections, spills and other illicit discharges when they are suspected or identified. Illicit connections and illicit discharges can be identified through techniques including field screening, inspections, complaints or reports, construction inspections, maintenance inspections, source control inspections, or monitoring information.
- Develop a public hotline or other telephone number for public reporting of spills and other illicit discharges.
- Develop an ongoing training program for all municipal field staff, who might come into contact with or observe an illicit discharge or connection to the stormwater system, on the identification and procedures for reporting and responding to the illicit discharge or connection.
- Implement an ongoing program designed to address illicit discharges and connections. The program shall include procedures for tracing the source of an illicit discharge; and procedures for eliminating the discharge, including notification of appropriate authorities
- Conduct screening for illicit connections using the most up-to-date Illicit Connection and Illicit Discharge Field Screening and Source Tracing Guidance Manual.
- Conduct field inspections and visually inspect for illicit discharges at all known stormwater outfalls and discharge points.
- Implement procedures to identify and remove illicit discharges.
- Provide staff training or coordinate with existing training efforts to educate staff on proper BMPs for preventing illicit discharges.
- Eliminate any illicit connections identified.

Implementing IDDE and source control in Brezee and McCormick Creeks

Beginning in December of 2018, there were multiple illicit connections identified in the City of La Center, where sanitary sewer infrastructure was directly connected to the municipal

stormwater system. These connections were identified through routine stormwater maintenance after detecting an odor from a manhole. La Center's Public Works team responded promptly to the issue and submitted an Environmental Incident Report (ERTS). Clark County Public Health responded to the report and worked with La Center to fix the problem. During the correction process, homeowners were required to immediately stop using household sanitary systems. Temporary portable sanitation facilities were provided to homeowners. Clark Regional Wastewater District provided the City with technical assistance to survey the stormwater system to identify potential illicit discharges and cross connections. Multiple cross connections were identified in a subdivision built in 2017. The contractor who built the subdivision was notified and worked quickly to correct the illicit connections.

Through this process, an opportunity to prevent illicit cross connections was identified for future implementation. In the past, the same color pipes were used to install sanitary sewer and stormwater infrastructure. La Center is planning to update its building code to require different colored pipes and unique stamping to distinguish sanitary and stormwater system infrastructure. Additionally, the City is now requiring a more thorough inspection process before new homes are occupied.

Although the cross connections were identified and corrected, additional investigation is needed to ensure illicit cross connections and discharges in the City of La Center's jurisdiction are eliminated. La Center continues to identify illicit connections as recently as late 2020 and early 2021. Initial focus should be placed on the Brezee Creek drainage where bacteria issues have persisted since 2005 and 2006. In 2020, high bacteria levels were confirmed at other locations in La Center's stormwater system through NPS investigation and monitoring. To address these issues, the City of La Center should conduct more system-wide field investigations, screening, and surveying to identify and correct potential problems. Additional information to support the development of an Illicit Discharge Detection Program in the City of La Center and Brezee Creek is listed below.

- Map the stormwater and sewer infrastructure network, including ditches and stormwater treatment and flow control BMPs.
- Identify and map contributing areas to stormwater outfalls in Brezee Creek including La Center and Clark County's stormwater infrastructure draining to stormwater outfalls in Brezee Creek; and the number of homes connected to municipal sewer versus septic systems.
- Complete a septic system records assessment. Understand septic system inspection, operation, and maintenance records, as well as information about septic system design, age, condition, and inspection frequencies.
- Utilize comprehensive stormwater planning to develop a stormwater management plan for La Center, which includes and IDDE and Source Control programs.

To increase stormwater resources, La Center should develop a comprehensive Stormwater Management Plan, which would enable the city to understand the location and condition of its stormwater system assets and prioritize future infrastructure investments and maintenance

needs. Stormwater Management Planning would also support IDDE work in Brezee Creek and prioritize areas for implementation of source control BMPs to reduce bacteria pollution.

La Center should also adopt the Stormwater Management Manual for Western Washington for its stormwater standards and operations. Proactively adopting and implementing the Manual could help the City prepare for future stormwater management needs and impending stormwater permit issuance. Between 2000 and 2018, population has increased by 101 percent in La Center, and between 2004 and 2018, the city's urban growth boundary has increased by 160 percent.

Participation in the new Poop Smart Clark, Pollution Identification and Correction (PIC) Program in partnership with Clark Conservation District, Clark County, Watershed Alliance, and Washington State University Extension is also recommended to address bacteria issues in the stormwater system. Engaging with the Stormwater Partners for Southwest Washington may also help La Center leverage stormwater resources and experience from other municipalities in the region.

Opportunities for La Center to collaborate with Clark County and other jurisdictions to implement an IDDE program are encouraged due to shared jurisdiction in the Brezee Creek subwatershed. This collaboration enables cross-jurisdictional training, interlocal agreements, and resource sharing are also recommended to build local capacity and expertise. As of 2021, La Center developed an Interlocal Agreement with Clark County to continue stormwater monitoring and IDDE work in its municipal stormwater system. La Center worked with Clark Clark County to implement microbial source tracking to identify what type of bacteria is currently entering the stormwater system. Monitoring confirmed high levels of human and dog DNA in stormwater runoff in the City of La Center. Recently, La Center started to include dog water quality education in local newsletters and utility bills to educate residents on best practices for managing pet waste. Additional outreach opportunities to address stormwater sources of bacteria should be pursued in Brezee Creek.

Impervious surfaces and development

The EFLR watershed is experiencing significant urbanization, population growth, and development. The cities of Ridgefield and La Center are some of the fastest growing municipalities in Washington. According to the *East Fork Lewis River Habitat Pilot Study,* the watershed has experienced a 47 percent increase in population since 2000.

Currently, eight percent of the watershed is impervious. Watersheds health is considered threatened when impervious land cover exceeds 10 percent. In total, the watershed has 18,731 acres of developed land cover. Approximately 12,585 acres have impervious landcover densities that are greater than the 10 percent target. In 2019, there were 9,956 building footprints in the watershed, on 364 acres of critical areas. Around 787 of these building footprints were in 26 acres of shoreline management areas.

In 2010, Clark County completed a *Stream Health Report*, which included a land cover assessment of subwatersheds. Subwatersheds with over 10 percent hard surfaces are priorities for stormwater management. These subwatersheds are located in the lower and middle

watershed and include Brezee, McCormick, Jenny, Lockwood, Mason, Dean, Mill, and Rock Creek North. Subwatersheds entering the EFLR mainstem at river miles 0, 3.19, and 7.25 are also priorities. Implementation of stormwater retrofits including low impact development (LID) practices, which maximize stormwater infiltration, can help achieve pollution reduction goals and help control runoff from impervious surfaces. Table 45 summarizes the estimated stormwater impervious densities in EFLR watershed.

Table 40. Impervious land cover in the EFLR subwatersheds, 2010.

Subwatershed	Percent impervious surfaces by subwatershed
Lower Watershed (RM0-6)	
Brezee Creek	16
Jenny Creek	12
McCormick Creek	19
EFLR RM 0.00	18
EFLR RM 3.19	15
Middle Watershed (RM 6-20)	
Dean Creek	13
Lockwood Creek	10
Mason Creek	11
Mill Creek	20
Rock Creek North	10
EFLR RM 7.25	19
EFLR RM 15.75	9
Upper Watershed (RM 20-32)	
Cedar Creek	5
Big Tree Creek	9
Rock Creek South (Lower)	5
Rock Creek South (Upper)	5
Yacolt Creek	8
EFLR RM 21.4	6
EFLR RM 26.3	5

Stormwater management enforcement

Ecology's goal is to work with stakeholders to achieve voluntary compliance with state law and the WQS. Ecology invests heavily in technical and financial assistance and provides multiple opportunities and pathways for stakeholders to proactively address pollution problems before enforcement is pursued. Ecology uses regulatory authority as a backstop when technical and financial assistance efforts fail to address identified pollution problems. Any person who violates or creates a substantial potential to violate any part of the Water Pollution Control Act, is subject to an enforcement order from Ecology pursuant to RCW 90.48.120.

If bacteria WQS are not achieved through implementation of BMPs for stormwater outlined in this Alternative Restoration Plan, a traditional TMDL study will be required in the EFLR to comply with the Clean Water Act.

Stormwater management implementation

To achieve clean water in the EFLR, meet WQS for bacteria, and support recreational uses, it is necessary to address water quality impacts from stormwater. The following implementation tables outline goals and actions for stormwater implementation in the EFLR. The long-term vision is to achieve a high level of stormwater management in the watershed, resulting in the implementation of illicit discharge, detection, and elimination, and bacteria source control activities. To achieve this goal, local organizations should prioritize stormwater implementation efforts in the lower watersheds where known bacteria problems exist, and in subwatersheds where impervious land cover exceeds 10 percent. Technical and financial assistance should be provided to the City of La Center and Ridgefield to develop and implement stormwater best practices in the most critical water quality areas.

Table 41. Stormwater implementation goals.

Implementation goals
• Prioritize stormwater implementation in the lower and middle watershed, focusing on Brezee and McCormick Creeks, and subwatersheds with imperious surfaces over 10 percent. • Achieve a high level of stormwater management in the EFLR by implementing structural and non-structural stormwater BMPs to manage runoff from impervious surfaces. Prioritize implementation of BMPs on pollutant generating impervious surfaces, directly discharging to the EFLR from pollutant generating land use types, businesses, and activities. • Develop and implement comprehensive stormwater management planning in the watershed, which prioritize the implementation of structural and non-structural stormwater BMPs, including Source Control and illicit discharge detection and Elimination programs, resulting in the elimination of stormwater impacts on water in the EFLR. • Permitted jurisdictions, WSDOT Clark County (Phase I) and the City of Battle Ground (Phase II) prioritize the EFLR for implementation of stormwater management practices, programs, and projects. • Non-permitted communities in the EFLR watershed, including La Center, Ridgefield, and Yacolt; should implement proactive and voluntary stormwater management measures to protect and improve water quality in the EFLR.

Table 42. Stormwater implementation actions.

SWM1	Illicit Discharge Detection and Elimination Programs
SWM1.1	Implement Illicit Discharge Detection and Elimination (IDDE) programs in the EFLR through Phase I and Phase II stormwater permit programs, and voluntary, proactive stormwater management activities. Prioritize implementation of IDDE in subwatersheds that have known bacteria and temperature impairments, focusing first on Brezee and McCormick Creek subwatersheds.
SWM1.2	Support the development of an Illicit Discharge Detection Program in the City of La Center and Brezee Creek by mapping the stormwater and sewer infrastructure network; including ditches and stormwater treatment, and flow control BMPs. Identify and map contributing areas to stormwater outfalls in Brezee Creek including La Center and Clark County's stormwater infrastructure draining to stormwater outfalls in Brezee Creek; and the number of homes connected to municipal sewer versus septic systems. Utilize comprehensive stormwater planning to develop and implement IDDE and Source Control programs in La Center.
SWM1.3	Develop and implement local ordinances or other regulatory mechanism to prohibit non-stormwater, illicit discharges into the stormwater system. Implement appropriate policies prohibiting illicit discharges and an enforcement plan to ensure compliance. Establish an ongoing program designed to detect and identify non-stormwater discharges and illicit connections into stormwater systems, which includes procedures for conducting investigations.
SWM1.4	Maintain a storm-sewer system map showing the locations of all known storm drain outfalls and discharge points.
SWM1.5	Develop procedures for reporting and correcting or removing illicit connections, spills and other illicit discharges when they are suspected or identified. Establish procedures for addressing pollutants entering the stormwater system from an interconnected, adjoining system. Illicit connections and illicit discharges can be identified through techniques including field screening, inspections, complaints or reports, construction inspections, maintenance inspections, source control inspections, or monitoring information.
SWM1.6	Implement an ongoing program designed to address illicit discharges and connections. The program shall include procedures for tracing the source of an illicit discharge; and procedures for eliminating the discharge, including notification of appropriate authorities
SWM1.7	Develop a public hotline or other telephone number for public reporting of spills and other illicit discharges.
SWM1.8	Develop an ongoing training program for all municipal field staff, who might come into contact with or observe an illicit discharge or connection to the stormwater system, on the identification and procedures for reporting and responding to the illicit discharge or connection. Provide staff training or coordinate with existing training efforts to educate staff on proper BMPs for preventing illicit discharges.

Table 43. Stormwater implementation actions (cont.)

SWM1	**Illicit Discharge Detection and Elimination Programs**
SWM 1.9	Conduct screening for illicit connections using the most recent Illicit Connection and Illicit Discharge Field Screening and Source Tracing Guidance Manual. Conduct field inspections and visually inspect for illicit discharges at all known stormwater outfalls and discharge points. Eliminate any illicit connections identified.
SWM2	**Source Control**
SWM2.1	Implement source control programs in the EFLR through Phase I and Phase II stormwater permit programs, and voluntary stormwater management activities.
SWM2.2	Prioritize implementation in subwatersheds that have known bacteria and temperature impairments. Target land uses that have the potential to generate bacteria and temperature pollution for implementation of operational and structural BMPs for source control.
SWM2.3	Implement operational and structural source control BMPs from the Stormwater Management Manual for Western Washington that address bacteria and temperature.
SWM2.4	Implement source control BMPs for pet waste; goose waste; commercial animal handling areas; preventative maintenance and good housekeeping; nurseries and greenhouses; commercial composting, pools, spas, hot tubs, and fountains; and fertilizer application.
SWM2.5	Prioritize the following business types for source control activities: food and kindred products, animal care services, commercial composting, and water and sewer districts and departments.
SWM2.6	Focus implementation of pet and goose waste BMPs at parks, public recreation areas, campgrounds, day use areas and wineries in the EFLR watershed.
SWM3	**Stormwater Management Planning**
SWM3.1	Develop and implement a comprehensive stormwater management plan for watersheds in the City of La Center and Ridgefield's jurisdictions. Minimally, stormwater management plans should include strategies for public education and outreach, public involvement and participation, illicit discharge detection and elimination, construction stormwater, post-construction stormwater management, and pollution prevention and good housekeeping for municipal operations.

Table 44. Stormwater implementation actions (cont.)

SWM3	Stormwater Management Planning
SWM3.2	Complete comprehensive stormwater management planning to support capital improvements and asset management programs. Planning efforts may include: • Inventorying and mapping all facilities and assets including pollutant generating impervious surfaces, drainage areas, outfalls, conveyance structures, ditches, and roads. • Assessing the condition of all assets and facilities to inform capital improvement and asset management programs. • Prioritizing facility upgrades, based on the condition and criticality of infrastructure • Prioritizing investments where the largest water quality benefits will be achieved. • Requiring LID principles and BMPs are implemented when updating, revising, and establishing new development-related codes, rules, standards, or other enforceable documents. • Implement development-related codes, rules, standards, or other enforceable documents to minimize impervious surfaces, native vegetation loss, and stormwater runoff. • Utilizing the Low Impact Development Code Update and Integration Toolkit to incorporate stormwater management into local planning efforts.
SWM4	**Education and Outreach**
SWM4.1	Implement stormwater education which generate public awareness, inspires stewardship and effects behavior change to improve water quality. Utilize community based social marketing practices to identify and target priority populations for stormwater education with culturally specific and appropriate messaging.
SWM4.2	Increase stormwater education and outreach on pet waste management and disposal, how to prevent illicit discharges, source control actions, and how stormwater management impacts water quality. Utilize Clark County's Canines for Clean water program to amplify education on how pet waste impacts water quality. Consider opportunities to collaborate with animal service providers including groomers, boarders, and veterinarians to increase public awareness. Increase pet waste facilities in the watershed and access to dog waste bags. When possible, partner with local solid waste authority, such as Clark County Green Neighbors, to develop an ordinance that requires pet owners pick up waste at least once weekly, or more often as necessary using a bag, and disposing in a sealed trash container.
SWM4.3	Provide education on yard care and yard waste management techniques that are protective of water quality.
SWM4.4	Educate homeowner associations on best practices for maintenance and management of private stormwater facilities and how proper management and investment in facilities benefits local water quality.

Table 45. Stormwater implementation actions (cont.)

SWM4	Education and Outreach
SWM4.5	Educate the development community on low impact development and opportunities to co-locate vegetation and stormwater management requirements in development projects.
SWM4.6	Educate local governments on the benefits of proactive stormwater management and best practices for incorporating stormwater management and low impact development into municipal programs
SWM4.7	Utilize the Stormwater Messaging Toolkit and Resource Reservoir for stormwater education and outreach.
SWM4.8	Implement a stormwater drain-stenciling program as a public education and outreach tool in the EFLR.
SWM5	**Other Stormwater Best Management Practices**
SWM5.1	Implement stormwater BMP setback requirements for BMPs located near septic systems to prevent impacts to sanitary infrastructure and bacteria loading to surface waters.
SWM5.2	Implement BMPs and source control activities to prevent bacteria from entering Underground Injection Control (UIC) wells.
SWM5.3	Achieve minimum stormwater management and design requirements for new development and redevelopment in the EFLR, as prescribed by the Stormwater Management Manual for Western Washington.
SWM5.4	Implement private facility inspections and maintenance programs in the EFLR to ensure stormwater infrastructure in residential areas are functioning optimally.
SWM5.5	Implement recommended flow control, runoff treatment, LID, Source Control, and Construction BMPs as outlined by the Western Washington Stormwater Management Manual.
SWM5.6	Implement Low Impact Development (LID) to maximize infiltration in the EFLR watershed.
SWM5.7	Implement stormwater BMPs that promote infiltration. Avoid detention and ponding BMPs that can contribute to warm water temperatures. BMPs most appropriate for bacteria and temperature impairments are outlined in the Stormwater Management Manual for Western Washington and the Department of Transportation's Highway Runoff Manual.
SWM5.8	Prioritize subwatersheds with over 10 percent impervious cover for stormwater management activities. From the *2010 Clark County Stream Health Repor*t, Brezee, Jenny, McCormick, Dean, Lockwood, Mason, Mill, Rock Creek North, and EFLR RM's 0, 3.19, and 7.25 are priorities for stormwater management.
SWM5.9	Calculate expected load reductions from implementation of stormwater management activities and report to Ecology and EPA.
SWM5.10	Implement best practices for local yard waste disposal programs to prevent bacteria loading to surface waters.
SWM5.11	Implement source control practices for dumpsters to prevent pollution to surface waters.
SWM5.12	Ensure proposal disposal of decant from street sweeping and street waste vehicles.

Table 46. Stormwater implementation actions (cont.)

SWM	Other Stormwater Best Management Practices
SWM5.13	Implement best practices from the Highway Runoff Manual for stormwater management on roads. Where possible, eliminate direct stormwater discharges from effective impervious surfaces and direct discharges from road infrastructure
SWM5.14	Update roads, ditches, and outfall mapping in the EFLR.
SWM5.15	Preserve natural areas to promote infiltration, restore streamflow, and increase groundwater recharge, to help provide sources of cool groundwater inputs to the EFLR.
SWM5.16	Retrofit existing impervious surfaces and bring old stormwater facilities up to modern design standards.
SWM5.17	Pursue Stormwater Financial Assistance Program funding to implement stormwater facilities and activities in the EFLR watershed.
SWM5.18	Continue implementation of construction stormwater, industrial stormwater, and sand and gravel permit requirements in watershed.

Milestones, targets, and timelines for stormwater management

To achieve bacteria water quality standards in the East Fork Lewis River, Ecology is proposing a phased approach for stormwater management in the East Fork Lewis River. In phase one, the highest priority for the City of La Center is to develop and implement an illicit discharge detection and elimination (IDDE) program in the watershed to find and fix illicit cross connections in Brezee Creek. Additionally, work to confirm, inventory and map stormwater assets will be necessary to support stormwater management and capital improvement efforts in the watershed into the future. Additionally, to ensure long-term water quality protection, Ecology is recommending the City of La Center to proactively develop a stormwater management plan and program, which includes illicit discharge detection and elimination and bacteria source control programming. Developing a private stormwater facility inspection and maintenance program may also help the city make progress towards achieving water quality standards. These plans should be developed by 2025, and implemented by 2030 due to documented sources of bacteria in La Center's stormwater infrastructure.

If water quality standards are not achieved in La Center's portion of Brezee Creek after phase one stormwater activities complete, then Ecology is recommending additional stormwater implementation in a phase two, which will focus on implementing stormwater retrofits to improve water quality treatment. The City of La Center's urban growth area is approximately 1,677 acres, or 2.62 square miles. The goal is to implement stormwater management efforts on one percent (1%) of La Center's total area, which would result in 17 acres of stormwater retrofits by 2035. This would cost the City an estimated $1.3 million dollars. More information on milestones, targets and timelines is included in Chapter 11 of this plan.

Criteria to measure stormwater management implementation progress

Ecology's phase I goal is to find and fix 100 percent of illicit cross connections contributing to bacteria pollution in Brezee Creek by 2030 through development and implementation of a new IDDE program in La Center. To achieve this goal comprehensive stormwater planning, mapping, and inventorying of stormwater infrastructure may be necessary. Additionally, establishing a formal illicit discharge detection and elimination program, source control inventory, private stormwater facility inspection and maintenance program, and retrofit prioritization plan will help support long-term stormwater investments. An annual survey will be sent to implementing partners to track and measure progress. Information collected from the annual survey will be used to develop an annual report.

Clark County completes routine monitoring in the watershed every five years. The last time the watershed was monitored was in 2020. The watershed will be monitored again in 2025, 2030, and 2035. It is recommended that the City of La Center continue to collaborate with Clark County on implementing monitoring every five years. The long-term goal for stormwater is to achieve bacteria water quality standards by 2035.

Ecology will formally reassess the watershed in 2035 to determine if bacteria water quality standards are being met. *E. coli* will be the primary parameter used to measure effectiveness of implementation actions. If bacteria water quality standards are not achieved by 2035, Ecology will determine if a formal TMDL study is needed in the watershed to address bacteria. Ecology will formally reassess the watershed for temperature in 2055. More detailed information on criteria to measure progress on stormwater implementation is included in Chapter 11. Cost estimates for implementation are outlined in Chapter 10.

Funding and partnerships for stormwater management

The Department of Ecology provides funding for stormwater activities and facilities through the Water Quality Combined Funding Program. The full list of eligible BMPs may be updated annually when new information or technology becomes available.

Table 47. Ecology funding for stormwater implementation.

Best Management Practice	Description
Stormwater facility projects	Stormwater facility projects provide water quality benefits by treating and providing flow control for water generated from impervious surfaces associated with urban development, such as roads and buildings. Planning, prioritization, design, and construction of stormwater facility projects are eligible for funding.
Stormwater activity projects	Stormwater activity projects provide water quality benefits by creating behavior change, preventing future impacts to water bodies, and protecting and restoring natural systems. Grant funding for stormwater activity projects should enhance, not replace, current local water quality efforts and stormwater management program requirements.

Information on BMP costing can be obtained by contacting Ecology's grant project managers and financial managers. To achieve WQS in the EFLR, significant financial investment is needed to address water quality impacts from stormwater. More information on estimated costs to address stormwater challenges is outlined in Chapter 10. The following organizations are working on stormwater related issues in the watershed.

Table 48. Stormwater implementation organizations and partners.

Implementation	Stakeholders
Primary organizations	City of La Center, City of Ridgefield, Clark County Clean Water Division, City of Battle Ground, Yacolt.
Partners	Clark Conservation District and Washington State University Extension, Stormwater Partners for Southwest Washington, Watershed Alliance of Southwest Washington, Clark County Public Health, Clark County Animal Control, and Washington State Department of Ecology.

Chapter 7 – Riparian Restoration

Introduction

No monitoring locations in the EFLR watershed met temperature WQS in 2005 and 2006. Efforts to lower warm water temperatures are important to protect aquatic life and support salmon recovery. Riparian restoration is one of the primary strategies needed to increase shade and lower warm water temperatures in the EFLR.

Today, there are around 2,000 acres of Clark County owned property that have been preserved for conservation and restoration purposes. Much of this public land is located in riparian areas along the EFLR mainstem, providing significant opportunities for restoration. An additional 9,000 acres have been identified for future acquisition and preservation. Multiple restoration projects have been implemented in the watershed to increase tree canopy and enhance natural resources; however, more work is needed. These projects have been funded through the Department of Ecology's Water Quality Combined Funding program, the Recreation Conservation Office's Salmon Recovery program, Clark County, Clark Public Utilities, local conservation programs, and by private landowners. Most of these projects are located in the middle and lower watershed.

The *East Fork Lewis River Pilot Study* included an analysis of hydrologic maturity of forested landcover in the watershed. Hydrologically mature forests are defined as evergreen or mixed forest types that have more than 70 percent canopy closure. Intermediate hydrology maturity are forests with 10-70 percent canopy closure. Hydrologically immature forests are hardwood and shrub land cover types that have less than 10 percent canopy. According to the assessment, 33 percent of the East Fork Lewis River watershed consists of hydrologically mature forest, with 11 percent intermediately mature, and 11 percent immature. Approximately 55 percent of the watershed is non-forested.

In 2016, the EFLR had around 74,505 acres of private and public forestlands. From 2004 to 2018, around 27,472 acres were permitted for harvest by the Department of Natural Resources. The watershed has an estimated 11,135 acres of wetlands, and 132,266 acres of non-impervious surfaces. In addition to riparian restoration, other cold-water enhancement projects such as wetland restoration, floodplain reconnection, streamflow restoration, and cold-water refuge enhancement are also important for long-term water quality and salmon recovery. These additional streamflow restoration activities are outlines in the Streamflow Restoration Chapter.

A summary of riparian restoration facts in the EFLR is listed in the following table.

Table 49. Riparian restoration facts in the EFLR.

Riparian restoration facts.
• 85 percent system potential riparian vegetation. • 27 percent shade deficit in lower watershed. • 35 percent average shade deficit in middle watershed. • 26 percent average shade deficit in upper watershed. • River miles 9 to 13 have shade deficits over 40 percent. • 2,000+ acres of conservation land in watershed through Clark County Legacy Lands program. • 9,000+ acres planned for acquisition. • 74,505 acres of forestland in 2016 • 27,472 acres of forestland permitted for harvest from 2004-2018.

System Potential Vegetation

According to the *East Fork Lewis River Source Assessment*, the system potential riparian vegetation that can be achieved in the EFLR is 85 percent tree canopy cover. System potential riparian vegetation is defined as the vegetation that can be achieved without human disturbance, based on climate, elevation, soil properties, plant biology and hydrologic processes. This target can be achieved by planting trees on all land that is not already paved or developed.

In Clark County, riparian habitat is defined by measuring from the stream's ordinary high water mark to the edge of the 100-year floodplain; or the area that is 250 feet from streams mapped as shorelines of statewide significance; 200 feet from fish bearing streams; 100 feet from non-fish bearing perennial streams; and 75 feet from non-fish bearing seasonal streams.

From river mile 0 to 7 in the EFLR, the primary tree species present are deciduous trees. The average 100-year tree height potential is around 75 feet, with an estimated overhang potential of approximately 7.5 feet. From river mile seven to the headwaters, the primary tree species are conifers. The average 100-year tree height potential is around 150 feet, with an estimated overhang potential of approximately 15 feet. To maximize tree canopy and shade in the EFLR, it is important to consider how channel orientation and site conditions can affect restoration success and maximize shade.

Current resources available to identify appropriate buffer widths for riparian restoration are Ecology's Riparian Buffer Width Map, the Department of Natural Resources Forest Practices Application Mapping Tool, and the Washington Department of Fish and Wildlife's SalmonScape mapping application. Based on recommendations in 2021, riparian buffers on the mainstem EFLR should be at least 100 feet wide to support water quality and salmon recovery. Some tributaries have smaller buffer requirements. More guidance on riparian restoration and best practices for buffer implementation will be published in the future *Voluntary Clean Water*

Guidance for Agriculture. The long-term goal is to achieve system potential riparian vegetation, maximum site potential tree height, and maximum overhang potential in the watershed.

The following table summarizes the total miles and acres of riparian buffers in the EFLR watershed. If every river mile has a 100-foot buffer planted, there is an estimated 1,510 acres of riparian land in the watershed, with the potential to support over 3 million trees.

Table 50. Estimated riparian restoration areas in the EFLR watershed.

Riparian restoration	River miles	Acres	Estimated number of trees (2,000 per are)
Riparian restoration mainstem	64.6	783 acres	1,566,000
Riparian restoration tributaries	60	727 acres	1,454,000
TOTAL	124.6	1,510 acres	3,020,000

Shade Deficit Analysis

In the *East Fork Lewis River Watershed Source Assessment*, a shade deficit analysis was completed on the river's mainstem to identify priority locations where riparian forest restoration and tree planting projects are needed to increase shade and help lower water temperatures. Shade deficits were calculated by subtracting effective shade, which is the total amount of solar radiation that is prevented from reaching the surface water, from potential shade. The priority area for tree planting projects is the middle watershed (RM 5.7-20.3), which has an average shade deficit of 35 percent. The middle watershed is also where some of the warmest water temperatures were measured in the Source Assessment.

Since this analysis was completed in 2005 and 2006, multiple restoration projects have been implemented in the EFLR watershed. How these projects have increased shade and reduced water temperatures is currently unknown. Future effectiveness monitoring and repeated shade deficit analysis is needed to measure how restoration activities are impacting water temperature and shade levels.

In the remainder of this section, results from the shade deficit analysis completed in the EFLR Source Assessment are described for the lower, middle, and upper EFLR watershed. These results help prioritize where future riparian restoration efforts should be targeted on the mainstem EFLR.

Lower watershed shade deficit results

The lower EFLR watershed (RM0-5.7) has the least effective shade, and the lowest potential shade. The potential shade that can be achieved is 35 percent and the average effective shade is 8 percent. The average shade deficit in the lower watershed is 27 percent. River miles 4-5 and 5-6 are priorities for riparian restoration and enhancement, with shade deficits exceeding 30 percent. The site-potential tree height in the lower watershed is approximately 75 feet tall, with a 7.5-foot overhang.

Table 51. Shade deficit results in the lower watershed.

River Mile	Average Potential Shade (%)	Average Effective Shade (%)	Average Shade Deficit (%)
1-2	24	13	9
2-3	32	7	25
3-4	39	9	28
4-5	37	3	34
5-6	42	8	36
TOTAL	35%	8%	27%

Most of the riparian land in the lower watershed is part of the EFLR Greenway, which is owned by Clark County's Legacy Lands program. Most of the properties on the south side of the river are in public ownership, and many of the parcels on the north side of the river are privately owned. Riparian restoration projects on public property should be prioritized on the south side of the river. Outreach to private landowners to encourage planting projects should be focused to the north side of the river. Clark County recommends that woody vegetation is not planted below the 12-foot contour line due to presence of freshwater marsh habitat, downstream of river mile six. Additionally, due to presence of Oregon Ash, Clark County has prioritized planting diverse tree species in riparian areas to help increase tree canopy resiliency to invasive species.

Lower Columbia Estuary Partnership and Clark Public Utilities have completed multiple riparian restoration projects on public property in the lower watershed. Trees planted during these projects are still maturing and will likely have positive impacts on shade levels in the lower watersheds. Once the trees have matured, effectiveness monitoring should be completed to measure how restoration activities have affected water quality.

Middle watershed shade deficit results

The middle watershed has the highest shade deficit in the EFLR. In the middle watershed, the potential shade that can be achieved is 63 percent and the average effective shade is 28 percent. This results in an average shade deficit of 35 percent in the middle watershed

Shade deficits exceeding 40 percent are located between river miles 9-10, 10-11, 11-12 and 12-13. River miles with shade deficits over 30 percent are located between river miles 6-7, 7-8, 13-14, and 16-17, and 19-20. Upstream of river mile 7, the primary species is conifer, which have a site potential tree height of 150 feet, and an overhand potential of 15 feet.

Table 52. Shade deficit results in the middle watershed.

River Mile	Average Potential Shade (%)	Average Effective Shade (%)	Average Shade Deficit (%)
6-7	47	15	31
7-8	42	5	36
8-9	42	12	30
9-10	54	15	40
10-11	65	21	40
11-12	55	13	45
12-13	67	16	49
13-14	72	39	37
14-15	70	43	29
15-16	69	40	25
16-17	71	36	38
17-18	71	41	28
18-19	74	46	27
19-20	80	47	34
TOTAL	63%	28%	35%

The middle watershed has less publicly owned property compared to the lower watershed. Most public property is located between river miles 6 to 14, and most privately owned property is located between river miles 14 to 20. Many organizations have focused restoration activities on the middle watershed, including Clark Public Utilities and the Lower Columbia Estuary Partnership's Ridgefield Pits Technical Advisory Committee. Through this committee, LCEP is developing restoration alternatives for river miles 7 to 10 to restore abandoned sand and gravel mining facilities. Additionally, Watershed Alliance and Clark County are implementing environmental and recreational improvements at Lower Daybreak Park, located between rivers miles 9 and 10. While restoration efforts on public properties are occurring in the middle watershed, additional restoration activities in the middle watershed should still be pursued. Outreach to private landowners is also important to enhance riparian connectivity between public and privately owned land.

Upper watershed shade deficit analysis results

The Upper EFLR is the most forested portion of the watershed with significant state, federal, and private forestlands. The potential shade that can be achieved in the upper watershed is 82 percent, with a site-potential tree height of 150 feet. The average effective shade is 56 percent, resulting in a shade deficit of 26 percent in the upper watershed.

While the upper watershed has the lowest average shade deficit, there are still opportunities to increase effective shade. Priority river miles for riparian forest restoration activities include river miles 20-21, 21-22, 27-28, 29-30, and 30-31, which have average shade deficits over 30 percent.

Table 53. Shade deficit results in the upper watershed.

River Mile	Average Potential Shade (%)	Average Effective Shade (%)	Average Shade Deficit (%)
20-21	73	40	32
21-22	69	36	34
22-23	73	50	25
23-24	82	59	22
24-25	78	54	25
25-26	82	62	21
26-27	82	52	27
27-28	87	55	34
28-29	85	59	26
29-30	87	57	30
30-31	89	61	30
31-32	91	72	21
32-33	94	80	13
TOTAL	82%	56%	26%

Clark County has some public property in the upper watershed, including Lucia Falls and Moulton Falls Regional Parks. The US Forest Service also manages Sunset Falls campground near the watershed boundary. Horseshoe Falls is also currently a target for acquisition along with the Yacolt Burn area. Most of the public land in the upper watershed is located between river miles 21 and 25. While there is significantly more private property in the upper watershed, there are significant state and federally owned forestlands, which are subject to management by Forest Practices regulations. Forest practices can help ensure riparian management zones and buffer remain intact for fish and wildlife, and that harvested lands are replanted. Efforts to educate private forest owners and provide conservation-planning services are a priority. Clark Conservation District employs a stewardship forester staff person to help private landowners manage and conserve private timberlands. Private landowner outreach should be prioritized between river miles 25 and 33.

Forested land cover in EFLR tributaries

The *East Fork Lewis River Source Assessment* completed a shade deficit analysis for the mainstem but did not complete a shade analysis for tributaries. Additional information and assessment is needed to understand riparian restoration needs on EFLR tributaries, as no monitoring sites on EFLR tributaries met temperature WQS in 2005 to 2006. Currently, there are an estimated 20 to 30 miles of tributaries, which need riparian buffers planted. In addition to low shade, many of these tributaries have man-made ponds that have been constructed near private residences. There are an estimated 350 acres of manmade ponds needing decommissioning and restoration on EFLR tributaries. Restoration to enhance cold-water on tributaries is critical to achieving temperature WQS in the mainstem EFLR.

In 2010, Clark County completed a *Stream Health Report*, which included a land cover assessment of subwatersheds. This assessment provides a starting point for prioritizing tributaries for riparian restoration. Subwatersheds with less than 40 percent forest cover are a

priority for riparian restoration. These subwatersheds are located in the lower and middle watersheds and include Brezee, McCormick, Dean Creek, and Mill Creeks; and subwatersheds entering the EFLR mainstem at river miles 0, 3.19, and 7.25. Outreach to private landowners to promote tree-planting projects are a priority in these subwatersheds.

Table 54. Forested landcover in the EFLR subwatersheds.

Subwatershed	Percent Forested
Lower Watershed	
Brezee Creek	38
Jenny Creek	40
McCormick Creek	20
EFLR RM 0.00	28
EFLR RM 3.19	23
Middle Watershed	
Dean Creek	37
Lockwood Creek	45
Mason Creek	41
Mill Creek	29
Rock Creek North	54
EFLR RM 7.25	36
EFLR RM 15.75	89
Upper Watershed	
Cedar Creek	88
Big Tree Creek	51
Rock Creek South (Lower)	85
Rock Creek South (Upper)	85
Yacolt Creek	52
EFLR RM 21.4	76
EFLR RM 26.3	84

Riparian forest implementation efforts

Clark County Legacy Lands Program

Clark County's Legacy Lands Program has worked for 30 years to acquire, protect, and restore natural resources, and critical areas in Clark County. Since its inception, the program has purchased over 2,000 acres of conservation areas in the EFLR. The EFLR has been a long-term focus area for the Legacy Lands program, due to the significant role this watershed plays in long-term recovery of ESA listed salmonid populations in the Lower Columbia River Basin. Through the Legacy Lands program, there are multiple regional parks and trail systems providing recreational use and enjoyment for residents and visitors in Clark County. Clark County works with Columbia Land Trust on conservation and acquisition projects.

As of 2021, properties under Clark County Legacy Lands Program's ownership in the EFLR include:

- Lower East Fork Lewis River Greenway.
- Lower East Fork Lewis Wildlife Area.
- La Center Bottoms, Mimsi Marsh.
- Becker-Lower Dean Creek.
- Lower Daybreak Park.
- Lewis River Ranch.
- Camp Lewisville (Camp Hope).
- Lucia Falls North and South.
- Moulton Falls.
- Lewis and Clark Regional Trail Corridor.
- Rock Creek Natural Area.
- Habersetzer – Upper East Fork Lewis River.

Some of these areas are open for passive recreation such as hiking, fishing, birding, and boating; and others are conservation areas that are closed to public access to protect critical natural resource areas. Areas closed for recreation, may provide opportunities for restoration and volunteer stewardship activities. Efforts to enhance riparian restoration on these properties should be pursued.

In 2017, Clark County Board of Councilors authorized the issuance of $7 million dollars in bonds to purchase 10 more properties for the Legacy Lands program. Six of these properties are in the EFLR. Acquisition of these properties will add over 9,000 acres of publicly owned conservation lands to the watershed. Listed in the following table are current acquisition priorities as of 2020. A longer list of acquisition priorities is listed in Chapter 10 of this plan.

Table 55. Future acquisitions in the EFLR.

Properties	Sponsor	Acres	Description
East Fork Lewis River – Mason Creek	Clark County	65	Implementing sixth highest rated salmon recovery project of 55 identified in the Lower East Fork Lewis River Aquatic Habitat Restoration Plan.
La Center – Bolen Creek	La Center	5.48	Acquiring a key link in the City's Trails and Pathway Plan, connecting northern portions of La Center to the river.
Lewis River Ranch – Phase 2	Clark County	160	Expanding an 89-acre legacy land between Daybreak and Lewisville Park to serve unmet recreational demands.
Yacolt Burn Forest – Phase 1	Columbia Land Trust	8,445	Acquiring a conservation easement to ensure high quality forest lands are committed to timber production and open to public access.
East Fork Lewis River Optimists	Columbia Land Trust	43	Protect significant resources along East Fork Lewis river and enable continued use of property for a youth camp.
Rock Creek Forest	Columbia Land Trust	362	Acquire a conservation easement to ensure high quality forestlands, and critical steelhead habitat, are committed to long-term timber production.
TOTAL		**9080.48**	

The following projects are restoration efforts that are currently underway by Clark County as of 2021. In addition to restoration projects, Clark County also provides stewardship of Legacy Lands through maintenance and invasive species treatment, removal, and management.

Lower Daybreak Master Plan – Manley Creek Restoration

Lower Daybreak Park is a 112-acre Clark County Regional Park located on the mainstem EFLR. This park is located in the middle watershed between river miles 9 and 11. There is a 40 percent shade deficit on the EFLR mainstem near this park. In 2010, Clark County developed a Masterplan for Lower Daybreak, which includes riparian restoration, streambank stabilization, and environmental education activities. At this park, there is significant erosion of the streambank and lack of riparian vegetation. To achieve clean water and increase effective shade in the EFLR, resources are needed to restore riparian forest at Lower Daybreak Park. In total, 20.2 acres of this site have been prioritized for reforestation and quarter mile of streambank has been prioritized for stabilization. The total tree canopy coverage that can be achieved at this site is approximately 68 acres, or 40 percent of the park's total area. In addition to reforesting the mainstem EFLR, riparian restoration on Manley Creek, which bisects the park, is also a priority. Watershed Alliance of Southwest Washington and Clark County are implementing a riparian restoration project on Manley Creek starting in 2020. Clark County completed some riparian restoration on Manley Creek in 2010 and 2011.

Mason Creek Acquisition & Restoration

Clark County acquired 48.5 acres of floodplain, wetland, and riverbank habitat adjacent Mason Creek and the EFLR. The County has purchased a conservation easement, on 7.4 acres of

habitat. The Lower Columbia Estuary Partnership will develop designs to restore more than 75 acres of floodplain and stream habitat at this site. More details on this project are outlined in the Streamflow Restoration Chapter.

East Fork Lewis River Schriber Reforestation

The East Fork Lewis River Schriber Reforestation project will plant native trees and shrubs on 12.3 acres of county-owned property stretching 4000 feet along the south bank of the EFLR. Portions of the southern bank in this area have a mature Oregon ash component, but the understory is dominated by reed canary grass. The project site is located in the lower watershed between approximately RM 3.8 and RM 4.8. Clark County will begin restoration at this site in 2021. Currently, there is a shade deficit of 28 percent between river miles 3 and 4 and 34 percent between river miles 4 and 5.

Columbia Land Trust

The Columbia Land Trust works to, "conserve and care for the vital lands, waters, and wildlife of the Columbia River region through sound science and strong relationships." The Land Trust was founded in 1990 and has conserved over 43,000 acres through purchasing land and conservation easements, accepting donation of land and easements, and supporting partners in conservation.

The EFLR is a top priority for the Columbia Land Trust. The Land Trust is currently working on 10 projects totaling 972 acres in the watershed. The Columbia Land Trust is working with Clark County Legacy Lands program as the lead sponsor to acquire the Yacolt Burn Forest – Phase 1, the East Fork Lewis River Optimists, and Rock Creek Forest projects. The Land Trust is also working to acquire the land near Horseshoe Falls for conservation purposes.

Additionally, the Land Trust has also collaborated with the Portland Audubon Society and Watershed Alliance of Southwest Washington to develop and implement a Backyard Habitat Certification Program. This program works with landowners to implement natural backyard habitats on private property. This program expanded to Clark County in 2019 and should be utilized in the EFLR watershed to promote private lands conservation.

Clark Public Utilities District

McCormick Creek Restoration

Clark Public Utilities District received a has funding from Ecology for the McCormick Creek Restoration project, which will implement extensive tree and shrubs plantings for over a half mile of McCormick Creek. Non-native, invasive plants will be removed from 20-acre project site. The site has 1,400 lineal feet of eroding bank along McCormick Creek that needs to be stabilized. The goal is to add 150 pieces of large woody debris (LWD) will be added to increase stream complexity, improve floodplain connectivity, and lower temperatures in the stream. Approximately 28,000 native trees and shrubs will be planted along 2,600 feet of McCormick Creek. Beaver dam analogues will also be added to the project area. This project is located downstream from La Center between river miles 2 and 3 and is expected to be complete by 2023.

East Fork Lewis River Knotweed Control Project

The East Fork Lewis Knotweed Control Project addressed water quality impairments through removal of invasive Japanese knotweed and planting native vegetation to increase riparian plant diversity and floodplain functions. The upper watershed has been targeted for surveys and invasive species treatment. The project is educating landowners and the community on invasive knotweed and how it affects water quality.

Clark Public Utilities District has attended outreach events, conducted landowner site visits, and initiated direct communication to around 1,000 landowners to increase public awareness. The project increased public participation by coordinating volunteers and staff to survey 50 stream miles and treat 150 acres of invasive species while monitoring and re-treating all previous sites, over three growing seasons.

Lockwood Creek

The Lockwood Creek project began in 2007 and finished in June of 2011. This project planted more than 47,131 trees and shrubs along 4,150 feet of stream on 23 acres. More than 1,500 feet of eroding streambanks were stabilized and at least 3,800 students learned the basics of the water cycle. Over 24 landowners participated in trainings and implementation.

Zimmerly Restoration Project

The East Fork Lewis Zimmerly Restoration Project addressed multiple water quality impairments through re-establishing vegetation in riparian corridors. Prior to planting, Clark PUD removed non-native invasive species with particular focus on Japanese knotweed to increase riparian plant diversity, restore floodplain function, and stabilize streambanks to decrease turbidity.

This project focused on river mile 5.8 in the East Fork Lewis watershed. Activities included removing invasive non-native vegetation and planting native species along the streambank. The goal is to help prevent erosion of the streambanks and will result in less turbidity and contamination in the water from runoff and erosion. In some areas, bank stabilization efforts were implemented to restore damage from bank erosion, and to reconnect lands that historically functioned as floodplains extending from the stream corridor. As trees grow and mature, they will provide shading to help lower the temperature of the water. A well-vegetated buffer will help prevent, reduce, and filter bacteria, from both animal and human sources, from entering into the system.

Clark Conservation District small forest land stewardship

The Regional Conservation Partnership Program (RCPP) is a USDA Natural Resources Conservation Service (NRCS) Farm Bill program that packages funding from multiple NRCS programs to provide landscape scale conservation benefits through partnerships with conservation organizations, agriculture, and forestry producers. The Southwest Washington Small Forest Lands Conservation Partnership provides RCPP funding to achieve conservation of forests in southwest Washington in a way that engages forest landowners and improves forest and watershed health to benefit people, fish and wildlife. Currently, Clark Conservation District has a Stewardship Forester staff person covering Clark, Wahkiakum, and Cowlitz counties. Since April 2019, significant conservation work has been implemented on private forestlands.

The following implementation has been achieved on private forestlands in between 2019 and 2020 through this new program.

- 20 people currently seeking conservation planning on 1,392 acres of forestland.
- 5 forest conservation plans completed on 79 acres.
- 28 technical assistance site visits completed on 860 acres of forestlands.
- 56 clients served on 2,330 acres.

Temperature enforcement

Ecology's goal is to work with stakeholders to achieve voluntary compliance with state law and the WQS. Ecology invests heavily in technical and financial assistance and provides multiple opportunities and pathways for stakeholders to proactively address pollution problems before enforcement is pursued. Ecology uses regulatory authority as a backstop when technical assistance efforts fail to address identified pollution problems.

Any person who violates or creates a substantial potential to violate any part of the Water Pollution Control Act, is subject to an enforcement order from Ecology pursuant to RCW 90.48.120. Ecology also has regulatory authority through the Forest Practices Act RCW 76.09, and WAC 222 to implement and enforce Forest Practices Rules and the Timber, Fish, and Wildlife agreement. Authority through the Shorelands and Environmental Assistance program, which overseas critical areas ordinances, shoreline management, and wetlands regulations, is also enforceable.

If the temperature WQS applicable to the waterbodies included in this *Alternative Restoration Plan* are not achieved through implementation of BMPs outlined in this *Alternative Restoration Plan*, a traditional TMDL study will be required to comply with the Clean Water Act.

Riparian restoration implementation

To achieve clean water in the EFLR, meet WQS for temperature, and support aquatic life uses, it is necessary to restore riparian forest areas and implement restoration projects that benefit riparian shade. The following implementation tables outline goals and actions for riparian forest implementation in the EFLR watershed. The long-term vision is to achieve system potential riparian vegetation of 85 percent tree canopy cover in the EFLR, by achieving site potential tree height in riparian areas. To achieve this goal, riparian forest restoration projects should be targeted to areas with the highest shade deficits, starting with the middle and lower watershed.

Table 56. Riparian restoration implementation goals.

Implementation Goals
• Achieve system potential riparian vegetation of 85 percent canopy cover in the EFLR watershed. • Achieve maximum tree height and overhang potential in the watershed. • Restore and enhance riparian forest in the EFLR, prioritizing the river miles with the highest shade deficits in the lower and middle watershed. The segments of the river with the highest shade deficits are located in the middle watershed from river miles 9 to 13. • Preserve existing riparian forest and stabilize eroding streambanks with existing riparian forest in the EFLR watershed. • Identify, acquire, preserve, and restore critical conservation lands in the EFLR Watershed.

Table 57. Riparian restoration implementation actions.

RR1	Riparian Forest Restoration
RR1.1	Implement riparian forest restoration projects on river miles with shade deficits over 30-40 percent.
RR1.2	In the lower watershed (RM 0-5.7), prioritize private landowner outreach for riparian forest implementation on the north side of the river. Focus implementation on public lands on the south side of the river within the EFLR Greenway.
RR1.3	In the middle watershed (RM 5.7-20.3), prioritize riparian forest implementation on public properties between river miles 6 and 14. Focus private landowner riparian restoration and conservation efforts between river miles 14 and 20.
RR1.4	In the upper watershed (RM 20.3 – 32.3), focus riparian restoration efforts on public lands between river miles 21 and 25. Prioritize riparian restoration on private properties between river miles 25 and 32.
RR1.5	Utilize the Ecology Riparian Buffer Width Map and other WDFW and DNR tools to identify the appropriate buffer widths to implement at project sites, including the forthcoming riparian buffer guidance in the Voluntary Clean Water Guidance for Agriculture.
RR1.6	Complete a shade deficit analysis on the EFLR tributaries, to identify tree-planting opportunities.
RR1.7	When possible, utilize volunteer groups, AmeriCorps members, Washington Conservation Crews, and Correctional Crews to implement tree-planting projects. Engage members of the public in restoration and stewardship activities.
RR1.8	Maintain riparian planting projects implemented in the EFLR watershed.
RR1.9	Conduct effectiveness monitoring on riparian restoration projects to understand how restoration efforts have affected water temperatures.
RR1.10	Calculate expected heat load reductions from riparian forest restoration projects.
RR1.11	Complete shade deficit analysis in 10-20 years post implementation to measure progress on increasing effective shade in the watershed.
RR2	**Private Lands**
RR2.1	Prioritize private landowner outreach for riparian forest restoration in the middle watershed (RM 5.7-20.3), where there is the most privately owned land. Prioritize outreach to private landowners with property on EFLR tributaries.
RR2.2	Increase the capacity of local organizations to develop, implement, and complete tree-planting projects; including outreach, planning, funding, maintenance, and implementation on private land.
RR2.3	Where appropriate, utilize Ecology, NRCS, RCO, and Clark CD funding to implement tree-planting projects on agricultural properties. If Ecology funding is supporting implementation, adhere to buffer width guidelines.
RR2.4	Complete forest stewardship conservation plans on properties with private forestlands.
RR2.5	Complete riparian planting plans for streamside properties with shade deficits.
RR2.6	Implement the Backyard Habitat Program in the EFLR.
RR2.7	Replicate the Watershed Alliance of Southwest Washington's Project Restore program in the EFLR.
RR2.8	Target land acquisition efforts to the middle and upper watershed, which has the least public ownership. In the lower watershed, prioritize properties on the north side of the river for continued acquisition efforts, and to support riparian connectivity in the EFLR greenway.

Table 58. Riparian restoration implementation actions (cont.)

RR2	Private Lands
RR2.9	Prioritize subwatersheds with less than 40 percent forest cover for forest restoration activities. From the 2010 Clark County Stream Health Report, Brezee, Jenny, McCormick, Dean, Lockwood, Mason, Mill, Rock Creek North, and EFLR RM's 0, 3.19, and 7.25 are priorities for forest restoration. The LCFRB's *East Fork Lewis River Habitat Pilot Study*, 2020 Clark County Stream Health Report, and WDFW change detection monitoring, will provide a more accurate depiction of forested land cover in the watershed to further target implementation efforts.
RR3	**Public Lands**
RR3.1	Implement riparian forest restoration projects on public lands in the EFLR including the Schriber project, La Center Wetlands Phase 2, Mason Creek, McCormick Creek, Lower Daybreak, and Man ley creek projects.
RR3.2	Focus riparian restoration efforts on public properties in the middle watershed, where there are the largest shade deficits.
RR3.3	Continue implementing riparian forest restoration project in the lower watershed.
RR3.4	Implement the proposed land acquisitions in the watershed to add an additional 9,000 plus acres to the watershed for preservation, conservation, and restoration.
RR3.5	Stabilize the eroding streambank and restore riparian forest vegetation at lower Daybreak Park, located between river miles 9 and 11.
RR3.6	Acquire priority properties through the Clark County Legacy Lands program, in partnership with Columbia Land Trust, for conservation, preservation, and restoration. Focus acquisition efforts in the middle and upper watershed.
RR3.7	Implement Washington State Forest Practices Act and associated rules on private and public forestlands Ensure forest practices activities are implemented on timberlands to preserve appropriate buffer widths for water quality and fish habitat. Forest practices activities are most prevalent in the upper watershed on timberlands.
RR3.8	Continue implementing Clark County's Conservation Areas Acquisition Plan in the EFLR through the Legacy Lands Program, and Columbia Land Trust programs.
RR3.9	Preserve forested areas in the upper watershed.
RR4	**Public Education and Outreach**
RR4.1	Educate private landowners on the benefits of retaining trees, planting native landscape, and adding backyard habitat to the EFLR.
RR4.2	Educate new landowners, homebuilders, developers, construction companies, and the real estate professionals, and building industry on the benefits of retaining riparian vegetation and forest on private property.
RR4.3	Conduct outreach to private landowners to educate, incentivize, and encourage riparian tree planting projects on private property.
RR4.4	Build the capacity of local organizations to conduct more private landowner outreach to increase tree planting and riparian forest restoration. If appropriate, develop a new private landowner tree planting partnership for outreach, branding, and marketing purposes.

Milestones, targets, and timelines for riparian restoration

To achieve temperature water quality standards in the East Fork Lewis River and support aquatic life uses, the highest priority is to implement riparian restoration projects to increase riparian shade. The long-term goal is to achieve system potential shade, which is 85 percent tree canopy. Efforts to restore riparian areas and plant trees is needed to increase effective shade and help lower warm water temperatures. Implementation on 100 percent of riparian areas needs to be achieved by 2035, with the goal that trees will reach maturity within 20 to 30 years by 2055 to 2065. To achieve this target, 25 percent of riparian areas needs to be planted by 2025. This would result in restoring 100-foot buffers on 378 acres along 31 river miles for an estimated cost of $5.8 million dollars. Fifty percent of implementation needs to be achieved by 2028, with the goal to achieve 75 percent by 2031, and 100 percent implementation by 2035. More information on milestones, targets, and timelines is included in Chapter 11 of this plan. Cost estimates for implementation are outlined in Chapter 10.

Criteria to measure riparian restoration implementation progress

Ecology's goal is to achieve 100 percent implementation on 124.6 river miles, or approximately 1,510 acres by 2035. An annual survey will be sent to implementing partners to track and measure progress. Information collected from the annual survey will be used to develop an annual report. Clark County completes routine monitoring in the watershed every five years. The last time the watershed was monitored was in 2020. The watershed will be monitored again every five years starting in 2025. The long-term goal for riparian restoration is to achieve temperature water quality standards by 2055. Ecology will formally reassess the watershed in 2055 to determine if temperature water quality standards are being met. If temperature water quality standards are not achieved by 2055, Ecology will determine if a formal TMDL study is needed in the watershed to address water temperatures. More detailed information on criteria to measure progress on riparian restoration implementation is included in Chapter 11. The following criteria should be utilized to measure progress.

Funding and partnerships for riparian restoration

The Department of Ecology provides funding for riparian restoration and other natural resource enhancement projects through the Water Quality Combined Funding Program. The full list of eligible BMPs may be updated annually when new information or technology becomes available.

Table 59. Ecology funding for riparian restoration implementation.

Best Management Practice	Description
Land Acquisition	The purchase of real property and conservation easements is eligible for financial assistance for the following purposes: wetland habitat preservation and protection, riparian area and watershed preservation and protection, and drinking water source protection.
Restoration Planning and Implementation – Riparian Area, Wetland, and Floodplain Restoration	Planning and implementation of riparian and wetland habitat restoration projects are eligible for loans or grants. Maintenance is eligible for up to 5 years of funding following planting. Applicants can include installation of livestock exclusion fencing as part of a riparian protection/restoration project.
Stream Restoration and Bank Stabilization	Stream restoration includes all in-stream work, such as daylighting, culvert removal, channel modification or re-establishment, large woody debris and engineered logjams, and bank stabilization using any materials beyond plants.
Water Quality Monitoring	Water quality monitoring before and during implementation, and after project completion is critical for tracking environmental and project results. Ecology may provide loans or grants for water quality monitoring projects. Typically, a recipient undertakes monitoring to characterize the existing conditions of ground waters and surface waters, to identify or quantify pollutant sources or loads, or to establish the effectiveness of BMPs. Monitoring may be the entire project or a component of a larger project.

Information on BMP costing can be obtained by contacting Ecology's grant project managers and financial managers. The USDA NRCS also serves as a strong resource for BMP cost estimation. The Lower Columbia Fish Recovery Board and the Washington State Recreation and Conservation Organization also have resources available to support implementation cost estimates. To achieve WQS in the EFLR, significant financial investment is needed to achieve riparian restoration and salmon recovery goals. More information on estimated costs to implement riparian restoration projects to reduce river temperatures is outlined in Chapter 10. The following organizations are working to restore riparian areas in the EFLR watershed.

Table 60. Riparian restoration implementation organizations and partners.

Implementation	Stakeholders
Primary organizations.	Clark County Public Works, Lower Columbia Estuary Partnership, Clark Public Utilities District, Columbia Land Trust, Watershed Alliance of Southwest Washington, Clark Conservation District, and Lower Columbia Fish Enhancement Group.
Partners	Washington State University Extension, Clark Skamania Fly Fishers, Washington State Conservation Commission, United State Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS), USDA Farm Service Agency, Washington State Department of Agriculture, Friends of Trees, Friends of the East Fork, and Washington State Department of Ecology.

Chapter 8 – Streamflow Restoration

Introduction

Streamflow restoration activities, to address low instream flow conditions, are a high priority in the EFLR watershed. According to LCFRB's *East Fork Lewis River Habitat Restoration Plan*, "low flows in the summer and early fall are of concern in the East Fork Lewis Basin, particularly in the tributaries and as it relates to warm summer temperatures."

The EFLR relies on the Troutdale Aquifer as a main source of streamflow to the river. This aquifer is also the sole source of drinking water for residents in Clark County. Streamflow issues in the EFLR have been linked to increased water withdrawal to support residential development. Streamflow issues have also been linked to land use change associated with timber harvest and increased resident development, which has impacted natural infiltration of water back into the sand and gravel aquifer. Climate change, increased air temperatures, and decreased snowmelt are other factors affecting the quantity of water entering the EFLR watershed each year.

Streamflow restoration activities can help address low instream flow challenges by implementing restoration and management practices that help increase the quantity of water available in the river. Implementations of these activities should be prioritized to critical areas, including groundwater recharge areas, and areas that are suitable for infiltration. Augmenting portions of the river where there are documented cold-water inputs and gaining reaches should also be prioritized.

In 2009, Ecology published the *Surface Water/Groundwater Exchange along the East Fork Lewis River* report. This report established priority river miles where the EFLR is gaining groundwater flows. These include river miles 4.6 to 8, 10.1 to 13.2 and river miles 26.9 to 29.

To improve streamflow in the EFLR, restoration efforts that go beyond tree planting and increasing shade are needed. Projects to restore the river's channel migration zone and address impacts to river geomorphology are necessary to achieve long-term restoration success and to support future riparian plantings. Project examples include restoring and reconnecting floodplains and wetlands, and projects to remove infrastructure, levees, and riprap from the floodplain for restoration purposes. These projects have the ability to help restore natural watershed and sediment processes and improve river dynamics.

In the remainder of this chapter, temperature projects that go beyond tree planting and increasing shade, to address and improve low instream flow conditions, are highlighted. Information about river geomorphology and watershed processes, salmon recovery, groundwater and surface-water exchange, watershed management planning, and local water use is described. Recommendations related to local water use are adapted from Ecology's *Surface Water / Groundwater Exchange along the East Fork Lewis River* report, and LCFRB's *Salmon-Washougal and Lewis Watershed Management Plan*. This chapter includes information active restoration projects that are underway to improve help improve streamflow in the EFLR and concludes with implementation actions for streamflow restoration.

Geomorphology and watershed processes

Geomorphology and watershed processes have a strong influence on water quality, instream flows, and salmon recovery in the EFLR. Historically, the EFLR had a significant amount of side-channel habitat, large wood, riparian habitat, a well-connected floodplain and wetlands, and established riparian vegetation. The Ridgefield Pits portion of the river, located between river miles 7 and 10, was highly complex, with multi-threaded anabranching channels. The Mason and Daybreak segments, located between river miles 6 and 10, were highly sinuous. The La Center segment, located in the most downstream part of the watershed, was single threaded but had multiple oxbows.

Land use change from forested landcover to agricultural and residential land uses has influenced the watershed's geomorphology and natural processes since the late 1800s. The lower watershed also experienced dredging from the 1800s to 1920s. The construction of bridges in the watershed, including the Lewisville, Daybreak, and La Center Bridges, have constricted the channel and floodplain. Instream mining from 1930 to 1975 also had significant impacts on watershed processes. Some floodplain fill has occurred from roads and development. Historically much of the large wood was removed from the river.

Today, there are challenges with bank armoring and riprap, as well as levees, which have impacts on channel migration and floodplain connectivity. Much of the floodplain is now disconnected, with less frequent inundation and fewer wetland areas. Overall, the channel migration zone is narrower than historical conditions, and anabranching channels are more confined.

Large woody debris

Presence of instream large wood is important to the health of the EFLR watershed. The National Marine Fisheries Service (NMFS) recommends that a properly functioning river system in the Western Cascades that is the size of the East Fork Lewis River should have at least 80 pieces of large wood per river mile. NMFS recommends that wood should be at least 50 feet long and 2 feet in diameter. According the *EFLR Ridgefield Pits Geomorphology report*, approximately 30 to 50 pieces of NMFS qualifying large wood have been observed per river mile in in the Upper Daybreak, Lower Daybreak and Ridgefield Pits sections of the EFLR. However, most of the wood observed in the watershed are much smaller than the size recommended by NMFS to establish logjams. Most of the large wood observed in the river is concentrated at river miles 10.5, 9.1 and 8.

Flow variability and flooding

The EFLR watershed has significant variation in seasonal flows. In the winter, the median flow is around 1,000 cubic feet per second (cfs). By August, the average median daily flow is around 69 cfs but summer flow levels often drop much lower than the median. Overall, the EFLR has seen an increase in stream flashiness, which is characteristic of increased stormwater runoff in watersheds experiencing land use change and urbanization. A USGS gage at Heisson Bridge has provided information on streamflow changes in the watershed.

Over the past 25 years, there have been three major flood events in the watershed. These include a 500-year flood event (28,300 cfs) in February 1996, which is the largest flood on

record, followed by a flood event in November 2006 and December 2015. The 1996 flood resulted in the river avulsing into the Ridgefield Pits, which is a historical sand and gravel mining site. The results of this avulsion are still adversely impacting habitat conditions today.

Ridgefield Pits avulsion

Historically, the Ridgefield Pits section of the river had a healthy, flowing, river-pool system and the avulsion caused a series of ponds, slowing down river flow. The deepest pond is expected to be 30 feet deep. In total, approximately 4,300 feet of salmonid spawning and rearing habitat was abandoned when the river avulsed. This avulsion has affected floodplain connectivity, side channel activation, sediment transport and storage, and overall river processes and habitat. The movement of the river into the gravel pits has influenced upstream and downstream channel incision and has impacted the elevation of the riverbed. At the time of avulsion, the elevation difference between the abandoned channel and new avulsion was 10 vertical feet. Today, the new channel is estimated to be 3 to 4 feet lower than the old channel. Downstream there have been impacts on sediment transport, which has resulted in more erosion. Today, the downstream portion of the Ridgefield Pits are accumulating fine sediments, and the slope of the river is changing. In the lower watershed, deposition of eroded sediment downstream is increasing channel widening, which can further affect water temperatures.

Ridgefield Pits restoration

In January 2020, the Lower Columbia Estuary Partnership in partnership with Inter-fluve, a leading river consulting firm working in the East Fork Lewis River, published the *East Fork Lewis River Ridgefield Pits Restoration Feasibility Analysis - Geomorphology Report*. *The East Fork Lewis River Ridgefield Pits Restoration Geomorphology Report* estimates how long it would take for the river avulsion into Ridgefield Pits to recover on its own. Current estimates project that it could take until 2075, or potentially longer, for the pits to fill on their own. Without restoration, geomorphic challenges in the watershed could continue for 55 or more years, and ultimately hinder water quality and salmon recovery. Currently, restoration alternatives are being evaluated for the Ridgefield Pits, with the goal to begin restoration of this portion of the watershed by 2025.

The *East Fork Lewis River Ridgefield Pits Restoration Geomorphology Report* provides important geomorphic information for the EFLR, with focus on river miles 7 to 10, where the river avulsed into the Ridgefield Pits area. This portion of the watershed has some of the warmest documented surface water temperatures in the *East Fork Lewis River Source Assessment*. The *Surface Water / Groundwater Exchange along the East Fork Lewis River* report also documents cold-water inputs entering the EFLR in this area, which provide opportunity for restoration. Addressing the geomorphic impacts from the Ridgefield Pits avulsion is important for future restoration of the watershed, to address warm water temperatures and support salmon recovery efforts.

Land use change in the channel migration zone

To understand land use change in the watershed, and changes in EFLR geomorphology, Inter-fluve evaluated aerial photography and maps back to 1854. This enables restoration practitioners to understand how the watershed has changed over time and evaluate restoration

options to help restore the river back to its natural state. To complete this assessment, the river was divided into five distinct segments between river miles 3 to 13. The river becomes more dynamic in its floodplain and has a larger channel migration zone in this portion of the watershed. Upstream of river mile 14, the river is naturally confined, which affects the river's ability to recruit large wood, interact with the floodplain, and erode sediment for transport.

Physical characteristics of the river segments are described in the following section.

- **Upper Daybreak – River miles 10 to 13:** This portion of the watershed is located between Lower Daybreak and Lewisville Parks. The Daybreak Bridge located at approximately river mile 10, was constructed in the 1930s. This bridge has had impacts on channel migration and sediment transport. The bridge impacts flow and has had impacts on erosion and channel incision, and floodplain interactions. Through this area between Lewisville Bridge and Manley Creek, an estimated 50 percent of the historical channel migration zone has been lost. Historical photos show little presence of large wood; however, some new wood accumulation is occurring. Some restoration work has been completed in this portion of the watershed. Recently, Clark County had to complete emergency repairs to help protect the Daybreak Bridge from erosion and scour.
- **Lower Daybreak – River miles 8 to 10:** This portion of the watershed was historically a very complex, dynamic, anabranching, multi-threaded system. However, between 1910 and 1940, the river changed to a single-threaded system. Overall, an estimated 50 percent of the channel migration zone has been impacted in this section of the watershed. Gravel mining in the 1950s and vegetation removal have had impacts on the river. Some restoration work has been completed in the watershed, and new wood accumulation is present. This section of the watershed has two side channels that present opportunities for enhancement. The active Daybreak Pits sand and gravel mining operation currently confines the north side of the river.
- **Ridgefield Pits - River miles 7 to 8:** This portion of the watershed has experienced extensive land use change for agriculture and mining. Beginning in the 1950s, extensive instream and floodplain gravel mining was completed, which has had long-term impacts to channel and habitat complexity. Approximately 4,300 feet of the river avulsed into the gravel pits during the 1996 flood, resulting in large deep pools in the new river mainstem. This event resulted in the river being contained in the pits, as well as significant changes to the channel migration zone. Some restoration work has been completed in this area, and some new wood accumulations are present. However, significant challenges remain in this portion of the watershed due to the 1996 avulsion. Geomorphic processes in this reach also have impacts on upstream and downstream geomorphology. Armoring at the gravel pits has affected river sinuosity. The most significant decrease in multi-threaded channels in the watershed has been observed in the Ridgefield pits segment.
- **Mason – River miles 6 to 7:** This portion of the watershed has experienced reduction of channel sinuosity. Some armoring was completed as well as removal of wood. Some restoration work has been completed in this portion of the watershed and future

restoration work is planned. Overall, the Mason segment has the greatest sinuosity in the lower watershed.

- **La Center – River miles 3 to 6:** This section of the watershed has been impacted by floodplain clearing, levee construction, armoring, and incision. Some restoration work has been completed to remove and breech levees, and to enhance tributary and off-channel areas. Although there is significant floodplain disconnection, some work has been completed to increase floodplain and off-channel connectivity. The lower portion of the watershed has challenges with width to depth ratios, and warm shallow water.

Recommendations from the *East Fork Lewis River Ridgefield Pits Restoration Geomorphology Report* are adapted in the implementation table at the end of this chapter.

Salmon recovery

The Lower Columbia Fish Recovery Board (LCFRB) is the Lead Entity and Regional Recovery Organization for salmon recovery in the Lower Columbia River region, which includes the East Fork Lewis River watershed. LCFRB developed Salmon Recovery Plans with its partners, and coordinates funding for implementation of salmon recovery projects. The EFLR watershed is home to five Endangered Species Act (ESA) listed populations of salmonids. These include Fall Chinook, Chum, Winter Steelhead, Summer Steelhead, and Coho. Restoring the watershed is a top priority for salmon recovery in the Lower Columbia region.

According to LCFRB's *East Fork Lewis Subbasin Plan*, the lower mainstem East Fork Lewis contains important spawning and rearing habitats for fall Chinook, chum, and Coho. These portions of the watershed are also some of the most impacted by the Ridgefield Pits avulsion and geomorphic consequences. The middle mainstem East Fork Lewis and Rock Creek South are most important for winter steelhead and summer steelhead also utilize these reaches. The upper East Fork Lewis tributaries are mostly utilized by summer steelhead, and sometimes winter steelhead. A Limiting Factors Analysis (LFA) determined that over 50 percent of the off-channel habitat and wetlands in floodplain areas of the EFLR have been disconnected from the river because of diking, ditching, and draining to protect agricultural, residential, and mining activities. Additionally, there are concerns with the availability of suitable pool habitat, low large-woody -debris concentrations, high road densities, sediment, turbidity, and temperature. Other limiting factors in the watershed include habitat connectivity; habitat diversity; channel stability; riparian function; floodplain function; streamflow; water quality; substrate and sediment; agriculture and grazing, rural and suburban development; forest practices; and channel manipulations. Most recently, LCFRB completed the *East Fork Lewis River Habitat Pilot Study*, which completed an analysis of land use and land cover change since 2004.

More information can be referenced in the **East Fork Lewis Subbasin Plan**. LCFRB has published the following strategic plans for the EFLR watershed.

- Washington Lower Columbia Salmon Recovery and Fish and Wildlife Subbasin Plan, 2010.
- Lower East Fork Lewis River Habitat Restoration Plan, 2009.
- Salmon-Washougal and Lewis Watershed Management Plan WRIAs 27-28, 2006.
- East Fork Lewis River Habitat Pilot Study, 2020.

Linking water quality and salmon recovery

From 2019 to 2020, LCFRB contracted with PC Trask and Associates to complete the *Lower Columbia Salmon Recovery Plan Partner Program Implementation Review: East Fork Lewis River Habitat Pilot Study*. This report serves a tool to evaluate how salmon recovery programs are being implemented on the ground, highlighting success stories and challenges, and identifying emerging risks to water quality and salmon recovery. The report also establishes a 2020 baseline for land use in the watershed.

To link water quality priorities to salmon recovery, it is important to understand how water quality and habitat quality impacts salmonids at critical life stages. The following table was adapted from the *Washington Lower Columbia Salmon Recovery and Fish and Wildlife Subbasin Plan* to summarize how water quality is a limiting factor for fish in the EFLR watershed at critical life stages. Implementing projects to address warm water temperatures and improve low instream flows are important to support salmon recovery.

Table 61. Water quality effects on salmon recovery in the EFLR.

Species and criticality	Life stage	Primary Limiting Factors	Secondary Limiting Factors
Fall Chinook			
Most Critical	Egg Incubation	Sediment	Temperature, Channel stability, key habitat
Second	Spawning	Temperature	Key habitat, habitat diversity
Third	Pre spawning holding	Temperature, habitat diversity	Flow
Chum			
Most Critical	Egg incubation	Sediment	Channel stability, key habitat
Coho			
Most Critical	Egg incubation	Sediment	Channel stability
Second	0-age winter rearing	Habitat diversity	Key habitat, flow
Third	0-age summer rearing	Temperature, habitat diversity, key habitat, food	Channel stability, flow
Summer Steelhead			
Most Critical	Egg incubation	Channel stability, sediment, key habitat	temperature
Second	0-1 age winter rearing	Channel stability, habitat diversity, flow	
Third	0-age summer rearing	Habitat diversity	Temperature, channel stability, flow
Winter Steelhead			
Most Critical	Egg incubation	Temperature, sediment	Key habitat, channel stability
Second	0-age summer rearing	Temperature, habitat diversity, pathogens	Flow, food
Third	0,1-age winter rearing	Habitat diversity	Channel stability, flow

Priority Streams for Salmon Recovery

To establish on-the-ground implementation priorities for salmon recovery, LCFRB has developed a tiered prioritization system for restoring and preserving streams in the EFLR. Tier 1 streams are high priority reaches for preservation and restoration, to recover one or more primary populations of salmonids. Listed below are the Tier 1 reaches for salmon recovery in the EFLR watershed. Each stream has been assigned a value for preservation and restoration using a scale from zero to 100 percent, with the higher percentage indicating a higher value for salmon recovery. Streams with a high value for restoration, are priorities for restoration. Stream with a high value for preservation are a high value for acquisition work. Restoration or preservation in these locations may benefit Chum, Coho, Fall Chinook, Summer Steelhead, or

Winter Steelhead. Many of these priority areas align with Ecology's priority areas for water quality improvement.

Table 62. Priority locations for salmon recovery and water quality.

Subwatershed	LCFRB Unique Identifier	Restoration Value	Preservation Value	Starting River Mile	Ending River Mile	Length (mi)
Brezee	B1_Brezee Cr 2	53%	47%	0.43	0.48	0.05
McCormick	McCormick Cr 1 D	29%	71%	2.25	2.28	0.03
McCormick	McCormick Cr 1 G (pond)	76%	24%	2.82	2.93	0.11
McCormick	McCormick Cr 1 H (pond)	85%	15%	2.93	3.03	0.1
Jenny	Jenny Cr	44%	56%	0	0.13	0.13
Mason	M1_Mason Cr RB Trib 1 A	37%	63%	0	0.04	0.04
Mainstem	EF Lewis 4 A	58%	42%	4.49	4.86	0.37
Mainstem	EF Lewis 4 B	50%	50%	4.86	5.39	0.53
Mainstem	EF Lewis 4 C	53%	47%	5.39	5.74	0.35
Mainstem	EF Lewis 5 A	44%	56%	5.74	7.03	1.29
Mainstem	EF Lewis 5 B	57%	43%	7.03	7.39	0.36
Mainstem	EF Lewis 6 A	55%	45%	7.39	7.66	0.27
Mainstem	EF Lewis 6 B	54%	46%	7.66	8.17	0.51
Mainstem	EF Lewis 6 C	57%	43%	8.17	9.36	1.19
Mainstem	EF Lewis 7	46%	54%	9.36	9.45	0.09
Mainstem	EF Lewis 8 A	52%	48%	9.45	10.7	1.25
Mainstem	EF Lewis 8 B	56%	44%	10.7	16.17	5.47
Mainstem	EF Lewis 9 A	56%	44%	16.17	17.86	1.69
Mainstem	EF Lewis 13	34%	66%	24.49	26.15	1.66
Mainstem	EF Lewis 15 B	42%	58%	29.12	29.54	0.42
Mainstem	EF Lewis 16	38%	62%	29.54	31.45	1.91
Mainstem	EF Lewis 17 A	28%	72%	31.45	31.52	0.07
Mainstem	EF Lewis 17 B	38%	62%	31.52	32.51	0.99
Mainstem	EF Lewis 18	39%	61%	32.51	33.96	1.45
Mainstem	EF Lewis 19 A	51%	49%	33.96	35.41	1.45
Mainstem	EF Lewis 20 B	35%	65%	39.14	39.22	0.08
Dean	Dean Cr 1 A	64%	36%	0	0.87	0.87
Mill Creek	Mill Cr 1 C	42%	58%	1.06	1.34	0.28
Manley	Manley Cr 1 A	68%	32%	0	0.15	0.15
Manley	Manley Cr 1 D	72%	28%	1.01	1.14	0.13
Manley	Manley Cr 1 E	73%	27%	1.14	1.38	0.24
Manley	Manley Cr 1 F	74%	26%	1.38	1.49	0.11
Manley	Manley Cr 1 G	65%	35%	1.49	1.52	0.03
Rock Creek South	Rock Cr 1	35%	65%	0	1.24	1.24
Rock Creek South	Rock Cr 2 A	26%	74%	1.24	1.43	0.19
Rock Creek South	Rock Cr 2 B	31%	69%	1.43	2.37	0.94
Rock Creek South	Rock Cr 3	32%	68%	2.37	3.12	0.75
Rock Creek South	Rock Cr 4	39%	61%	3.12	5.23	2.11

Additional information on priority projects for salmon recovery are outlined in Chapter 5 of LCFRB's *Lower East Fork Lewis River Habitat Strategy* and included in the Implementation Cost Estimates chapter at the end of this document. LCFRB plans to update *the Lower East Fork Lewis River Habitat Strategy* for the EFLR using information from the Lower Columbia Estuary Partnership's Thermal Refuge Assessment, which will identify opportunities to enhance cold-water refuge.

Active streamflow restoration projects

The Lower Columbia Estuary Partnership has restored over 600 acres of riparian habitat along 10 miles of river in the EFLR watershed, with multiple projects planned for future implementation. The following information summarizes major projects underway by Lower Columbia Estuary Partnership to benefit streamflow, address challenges with river geomorphology, and restore natural watershed processes. LCEPs goal is to complete implementation of these projects by 2025. A full list of projects and estimated costs is included in the Implementation Cost Estimates chapter. Additional active restoration projects are described in the Riparian Restoration chapter.

Thermal Refuge Assessment – River miles 3 to 19

Currently, LCEP has funding for a Phase 1 project to complete a thermal profile of the EFLR from river miles 3 to 19. The goal of this project is to identify thermal refuge areas where the river is gaining cold-water. This assessment will help identify restoration opportunities to augment and restore cold-water inputs to the EFLR to benefit water quality and salmon recovery. The Phase 2 Thermal Assessment will extend this effort into the headwaters from river miles 19 to 32, to identify additional cold-water restoration opportunities. Within this project, LCEP is mapping the locations, size, and habitat conditions of cold-water refuge areas along the mainstem, tributaries, and off-channel areas that are temperature-limited for juvenile and adult Coho, Chinook, steelhead, and chum salmon. With a Technical Oversight Committee, LCEP is prioritizing locations, developing restoration alternatives, and developing conceptual designs for three sites. LCEP is working with Clark County to complete this project and the Department of Ecology has been invited to the oversight committee. Results of the project will be used to revise project priorities in the Lower EFLR as part of LCFRB's *Lower East Fork Habitat Restoration Plan* update.

Project milestones include reviewing existing temperature data, deploying temperature data loggers, collecting and analyzing data, conducting remote sensing using thermal infrared cameras, completing field investigation to understand temperature and habitat conditions, and conducting a feasibility analysis. The Technical Oversight group will review data and rank restoration opportunities. Final deliverables include a final report, conceptual designs, and preferred alternatives for three sites, and revision of the *Lower East Fork Lewis River Restoration Plan*.

The goal for project completion is 2022. The estimated cost is approximately $150,000 for the phase 1 assessment of river miles 3 to 19. Phase 1 was already funded through LCFRB and RCO salmon recovery funding and is currently underway. Preliminary and final designs for the top

five projects is estimated at $150,000. Final construction of the top five projects is estimated to cost at least $1 Million dollars, or approximately $200,000 per project.

Ridgefield Pits Restoration – River miles 7 to 10

Efforts to restore the Ridgefield Pits area between river miles 7 and 10, where the river historically avulsed into abandoned sand and gravel mining pits, is a high priority for long-term water quality and salmon recovery. This portion of the river has documented cold-water inputs, where the river gains streamflow, and groundwater exchanges with surface water. Efforts to restore this segment of the river can help address streamflow and temperature issues in the watershed, while improving river geomorphology and natural watershed processes.

The Ridgefield Pits Restoration Project will develop restoration alternatives for the Ridgefield Pits to restore fluvial processes and sediment transport, while evaluating aquatic and physical conditions below Daybreak Bridge on the EFLR. Restoration of the Ridgefield Pits site was identified as the number one priority for restoration in LCFRB's *East Fork Lewis River Habitat Restoration Plan*

To complete this project, LCEP collected temperature and flow data, completed field topographic, bathymetric, and fish surveys. LCEP also completed geomorphic surveys and photo interpretation and is updating a hydraulic model to complete geomorphic and temperature modeling. Restoration alternatives will be proposed to help select a final preferred alternative. Preliminary design, engineering drawings, and construction estimates will also be developed. The goal is to complete the assessment and preliminary design for Restoration Alternatives by the end of 2021. The target to complete implementation of the preferred alternative is 2025. The total estimated cost for assessment and preliminary engineering was approximately $240,000. This portion of the project was funded by LCFRB and RCO Salmon Recovery funding and is currently underway. Final engineering and implementation is estimated to cost approximately $5 million dollars. Information obtained from the East Fork Lewis River Thermal Assessment will also be utilized to inform the final implementation plan for Ridgefield Pits.

East Fork Lewis River Habitat Improvement Design – River miles 6.5 to 6.8

The East Fork Lewis River Habitat Improvement Design project is developing preliminary designs for the removal of 1,200 feet of hardened shoreline between river miles 6.5 and 6.8 on the EFLR mainstem. This portion of the river has lost 65 percent of its historical channel migration zone and has reduced connectivity to the floodplain. This project will also reconnect two tributaries to the mainstem, improve function of a 10-acre floodplain wetland, and restore riparian habitat complexity by re-establishing native plant species. This project is located directly downstream from the Ridgefield Pits restoration project. Information from the East Fork Lewis River Thermal Assessment will be utilized to inform final design.

Key tasks and deliverables associated with this project are to collect field data and conduct surveys, completed hydrologic and geomorphic modeling, develop preliminary designs and a final report. Project permitting will also be initiated. The final assessment and restoration alternatives are expected in 2021, with conceptual designs and permits expected in 2022. The desired outcomes from this project are to restore natural channel sinuosity and increase channel complexity, restore quantity and quality of habitat, reduce channel energy to allow

sediment deposition and streambed aggradation, and connect existing off-channel wetlands and two tributaries to the mainstem. Additionally, this project aims to enhance cold water thermal refuge areas, improve riparian conditions and establish native riparian buffers, and achieve greater hydrologic connectivity to floodplain, wetlands, and cool water tributaries ultimately improving water quality and habitat for salmonids and water quality. The estimated cost for this preliminary design project is approximately $180,000, which was awarded funding through LCFRB and RCO Salmon Recovery Funding. Funding for final engineering and implementation is still needed.

Mason Creek Restoration

Mason Creek has been impacted by the removal of vegetation and draining of wetlands for agricultural activities. This area also has challenges with erosion due to upstream land use change in Mason Creek, and by upstream challenges caused by Ridgefield Pits. Mason Creek has a lack of instream habitat and floodplain connectivity. Historically, this area had wetlands, floodplain connectivity, and significant sinuosity. This project will acquire 48.5 acres in fee and 7.4 acres in conservation easement that will adjoin a 19.25-acre parcel already owned by Clark County at the confluence of Mason Creek and the EFLR. Restoration actions will focus on two sites on Mason Creek and the EFLR mainstem. These include restoring 2,600 ft. along the East Fork and 4,000 ft. of lower Mason Creek. This project was identified as a priority through LCFRB's salmon recovery planning and by Clark County's Critical Areas Acquisition Plan. Final deliverables will include acquisition of lands for restoration, and the development of preliminary restoration designs. Estimated costs for acquisition are approximately $580,000, and acquisition is expected to be complete in 2021. Restoration designs are expected to cost approximately $120,000 and will be complete by 2022.

Surface water and groundwater exchange

Temperature projects that go beyond tree planting and shade to help lower warm water temperatures are needed in the EFLR watershed. The *Surface Water/Groundwater Exchange along the East Fork Lewis River* study was published in 2009 to identify locations where the river is gaining cold-water inputs, and to estimate the temperature of groundwater entering the river. This information helps prioritize locations for streamflow restoration projects to promote infiltration, augment cold-water baseflow, and establish cold-water refuge areas.

The total streamflow gain to the EFLR from groundwater was 64 cubic feet per second (cfs) during the summer of 2005. The average temperature of groundwater inputs were 10.6 to 12.5 degrees Celsius, indicating that groundwater entering the EFLR is much cooler than surface water temperatures and the 16.5-degree temperature water quality standard in the river. Priority gaining reaches, where cold groundwater inputs enter the Eat Fork Lewis River are summarized in the following table. River miles 4.6 to 7.3 have the largest streamflow gains in the watershed, followed by river miles 7.3 to 8. Streamflow losses were recorded between river miles 24.7 to 26.9 and 8.9 to 10.1. No gains or losses were measured between river miles 13.2 to 24.7, and 29 to 32.3. The middle watershed provides the most significant opportunity for enhancing and protecting cold groundwater inflow in the watershed.

Table 63. Priority river miles for groundwater inflow in the EFLR.

River miles	Location	CFS of groundwater inflow per mile (cfs/mile)
4.6 to 7.3 Lower and middle watershed	Lower and middle watershed	13.3
7.3 to 8 Middle watershed	Middle watershed	6.3
26.9 to 29 Upper watershed	Upper watershed	6.1
10.1 to 13.2 Middle watershed	Middle watershed	2.0

In addition to augmenting streamflow at priority river miles, the following recommendations were provided in the *Surface Water/Groundwater Exchange along the East Fork Lewis River* report.

- Track and analyze water levels over time in the Sand and Gravel Aquifer, which is the main water source for the EFLR.
- Determine where the river is directly connected with the Sand and Gravel Aquifer to help clarify where the river is gaining groundwater.
- Utilize information about the effects of current and future water withdrawals when making water rights decisions in the basin.

Watershed Management Plan and Local Water Use

According to the *Surface Water/Groundwater Exchange along the East Fork Lewis River* report, "Public supply wells withdraw substantial amounts of water from the main aquifer supplying baseflow to the EFLR. These withdrawals, which are increasing in some areas, may be changing groundwater flow to the river." The State Watershed Management Act (RCW 90.82) recognized that water withdrawals for water supply and other human activities could have an impact on water quantity, and streamflow for fish. To assess streamflow and understand water allocations and mitigation needs, the *Salmon-Washougal and Lewis Watershed Management Plan*, which was adopted in 2006. In 2008, the Department of Ecology established a water management rule (Chapter 173- 527 Washington Administrative Code) for the Lewis River Basin. This rule determined that based on historical and current low flows and water withdrawals by existing water right holders, no waters in the EFLR are reliably available for new consumptive uses from surface water sources in the basin. This includes the entire EFLR from Interstate-5 to the headwaters. The ultimate goal of eliminating issuance of new water rights in the basin is to ensure adequate instream flows are available to support salmonids and other aquatic life. Table 6 of the *Salmon-Washougal and Lewis Watershed Management Plan* includes detailed recommendations for streamflow restoration and management in the East Fork Lewis River watershed.

Mitigation and offsetting water use

To mitigate and offset water use in the EFLR watershed, the Salmon-Washougal and Lewis Watershed Management Plan sets goals, strategies, measures, and actions for managing water resources. To protect streamflow, the plan proposes minimum streamflow needs, establishes water reserves to meet future community needs, and develops flow and habitat mitigation measures to improve streamflow over the long-term.

This plan recommends protecting instream flows through management of water withdrawals, water rights closures and enforcement, curtailments of unauthorized water withdrawals, acquisition of water rights, drought management, and implementation of water conservation measures. The *Salmon-Washougal and Lewis Watershed Management Plan* also recommends implementation of channel and off-channel habitat restoration, in-channel improvements, wetland restoration, floodplain reconnection, riparian preservation and restoration. Some stormwater infiltration projects may also help promote groundwater recharge.

Funding for streamflow restoration

Currently, the Department of Ecology has streamflow restoration competitive grants available for water rights acquisition, altered water management or infrastructure, environmental monitoring, water storage and managed aquifer recharge projects, and watershed function, riparian, and fish habitat improvements. The long-term goal is to implement projects that achieve a net ecological benefit for streamflow, where the quantity of streamflow restored to the river is greater than the water withdrawn. The following information provides more detail on BMPs for streamflow restoration and increasing the quantity of water available in the watershed. These activities are eligible for funding through the Department of Ecology's Streamflow Restoration Competitive Grant Program.

- **Water rights acquisition:** This activity involves purchasing a water right and permanently conveying it to Ecology to be held and managed in the Trust Water Rights Program. Ecology's Trust Water Rights program allows water rights to be held for future use without risk of forever relinquishing the right. They are held in trust to contribute to streamflow and groundwater recharge. The program allows flexibility to establish water right banks, and to temporarily hold rights until future use.
- **Water storage**: These projects involve capturing water when it is available during high flow-periods and releasing water when it is needed. Examples include active surface storage, managed aquifer recharge, and cisterns.
- **Altered water management or infrastructure improvement:** These projects change how and when water is diverted, withdrawn, or conveyed. Examples include conservation and efficiency projects such as diversion modifications, ditch improvements, sprinkler conversion, and other irrigation efficiencies, including streamflow retiming, and source switches.
- **Watershed function, riparian, and fish habitat improvement:** These projects include in-channel habitat improvements such as streambank restoration, gravel and woody structure augmentation, and channel re-meandering.

Riparian restoration, land acquisition, levee and floodplain modification, large wood placement, fish passage improvements, and beaver dam analogs or beaver introduction are also beneficial to streamflow.

- **Environmental monitoring:** These projects may include stream gaging and groundwater monitoring to assess streamflow.

Completing a study to confirm and verify water rights and water use in the EFLR may be necessary, as significant development has occurred in the watershed since the Watershed Management Plan was complete in 2006 and instream flow rules were adopted in 2008. Additionally, an effort to investigate and identify unauthorized water withdrawals should be implemented in the watershed to educate landowners on water rights and withdrawal requirements. Outreach and education to landowners may be necessary to help landowners understand their water rights, and to implement water conservation measures, restoration activities, and irrigation efficiencies.

Paradise Point Water Supply

Clark Public Utilities (CPU) is the primary regional supplier of drinking water in Clark County. As of 2020, there are three major water withdrawal points for Clark County water supply. One of these locations is located at Paradise Point, in the lower EFLR Watershed. CPU has water rights to withdrawal water from Paradise Point. As of 2016, the public supply reservation in the EFLR allocated for Clark Public Utilities was 0 percent used, and the infrastructure to utilize this water source is still being constructed. Water allocations for domestic wells and small systems were 13 percent used. The Paradise Point water supply source is more sustainable compared to private wells in the middle and upper watershed, due to tidal influence from the Lower Columbia, which has the ability to help replenish the water supply. By developing and providing the Paradise Point water supply source, the goal is to help take pressure off additional water wells located in the Middle EFLR located in the middle watershed. The Paradise Point regional water source has been under construction for many years, with the goal to extend water service out to homes in the Middle and Upper EFLR watershed. This project is expected to return an estimated 3.1 cfs of water back to the EFLR by taking pressure off withdrawals in the middle watershed. Completing construction of the Paradise Point regional water source is a priority for streamflow restoration in the EFLR. Additionally, CPU has expressed interest in extending water service to the Village of Yacolt to help address water quality concerns associated with local groundwater, and to eliminate additional water withdrawal from the aquifer supplying base flow to the EFLR watershed. Additional opportunities to provide public water supply to homes with domestic wells should be explored in the watershed to benefit streamflow.

Streamflow enforcement

The Department of Ecology's Water Resources Department is responsible for assisting the public with complying with requirements related to their water rights and stipulations outlined in the Lewis Watershed Management Plan. The goal is to achieve voluntary compliance for local water use by providing education technical assistance to landowners and organizations with water rights. If education and technical assistance do not achieve compliance, Ecology has the

authority to issue a notice of violation. Instream flow rules established through WAC 173-527 provide regulatory authority for enforcement related to water consumption and streamflow in the watershed.

Streamflow restoration implementation

To achieve clean water in the EFLR, meet WQS for temperature, and support aquatic life uses, it is necessary to implement streamflow restoration projects that go beyond tree planting and shade to address low instream flows, restore streamflow, and improve stream temperatures. The following implementation tables outline goals and actions for streamflow restoration in the EFLR watershed. The long-term vision is to achieve and sustain instream flow conditions that support aquatic life, water quality, and salmon recovery goals in the EFLR watershed.

Table 64. Streamflow restoration implementation goals

Implementation Goals
• Achieve and sustain instream flow conditions that support aquatic life, water quality, and salmon recovery goals in the EFLR watershed. • Implement streamflow restoration activities to improve instream flow conditions in the EFLR watershed. • Prioritize implementation of streamflow restoration projects between river miles 4.6 to 8, 10.1 to 13.2 and 26.9 to 29 where cold groundwater inputs enter the EFLR.

Table 65. Streamflow restoration implementation actions.

SF1	Geomorphology and Watershed Processes
SF1.1	Prioritize river miles 4.6 to 8, 10.1 to 13.2 and 26.9 to 29 for streamflow restoration activities.
SF1.2	Implement restoration projects in the EFLR that consider the complex geomorphological challenges associated with the Ridgefield Pits, sediment dynamics, and the river's channel migration zone.
SF1.3	Implement BMPs that will support the restoration of a sinuous and complex river system to increase aquatic habitat complexity. These conditions will also support temperature refuge by creating opportunities for surface-water groundwater exchange.
SF1.4	Identify opportunities to install large wood and implement beaver dam analogs to restore natural watershed processes. Implement restoration actions that increase large wood and result in instream logjams, to mimic and restore historical large wood levels. Increase implementation of projects that include more stable and larger wood structures that can trap and retain wood in the watershed, to restore historical wood conditions.
SF1.5	Where appropriate, remove structures, artificial bank armoring, fill, or levees that limit rivers dynamics.
SF1.6	Design projects for resiliency and ability to withstand fluctuations in sediment as restoration interventions are implemented to address historical geomorphological challenges.
SF1.7	Remove and avoid adding new permanent structures that constrain floodplain or channel migration zone processes.
SF1.8	Prioritize restoration of the Ridgefield Pits site, to address geomorphological challenges associated with this priority river reach for salmon recovery and water quality, and to enhance cold-water inputs, and increase riparian vegetation and forested areas in the middle watershed.
SF1.9	Implement BMPs to avoid future avulsion into the Daybreak Pits, located in the floodplain of the EFLR.
SF1.10	Incorporate cold-water restoration elements into the Habitat Conservation Plan for the Daybreak Mine. Identify opportunities for future restoration of the Daybreak Pits to achieve habitat quality beneficial for water quality and salmon recovery.
SF1.11	Consider geomorphologic challenges and opportunities when restoring the rapidly eroding bank at Lower Daybreak Park. This portion of the watershed is providing sediment that will help support filling of the Ridgefield Pits and erosion on the streambank may help facilitate floodplain reconnection; however, the site has no riparian vegetation and is one of the largest shade deficits in the river.
SF1.12	Implement restoration actions that increase connectivity of the side-channel on river-right, just downstream from the Lower Daybreak river segment, which starts at river mile 8. .
SF1.13	Consider upstream geomorphology when implementing projects near the Manley and Mill confluence area. Consider how restoration actions implemented between river miles 7 and 13 will potentially affect each other.
SF1.14	Remove bank armoring in the Mason creek segment of the watershed. When implementing restoration actions at Mason Creek, consider how sediment dynamics caused by Ridgefield Pits may influence downstream erosion, incision, and large wood placement.
SF1.15	Restore complexity of the watershed to support native plant communities and reduce invasive species.

Table 66. Streamflow restoration implementation actions. (cont.)

SF1	Geomorphology and Watershed Processes
SF1.16	Implement salmon recovery priorities on Tier 1 priority streams for salmon recovery.
SF1.17	Complete a thermal refuge assessment to identify critical cold-water refuge areas, off-channel habitat, and side channels for restoration.
SF1.18	Acquire, preserve, and restore critical aquifer recharge areas.
SF1.19	Supplement riparian restoration activities with wetland enhancement, floodplain reconnection, streambank stabilization, addition of large woody debris and beaver dam analogues, and the enhancement of cold-water refuge.
SF1.20	Identify and inventory any illegal impoundments, dams, or manmade ponds. Work with local jurisdictions and watershed groups to assess and decommission manmade impoundments to implement restoration activities.
SF1.21	Implement erosion control measures to prevent and reduce sediment loading to the watershed.
SF1.22	Review effects of stormwater discharges on streamflow and habitat. Identify opportunities to increase infiltration, reduce stream flashiness, and restore streamflow. Implement stormwater BMPs to reduce stream flashiness in the watershed and to help promote infiltration of stormwater for streamflow benefits.
SF1.23	Work with local jurisdictions in the EFLR to establish strong planning and enforcement programs that prioritize protection of critical areas that benefit water quality, streamflow, and salmon recovery through Critical Areas Ordinances, Shoreline Masterplans, and the Comprehensive Plan.
SF1.24	Implement restoration projects to decrease the width to depth ratio of the river.
SF1.25	Protect and restore headwater areas in tributaries.
SF2	**Watershed Management Planning and Local Water Use**
SF2.1	Implement recommendations from WRIA 27/28 Salmon-Washougal and Lewis River Management Plan through identification of funding, coordination, and monitoring of progress.
SF2.2	Implement planning studies to explore alternative sources of water supply to replace existing sources and implement source substitutions.
SF2.3	Consider the effects of individual domestic wells when modifying or adopting comprehensive plans, zoning designations, or other land use regulations.
SF2.4	Considering switching agricultural water users from surface to groundwater. Discourage new uses of surface water on agricultural properties. Agricultural landowners should work with the conservation district to implement BMPs for off-stream watering, water conservation, and irrigation efficiencies.
SF2.5	Consider and address effects of forest practices on stream flow. Implement the Forest Practices Act to protect water quality and streamflow. Monitor effectiveness of Forest and Fish Rules and NW Forest Plan.
SF2	**Watershed Management Planning and Local Water Use**
SF2.6	Identify floodplain restoration projects and implement where feasible. Protect floodplains from modifications that would impair hydrologic functions or habitat

Table 67. Streamflow restoration implementation actions (cont.)

SF2	Watershed Management Planning and Local Water Use
FF2.7	Complete wetland inventories and ordinances. Assess and protect hydrologic functions of wetlands and consider strengthening mitigation ratios.
SF2.8	When necessary, implement short-term drought response and water curtailment programs to protect stream flows
SF2.9	When modifying or adopting comprehensive plans, zoning designations, or other land use regulations, consider the water balance implications of allowing extension of sewer service to communities formerly served by septic systems
SF2.10	Ensure that standard procedure for engineering studies; approval of water system plan; water rights processing; other permitting; SEPA compliance; construction; operations & maintenance and implemented during development of new or expanded Public Water Supply.
SF2.11	Develop maps of region's aquifers with emphasis on surface water and groundwater hydraulic continuity
SF2.12	Develop water-level monitoring program for aquifers. Implement environmental monitoring projects, which include stream gaging and groundwater monitoring to assess streamflow. Maintain existing stream gages. Install new gages at selected locations. Establish target flow monitoring and management program
SF2.13	Continue to restrict issuance of new water rights in the EFLR.
SF2.14	Complete surveys to identify unauthorized water users and take enforcement actions.
SF2.15	Implement Water rights acquisition projects, which involve purchasing a water right and permanently conveying it to Ecology to be held and managed in the Trust Water Rights Program. Purchase or lease of water rights from willing sellers, for State Trust program. When possible, retire water rights to restore streamflow to the watershed.
SF2.16	Implement water storage projects, which involve capturing water when it is available during high flow-periods and release water when it is needed. Examples include active surface storage, managed aquifer recharge, and cisterns.
SF2.17	Implement altered water management or infrastructure improvement projects which change how and when water is diverted, withdrawn, or conveyed. Examples include conservation and efficiency projects such as diversion modifications, ditch improvements, sprinkler conversion and other irrigation efficiencies, including streamflow retiming and source switches.
SF2.18	Implement watershed function, riparian, and fish habitat improvement projects. These projects include in-channel habitat improvements such as streambank restoration, gravel and woody structure augmentation, and channel re-meandering. Riparian restoration, land acquisition, levee and floodplain modification, large wood placement, fish passage improvements, and beaver dam analogs or beaver introduction are also beneficial to streamflow.
SF2.19	Track and analyze water levels over time in the Sand and Gravel Aquifer, which is the main water source for the EFLR. Determine where the river is directly connected with the Sand and Gravel Aquifer to help clarify where the river is gaining groundwater.

Table 68. Streamflow restoration implementation actions (cont.)

SF2	Watershed Management Planning and Local Water Use
SF2.20	Utilize information about the effects of current and future water withdrawals when making water rights decisions in the basin .
SF2.21	Complete the development of the Paradise Point water supply and retire water supply uses in the middle watershed to restore vital streamflow to the watershed. Where appropriate and feasible, connect private well owners to public water supply.
SF3	**Public Education and Outreach**
SF3.1	Build the capacity of local organizations to conduct more private landowner outreach to provide technical assistance related to water rights, irrigation, and best practices for water conservation.
SF3.2	Increase outreach and education on BMPs for wellhead protection to prevent impacts to ground water quality from land use activities.
SF3.3	Work with private landowners to implement BMPs for water conservation and wellhead protection.

Funding and partnerships for streamflow restoration

The Department of Ecology provides funding for riparian restoration and other natural resource enhancement projects through the Water Quality Combined Funding Program. The Streamflow Restoration grant program, managed through Ecology's Water Resources Program, also helps support projects related to water resources management. The Recreation Conservation Organization Salmon Recovery Funding Board invests a significant amount of money into watersheds every year. Listed below are Ecology's funding sources for Streamflow Restoration.

Table 69. Ecology funding for streamflow restoration.

Best Management Practice	Description
Water Quality Combined Funding Program	Land Acquisition, Riparian Restoration, Wetland, and Floodplain Restoration, Stream Restoration and Bank Stabilization, Water Quality Monitoring.
Streamflow Restoration Funding Program	Water rights acquisition, Water storage, Altered water management or infrastructure improvement, Watershed function, riparian, and fish habitat improvement, Environmental monitoring, and Feasibility Analysis.

Information on BMP costing can be obtained by contacting Ecology's grant project managers and financial managers. The USDA Natural Resources Conservation Service also serves as a strong resource for BMP cost estimation. The Lower Columbia Fish Recovery Board and the Washington State Recreation and Conservation Organization (RCO) also have resources available to support implementation cost estimation. Clark County and Clark Public Utilities may also support local cost estimates. To achieve WQS in the EFLR, significant financial investment is needed to achieve streamflow restoration goals. More information on estimated costs to achieve streamflow restoration goals is outlined in Chapter 10. The following organizations are working to improve streamflow and salmon recovery in the watershed.

Table 70. Streamflow Restoration implementation organizations and partners.

Implementation	Stakeholders
Primary organizations.	Clark County Public Works, Lower Columbia Estuary Partnership, Clark Public Utilities District, Columbia Land Trust, Watershed Alliance of Southwest Washington, Clark Conservation District, and Lower Columbia Fish Enhancement Group.
Partners	Washington State University Extension, Clark Skamania Fly Fishers, Washington State Conservation Commission, United State Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS), USDA Farm Service Agency, Washington State Department of Agriculture, Friends of Trees, Friends of the East Fork, and Washington State Department of Ecology.

Chapter 9 – Public Education and Outreach

Introduction

Public education and outreach efforts are a fundamental component of the *East Fork Lewis River Alternative Restoration Plan*. These efforts help raise general awareness, create stewardship opportunities, and effect behavior change to improve water quality. It is important to educate residents and visitors in the EFLR watershed, on how their individual and collective actions can help improve water quality. Targeted education and outreach efforts are needed to promote voluntary implementation of water quality BMPs. Community Based Social Marketing practices, which utilize demographic analysis and social sciences, can help support targeted education and culturally specific outreach for water quality.

The primary public education and outreach need in the EFLR is to increase outreach to private landowners to encourage voluntary implementation of water quality BMPs on streamside properties. These outreach efforts should be targeted to three different audiences.

1. **Agricultural landowners with properties adjacent to the East Fork Lewis River** and its tributaries. Agricultural landowners in subwatersheds where there are known bacteria issues are priorities for outreach.
2. **Homeowners with septic systems adjacent to the East Fork Lewis River** and its tributaries that are past due for inspection and maintenance or need repair.
3. **Public and private landowners with riparian properties** adjacent to the highest shade deficits on the EFLR mainstem and tributaries. Outreach to these landowners to promote tree planting, riparian restoration, and streamflow restoration activities is needed.

For bacteria related outreach, there are three priority areas to target education efforts. Brezee and McCormick Creeks are the top priority for bacteria reduction. Rock Creek North, Jenny, Riley, and Lockwood Creek are secondary priorities. Mason and Yacolt Creeks are the third priority for bacteria reduction. Outreach to property owners in these tributaries is needed.

For riparian restoration and tree planting, there are different priorities in the lower, middle, and upper watershed. In the lower watershed (RM 0-5.7), private landowner outreach for tree planting and riparian restoration should be targeted to the north side of the river, as most of the land on the south side is publicly owned. In the middle watershed (RM 5.7-20.3), outreach to private landowners should be focused between river miles 14 and 20. In the upper watershed (RM 20.3 – 32.3), outreach for riparian restoration should be targeted between river miles 25 and 32. Additionally, there are an estimated 20 to 30 miles of riparian restoration needed on EFLR tributaries.

For streamflow restoration, outreach should be targeted to landowners who are using water without water rights, agricultural properties needing off-stream water BMPs or irrigation, and property owners with critical aquifer recharge areas between river miles 4.6 to 8, 10.1 to 13.2, and 26.9 to 29.

Public education and outreach goals

The long-term goal for public education and outreach efforts in the EFLR is to inspire behavior change and voluntary adoption of BMPs for water quality. Additionally, it is important to achieve a mutual understanding and shared responsibility of how individual and collective actions, and shared investments can lead to better water quality and a better quality of life for people, plants, fish, and wildlife. Public education and outreach efforts that promote behavior change will ultimately help reduce bacteria, lower water temperatures, meet WQS, and support all beneficial uses in the EFLR watershed.

This public education and outreach strategy highlights existing programs that help raise public awareness about water quality issues in Clark County watersheds. Some organizations have already made commitments to increase public education and outreach in the EFLR. Efforts to coordinate messaging across different outreach programs can help amplify clean water messaging and lead to greater outcomes for water quality. Additional goals and actions for public education and outreach are recommended at the end of this chapter and throughout the *Alternative Restoration Plan*.

Implementing Organizations

Clark County Clean Water

Clark County has a Phase I Municipal Stormwater Permit, which requires the County to develop and implement an educational program for water quality. The goals of this program are to raise general awareness, inspire stewardship, and effect behavior change to reduce or eliminate stormwater pollution.

To achieve these goals, Clark County has developed a Stormwater Management Plan, which includes strategies for Public Involvement, Education, and Outreach. Through this plan, Clark County is implementing the following public education and outreach programs, which support Water Cleanup efforts in the EFLR.

Canines for Clean Water

Clark County's Canines for Clean Water program provides information to dog owners about proper management and disposal of pet waste. According to the program, Clark County has over 110,000 dogs adding more than 13,000 tons of pet waste to Clark County watersheds each year. The program's webpage provides educational information, directions for properly managing and disposing of pet waste, and a pledge for dog owners to pick up after their dogs. The webpage (www.cleanwaterdogs.com) also provides information for community members to work in their neighborhood to support pet waste pick-up. Signs are available to place in yards and common pet walking areas. Canines for Clean Water educational material will be used in the EFLR during outreach events and shared with the City of La Center. This program will also be used in future Pollution Identification and Correction (PIC) Program efforts. Relationships with business that provide pet waste removal services should also be formed, to foster new programs to remove dog waste from watersheds.

Partnerships with local veterinarians, groomers, pet boarding, shelters, pet stores, and dog licensing agencies should also be explored to educate dog owners on what they can do to protect watershed health.

Social media and online engagement

Public Works utilizes several forms of social media to increase outreach including Facebook, Twitter, Instagram, and NextDoor. Clark County also has a comprehensive, "What you can do for clean water," website with many educational materials for public use. Targeted, short messages for bacteria reduction, septic systems, pet waste, agriculture, and tree planting and backyard habitat should be developed for social media use. Information about local programs for private landowners should also be shared on social media. Opportunities to coordinate and share social media messaging should be explored by local partners to amplify and streamline social media messaging and achieve coordination on social media campaigns or short videos. Social media messages should be targeted to EFLR watershed residents through Facebook, NextDoor, and other social media platforms. When appropriate, webinar opportunities should be used for education and outreach.

Mass Media

Clark County implemented a mass media buy from a local television station. Meteorologists delivered stormwater public service announcements on various topics including pet waste and native plants. Messages from the *East Fork Lewis River Alternative Restoration Plan* and WSU Small Acreage Program should be incorporated into future mass media outreach plans, to educate Clark County residents on the importance of reducing bacteria and cooling warm water temperatures. Opportunities to use radio and billboards should also be explored to educate Clark County residents on clean water.

Stormwater Partners for Southwest Washington

Stormwater Partners of Southwest Washington is a collaborative group of local jurisdictions and watershed groups which implement stormwater education and outreach focused on raising public awareness, providing stewardship opportunities, engaging communities, and effecting behavior change. The county coordinates and facilitates quarterly meetings focused on maximizing education and outreach through the sharing of resources, collaboration on projects, and the development of consistent messaging. Together, Stormwater Partners has developed an interactive and educational online map to, "Explore Your Watershed" in Clark County, which includes the EFLR**.** Stormwater Partners have also updated road-stream crossing signs throughout the county to raise the public's awareness about local rivers and streams. Messages from the *East Fork Lewis River Alternative Restoration Plan* should be incorporated into the "Explore Your Watershed." Individual actions that the public and landowners can take to improve water quality should be one of the focus areas. Road-stream crossing signs in the EFLR should also be updated to raise public awareness.

Student Watershed Monitoring Network

In partnership with City of Vancouver's Vancouver Water Resources Education Center, Clark County engages students in grades K-12 in water quality monitoring at sites near their schools. Teachers and students receive mentoring in water quality and macroinvertebrate monitoring,

and conduct stream studies. Students share their findings with peers and the community at an annual Student Watershed Congress. About 3,500 students participate each year. In 2019, the Student Watershed Congress included discussions on the EFLR watershed. School districts within the EFLR should continue to engage in student monitoring and the annual watershed congress.

Clean water stories

In an effort to support schools that want to provide water quality education to large groups, the Clean Water Division has contracted with a regional storytelling expert who is available to large school groups, school assemblies, and student focused events. Clean Water Storytelling should occur at public education and outreach events in the EFLR, especially when working with K-12 audiences.

Enviroscape

The Clean Water Division has an Enviroscape watershed model available for schools to use for watershed and stream health studies. The Enviroscape watershed model should be used at education and outreach activities in the EFLR, especially when working with K-12 audiences.

Green Neighbors Program

Clark County launched the Green Neighbors program in 2012 to promote sustainable practices to homeowners. The program also hosts workshops and other educational events related to sustainability. The program is administered within Clark County Public Health, in partnership with Public Works, to provide timely messaging of upcoming events and activities, including a community event calendar. Workshops and outreach events in the EFLR watershed should be publicized on the Clark County Green Neighbors website and community event calendar.

Clark County Green Business

Clark County's Green Business Program recognizes and promotes local businesses that have implemented "green" practices, including practices that are good for water quality. The program currently celebrates over 50 local businesses that have completed sustainability assessments and have met the requirements to be a local Green Business. This program is now managed through Clark County Public Health. Outreach to businesses in the EFLR should occur through the Clark County Green Business program. This outreach will focus on businesses that are priorities for temperature and bacteria source control activities.

Publications and displays

Clean Water Division staff produce interpretive displays and publications on various topics including pet waste management, natural gardening, pollution prevention techniques, watershed education, and others. A sign to educate residents and visitors on water quality in the EFLR watershed should be developed.

Outreach events

Public Works Clean Water Division staff host informational booths at a variety of community events. Outreach includes information about water quality, the effects of stormwater pollution, pollution prevention, and other targeted environmental protection messages. Clark County

Public works should attend EFLR specific community events to conduct clean water outreach. Clark County should be willing to share EFLR specific messaging and outreach materials at any informational booths they have in Clark County.

Community presentations

As requested, Clean Water Division staff will provide information on the program's activities to community, neighborhood and civic groups. Clark County has presented at multiple EFLR Partnership meetings since August 2018. Clark County Clean Water Division should continue presenting on their Clean Water programs at EFLR community events.

Washington State University Extension – Small Acreage Program

Washington State University (WSU) Extension works in partnership with Clark County Public Works and Public Health to provide educational workshops and other outreach to rural property owners through the Small Acreage Program. Through this program, WSU provides workshops and other outreach to residents on water quality topics unique to rural properties. Topics include mud and manure management, pasture management, well and septic maintenance, and best practices for livestock management. To support the *East Fork Lewis River Alternative Restoration Plan*, Clark County made the commitment to target Small Acreage program implementation in the EFLR starting in 2019. The following education commitments were achieved in 2019.

- **Private Landowner Outreach through Direct Mailings** - A direct mailing to at least 1,000 property owners in the EFLR Watershed occurred in 2019 and 2020. The properties targeted for outreach were determined in partnership with Washington State University Extension and the Department of Ecology, in alignment with water quality priorities.
- **Well and Septic System Maintenance Workshop** – One Well and Septic workshop was held in the EFLR watershed in 2019 in the City of La Center, which is a priority area for bacteria reduction. This workshop was hosted in partnership with Clark County Public Health.
- **Best Management Practices Workshop** - At least one workshop focused on BMPs for manure management and composting was hosted in the EFLR in 2019

Department of Ecology will continue to collaborate with Clark County and WSU Extension to support Small Acreage outreach and promotion efforts in the EFLR Watershed for 2020 to 2030. Implementation of additional WSU Small Acreage workshops is one element of Poop Smart Clark, which is a new Pollution Identification and Correction program in Clark County.

Other Small Acreage outreach events include the Living on the Land Education Series, Small Acreage Expo, the Small Acreage Recognition Program, Well and Septic Workshops, and Best Management Practices Workshops. In 2018, approximately 936 members of the public participated in Washington State University Extension's public education and outreach events in Clark County. These participants owned approximately 1,068 acres of land in Clark County watersheds. WSU's Small Acreage Program has been working in Clark County since 2003.

Listed below, are details regarding WSU's public education and outreach through the Small Acreage programs. The Small Acreage program is partially funded by Clark County Clean Water Division.

Small Acreage Expo

The Small Acreage Expo is held annually in Clark County. This expo includes a series of workshops, which cover grazing and sustainable pasture management, native landscaping, weed identification and control, sustainable timber harvest, goat management, septic inspection certification, composting, pond care, keeping well water healthy, drainage solutions, and sustainable living for small farms. In 2018, 106 people attended the Small Acreage Expo. In 2019, Ecology attended the Expo and was invited to talk about Partnerships for Clean Water and share educational resources for water quality at an information booth. The Small Acreage Expo should be advertised to landowners in the EFLR through WSU's direct mailings and social media in starting in 2020. Ecology should be invited to participate in this Expo annually to educate residents about water quality studies, priorities, and efforts in Clark County.

Living on the Land Program

The Living on the Land Program is a 12-week educational series for small acreage landowners to learn best practices to help steward and take care of their land. Topics covered during the series include soil, water, plants, and animals; pasture management, controlling weeds, wildlife, soil health, well and septic maintenance, and much more. Between 2003 and 2018, 83 people from the City of La Center graduated from the Living on the Land Series and 76 from Yacolt. Residents from Ridgefield and Battleground also participated in the education series. Around 81 percent of participants felt that they learned something from the program. All of the learning modules, activity sheets, and supplemental resources are available on WSU's Small Acreage website. The Living on the Land Program should be advertised to landowners in the EFLR through WSU's direct mailings in 2020 to 2030. When appropriate, consider opportunities to include Ecology in the Living on the Land Program curriculum. Since the EFLR Partnership started, more residents in the watershed registered for this course in 2019 compared to past years.

Best Management Practices Workshop

WSU hosts Best Management Practices Workshops, which cover manure composting and management, pasture management, and streamside planting with native plants. In 2018, 40 people signed up for Best Management Practices workshops. These participants owned 291 acres in Clark County watersheds. At least 46 percent of attendees learned how BMPs could affect clean water after attending workshop. WSU should commit to hosting at least one, annual Best Management Practices Workshop in the EFLR watershed from 2020 to 2030. The Best Management Practices Workshop should be advertised to landowners in the EFLR through WSU's direct mailings and social media. When appropriate, consider opportunities to include Ecology in the BMP Workshop curriculum.

Well and Septic Workshop

Well and Septic Workshops are hosted by WSU and Clark County Public Health every year. At these workshops, homeowners learn tips for maintaining their septic systems and protecting

their water supply. By attending this workshop, Clark County homeowners with owner-occupied, gravity fed septic systems can be certified to perform their own septic system inspection. These systems are required to be inspected every three years, with every other inspection needing to be completed by a certified professional. Participation in the workshop, followed by a short exam, enables homeowners to perform their own inspection.

In 2018, 126 residents attended a Well and Septic Workshop. These residents owned about 525 acres in Clark County watersheds. From a survey, around 87 percent of attendees indicated that they had increased their knowledge on well and septic system maintenance and health after attending a workshop. On average, 75 percent indicated that they had learned something about how septic management practices effects clean water.

One workshop was held in the EFLR watershed in 2019, in partnership with Clark County Public Health. This workshop was held in the City of La Center, which is a priority for bacteria reduction. All Well and septic classes held in 2019 were at full capacity. More septic workshops in Clark County would be beneficial to meet public demand for septic system technical assistance.

WSU and Clark County Public Health should commit to hosting at least one, and ideally multiple, Well and Septic workshops in the EFLR watershed from 2020 to 2030. The Well and Septic workshop should be advertised to landowners in the EFLR through WSU's direct mailings and social media. Increasing local capacity to host more of these workshops is one goal of the EFLR Pollution Identification and Correction Program, Poop Smart Clark. Offering courses online may help increase public attendance.

Small Acreage Recognition Program

The Small Acreage Recognition program recognizes Clark County residents that are implementing water quality BMPs on their properties. This program evaluates the property's drainage, vegetation features, soil health and erosion, septic systems, wellheads, safe chemical and fuel storage, pasture and manure management, and livestock practices. Property owners that complete an, "Assessment Guide," for Small Acreage and can apply to receive a Clean Water Recognition Sign.

In 2018, two properties were assessed in the EFLR and one property was recognized for its land management practices. This Small Acreage Recognition Program should be advertised to landowners in the EFLR through WSU's direct mailings and social media from 2020 to 2030. Local partners should be encouraged to identify properties that are eligible for this certification while conducting site visits and share information with landowners to contact WSU.

Other events and resources

WSU hosts other educational events including Small Farm Tours, workshops on Farm Business Planning, an annual Harvest Celebration, and a Women in Agriculture event. WSU also has a series of publications available on their website that can be used for public education and outreach. These publications cover a wide variety of topics relevant to rural landowners. In 2018, around 3,221 people accessed WSU's Small Acreage webpages and 4,531 people accessed their video clips. Local partners should use WSU Small acreage Program's educational materials during outreach events and local partners should have copies of WSU's educational

materials to share with landowners when conducting site visits. A thorough review of these materials should be completed to potentially update, shorten, or modernize the materials as appropriate. Efforts to develop an educational packet for different organizations working with private landowners should be pursued.

Program Evaluation

Washington State University Extension has a robust evaluation process to keep track of how many acres of land, number of livestock, and people its program has influenced. The outcomes and impacts of WSU programs are summarized annually by WSU. Multiple people, who participate in the Small Acreage program, often implement BMPs after attending workshops.

Clark Conservation District

Clark Conservation District is a non-regulatory agency that was established in 1942 to help bridge the gap between landowners with natural resource needs, and state and federal government. Clark Conservation District works with landowners to provide education, and technical and financial assistance to landowners that have natural resources needs. Clark Conservation District provides direct support through site visits, technical assistance, and conservation planning services. The Conservation District offers a manure exchange program and has a manure spreader and poultry processor available for rent. Additionally, the Conservation District offers different programs, classes, and workshops, which include free Watershed Stewardship, and Amphibian and Stormwater classes, and an annual plant sale. Most recently, Clark Conservation District is the lead organization developing the new "Poop Smart Clark," Pollution Identification and Correction program in Clark County. This program includes resources to educate the public on best practices to reduce bacteria and protect water quality. The Conservation District also has a Stewardship Forester that assists private forest owners with conservation planning and implementation.

Watershed Alliance of Southwest Washington

The Watershed Alliance of Southwest Washington works to educate and engage community members in Southwest Washington to be active stewards of natural resources. The Watershed Alliance has multiple programs that educate the public through workshops, events, hands on stewardship opportunities, and working with private landowners to implement BMPs on their properties.

The Watershed Alliance has a successful history working with private landowners in the Burnt Bridge Creek and Washougal watersheds. Currently, the Watershed Alliance is expanding its programs to the EFLR Watershed, through a grant to implement riparian restoration in Lower Daybreak Park, and conduct outreach to private landowners in Manley Creek to promote tree planting. The Watershed Alliance is also a partner in Poop Smart Clark and will help conduct door-to-door outreach to promote implementation of water quality BMPs on private property. This includes the development of a septic system inspection and maintenance rebate program to address septic systems issues in Clark County.

Lower Columbia Estuary Partnership

The Lower Columbia Estuary Partnership engages students and the public in education programs and stewardship opportunities, which includes science lessons and field trips. LCEP also provides teachers with curriculum and methods to self-implement their own environmental education units. Teachers can request LCEP to visit their classrooms to cover many Columbia River topics. In the EFLR, LCEP has engaged student groups in restoration and stewardship activities, including volunteer events for riparian restoration and tree planting at restoration sites.

Clark Public Utilities District

Clark Public Utilities (CPU) implements countywide educational opportunities through the Stream Stewards and Stream Team programs. The Stream Stewards program helps increase public awareness of geology, hydrology, riparian, and wetland habitat, wildlife, water quality, and stream restoration. Tuition for this program is free of charge, and participants complete 45 hours of volunteer time with local environmental organizations. Clark County also hires AmeriCorps interns, to provide career advancement and education opportunities to college-aged students to support environmental workforce development. Clark Public Utilities has used multiple members of its Stream Team, Stream Stewards, and AmeriCorps program to implement projects in the EFLR. CPU also works with inmate crews to implement restoration projects.

La Center Schools

La Center's High School is a certified, platinum Washington Green School with a strong environmental curriculum and dedicated environmental leadership. Students benefit from the Salmon in the Classroom program, and by participating in the Vancouver Water Resource Center's student watershed-monitoring network. Students in Environmental Studies classes complete water quality monitoring, macroinvertebrate identification, and vegetation assessments. Each year, the students raise and release salmon into Brezee Creek in the EFLR.

Clark County Public Health - Swim Beach Program

Clark County Public Health (CCPH) is the primary jurisdiction responsible for protecting public health risks at designated swim beaches. Currently, Clark County Public Health monitors four designated swim beaches at Vancouver Lake, Klineline Pond, Lacamas Lake, and Battle Ground Lake. A designated swim beach has characteristics to prevent drowning and illness, such as physical barriers around the swimming area, restrooms, a gradually sloped bank, and vegetation management in the swimming area to increase visibility. CCPH monitors these three locations bi-weekly from Memorial Day to Labor Day for *E. coli* bacteria, following the Environmental Protection Agency (EPA) testing guidelines. They also respond to and investigate potential public health hazards at any water body within Clark County, which may include harmful algae blooms, recreational waterborne illness outbreaks, or an untreated sewage release.

To educate the public on healthy swimming activities, Clark Public Health issued a "Healthy Swimming is Safe Swimming," press release in 2019 highlighting best practices for reducing

bacteria at swimming areas. Clark County Public Health recommends parents keep children who are not toilet-trained out of the water at swim beaches. Swim diapers and plastic covers are not effective and may give parents a false sense of security. While swim diapers may contain solid feces, they are not leak proof. Bacteria and parasites that can cause illness may still leak into the water. Swimmers can keep themselves and others healthy by following these simple steps.

- Rinse off before and after swimming.
- Do not swim if you have had diarrhea or vomiting in the last two weeks.
- Keep children who are not toilet trained out of the water and require swim diapers out of unchlorinated water.
- Know where the bathrooms and changing stations are located.
- Take frequent bathroom breaks. Young children should be taken to the bathroom every hour.

In 2019, CCPH was awarded a grant from the National Environmental Health Association (NEHA) to fund an intern for 10 weeks to conduct a swim beach survey to assess risk of drowning or injury and bacterial contamination at 12 public parks within Clark County. The data from the survey will be used to provide recommendations to local park agencies. CCPH is also currently updating signage related to swimming advisories and beach closures in the County.

Ecology also has a swim beach program, which primarily focuses on monitoring marine waters. However, Ecology has some recommendations for how to keep swim beaches clean. These recommendations include picking up after pets, picking up trash, swimming only when well, helping children to keep water clean, not discharging from boats, throwing fish guts into trash, and not feeding wildlife. Individuals can do their part to keep beaches clean by scooping and bagging pet poop and throwing it in the trash, inspecting and maintaining home septic systems, pumping recreational boat holding tanks in authorized pump stations, and picking up trash at the beach, especially diapers.

In 2019, community members living in the EFLR watershed became concerned about high levels of bacteria in non-designated swimming areas. Developing educational information on healthy swimming behaviors to reduce bacteria in surface water has become a priority in the EFLR. Considering opportunities to disseminate this information at Paradise Point State Park and campground, Sunset Falls campground, Daybreak, Lewisville and Moulton Falls and other informal swimming areas or boat launches, would be beneficial to educate the public on public health risks associated with human bacteria, and what individuals can do to help improve water quality. Providing this information at other popular swimming areas, such as the informal swimming area near La Center Bridge, would also be beneficial.

Water quality public town hall

Ecology and EFLR partners hosted the EFLR Water Quality Public Town Hall in June 2019. Fifty-four people attended the public meeting in La Center, including forty members of the public, and fourteen people from environmental organizations. The goals of the Town Hall were to raise awareness about water quality in the EFLR; share information about local environmental

programs, projects, and priorities; provide landowners with resources to improve water quality on private property; and answer questions. Clark County newspapers highlighted the Town Hall to raise public awareness. This town hall was a new strategy to engage and educate members of the public on local water quality concerns and implementation opportunities. A similar community coffee was also hosted in La Center. Efforts to increase public awareness through town halls, community coffees, open houses, and relationships with local newspapers are needed in the EFLR.

Media and news articles

Multiple newspapers have been partners to educate the public about water quality work in Clark County and the EFLR watershed. The following news articles have been published on the *East Fork Lewis River Alternative Restoration Plan*.

- Streamflow issues on the East Fork a priority for local recovery groups
- East Fork partnership draft cleanup plan released
- East Fork partnership calls for restoration project proposals
- Year-end report highlights East Fork restoration efforts
- Project aims to ease East Fork of Lewis River's woes
- Town hall on East Fork water quality set for June 3rd
- East Fork: Officials offer insight on elevated temperature, bacteria levels
- Partnership seeks to improve East Fork water quality
- State to provide $4M for six Clark County water projects

Community organizations

Multiple community organizations in Clark County are concerned about the environment. These organizations include Friends of Clark County, Friends of the East Fork, Fish First, East Fork Community Coalition, Trout Unlimited, Ducks Unlimited, Salmon Creek Fly Fishers, and Clark-Skamania Fly Fishers. Establishing partnerships with these grassroots, community-based organizations is essential to reach landowners in the EFLR watershed that can implement BMPs for water quality. Additionally, these organizations often have volunteer networks that can support water quality and salmon recovery efforts through stewardship events and small grants.

Public outreach for culturally specific communities

The Environmental Protection Agency's (EPA) Environmental Justice Screening and Mapping Tool (EJ Screen) was developed to support culturally specific community outreach, while increasing accessibility, diversity, equity, and inclusion. This tool summarizes data from the United States Census American Community Survey Report from 2013-2017. Understanding demographic data can help support Community Based Social Marketing efforts to target culturally specific communities for outreach and engagement.

Priority demographics to target are communities where more than five percent do not speak English. For these audiences, outreach materials should be translated, and language interpreters should be provided.

In Clark County, the Hispanic population is the most common minority community making up nine percent of the County population. Building environmental outreach resources to engage the Hispanic community is necessary. Establishing relationships with Fourth Plain Forward, the Hispanic Metropolitan Chamber of Commerce, and the League of United Latin American Citizens (LULAC) are recommended first steps. Recruiting volunteers that speak Hispanic languages and translating outreach materials are also priorities. Additionally, building resources to engage the Asian community in Clark County, which makes up 5 percent of the County's total population, is also important. Specifically, developing resources to engage Chinese, Vietnamese, Korean, Filipino, and other Asian communities is needed. Resources to engage the growing Chuukese population is also a priority.

As of 2018, around 63,944 people in Clark County lived in a non-English speaking home. Approximately six percent of the County's population, or around 25,024 people, speak English "less than very well." Specifically, there are 4,868 linguistically isolated households in Clark County, where no one over the age of 14 speaks English. Approximately 35 percent of these linguistically isolated households speak Spanish, 34 percent speak Indo-European Languages, and 25 percent speak Asian-Pacific Island languages. Clark County has a significant number of households that speak Russian. Developing outreach and language resources to support these linguistically isolated households is essential

To understand demographics and language at the tributary and subwatershed level, demographic analysis should be repeated at a more localized level. This information should also be updated when new demographic data from the 2020 census becomes available.

Public education and outreach implementation

To achieve clean water in the EFLR, meet WQS for bacteria and temperature, and support aquatic life and recreational uses, it is important to increase general awareness, provide stewardship opportunities, and effect behavior change to improve water quality. The following implementation tables outline goals and actions for public education and outreach in the EFLR. The long-term goal is to achieve a mutual understanding and shared responsibility of how individual and collective actions can lead to better water quality in the EFLR. Additional public education and outreach actions are listed in the septic system, small acreage agriculture, riparian forest restoration, and stormwater management implementation sections.

Table 71. Public education and outreach implementation goals.

Implementation Goals
Inspire behavior change, while achieving a mutual understanding and shared responsibility of how individual and collective actions can lead to better water quality in the EFLR. Raise general awareness, create stewardship opportunities, and effect behavior change to improve water quality.

Table 72. Public education and outreach Implementation actions.

ED1	Target Audiences
ED1.1	Prioritize outreach and education to agricultural landowners with properties adjacent to the EFLR and its tributaries. Agricultural landowners in subwatersheds where there are known bacteria issues are priorities for outreach.
ED1.2	Prioritize outreach and education to homeowners with septic systems that are past due for inspection and maintenance on properties adjacent to the EFLR and its tributaries. Septic system owners in subwatersheds where there are known bacteria issues are a priority for outreach.
ED1.3	Prioritize outreach and education to public and private landowners with riparian properties adjacent to the highest shade deficits on the EFLR mainstem and tributaries. Outreach to these landowners to promote tree planting and riparian restoration is a priority.
ED1.4	Prioritize outreach and education to public and private landowners who are using water without water rights, agricultural properties needing off-stream water BMPs or irrigation, and property owners with critical aquifer recharge areas between river miles 4.6 to 8, 10.1 to 13.2, and 26.9 to 29.
ED2	**Clark County Public Works – Clean Water Division**
ED2.1	Continue collaboration between Clark County, Washington State University, and Ecology to conduct ongoing outreach and education on sending targeted mailings to private property owners and hosting educational workshops.
ED2.2	Utilize Canines for Clean Water educational for public education and outreach. Establish relationships with business that provide pet waste removal services should also be formed, to foster new programs to remove dog waste from watersheds. Partnerships with local veterinarians, groomers, pet boarding, shelters, pet stores, and dog licensing should also be explored to educate on water quality.
ED2.3	Develop targeted, short messages for bacteria reduction, septic systems, pet waste, and agriculture, tree planting and backyard habitat for social media use. Opportunities to coordinate and share social media messaging should be explored by local partners, and when possible. Opportunities to develop social media campaigns or short videos should be coordinated between education and outreach partners. Target social media messages to EFLR watershed residents through Facebook and NextDoor.
ED2.4	Incorporate messages from the *East Fork Lewis River Alternative Restoration Plan* and the Small Acreage Program into Clark County's mass media outreach plan for television and radio, to educate Clark County residents on the importance of reducing bacteria and lowering warm water temperatures.
ED2.5	Incorporate messages from the Alternative Restoration Plan into the Stormwater Partners "Explore your Watershed Map," focusing on individual actions that the public and private landowners can take to improve water quality.
ED2.6	Update road-stream crossing signs in the EFLR to raise public awareness.

Table 73. Public education and outreach implementation actions (cont.)

Implementation Actions	Implementation Actions
ED2.7	Continue the student watershed monitoring network and annual student watershed congress facilitated by the Vancouver Water Resource Center. Continue inviting school districts within the EFLR to engage in the annual watershed congress and water quality activities.
ED2.8	Continue clean water storytelling at public education and outreach events in the EFLR, especially when working with K-12 audiences.
ED2.9	Utilize the Enviroscape watershed model should be used at education and outreach activities in the EFLR, especially when working with K-12 audiences.
ED2.10	Publicize workshops and outreach events in the EFLR watershed should be publicized on the Clark County Green Neighbors website and community event calendar.
ED2.11	Complete outreach to businesses in the EFLR will occur through the Clark County Green Business program. This outreach will focus on businesses that are priorities for temperature and bacteria source control activities.
ED2.12	Develop new signage to educate residents and visitors on the EFLR watershed. Include individual actions people can take to improve water quality. Prioritize implementation of signage at Clark County Regional Parks, and other local parks on the EFLR, including Sternwheeler Park in the City of La Center.
ED3	**Washington State University Extension Small Acreage Program**
ED3.1	Continue advertising Small Acreage events to residents in the EFLR through direct mailings and social media in 2020-2030. Consider collaborating with other organizations to include additional water quality information and resources in mailings.
ED3.2	Continue advertising Small Acreage events to residents in the EFLR through direct mailings and social media in 2020-2030. Consider collaborating with other organizations to include additional water quality information and resources in mailings.
ED3.3	Advertise the Small Acreage Expo to landowners in the EFLR through WSU's direct mailings and social media in 2020-2030. Ecology should be invited to participate in this Expo annually to educate residents about water quality studies, priorities, and efforts in Clark County.

Table 74. Public education and outreach implementation actions (cont.)

Implementation Actions	Implementation Actions
ED3.4	Advertise the Living on the Land Program to landowners in the EFLR through WSU's direct mailings and social media in 2020-2030. When appropriate, consider opportunities to include Ecology into the Living on the Land Program curriculum.
ED3.5	Commit to hosting at least one, annual Best Management Practices Workshop in the EFLR watershed in 2020-2030. Advertise the Best Management Practices Workshop to landowners in the EFLR through WSU's direct mailings and social media in 2020-2030. When appropriate, consider opportunities to include Ecology in the BMP Workshop curriculum.
ED3.6	Commit to hosting at least one, and ideally multiple, annual Well and Septic workshop in the EFLR watershed in 2020-2030. Advertise the Well and Septic workshop to landowners in the EFLR through WSU's direct mailings and social media in 2020-2030.
ED3.7	Advertise the Small Acreage Recognition Program to landowners in the EFLR through WSU's direct mailings and social media in 2020-2030. Encourage local partners to identify properties that are eligible for this certification while conducting site visits and share information with landowners to contact WSU.
ED3.8	Utilize WSU Small Acreage Programs educational materials during outreach events. Local partners should have copies of WSU's educational materials to share with landowners when conducting site visits. A thorough review of these materials to potentially update, shorten, or modernize educational materials and handouts should be considered. Efforts to develop an educational packet for different organizations working with private landowners should be pursued.
ED4.1	Continue engaging the EFLR Partnership through regular email updates, by maintaining and updating the EFLR website, continuing to host Partnership meetings, and engaging partners in the implementation, monitoring and adaptive management of the EFLR Alternative Restoration Plan.
ED4.2	Develop and implement a new healthy swim behavior campaign and messaging toolkit. Consider opportunities to disseminate this information at Paradise Point State Park, or the popular Clark County Regional Parks - Daybreak, Lewisville and Moulton Falls to educate the public on what they can do to help improve water quality.
ED4.3	Increase public education through town halls, community coffees, and open houses in the EFLR.
ED4.4	Incorporate Agriculture in the Classroom and Salmon in the Classroom programs into schools in the EFLR.
ED4.5	Host Clark Conservation District's Watershed Stewardship workshops program in the EFLR watershed.

Table 75. Public education and outreach and implementation actions (cont.)

Implementation Actions	Implementation Actions
ED4.7	Review and update all agricultural and septic system outreach materials from various organizations to develop a common educational packet or toolkit for different organizations working with private landowners.
ED4.8	Continue educating K-12 aged children in volunteer stewardship activities and classroom programs.
ED4.9	Implement Skagit County's Poop Smart campaign in Clark County, as Poop Smart Clark.
ED4.10	When appropriate, collaborate with the media, utilize press releases and news articles as a public education, and outreach tool to raise public awareness and encourage public involvement.
ED4.11	Develop and implement a new healthy swimming behavior campaign in the EFLR by 2023. Provide educational signage and information on what swimmers can do to protect clean water by 2025.

Funding and partnerships for public education and outreach

Table 76. Ecology funding for public education and outreach.

Best Management Practice	Description
Public education and outreach	Projects with public outreach and education components are eligible for loan or grant funding.

Table 77. Public education and outreach implementing organizations and partners.

Implementing Organizations	Clark County Public Health, Clark County Public Works, Watershed Alliance of Southwest Washington, Washington State University Extension, Clark Public Utilities, Clark Conservation District, Lower Columbia Estuary Partnership, La Center Schools
Implementing Partners	City of La Center, City of Battleground, Natural Resource Conservation Service, Washington State Conservation Commission, Washington Department of Agriculture, Lower Columbia Fish Enhancement Group, Lower Columbia Fish Recovery Board, Friends of Clark County, Friends of the East Fork, Fish First, East Fork Community Coalition, Trout Unlimited, Ducks Unlimited, Salmon Creek Fly Fishers, and Clark-Skamania Fly Fishers..

Chapter 10 – Implementation Cost Estimates

Introduction

This chapter provides implementation cost estimates to achieve water quality goals outlined in this Alternative Restoration Plan, and address NPS pollution challenges in the EFLR watershed.

This activity was completed to satisfy the Environmental Protection Agency's for Alternative Restoration Plans and Nine Minimum Element Plans outlined by Section 319 grant funding guidelines. Cost estimates incorporated into this chapter represent the estimated costs to implement projects using funding from public sources, including State and Federal grant programs. If private landowners choose to implement water quality BMPs without financial assistance from public funders, costs for self-implementation may be significantly lower. Cost estimates in this chapter, are based on current dollars in 2020 and are not adjusted for future inflation.

Overall, stormwater implementation is the most expensive implementation priority with an estimated $200 million dollar investment needed to address water quality impacts from stormwater. Riparian restoration and land acquisition needs in the watershed are the second most costly implementation category, needing up to $43 million dollars to achieve restoration goals. Streamflow restoration priorities are estimated to cost almost $20 million dollars. Agricultural implementation in the watershed is expected to cost $12.8 million a dollars addressing priority septic systems will cost at least $10.2 million dollars. The total investment needed to protect water quality in the EFLR is an estimated $285 million dollars. Achieving this investment goal will require collaboration and shared investment from multiple funding sources including, federal, state, and local governments, as well as investment from private landowners, private business, philanthropic organizations, taxpayers, and ratepayers. Future work to evaluate costs compared to water quality benefits may support project prioritization. Opportunities to strategically sequence projects, share resources, and coordinate across jurisdictions and organizations may generate long-term cost efficiencies. If WQS are achieved before the full estimated investment is implemented, implementation strategies and cost estimates should be revisited and adaptively managed.

The following cost estimate assumptions were adopted while developing this chapter.

Cost estimate assumptions

- **Current costs** – Cost estimates provided in this chapter are based on current costs in 2020. When using this resource for budget development, future costs and inflation should be considered.
- **Public grant funding** – These cost estimates reflect the cost to complete projects using public grant funding from federal and state sources. They also reflect the cost for a public or nonprofit organization to assist private landowners with project implementation. State fiscal years are referenced in the document as SFY and federal fiscal years are referenced as FFY. If landowners choose to complete implementation on their own, cost estimates may be significantly lower.

- **Omitted** – Cost estimates provided in this document do not include total costs for program administration or project management, or education and outreach to private landowners. The full costs for engineering and design are also not included in all cost estimates. Final project costs may be higher depending on landowner willingness, site conditions, hydrogeology, and complexity of BMPs needed to address water quality concerns.
- **Adaptive management** – Implementation needs are subject to change based on water quality and habitat conditions, and any relevant land use changes. If new water quality priorities emerge and more tributaries have water quality impairments, costs to achieve clean water in the EFLR may be higher. If WQS are achieved, certain tributaries may be de-prioritized, resulting in lower implementation costs.

The following table provides an overview of the estimated costs to implement water quality BMPs in priority locations in the EFLR watershed. More detailed cost estimates and alternative cost scenarios are provided throughout this chapter.

Table 78. Summary of cost estimates for BMPs in priority areas of the EFLR watershed, 2020.

Implementation Activity	Description	Total cost estimate in 2020
Septic Systems	*Estimated cost to address NPS pollution from 449 noncompliant septic systems within 200 feet of McCormick, Brezee, Jenny, and Rock Creek North.*	
Septic system inspection	Complete inspections on 449 priority septic systems in the watershed at a cost of $130 per system every 3 years, for 10 years.	$194,567
Septic system maintenance	Complete maintenance on 449 priority septic systems in the watershed at a cost of $500 per system every 5 years, for 10 years.	$449,000
Septic system replacements	Replace 449 septic systems in watershed at a cost of $21,000 per system over 10 years.	$9,429,000
Septic system rebate program administration	Assist landowners with issuing rebates for septic system inspection and maintenance at an estimated annual cost of $21,000 for 10 years.	$210,000
Septic system total	Complete inspection, maintenance, and replacement of 449 systems. Final cost will be lower if eligible septic systems connect to sewer. Final cost will be higher to address all of the septic systems in the watershed.	$10,282,567
Agriculture	*Estimated cost to address NPS pollution on 689 agricultural parcels, located within 200 feet of McCormick, Brezee, Jenny, and Rock Creek North.*	
Agriculture site visits technical assistance	Complete site visits and technical assistance on 689 agricultural properties in priority subwatersheds at a rate of $2,250 per property (30 hours each at an hourly rate of $75.00).	$1,550,250
Agricultural conservation planning	Complete conservation planning on 689 agricultural properties in priority subwatersheds at a rate of $6,375 per property (85 hours each at an hourly rate of $75.00).	$4,392,375
Agricultural implementation	Implement $10,000 worth of BMPs on 689 properties in priority subwatersheds.	$6,890,000
Agriculture total	Complete site visits, technical assistance, conservation planning, and BMP implementation on 689 properties.	$12,832,625

Table 79. Summary of cost estimates for BMPs in priority areas of the EFLR watershed, 2020 (cont.).

Stormwater	*Estimated cost to implement stormwater facility retrofits on 1,810 acres of imperviousness at $78,000 per acre, including 10 years of maintenance, and completion of priority stormwater activities.*	
Stormwater facility retrofits	Retrofit 1,810 acres of imperviousness at $78,000 per acre (approximately 10% of total impervious surfaces in watershed).	$141,180,000
Stormwater maintenance	Complete annual maintenance on 1,810 acres of impervious surfaces at $3,200 per acre for 10 years.	$57,920,000
Stormwater activity and comprehensive planning	Complete stormwater management planning activities for La Center, Ridgefield Yacolt, Battleground, and Unincorporated Clark County.	$760,000
Stormwater total	Estimated stormwater facility and activity costs.	$199,860,000
Riparian restoration	*Estimated cost to implement riparian restoration on 124.6 river miles of EFLR mainstem and tributaries at an average cost of $15,500 acre. Costs for land acquisition of priority conservation areas are also included.*	
Riparian Restoration	Restore 124.6 river miles, or approximately 1,510 acres of riparian areas with 100-foot buffers, adding over 3 million trees to the watershed at an average cost of $15,500 per acre.	$23,405,000
Land acquisition	Acquire 15,397 of Critical Conservation Areas identified through Clark County's Legacy Lands program	$19,253,999
Riparian Restoration total	Riparian restoration and land acquisition estimated costs	$42,658,999
Streamflow restoration	*Estimated cost to implement the EFLR Habitat Restoration Plan, which established salmon recovery and streamflow restoration priorities for river miles 0 to 15.*	
Lower East fork Lewis River Habitat Restoration Plan	Implement all of the priority projects identified in the *Lower East Fork Lewis River Habitat Restoration Plan* for river miles 0 to 15.	$19,589,000
Streamflow restoration total	Total streamflow restoration, salmon recovery, and temperature assessment estimated costs.	$19,589,000
Water quality monitoring	*Estimated cost to implement monitoring programs in the EFLR watershed.*	
Water Quality Monitoring	Complete water quality monitoring in EFLR watershed from 2005 to 2030	$474,836
Water quality monitoring total	Water quality monitoring estimated costs.	$474,836
TOTAL	*Implementation of water quality BMPs in priority locations.*	$285,698,027

Septic System Cost Estimates

As of 2020, there are 1,798 known septic systems in priority subwatersheds in the EFLR watershed. These priority subwatersheds include Jenny, Brezee, and McCormick Creeks and Rock Creek North, which do not meet WQS for bacteria. Of these 1,798 septic systems, approximately 581 have not been inspected and are considered noncompliant. Around 449 noncompliant septic systems are located with 200 feet of priority tributaries and may have impacts on water quality. Phase 1 septic system implementation should be prioritized to the 449 noncompliant septic systems within 200 feet of priority tributaries.

In total, there are 6,161 septic systems in the EFLR watershed and approximately 1,995 are noncompliant because of past due inspections. Approximately 1,328 of these systems are within 200 feet of the stream.

Table 80. Septic system priorities in EFLR watershed.

Priority Subwatersheds	Number of Parcels with Septic Systems	Number of parcels with noncompliant septic systems	Number of parcels with noncompliant septic systems within 200 feet of stream
Jenny Creek	351	114	94
Brezee Creek	166	67	50
McCormick Creek	309	88	66
Rock Creek North	972	312	239
Total septic systems in priority subwatersheds	1798	581	449
Total septic systems in watershed	6,161	1995 (approx. 32%)	1328

Source: Clark Conservation District SFY 2022 Water Quality Combined Funding Application WQC-2022-ClarCD-00025.

Septic system inspection cost estimates

To support implementation of BMPs for septic systems, the first step is to complete septic system inspections to understand septic system age, condition, maintenance, and repair needs. The estimated cost to complete a septic system inspection is around $130 per system. This number does not include costs for labor, or education and outreach to work with landowners and promote septic system inspections. Septic systems should be inspected every three years. To inspect the 449 priority septic systems within 200 feet of priority streams, the total cost is approximately $194,567 dollars over 10 years, or $19,547 annually, if 33 percent of septic systems are inspected each year.

Table 81. Septic system inspection cost estimates for noncompliant systems within 200 feet of streams in 2020**.**

Priority Subwatersheds	Number of Parcels with noncompliant Septic Systems within 200 feet of stream	Total cost estimate - Inspections $130 every 3 years	Annual cost estimate (33% of systems per year) in 2020	10 year cost estimates (all systems inspected on 3 year rotation)
Jenny Creek	94	$12,220	$4,073	$40,733
Brezee Creek	50	$6,500	$2,167	$21,667
McCormick Creek	66	$8,580	$2,860	$28,600
Rock Creek North	239	$31,070	$10,357	$103,567
Total noncompliant septic systems in priority subwatersheds	449	$58,370	$19,457	$194,567
Total noncompliant septic systems in watershed	1,328	$172,640	$57,547	$575,467

Source: Clark Conservation District SFY 2022 Water Quality Combined Funding Application WQC-2022-ClarCD-00025.

Over 10 years, the total cost to inspect the total 1,798 systems in priority subwatersheds on a 3-year rotational basis is approximately $779,133. To inspect the total 6,161 septic systems in the watershed, the estimated cost is around $830,930 dollars, which is approximately $266,977 dollars annually or $2,669,767 dollars over 10 years.

Table 82. Septic system inspection cost estimates in 2020.

Priority Subwatersheds	Number of Parcels with Septic Systems	Total cost estimate *$130 per system every 3 years	Annual cost estimate (33% of systems per year)	10 year cost estimates (all systems inspected on 3 year rotation)
Jenny Creek	351	$45,630	$15,210	$152,100
Brezee Creek	166	$21,580	$7,193	$71,933
McCormick Creek	309	$40,170	$13,390	$133,900
Rock Creek North	972	$126,360	$42,120	$421,200
Total septic systems in priority subwatersheds	1798	$233,740	$77,913	$779,133
Total septic systems in watershed	6,161	$800,930	$266,977	$2,669,767

Source: Clark Conservation District SFY 2022 Water Quality Combined Funding Application WQC-2022-ClarCD-00025.

Septic system maintenance cost estimates

Routine septic system maintenance is necessary to support optimal performance of septic systems throughout its lifecycle. The estimated cost to complete septic system maintenance, also known as tank pumping, is around $500 dollars. According to the Environmental Protection Agency, septic systems should be maintained every three to five years. Typically, individual landowners pay septic system maintenance costs. While some landowners complete inspections and maintenance on their own, other landowners require various levels of education and outreach from third parties to encourage septic system care. The $500 dollar cost estimate for maintenance does not include labor costs for education and outreach to work with landowners.

To complete maintenance on the 449 priority noncompliant septic systems located within 200 feet of stream, the total cost is approximately $224,500 dollars or $44,900 dollars annually, if 20 percent of all septic systems are maintained each year. The estimated cost to achieve septic maintenance on 449 systems over 10 years is $449,000.

Table 83. Septic system maintenance cost estimates for noncompliant systems in 2020.

Priority Subwatersheds	Number of Parcels with noncompliant Septic Systems within 200 feet of stream	Total cost estimate *Maintenance $500 every 5 years	Annual cost estimate (20% of systems a year)	10 year cost estimates
Jenny Creek	94	$47,000	$9,400	$94,000
Brezee Creek	50	$25,000	$5,00	$50,000
McCormick Creek	66	$33,000	$6,600	$66,000
Rock Creek North	239	$119,500	$23,900	$239,000
Total noncompliant septic systems in priority subwatersheds	449	$224,500	$44,900	$449,000
Total noncompliant septic systems in watershed	1,328	$664,000	$132,800	$1,328,000

Source: Clark Conservation District SFY 2022 Water Quality Combined Funding Application WQC-2022-ClarCD-00025.

Over 10 years, the total cost to maintain the 1,798 septic systems in priority subwatersheds is approximately $1,798,000 dollars. To complete maintenance on all 6,161 systems in the watershed, the estimated cost is around $3,080,500 dollars, which is $616,100 annually and approximately $6,161,000 over 10 years. While some landowners will pay maintenance costs and comply with the recommended maintenance schedules without assistance, providing financial assistance through public programs may improve compliance rates by providing education, outreach, and financial assistance to landowners. Investments to increase voluntary septic system inspections and maintenance are likely more cost effective than replacing and remediating pollution problems from failed septic systems.

Table 84. Septic system maintenance cost estimates in 2020.

Priority Subwatersheds	Number of Parcels with Septic Systems	Total cost estimate *Maintenance is $500 every 5 years	Annual cost estimate (20% of systems a year)	10 year cost estimate (all systems maintained on 5 year basis)
Jenny Creek	351	$175,500	$35,100	$351,000
Brezee Creek	166	$83,000	$16,600	$166,000
McCormick Creek	309	$154,500	$30,900	$309,000
Rock Creek North	972	$486,000	$97,200	$972,000
Total septic systems in priority subwatersheds	1798	$899,000	$179,800	$1,798,000
Total septic systems in watershed	6,161	$3,080,500	$616,100	$6,161,000

Source: Clark Conservation District SFY 2022 Water Quality Combined Funding Application WQC-2022-ClarCD-00025.

Septic system replacement cost estimates

Septic system replacement may be necessary if routine inspection or maintenance identifies septic systems that are failing and in disrepair. As of 2020, the Department of Ecology's Water Quality Combined Funding Program estimates that replacing a residential septic system may cost up to $21,000 dollars. According to the EPA, the average lifespan of septic system is 15 to 40 years. To replace the 449 priority septic systems in the EFLR watershed, the estimated cost is $9,429,000 dollars. Annually, a replacement program to address 449 septic systems would cost around $942,900 dollars, if 10 percent of septic systems are addressed each year over 10 years.

Table 85. Septic system replacement cost estimates for noncompliant systems within 200 feet of streams.

Priority Subwatersheds	Number of Parcels with noncompliant Septic Systems within 200 feet of stream	Total replacement cost estimate *$21,000 every 25 years.	Annual replacement cost estimate (Replace 10% of total systems per year)
Jenny Creek	94	$1,974,000	$197,400
Brezee Creek	50	$1,050,000	$105,000
McCormick Creek	66	$1,386,000	$138,600
Rock Creek North	239	$5,019,000	$501,900
Total noncompliant septic systems in priority subwatersheds	449	$9,429,000	$942,900
Total noncompliant septic systems in watershed	1,328	$27,888,000	$2,788,800

Source: Clark Conservation District SFY 2022 Water Quality Combined Funding Application WQC-2022-ClarCD-00025

To replace the total 6,161 septic systems in the watershed, it would cost around $129,381,000, which is approximately $12,938,100 annually.

Table 86. Septic system replacement cost estimates in 2020.

Priority Subwatersheds	Number of Parcels with Septic Systems	Total replacement cost estimate *$21,000 every 25 years.	Annual replacement cost estimate (10 % a year)
Jenny Creek	351	$7,371,000	$737,100
Brezee Creek	166	$3,486,000	$348,600.00
McCormick Creek	309	$6,489,000	$648,900
Rock Creek North	972	$20,412,000	$2,041,200
Total septic systems in priority subwatersheds	1798	$37,758,000	$3,775,800
Total septic systems in watershed	6,161	$129,381,000	$12,938,100

Source: Clark Conservation District SFY 2022 Water Quality Combined Funding Application WQC-2022-ClarCD-00025and Clark County Public Health.

Septic system rebate program administration

Local organizations are developing a new septic system inspection and maintenance rebate program, where landowners can have septic systems inspected and maintained, and receive financial reimbursements for completing the service. The goal of this program is to provide financial assistance to landowners while increasing septic system compliance rates. The estimated cost for the Watershed Alliance of Southwest Washington to administer this new

rebate program is approximately $105,000 over five years, or $21,000 annually. The estimated 10-year cost to implement this program is $210,000, based on cost estimates developed in 2020. This cost estimate only accounts for time spent processing rebates and does not account for additional technical assistance or education and outreach to landowners. This figure was provided in the Clark Conservation District SFY 2022 Water Quality Combined Funding Application.

Table 87. Estimated cost for administration of septic system rebate program in 2020.

Timeframe	Cost estimate
Annual Cost	$21,000
5 Year Cost	$105,000
10 year cost	$210,000

Sewer connection cost estimates

Some homes with septic systems may be eligible for sewer connection based on their proximity to sewer conveyance infrastructure and wastewater treatment plants. In the EFLR watershed, there are two wastewater service providers located in priority subwatersheds. These include the City of La Center, which has jurisdiction in Brezee and Jenny Creeks, and Clark Regional Wastewater District, which provides service in McCormick Creek. An estimated 826 septic systems may become eligible to connect to sewer in the EFLR watershed as development continues and sewer service lines are extended in urban growth areas. It is currently unknown which septic systems are eligible or when sewer services will be extended to homes with septic systems.

As septic owners qualify for municipal sewer system connections, there are opportunities for long-term cost savings from decreasing the number of septic systems needing inspections, maintenance and replacement in the watershed. Additionally, reducing the number of homeowners on septic systems could result in additional cost savings from reduced education and outreach needs to septic system owners, while increasing local revenue from sewer ratepayers.

It is estimated that it may cost up to $19,000 dollars to connect single-family properties to sewer. This estimate is based on the City of Vancouver's Sewer Connection Incentive Program, and accounts for the cost for the sewer line, system development charge, plumber costs, and administration fees. Costs within the City of Ridgefield, Clark County, and City of La Center might vary.

Septic systems in Brezee, Jenny, and McCormick Creek are most likely to become eligible for sewer services before other systems in the watershed. There are an estimated 210 noncompliant septic located within 200 feet of stream in Brezee, Jenny, and McCormick Creeks. It would cost an estimated $3,990,000 to connect these priority septic systems to municipal sewer service.

Table 88. Sewer connection costs for noncompliant septic systems within 200 feet of priority streams.

Priority Subwatersheds	Number of Parcels with Septic Systems	Total cost estimate *Sewer connection costs an estimated $19,000
Jenny Creek	94	$1,786,000
Brezee Creek	50	$950,000
McCormick Creek	66	$1,254,000
TOTAL	210	$3,990,000

To connect the total 826 septic systems located in Jenny, Brezee, and McCormick Creeks to municipal sewer services, the estimated cost is approximately $15,694,000 dollars.

Table 89. Sewer connection cost estimates in EFLR watershed in 2020.

Priority Subwatersheds	Number of Parcels with Septic Systems	Total cost estimate *Sewer connection costs an estimated $19,000
Jenny Creek	351	$6,669,000
Brezee Creek	166	$3,154,000
McCormick Creek	309	$5,871,000
TOTAL	826	$15,694,000

Future project budget development

These cost estimates were developed in 2020 using spatial analysis and data from 2017 to 2020, and a SFY 2022 funding application to the Department of Ecology. Numbers were also estimated using recommendations from the Environmental Protection Agency and cost information from City of Vancouver sewer programs. When utilizing these cost estimates for project budget development, project sponsors should adjust numbers to account for inflation, current water quality conditions, septic system inspection, maintenance, and system failure rates, sewer availability, and any relevant land use changes

Agriculture Cost Estimates

As of 2020, there are 855 agricultural parcels located in priority subwatersheds in the EFLR watershed. These priority subwatersheds include Jenny, Brezee, and McCormick Creeks, and Rock Creek North, which do not meet WQS for bacteria. Of these parcels, approximately 689 are located within 200 feet of the stream and may have impacts to water quality. Phase 1 agricultural implementation should be focused on the 689 agricultural parcels in priority subwatersheds shown in Table 101.

Table 90. Agriculture priorities in the EFLR watershed.

Priority Subwatersheds	Parcels with Agriculture	Parcels with agriculture within 200 feet of stream
Jenny Creek	201	167
Brezee Creek	156	129
McCormick Creek	170	140
Rock Creek North	328	253
Total	855	689

Source: Clark Conservation District SFY 2022 Water Quality Combined Funding Application WQC-2022-ClarCD-00025

Cost estimates shown in this chapter are based on a state fiscal year (SFY) 2022 grant funding application developed by Clark Conservation District, in partnership with other local partners. The total estimated cost to implement site visits, technical assistance, conservation planning, and implement $10,000 dollars' worth of BMPs on 689 priority agriculture parcels located within 200 feet of the stream is $12,832,625 dollars. This estimate was generated using costs in 2020.

Table 91. Estimating costs for addressing agricultural pollution priorities within 200 feet of the stream in priority subwatersheds in 2020.

Priority Subwatersheds	Number of parcels with agriculture within 200 feet of stream	Technical Assistance $2,250 per parcel	Conservation Plans $6,375 per parcel	BMP Implementation *Low cost estimate $10K per parcel	Total cost estimate per subwatershed in 2020.
Jenny Creek	167	$375,750	$1,064,625	$1,670,000	$3,110,375
Brezee Creek	129	$290,250	$822,375	$1,290,000	$2,402,625
McCormick Creek	140	$315,000	$892,500	$1,400,000	$2,607,500
Rock Creek North	253	$569,250	$1,612,875	$2,530,000	$4,712,125
Total	689	$1,550,250	$4,392,375	$6,890,000	$12,832,625

Source: Clark Conservation District SFY 2022 Water Quality Combined Funding Application WQC-2022-ClarCD-00025

To assist all of the 855 landowners in priority subwatersheds, it will cost an estimated $15,924,375 dollars.

Table 92. Estimated costs for addressing agricultural pollution in priority subwatersheds, 2020.

Priority Subwatersheds	Parcels with Agriculture	Technical Assistance $2,250 per parcel	Conservation Plans $6,375 per parcel	BMP Implementation *Low cost estimate $10K per parcel	Total cost estimate per subwatershed in 2020.
Jenny Creek	201	$452,250	$1,281,375	$2,010,000	$3,743,625
Brezee Creek	156	$351,000	$994,500	$1,560,000	$2,905,500
McCormick Creek	170	$382,500	$1,083,750	$1,700,000	$3,166,250
Rock Creek North	328	$738,000	$2,091,000	$3,280,000	$6,109,000
Total	855	$1,923,750	$5,450,625	$8,550,000	$15,924,375

Source: Clark Conservation District SFY 2022 Water Quality Combined Funding Application WQC-2022-ClarCD-00025

Site visits and technical assistance cost estimates

To support implementation of agricultural BMPs, initial site visits site visits and technical assistance are often needed to help landowners with their water quality and natural resource challenges. The estimated cost to complete a site visit and technical assistance letter is approximately $2,250 dollars per property. This number is based off the assumption that one site visit and technical assistance letter will take approximately 30 hours to complete, at an hourly composite rate of $75 dollars. The total estimated cost to complete site visits and technical assistance on the 689 priority agricultural parcels in is $1,550,250 dollars. This information is outlined in table 102. The hourly cost estimates provided by Clark Conservation District are lower than NRCS federal cost estimates.

Conservation planning cost estimates

Before landowners can benefit from public grant funding to implement agricultural BMPs, conservation planning for water quality BMP implementation is sometimes necessary to support project planning and implementation. For example, USDA NRCS now requires comprehensive nutrient management plans for every property that installs BMPs that affect manure, including manure storage, composting facilities, heavy use areas, and wastewater storage. These plans can cost $3,000 to $6,000 dollars to complete. The estimated cost to complete a conservation plan specific to water quality BMP implementation is approximately $6,375 dollars per plan. This number is based off the assumption that one conservation plan will take approximately 85 hours to complete, at an hourly composite rate of $75 dollars. The total estimated cost to complete conservation planning on the 689 priority agricultural parcels located within 200 feet of a stream is $4,392,375 dollars.

Summary of agricultural cost estimates for technical assistance and planning.

Overall, to complete technical assistance and conservation planning on 689 priority agriculture parcels in the EFLR it will cost an estimated $5,942,895 dollars. This investment in planning and technical assistance can help support implementation of agricultural BMPs on private property. Technical assistance and conservation planning does not need to be completed on every site across the watershed before implementation can start. Conservation planning and implementation is an iterative process that can happen on a rolling basis.

Agricultural implementation cost estimates

Specific cost estimates for agricultural implementation are unknown at this time; however, some cost estimates can be developed. If each of the 689 agricultural landowners implements $10,000 - $50,000 dollars' worth of agricultural BMPS on their properties, the estimated implementation needed in the watershed is at least $6.9 million dollars and up to $34 million dollars. The needs of individual sites will vary, and site-specific cost estimates for BMP implementation should be determined through the technical assistance and conservation planning process described in this chapter.

Table 93. Estimated costs to complete agricultural implementation in 2020.

Estimated BMP implementation costs	Total cost estimate to implement on 689 properties in 2020.
$10,000	$6,890,000
$25,000	$17,225,000
$50,000	$34,450,000

NRCS labor costs and cost estimate tools

Cost estimate tools from USDA NRCS should be used to develop accurate and detailed budgets for agricultural projects in the EFLR watershed. NRCS provides detailed payment schedules and information for the Environmental Quality Invective's Program, Conservation Stewardship Program, Agricultural Conservation Easement Program, and Regional Conservation Partnership Program. These tools estimate costs for labor, mobilization, excavation, and implementation of a wide range of agricultural BMPs. These resources are Washington specific and are updated each fiscal year between October and December.

When developing projects, project sponsors should use the most recent cost estimates from NRCS during budget development. NRCS also has a fence cost estimate tool for wire or electric fence that is available to estimate costs to implement fencing on pasture and rangelands. In addition, NRCS provides the Conservation Practice Physical Effects matrix for use by field planners to understand the environmental and economic effects of each conservation practice. Department of Ecology is also developing the Voluntary Clean Water Guidance for Agriculture, which recommends BMPs for water quality.

As of federal fiscal year (FFY) 2021, NRCS estimates that the hourly cost for a conservation scientist to manage, improve, and protect natural resources on agricultural properties is $78.44 dollars per hour. Additionally, the hourly cost for a professional engineer to apply knowledge of

engineering technology to agricultural land uses is $103.58 dollars. Listed below are NRCS cost estimates for professionals working in agricultural conservation. Local cost estimates provided by Clark Conservation District are lower than federal cost estimates for agricultural work in Washington State. These cost estimates are a composite rate, which includes taxes and benefit but do not include any indirect rates.

Table 94. NRCS labor cost estimates from FFY 2021.

Agricultural Conservation Job	Description	Hourly Wage
Processional Engineer Labor	Applies knowledge of engineering and biological technology to agricultural properties.	$103.58
Specialist Labor	Agronomists, foresters, biologists	$120.14
Agronomist Labor	Soil management and crop production specialist	$80.29
Conservation Scientist Labor	Works with landowners to manage, improve and protect natural resources by providing technical assistance and conservation planning services for BMP implementation.	$78.84
Supervisor or manager	Crew supervision, foreman, farm, or ranch managers	$47.93
Skilled Labor	Carpenter, welder, electricians, conservation professionals involved with data collection, monitoring and record keeping	$44.38
General Labor	Pipe layer, herder, concrete placement, materials spreader, and flagger.	$29.24

Source: NRCS Washington Payment Schedules for FFY 2021

Future project budget development

These cost estimates were developed in 2020 using spatial analysis and data from 2017 to 2020, a SFY 2022 (2021-2024) funding application to the Department of Ecology, and a FFY 2021 (2020-2025) funding application to USDA NRCS Regional Conservation Partnership Program. When utilizing these cost estimates for budget development, project sponsors should adjust numbers to account for inflation, current water quality conditions, and any relevant land use changes.

Clark Conservation District estimates that completing the necessary education and outreach work to establish relationships with willing landowners may increase project costs. On average, staff time to complete education and outreach, technical assistance, and conservation-planning necessary to implement agricultural BMPs can add an additional 10 to 25 percent on top of the total project cost.

Stormwater Cost Estimates

According to the *East Fork Lewis River Habitat Pilot Study*, the EFLR watershed has an estimated 18,731 acres of impervious surfaces. Approximately 12,585 acres of land cover have impervious surface densities over 10 percent, which is often associated with degraded watershed health. Addressing stormwater runoff in the watershed is a priority, especially in the lower watershed. The Brezee Creek subwatershed has documented bacteria pollution issues associated with stormwater runoff in the City of La Center's jurisdiction. The City of La Center has a jurisdiction

area of 2.62 square miles, which is approximately 1,677 acres. In total, the EFLR watershed has around 1,810 acres of commercial and industrial land uses, with 1,075 acres of commercial land use, and 735 acres of industrial land use.

Prioritizing stormwater implementation to pollutant generating impervious surfaces in urban areas where hydrogeological conditions are suitable for stormwater infiltration will help address stormwater sources of bacteria and thermal pollution. Additionally, prioritizing stormwater implementation to land uses that generate greater bacteria loads can help support bacteria reduction efforts. In a 2015 report, the Department of Ecology determined that industrial, commercial, and high-density residential land uses generate more bacteria than low-density residential areas. These areas generate stormwater runoff from roofs, pavement, and yards. This information reinforces the importance of prioritizing stormwater retrofit implementation in urban growth areas, including the City of La center and Ridgefield in Brezee and McCormick Creeks.

Based on this information, stormwater implementation in the EFLR is prioritized to 1,810 acres of impervious surface. This number is equal to the total acres of commercial and industrial land use and is close to 10 percent of the total 18,731 acres of imperviousness in the watershed. This target for stormwater retrofits is just higher than the City of La Center's jurisdictional area, which is approximately 1,677 acres.

Vacant buildable lands in urban growth areas should have infiltration BMPs implemented to support stormwater management as new development occurs. Additionally, where feasible and likely to generate water quality benefits, roadside ditches should be retrofitted with stormwater infiltration systems to address road runoff in rural areas. Roads with the highest vehicular traffic should be prioritized for stormwater retrofits.

Total stormwater investment needed in the EFLR is estimated at $200 million for facility retrofits, maintenance, and completion of necessary stormwater activities.

Stormwater facility retrofit cost estimates

According to the *Puget Sound Stormwater Retrofit Report Cost Estimate Appendix A,* the average cost to retrofit impervious surfaces with water quality treatment facilities is $20,000 to $78,000 per acre. This estimate is for water quality facilities that remove 80 percent of total suspended solids and does not consider the cost to remove other pollutants carried in stormwater, or the cost to acquire land to construct stormwater facilities. This number also does not include costs for flow control. Depending on the water quality impairments, different suites of stormwater BMPs may be necessary, and costs can be much higher. These estimates were also produced in 2010; therefore, the estimates for 2020 to 2030 are likely more costly.

To retrofit 1,810 priority acres of impervious surfaces in the watershed, the estimated cost is $141,180,000 dollars. To retrofit only the 1,677 acres in City of La Center's jurisdiction, the estimated cost is around $131 million. The cost to retrofit 1,075 acres of commercial land use in the watershed is $83.85 million and retrofitting 735 acres of industrial land use is estimated to cost $57.33 million.

Table 95. Stormwater retrofit cost estimates in EFLR watershed in 2020.

Impervious Surface Type	Acres	Total cost estimate to retrofit at $78,000 per acre
100% industrial land uses	735	$57,330,000
100% of commercial land use	1,075	$83,850,000
100% of City of La Center	1,677	$130,790,400
100% of commercial and industrial land uses	1,810	$141,180,000
10% of total impervious surfaces	1,873	$146,101,800
25% of total impervious surfaces	4,683	$365,254,500
50% of total impervious surfaces	9,366	$730,509,000
Acres with impervious densities greater than 10%	12,585	$981,630,000
Total impervious surfaces	18,731	$1,461,018,000

Source: Parametrix. 2010. Puget Sound Stormwater Retrofit Cost Estimate Appendix A. Prepared by Parametrix and Bissonnette Environmental Solutions, LLC, Bellevue, Washington. October 2010.

Cost estimates from Ecology's Stormwater Financial Assistance Program

Ecology's Water Quality Combined Funding Program completed a cost estimate analysis of stormwater BMP projects in 2021, based on 54 previously funded grant agreements in Ecology's Southwest Regional Office. The following table includes cost estimates for implementation of stormwater BMPs using public grant funding. Final costs may vary based on specific site conditions, hydrogeology, project scale, complexity of design and engineering, land costs, and the suite of BMPs implemented. On average, implementation of water quality treatment BMPs can range from $25,535 to $616,286 per acre, depending on the complexity of stormwater BMPs and project size. Typically, larger scale projects have a lower cost per acre compared to smaller scale projects.

Table 96. Average cost of stormwater BMPs from Ecology's Water Quality Combined Funding in 2020.

BMP	Sample size	Average cost per acre
Water quality treatment	51 projects	$25,535.63
Water quality treatment 2 to 10 acres	25 projects	$140,877.14
Water quality treatment less than 2 acres	8	$616,286.36
Emerging stormwater treatment technologies (TAPE)	18	$43,290.57
Emerging stormwater treatment technologies (TAPE) if project is 2 to 10 acres	6	$164,581.65
Emerging stormwater treatment technologies (TAPE) if project is less than 2 acres	2	$328,540.15
Permeable pavement	7 projects	$238,677.83

Source: Ecology's Stormwater Financial Assistance Program, 2020.

Stormwater maintenance cost estimates

The *Puget Sound Stormwater Retrofit Report Cost Estimate Appendix A* estimated that annual maintenance costs $300 to $3,200 dollars per acre. The estimated annual maintenance cost to maintain 1,810 acres in the EFLR range from $2.3M to $59.9M depending on maintenance frequency and the total acres maintained.

Table 97. Stormwater maintenance cost estimates in 2020.

Impervious Surface Type	Acres	Total cost estimate *$3,200 per acre	Total cost estimate for 10 years
100% industrial land uses	735	$2,352,000	$23,520,000
100% commercial land uses	1,075	$3,440,000	$34,400,000
100% of City of La Center	1,677	$5,366,400	$53,664,000
100% of commercial and industrial land uses	1,810	$5,792,000	$57,920,000
10% of total impervious surfaces	1,873	$5,993,600	$59,936,000
25% of total impervious surfaces	4,683	$14,985,600	$149,856,000
50% of total impervious surfaces	9,366	$29,971,200	$299,712,000
Acres with impervious densities greater than 10%	12,585	$40,272,000	$402,720,000
Total impervious	18,731	$59,939,200	$599,392,000

Source: Parametrix. 2010. Puget Sound Stormwater Retrofit Cost Estimate Appendix A. Prepared by Parametrix and Bissonnette Environmental Solutions, LLC, Bellevue, Washington. October 2010.

Clark County Stormwater Cost Estimates

In 2017, Clark County published the *Whipple Creek watershed-Scale Stormwater Plan Report, Appendix O: Cost Estimates*. This report was prepared to develop cost estimates for stormwater facility retrofits and restoration projects to address stormwater and water quality challenges in Whipple Creek, which is an impaired watershed located in northwest Clark County. The cost estimates were generated using historical land costs, costs for engineering design and construction, operations, and maintenance. The following is a summary of cost estimates prepared by Clark County, specific to stormwater implementation. These cost estimates provide a local example of the cost of stormwater projects in Clark County in 2017.

- **Land cost**: Based on Clark County Assessor data, urban land acquisition cost was estimated at $2,308,680 dollars per acre and rural land cost was estimated at $430,000 dollars per acre. Cost estimates for property acquisition are included due to the need to acquire land for construction of bioretention facilities and detention ponds. The amount of land needed for construction of bioretention facilities is estimated as 1.1 times the surface area of the BMP, and 1.8 times the surface area for detention ponds. It is assumed that there are no acquisition costs for implementation of stormwater BMPs in the road right-of-way.
- **Bioretention (water quality treatment and infiltration**): Capital costs for bioretention is estimated at $2,178,000 dollars per acre of BMP. The annual operating cost for bioretention facilities is estimated at $82,764 dollars per acre of BMP, with a facility lifecycle of 30 years.
- **Detention ponds (flow control):** Capital costs for detention ponds is estimated at $300,000 dollars per acre of BMP. The annual operating cost for detention ponds is estimated at $8,712 per acre of detention pond facility, with a facility lifecycle of 30 years.

Table 98. Clark County stormwater implementation cost estimates from 2017.

Stormwater Facility or Activity	Cost per acre
Urban land acquisition for facility construction	$2,308,680
Rural land acquisition for stormwater facility construction	$430,000
Bioretention capital costs per acre of facility	$2,178,000
Annual operating cost per acre of bioretention facility	$82,764
Detention pond capital cost per acre of facility	$300,000
Annual operating cost per acre of detention pond facility	$8,712
Riparian restoration	$77,000
Channel restoration	$3.3 million (river mile)

Source: Whipple Creek watershed-Scale Stormwater Plan Report, Appendix O: Cost Estimates 2017.

Stormwater activity cost estimates

To support implementation of stormwater facility retrofits, comprehensive stormwater planning is needed to assess stormwater needs, complete stormwater mapping, and complete capital improvements and asset management planning. Table 110 provides an overview of the

Stormwater Activities needed in the EFLR watershed. These include, developing comprehensive stormwater management plans for the City of La Center, City of Ridgefield, and Village of Yacolt. The estimated minimum total cost for comprehensive stormwater management planning is $125,000 dollars per plan. This total cost estimate was developed by the City of La Center for Ecology's Stormwater Financial Assistance Program in SFY 2021. The City of Battle Ground submitted a funding application for a Stormwater Retrofit Prioritization Plan, at an estimated cost of $140,000 dollars in SFY 2022. From 2008 to 2010, Clark County completed Stormwater Needs Assessment Planning for stormwater infrastructure in unincorporated Clark County's portion of the EFLR watershed. The estimated cost to update these plans is a minimum of $125,000 dollars. Focus for the unincorporated Clark County Plan should be identifying stormwater retrofit opportunities where there are recorded water quality impairments and hydrogeological conditions that are suitable for infiltration.

Other stormwater activities necessary in the watershed include establishing private stormwater facility inspection and maintenance programs. The estimated cost to develop this type of program is $60,000 dollars based on past funding awarded to the City of Vancouver. This estimate does not include the cost to manage and implement the program.

The total minimum cost to implement stormwater activities in the EFLR watershed is an estimated $760,000 dollars. Completing these activities will support long-term prioritization and implementation of stormwater facility retrofit projects to benefit water quality.

Table 99. Stormwater activity costs in EFLR watershed in 2020.

Stormwater Activity	Minimum total cost estimate
Comprehensive Stormwater Management Plan – City of La Center	$125,000
Comprehensive Stormwater Management Plan – City of Ridgefield	$125,000
Comprehensive Stormwater Management Plan – Village of Yacolt	$125,000
Private stormwater facility inspection program – City of La Center	$60,000
Private stormwater facility inspection program – City of Ridgefield	$60,000
City of Battle Ground Stormwater Retrofit Prioritization Plan	$140,000
Clark County Stormwater Needs Assessment Updates	$125,000
TOTAL	$760,000

Source: SFY 2021 and SFY 2022 grant funding applications for Ecology's Stormwater Financial Assistance Program.

Future project budget development

These cost estimates were developed using a report published in 2010, a Clark County report from 2017, and using spatial analysis and information from funding applications submitted to the Department of Ecology. When utilizing these cost estimates for budget development, project sponsors should adjust numbers to account for inflation, current water quality conditions, hydrogeological conditions and any relevant land use changes, as well as the complexity of the stormwater BMPs needed at the site.

Riparian Restoration Cost Estimates

The Department of Ecology completed assessment on 32.3 river miles of the EFLR mainstem from the mouth to the headwaters. Together, the north and south side of the river make up approximately 64.6 river miles of riparian area. One river mile (approximately 5,280 feet) with 100 feet of riparian buffer, makes up an area of 528,000 square feet, which is approximately 12.12 acres of riparian area per river mile. To achieve 100 feet of riparian buffer on the north and south side of the EFLR mainstem, approximately 783 acres of riparian area needs to be planted.

Additionally, a desktop analysis determined that approximated 60 river miles of EFLR tributaries need riparian restoration. To implement 100-foot riparian buffers on 60 river miles of tributaries, approximately 727 acres of riparian restoration is needed for a total implementation need of 1,510 acres of riparian restoration in the watershed.

Riparian restoration cost estimates

Ecology's Water Quality Combined Funding Program estimated that the average cost to complete riparian restoration is approximately $15,500 per acre, based on 33 previously funded grant agreements across the state from State Fiscal Years 2016 to 2019. Cost per acre varies based on specific site conditions and project scale. Costs range from approximately $3,500 dollars to $35,000 dollars, depending on extent of invasive species control, ease of access, plant stock quality, and if maintenance is included in the budget. Typically, larger scale projects have a lower cost per acre. Based on the average cost per acre, the total estimated cost to achieve 100-foot buffers on the north and south side of the EFLR mainstem is approximately $12,136,500 dollars. The cost to achieve riparian restoration on tributaries is estimated at $11,268,500 dollars. In total, up to $23,405,000 dollars of investment may be needed to achieve 1,510 acres of riparian restoration in the watershed. If 2,000 trees are planted on each acre, approximately 3,020,000 trees could be planted in riparian areas. These cost estimates represent the costs to implement riparian restoration projects using public funding. If landowners choose to implement riparian restoration efforts on their own, costs may be significant lower depending on the costs of trees, site preparation, and any contracted labor.

Table 100. Riparian restoration cost estimates in EFLR watershed in 2020.

Riparian restoration	River miles	Acres	Estimated number of trees (2,000 per are)	Total cost estimate ($15.5K per acre)
Riparian restoration mainstem	64.6	783 acres	1,566,000	$12,136,500
Riparian restoration tributaries	60	727 acres	1,454,000	$11,268,500
TOTAL	124.6	1,510 acres	3,020,000	$23,405,000

*Note: $15,500 per acre estimate includes invasive species removal, planting, and 1-2 years of maintenance provided through analysis completed on average costs of publicly funded riparian restoration projects in Ecology's Water Quality Combined Funding program.

Clark County Cost Estimates

In addition to cost estimates represented above, Clark County also developed cost estimates for riparian restoration in the 2017, *Whipple Creek watershed-Scale Stormwater Plan Report, Appendix O: Cost Estimates*. Costs to restore riparian areas is estimated at $700,000 dollars per mile of stream, which is approximately $77,000 dollars per acre. The cost includes estimated costs to acquire land or easements, complete outreach, and implement a four-year maintenance program for plant establishment. Overall, Clark County cost estimates are higher than averages provided by Ecology's water quality combined funding program. This highlights how variable costs can be for different riparian restoration projects depending on the full project scope.

Land acquisition cost estimates

Clark County's Legacy Lands Program protects highly valued land for habitat, scenic corridors, low impact recreation, and other environmental benefits. Currently, Clark County owns over 2,000 acres of conservation and recreation lands in the EFLR watershed. Much of this land is located in riparian areas. The County updated its Conservation Areas Acquisition Plan in April 2020, which includes a six-year Conservation Areas Acquisition Plan Project Opportunities list in Appendix B. This plan identifies 15,397 acres of land in the EFLR watershed for future acquisition. The total estimated cost to acquire all of these properties is $19,253,999 dollars.

Table 101. Land acquisition cost estimates in EFLR watershed in 2020.

Land acquisition priorities	Acres	Total cost estimate
Lewis River Ranch Phase 2	160	$2,300,000
Mason Creek	65 acres (50 acres in fee and 15 acre easement)	$726,599
Lewis River Ranch Phase 3	60	$0
La Center Bottoms addition	15	$200,000
Yacolt to Moulton Falls Trail	20	$250,000
Lewis River Ranch Phase 4	160	$1,900,000
Bolen Creek Trail Corridor	5.48	$154,000
East Fork Lewis River Optimists	43 acre conservation easement	$539,500
Yacolt Burn Forest Phase 1	8,445 acre easement	$4,332,500
Hantiwick road to Moulton Falls Trail	377.5	$750,000
Horseshoe Falls	21	$278,700
Ridgefield Pits	125	$1,588,000
Yacolt Burn Forest Phase 2	5,900 acres of conservation easement	$6,234,700
TOTAL	15,397	$19,253,999

Source: Draft Update Clark County Conservation Areas Acquisition Plan, Clark County Public Works Department Parks and Lands Division, April 2020

Future project budget development

These cost estimates were developed using information from Ecology's Water Quality Combined Funding Program in 2020, and information in reports produced in 2017 and 2020. When utilizing these cost estimates for project budget development, project sponsors should adjust numbers to account for inflation, current economic conditions, and location specific conditions. In some cases, it may be cost effective to encourage landowners to implement planting projects on their own through education and outreach programs. Opportunities to increase landowner participation in USDA's Conservation Reserve Enhancement Program could help increase agricultural landowner participation in river restoration and provide financial incentives for riparian buffer installation. Developing local tax incentive programs or subsidies may also help increase private landowner riparian restoration efforts and lower long-term costs.

Streamflow Restoration Cost Estimates

The Lower Columbia Fish Recovery Board (LCFRB) has served as a restoration planning leader and regional funding organization for salmon recovery implementation in the EFLR for many years. To provide this leadership, LCFRB developed the *Lower East Fork Lewis River Habitat Restoration Plan* in 2009, which outlines restoration project needs in the watershed from river

mile 0 to 15. In Chapter 5 of LCFRB's plan, restoration and acquisition project opportunities are identified and cost estimates were provided for project implementation. These projects are listed in Tables 113 to 115. The status of each project as of November 2020 is also provided as either identified, conceptual, planning or design, active, or complete. Identified projects are projects that have been identified as a potential project. Conceptual projects are projects where a drawing or narrative description has been prepared for proposal development. Design or planning projects are projects that have not been implemented but have receiving funding to complete final design. Active projects are those that are currently being implemented and completed projects have been finished.

In total, the projects identified by the *Lower East Fork Lewis River Habitat Restoration Plan* for river miles 0 to 15 are valued at an estimated $19,589,000 dollars. These projects are focused on salmon recovery, but can also have benefits for water temperatures, instream flows, riparian areas, and restoring natural watershed processes. Restoration cost estimates for the upper watershed from river miles 15 to 32.3 are not fully understood.

Information to develop this table was provided by Lower Columbia Fish Recovery Board with significant contribution from Inter-fluve, a river restoration-consulting firm that has worked on many restoration projects in the EFLR watershed. Going forward, close coordination with the LCFRB is recommended for implementation of temperature projects that benefit salmon recovery.

Refer to tables 113 to 115 for cost estimates and project status or reference Chapter 6 of the *Lower East Fork Lewis River Habitat Restoration Plan*. In the next five years, project sponsors have the goal to complete projects highlighted in the table.

Table 102. Estimated costs to implement the Lower EFLR Habitat Restoration Plan.

2009 Project ID	Description	Project Type	Project status and sponsor as of November 2020	High cost estimate
BR 01	Brezee Creek Dam	Restoration	Identified	$648,000
DE 01	Lower Dean Channel enhancement (downstream)	Restoration	Identified	$292,000
DE 02	Lower Dean Creek Channel Enhancement	Restoration	Identified	$350,000
DY 02	Dyer reach 4 channel and passage enhancement	Restoration	Identified	$502,000
EF 01	Side-channel restoration	Restoration	Identified	$200,000
EF 02	Side/off-channel restoration	Restoration	Identified	$739,000
EF 03	Side-channel restoration	Restoration	Identified	$114,000
EF 04	Streambank/in-channel enhancement	Restoration	Identified	$203,000
EF 05	Off-channel habitat enhancement (RM 14)	Restoration	Conceptual	$195,000
EF 06	Streambank enhancement	Restoration	Identified	$10,000
EF 07	Side-channel/in-channel enhancement	Restoration	Identified	$454,000
EF 08	Riparian restoration / streambank enhancement	Restoration	Identified	$142,000
EF 09	Side-channel restoration	Restoration	Identified	$228,000
EF 10	Side channel habitat engagement (RM 13-13.5)	Restoration	Conceptual	$702,000
EF 11	Side/off-channel restoration	Restoration	Identified	$463,000
EF 12	Instream habitat enhancement (RM 11-11.3)	Restoration	Conceptual	$399,000
EF 13	Side/off-channel restoration	Restoration	Identified	$1,140,000
EF 14	Side/off-channel restoration	Restoration	Identified	$570,000
EF 15	Streambank (rip-rap) enhancement	Restoration	Identified	$194,000
EF 16	Side/off-channel restoration	Restoration	Conceptual – Clark County	$535,000
EF 17A	Riparian restoration	Restoration	Identified	$61,000
EF 17B	Riparian restoration	Restoration	Identified	$61,000
EF 18	Streambank/in-channel habitat enhancement	Restoration	Identified	$292,000
EF 20	Side-channel and backwater habitat enhancement (10.7)	Restoration	Conceptual	$595,000
EF 21	Side channel enhancement (RM 10.5)	Restoration	Conceptual	$390,000
EF 22	Chum channel	Restoration	Identified	$259,000

Table 103. Estimated costs to implement the Lower EFLR Habitat Restoration Plan (cont.)

2009 Project ID	Description	Project Type	Project status and sponsor as of November 2020	High cost estimate
EF 24	Side-channel/off-channel restoration	Restoration	Design or Planning	$257,000
EF 25	Side-channel restoration	Restoration	Identified	$285,000
EF 26	Streambank/in-channel habitat enhancement	Restoration	Design or Planning	$729,000
EF 27	Off-channel restoration	Restoration	Design or Planning - LCEP	$146,000
EF 28	Side channel restoration (RM 9-9.5)	Restoration	Design or Planning – LCEP	$714,000
EF 34	Streambank restoration; channel structure	Restoration	Identified	$146,000
EF 35	Remove rip-rap / in-channel enhancement	Restoration	Design or Planning - LCEP	$486,000
EF 36	Remove rip-rap / in-channel enhancement	Restoration	Design or Planning – LCEP	$243,000
EF 37	Enhance rip-rap	Restoration	Identified	$73,000
EF 38	Off-channel enhancement	Restoration	Identified	$113,000
EF 39	Off-channel habitat enhancement	Restoration	Identified	$162,000
EF 40	Streambank restoration; channel structure	Restoration	Identified	$97,000
EF 41	Riparian restoration (5.7-7.3)	Restoration	Conceptual	$432,000
EF 42	Levee and drainage ditch removal (5.1)	Restoration	Completed	$161,000
EF 43	Levee removal/set-back	Restoration	Completed	$527,000
EF-A 01	Ridgefield Pits alternatives assessment (RM 7.3-8.3)	Restoration	Design or Planning - LCEP	$290,000
EF-A 02	Daybreak pits avulsion risk assessment (RM 7.3-9.5)	Planning	Conceptual	$221,000
EF-A03	Temperature and groundwater assessment (RM 5.7-15)	Restoration	Identified	$137,000
JIE 01	Lower Jenny Cr channel enhancement and off-channel creation	Restoration	Identified	$305,000
MC 01	Lower McCormick channel enhancement	Restoration	Active – Clark Public Utilities District	$583,000
MC 02	Restore passage at La Center Road Crossing	Restoration	Identified	$810,000

Table 104. Estimated costs to implement the Lower EFLR Habitat Restoration Plan (cont.)

2009 Project ID	Description	Project Type	Project status and sponsor as of November 2020	High cost estimate
MC 03	Residential 1D	Restoration	Identified	$65,000
MC 04	Residential pond reach 1G and 1H	Restoration	Identified	$356,000
MI 01	Mill Creek 1 C habitat enhancement	Restoration	Identified	$292,000
MN 02	Manley creek habitat enhancement (downstream of 259th - RM 0.2-0.75)	Restoration	Conceptual	$390,000
MN 03	Manley Creek passage restoration and habitat enhancement (upstream of 259th)	Restoration	Identified	$822,000
MS 01	Lower mason habitat enhancement (0-1)	Acquisition and Restoration	Design or Planning – Clark County	$669,000
MS 02	Mason channel enhancement reach 3-4	Restoration	Identified	$340,000
TOTAL				$19,589,000

SOURCE: Inter-fluve and LCFRB, November 2020.

Streamflow restoration projects and thermal assessment

The Lower Columbia Estuary Partnership has restored over 600 acres of riparian habitat along 10 miles of river in the EFLR watershed. LCEP is also providing essential assessment, planning, and design expertise in the watershed. Currently LCEP is leading a Thermal Refuge Assessment of the watershed, which is developing a thermal profile of the river up to river mile 19 in Phase 1. The Phase 2 project identified in Table 116 will extend this assessment into the upper watershed. This assessment work will identify cold-water refuges and areas where the watershed is gaining cold-water inputs. This will provide essential information for future work to enhance cold-water areas and address low-instream flow issues in the watershed. The Assessment will also inform the Ridgefield Pits restoration work, which is developing restoration alternatives and preliminary designs between river miles 7 to 10 where the river historically avulsed into sand and gravel mining pits. Construction of the preferred alternative for Ridgefield Pits is expected to cost at least $5.5 million dollars. Listed below is a 5-year list of LCEP's priority projects in the watershed and project status. The estimated cost for these projects is almost $8 million dollars for final planning, design, and implementation. These cost estimates do not include other LCEP work in the watershed, which includes a large wetland restoration project downstream from the City of La Center, known as La Center Bottoms Phase 2, or the education, outreach, and volunteer coordination work LCEP completes with the public and students.

Table 105. Lower Columbia Estuary Partnership project cost estimates November 2020.

Project Number	Project Name	RM	Length (ft.)	Project Type	Status	Cost estimate
EF 35 & 36	E. Fork Lewis Restoration	7	3,000	Restoration	Identified	$161,000
EF 35 & 36	E. Fork Lewis Restoration Final Design & Construction	7	3,000	Restoration	Identified	$475,000
EF A 02	Daybreak Avulsion Risk	7.5	5,000	Restoration	Identified	$175,000
Rock Cr. 1	Rock Cr. Assessment	24	49,000	Assessment or Planning	Identified	$125,000
-	Middle E. Fork Habitat Improvements	33	5,000	Restoration	Identified	$175,000
EF A 03 (extended upstream- currently only goes to RM 19)	East Fork Thermal Assessment Phase 2	19-39	105,600	Restoration	Identified	$180,000
EF A 01 (only through concept design)	Ridgefield Pits Final Design	7.5	10,560	Restoration	Conceptual	$500,000
EF A 01 (only through concept design)	Ridgefield Pits construction	7.5	10,560	Restoration	Conceptual	$5,500,000
MS -01 (only through concept design)	Mason Creek & E. Fork Final Design & Construction	5.5	5,280	Restoration	Conceptual	$450,000
TOTAL			197,00 feet or 37 river miles			$7,741,000

Source: Lower Columbia Estuary Partnership, November 2020.

Future project budget development

These cost estimates were developed using information from LCFRB's *Lower East Fork Lewis River Habitat Restoration strategy* developed in 2010, and information obtained from partner organizations in 2020. When utilizing these cost estimates for project budget development, project sponsors should adjust numbers to account for inflation. In addition to cost estimates represented in this chapter, Clark County also developed cost estimates for channel restoration in the 2017 *Whipple Creek watershed-Scale Stormwater Plan Report, Appendix O: Cost Estimates*. Channel restoration costs were estimated at $3,300,000 dollars per stream mile, based on Clark County's past channel restoration work in the upper Whipple Creek watershed. Cost estimates for other streamflow restoration activities including water rights acquisition, implementing local water use programs, irrigation efficiencies, or other water conservation

activities are not included in this chapter. Ecology's Streamflow Restoration Competitive Grant Program should be consulted when developing streamflow restoration costs.

Monitoring Cost Estimates

Department of Ecology and local partners have completed monitoring in the EFLR watershed for many years. Department of Ecology's assessment began in 2005, and investigative monitoring was completed as recently as 2020. A summary of monitoring costs is included in table 117.

As of 2020, the Department of Ecology has invested $61,866 dollars in water quality monitoring in the EFLR watershed. Most of the monitoring was focused on collecting and processing temperature and bacteria samples. This number does not include the cost for staff time spent collecting, analyzing, or reporting on the data. Clark County also invested monitoring resources in the watershed, costing an estimated $26,440 dollars. The total known monitoring investment from in the watershed between 2005 and 2020 is approximately $80,306 dollars without staff time. Future monitoring costs are estimated at around $49,704 dollars for Clark County to complete three years of pollution identification and correction (PIC) monitoring through 2023. An additional $99,408 dollars is needed to continue PIC monitoring over the next 10 years.

Future effectiveness monitoring cost estimates are based on the assumption that all monitoring completed in the watershed, will need to be completed again starting in 2027. The estimated cost for effectiveness monitoring could be up to $238,000 dollars. This is comparable to cost estimates provided by the Lower Columbia Fish Recovery Board in the WRIA 27 Watershed Management Plan, which estimated monitoring costs to be approximately $214,600 in the first year and $154,650 dollars annually in subsequent years.

The total conservative cost estimate for monitoring investment in the EFLR, including past, present and future monitoring, is approximately $475,000 dollars.

This is not a full list of all monitoring completed in the watershed. Costs of Washington Department of Fish and Wildlife and USGS monitoring are unknown. Future streamflow monitoring, Stream Health Report monitoring, and long-term index site monitoring are not accounted for in these cost estimates. Stormwater and habitat status and trends monitoring needs are also not included in these cost estimates. Completing these additional monitoring activities may be helpful for assessing Alternative Restoration Plan success.

Table 106. Water quality monitoring costs in EFLR watershed in 2020.

Water Quality Monitoring	Number of Samples	Cost per sample	Total cost estimate
2005 Water Quality Sampling (Ecology)	1,848	$21	$38,808
2017-2018 Water Quality Assessment (Ecology)	46	$25	$14,280
2019-2020 Investigative Monitoring (Ecology)	209	$42	$8,778
2020 Microbial Source Tracking (Clark County)	30	Varies	$26,440
2021-2023 Pollution Identification and Correction Monitoring and data analysis (Clark County)	TBD	TBD	$49,704
2023-2029 Pollution Identification and Correction Monitoring and data analysis	TBD	TBD	$99,408
Estimated future Effectiveness monitoring (TBD)	TBD	TBD	$237,418
Streamflow monitoring	TBD	TBD	TBD
TOTAL	TBD	TBD	$474,836

Source: 2005, 2017, and 2020 QAPPs, Clark County monitoring plan and Clark Conservation District SFY 2022 Water Quality Combined Funding Application WQC-2022-ClarCD-00025 and Clark County Public Health.

Future project budget development

These cost estimates were developed using information from Quality Assurance Project Plans developed between 2005 and 2020, information from Clark County, as well as a Clark Conservation District SFY 2022 Water Quality Combined Funding Application. When utilizing these cost estimates for project budget development, project sponsors should adjust numbers to account for inflation and consult with laboratories that will be processing and analyzing water quality samples.

Chapter 11 – Criteria to Measure Progress

The following chapter includes details of how Ecology and the East Fork Lewis River Partnership will evaluate implementation progress in the watershed. This chapter also includes milestones, targets, and timelines for long-term implementation. Ecology believes that the actions outlined in this ARP will result in the attainment of water quality standards. Ecology has established criteria to measure progress and key milestones to determine if water quality standards are being achieved. Effectiveness monitoring will be the primary tool used to assess progress. Temperature and *E. coli* are the most important water quality parameters Ecology will utilize to evaluate success. Ecology will use results from annual reporting and effectiveness monitoring to adaptively manage this plan and determine if the ARP has been successful or if a traditional TMDL is needed. If water quality standards are not achieved through implementation actions outlined in this Alternative Restoration Plan, a formal TMDL will be required for the watershed to comply with the Clean Water Act.

Septic systems milestones, targets, and timelines

To achieve bacteria water quality standards in the East Fork Lewis River, one of the highest priorities is to address noncompliant septic systems located within 200 feet of a stream. Noncompliant septic systems are those that are past due for operations and maintenance, which includes inspections and routine tank pumping. Septic system inspections and maintenance are necessary to ensure septic systems are functioning properly to protect water quality. If systems are not functioning properly than maintenance, repair, or replacement may be needed. McCormick, Brezee, Jenny and Rock Creek North are the highest priorities for reducing bacteria and improving water quality.

Short-term milestones for septic implementation

The short-term goal is to provide technical and financial assistance for septic system inspections and maintenance on the 1,328 noncompliant septic systems located within 200 feet of all streams in the East Fork Lewis River by 2030. This will cost approximately $836,640 dollars. To achieve this goal, 10 percent of these septic systems (approximately 133 septic systems) should have O&M completed by 2022, and 25 percent (332 septic systems) should be addressed by 2023.

Ecology is confident in the ability to achieve 25 percent implementation by 2023 due to the new Poop Smart Clark pollution identification and correction program, which will be implemented in the watershed starting in 2021 to 2022. This program includes funding for septic system inspections and maintenance in priority areas for water quality. The ultimate goal is to achieve 50 percent of septic system inspections and maintenance by 2025, and 75 percent by 2027, with 100 percent implementation on noncompliant septic systems within 200 feet of a stream by 2030.

Table 107. Milestones, targets, and timelines for noncompliant septic systems within 200 feet of stream.

Priority Subwatersheds	Number of parcels with noncompliant septic systems within 200 feet of a stream	75 percent	50 percent	25 percent	10 percent
Jenny Creek	94	71	47	24	9
Brezee Creek	50	38	25	13	5
McCormick Creek	66	50	33	17	7
Rock Creek North	239	179	120	60	24
Total in priority subwatersheds	449	337	225	112	45
Total in EFLR watershed	1,328	996	664	332	133
Estimated cost for inspection and maintenance in full watershed	$836,640	$627,480	$418,320	$209,160	$83,790
Target Implementation Year	**2031**	**2027**	**2025**	**2023**	**2022**

**Noncompliant septic systems are past due for inspections and maintenance as determined by Clark County Public Health in 2020.*
**Estimated cost for inspections is $130 dollars and maintenance is $500 dollars. The total cost for both activities is $630 per system.*

Septic system effectiveness monitoring

Clark Conservation District, Clark County Public Health, and other Poop Smart Partners will report progress on septic system implementation annually to the Department of Ecology. Water quality monitoring, including microbial source tracking, source tracing, and illicit discharge detection and elimination methodology will be utilized to confirm sources of human bacteria and target septic related outreach and implementation. Once implementation is complete, water quality effectiveness monitoring will be the primary tool used to assess progress towards meeting water quality standards. *E. coli* will be the monitoring parameter used to assess progress towards meeting bacteria standards and achieving recreational uses.

Clark County implements routine water quality monitoring in the East Fork Lewis River every five years. The last water year of monitoring implemented by Clark County was completed in 2020. The watershed will have effectiveness monitoring implemented by Clark County every five years starting in 2025 until water quality standards are attained. Implementation of BMPs for septic systems will be adaptively managed based on results from Clark County's water quality monitoring and progress made by Poop Smart Clark. If water quality standards are achieved in certain areas of the watershed, implementation will shift to other areas that are not meeting standards until all waters in the East Fork Lewis River comply with bacteria standards.

If water quality standards are still not attained after addressing all of the noncompliant septic systems within 200 feet of the stream, partners will prioritize implementation at the remaining noncompliant septic systems in the watershed that are more than 200 feet away from the stream. In total, there are 1,995 noncompliant septic systems in the watershed. Approximately 67 percent of those are within 200 feet of a waterway.

Table 108. Milestones, targets, and timelines for noncompliant septic systems watershed wide.

Priority Subwatersheds	Number of parcels with noncompliant septic systems	75 percent	50 percent	25 percent	10 percent
Jenny Creek	114	86	57	29	11
Brezee Creek	67	50	34	17	7
McCormick Creek	88	66	44	22	9
Rock Creek North	312	234	156	78	31
Total in priority subwatersheds	581	436	291	145	58
Total in EFLR watershed	1,995	1,496	998	499	200
Estimated cost for inspection and maintenance in full watershed	$1,256,850	$942,480	$628,740	$314,370	$126,000
Target Implementation Year	**2032**	**2030**	**2027**	**2025**	**2022**

Long-term milestones for septic implementation

If 100 percent of the noncompliant septic systems have been addressed and water quality challenges persist, then implementation will shift to all septic systems in the watershed. In total, the East Fork Lewis River has an estimated 6,161 septic systems. Around 32 percent are considered out of compliance. To achieve clean water, routine septic system inspections, maintenance, repair, and replacement will need to be implemented in the watershed in perpetuity until septic systems are connected to municipal sewer service. Clark County recommend septic systems are inspected every 3 years, and maintenance is completed every 5 years. Replacement of septic systems is needed every 15 to 40 years.

If water quality is not improving after significant septic implementation, than the East Fork Lewis River Partnership will assess if more investment is needed in other implementation areas to address sources of bacteria from agriculture, dogs, wildlife, and stormwater runoff.

Table 109. Milestones, targets, and timelines for all septic systems in watershed.

Priority Subwatersheds	Number of Parcels with Septic Systems	75 percent	50 percent	25 percent	10 percent
Jenny Creek	351	263	176	88	35
Brezee Creek	166	125	83	42	17
McCormick Creek	309	232	155	77	31
Rock Creek North	972	729	486	243	97
Total septic systems in priority subwatersheds	1798	1349	899	450	180
Total septic systems in EFLR watershed	6,161	4,621	3,081	1,540	616
Estimated cost for inspection and maintenance	$3,881,430	$2,911,230	$1,941,030	$970,200	$388,080
Target Implementation Year	**2045**	**2040**	**2035**	**2030**	**2025**

Agriculture milestones, targets, and timelines

To achieve bacteria water quality standards in the East Fork Lewis River, one of the highest priorities is to address nonpoint source runoff from agricultural properties located within 200 feet of streams in priority subwatersheds. Providing technical assistance and conservation planning to support implementation of agricultural BMPs are the first steps towards helping agricultural landowners improve water quality on their properties. BMPs may include livestock exclusion fencing, off-stream watering facilities, implementation of heavy use area protection, and manure management facilities. McCormick, Brezee, Jenny and Rock Creek North are the highest priorities for reducing bacteria and improving water quality.

Short-term milestones for agricultural implementation

The short-term goal is to provide technical and financial assistance to the 689 agricultural landowners located within 200 feet of a stream by 2031 to support implementation of agricultural BMPs. This will cost approximately $5.9 million dollars, which does not include the costs for design, engineering, planning, construction, or implementation of BMPs. To achieve this near-term goal, 10 percent of agricultural landowners should have technical assistance and conservation planning completed by 2023, and 25 percent should be addressed by 2025.

Ecology is confident in the ability to make progress on agricultural implementation due to the new Poop Smart Clark pollution identification and correction program, which will start in 2021-2022. This program includes funding for technical assistance, conservation planning, and BMP implementation in priority areas for water quality.

The ultimate goal is to achieve 50 percent of agriculture implementation on parcels located within 200 feet of priority streams areas for by 2027, and 75 percent by 2029, with 100 percent implementation on agricultural properties within 200 feet of a stream by 2031.

Table 110. Milestones, targets, and timelines for agriculture properties within 200 feet of stream.

Priority Subwatersheds	Parcels with agriculture within 200 feet of a stream	75 percent	50 percent	25 percent	10 percent
Jenny Creek	167	126	84	42	17
Brezee Creek	129	97	65	32	13
McCormick Creek	140	105	70	35	14
Rock Creek North	253	190	127	63	25
Total agriculture within 200 feet of priority tributaries	689	517	345	173	69
Estimated cost for technical assistance, conservation planning, and $10,000 BMP implementation.	$5,942,625	$4,459,125	$2,975,625	$1,492,125	$595,125
Target Implementation Year	**2031**	**2029**	**2027**	**2025**	**2023**

Agriculture effectiveness monitoring

Clark Conservation District, Clark County Public Health, and other Poop Smart Partners will report progress on agricultural implementation annually to the Department of Ecology. Water quality monitoring including microbial source tracking, source tracing, and illicit discharge detection and elimination methodology will be utilized to confirm sources of bacteria from livestock and to target agricultural related outreach and implementation. Once implementation is complete, water quality monitoring will be the primary tool used to assess progress towards meeting water quality standards. *E. coli* will be the monitoring parameter used to assess progress towards meeting bacteria standards and achieving recreational uses.

Clark County implements routine water quality monitoring in the East Fork Lewis River every five years. The last water year of monitoring was completed in 2020. The watershed will have effectiveness monitoring implemented by Clark County every five years starting in 2025 until water quality standards are attained. Implementation of BMPs for agriculture will be adaptively managed based on results from Clark County's water quality monitoring.

If water quality standards are still not attained after addressing all of the agricultural priorities within 200 feet of the stream, partners will prioritize implementation on the remaining agricultural properties in priority subwatersheds that are more than 200 feet away from the

stream. In total, there are 855 agricultural properties located in priority subwatersheds. Approximately 81 percent of those are within 200 feet of a waterway.

If water quality is not improving after significant agricultural implementation, then the East Fork Lewis River Partnership will assess if more investment is needed in other implementation areas to address sources of bacteria from humans, dogs, wildlife, and stormwater runoff.

Table 111. Milestones, targets, and timelines for agriculture watershed wide.

Priority Subwatersheds	Parcels with Agriculture	75 percent	50 percent	25 percent	10 percent
Jenny Creek	201	151	101	50	20
Brezee Creek	156	117	78	39	16
McCormick Creek	170	128	85	43	17
Rock Creek North	328	246	164	82	33
Total agriculture in priority areas of EFLR watershed	855	641	428	214	85
Estimated cost for technical assistance and conservation planning for BMP implementation.	$7,374,375	$5,528,625	$3,691,500	$1,845,750	$733,125
Target Implementation Year	**2033**	**2030**	**2028**	**2026**	**2024**

Stormwater management milestones, targets, and timelines

To achieve bacteria water quality standards in the East Fork Lewis River, Ecology is proposing a phased approach for stormwater management in the East Fork Lewis River. In phase one, Ecology is recommending that the City of La Center develop and implement illicit discharge detection and elimination (IDDE) program in the watershed to find and fix illicit cross connections. Additionally, work to survey, map, and inventory stormwater assets will be necessary to support stormwater management efforts and capital improvements in the city.

Currently, the City of La Center does not have a stormwater management plan or program in place because the city has not reached the population threshold that triggers stormwater permit requirements. If La Center were to come under stormwater permit coverage it would likely occur in 2024 or 2029, which are the next dates for stormwater permit reissuance in Washington State. Therefore, all stormwater activities in the City of La Center's portion of Brezee Creek are voluntary. To ensure long-term water quality protection, Ecology is recommending the City of La Center to proactively develop a stormwater management plan and program, which includes illicit discharge detection and elimination practices, and bacteria source control programming, and a private stormwater facility inspection and maintenance program. These plans should be developed by 2025, and implemented by 2030 due to documented sources of bacteria in La Center's stormwater infrastructure. Monitoring recently confirmed that bacteria is coming from human and dog sources.

If water quality standards are not achieved in La Center's portion of Brezee Creek after phase one stormwater implementation, phase two of stormwater implementation will focus on implementing stormwater retrofits. The City of La Center's urban growth area is approximately 1,677 acres, or 2.62 square miles. The goal is to implement stormwater management efforts on one percent (1%) of La Center's total area, which would result in 17 acres of stormwater retrofits by 2035. This would cost the City an estimated $1.3 million dollars

To support progress on phase two implementation, La Center should work towards the target of having ten percent of its total jurisdiction with stormwater retrofits and water quality treatment BMPs implemented by 2045. This would result in 168 acres of impervious surfaces with stormwater BMPs implemented at an estimated cost of $13 million dollars. The City currently has a stormwater utility generating a local source of funding for stormwater investments and the city is eligible for funding through the Stormwater Financial Assistance Program (SFAP) to help meet this target.

Table 112. Milestones, targets, and timelines for stormwater implementation.

Impervious Surface Type	Acres	75%	50%	25%	10%	5%	1%
100% City of La Center	1,677	1,258	839	419	168	84	17
Estimated cost for retrofit	$130.8M	$98.1M	$65.4M	$32.7M	$13.1M	$6.5M	$1.3M
Target Implementation Year	**2065**	**2060**	**2055**	**2050**	**2045**	**2040**	**2035**

Long-term milestones for stormwater implementation

The long-term goal is to implement stormwater BMPs on 10 percent of the total impervious surfaces in the East Fork Lewis River watershed by 2065. Currently, the watershed has an estimated 18,731 acres of impervious surfaces. Priority areas for implementation are Brezee, McCormick, and Jenny Creeks, which are experiencing the most urbanization in the watershed. To implement stormwater BMPs on 10 percent of the total impervious area in the watershed, approximately 1,873 acres would need to be retrofitted at an estimated cost of $146 million dollars. This implementation will be achieved through activities completed by Clark County, Washington Department of Transportation, Battle Ground, the City of La Center, and the City of Ridgefield. If water quality is not improving after significant stormwater implementation, than the East Fork Lewis River Partnership will assess if more investment is needed in other implementation areas to address sources of bacteria from septic systems, dogs, wildlife, and livestock.

Stormwater effectiveness monitoring

Currently, Clark County has an interlocal agreement with the City of La Center to provide illicit discharge detection and elimination support in its stormwater system. This includes implementation of water quality monitoring and microbial source tracking (MST) to identify

what types of bacteria sources are being conveyed through La Center's stormwater system. This work is being implemented in 2021 and it is unknown how long this work will continue. Ecology recommends that La Center continue to collaborate with Clark County on monitoring until all sources of bacteria in stormwater are identified and removed. In addition to the IDDE and MST work in La Center, Clark County implements routine water quality monitoring in the East Fork Lewis River every five years. The last water year of monitoring was completed in 2020. The watershed will have effectiveness monitoring implemented by Clark County every five years starting in 2025 until water quality standards are attained. Implementation of BMPs for stormwater will be adaptively managed based on results from Clark County's water quality monitoring. If water quality standards are achieved through implementation of the Phase one stormwater activities, Ecology will adaptively manage its recommendation for stormwater retrofits in phase two.

Riparian restoration milestones, targets, and timelines

To achieve temperature water quality standards in the East Fork Lewis River and support aquatic life uses, the highest priority is to implement riparian restoration projects to increase riparian shade. The long-term goal is to achieve system potential shade, which is 85 percent tree canopy. Efforts to restore riparian areas and plant trees is needed to increase effective shade and help lower warm water temperatures. Implementation on 100 percent of riparian areas needs to be achieved by 2035, with the goal that trees will reach maturity within 20 to 30 years by 2055 to 2065. To achieve this target, 25 percent of riparian areas needs to be planted by 2025. This would result in restoring 100-foot buffers on 378 acres along 31 river miles for an estimated cost of $5.8 million dollars. Fifty percent of implementation needs to be achieved by 2028, with the goal to achieve 75 percent by 2031, and 100 percent implementation by 2035.

Table 113. Milestones, targets, and timelines for riparian restoration by river mile.

Riparian restoration	River miles	75 percent	50 percent	25 percent	10 percent
Riparian restoration mainstem	64.6	48	32	16	6
Riparian restoration tributaries	60	45	30	15	6
TOTAL	124.6	93	62	31	12
Target Implementation Year	**2035**	**2031**	**2028**	**2025**	**2023**

Table 114. Milestones, targets, and timelines for riparian restoration by acre.

Riparian restoration	Acres	75 percent	50 percent	25 percent	10 percent
Riparian restoration mainstem	783	587	392	196	78
Riparian restoration tributaries	727	545	364	182	73
TOTAL	1,510	1,133	755	378	151
Estimated cost for riparian restoration at $15,500 per acre	$23,405,000	$17,561,500	$11,702,500	$5,859,000	$2,340,500
Target Implementation Year	**2035**	**2031**	**2028**	**2025**	**2023**

Riparian restoration effectiveness monitoring

The East Fork Lewis River is a top priority for salmon recovery; therefore, significant implementation has already occurred in the watershed, Ecology is confident that restoration partners will be able to achieve goals outlined in this Alternative Restoration Plan. The biggest barrier to implementation will be private landowner willingness. Additional outreach and education to private landowners will be necessary to achieve riparian restoration goals.

Restoration practitioners, which include Clark County, Clark Public Utilities, Lower Columbia Estuary Partnership, Watershed Alliance of Southwest Washington, and Lower Columbia Fish Enhancement Group, will report progress on riparian restoration and tree planting annually to the Department of Ecology. Ecology will also work with Lower Columbia Fish Recovery Board, which is the lead entity and regional organization responsible for salmon recovery, to track implementation progress in the watershed.

Clark County implements routine water quality monitoring in the East Fork Lewis River every five years. The last water year of monitoring was completed in 2020. The watershed will have effectiveness monitoring implemented by Clark County every five years starting in 2025 until water quality standards are attained. Temperature monitoring will be the parameter used to assess progress towards attaining water quality standard and aquatic life uses. Implementation of riparian restoration projects will be adaptively managed based on results from Clark County's water quality monitoring. Any monitoring completed by Department of Fish and Wildlife will also be considered Once riparian areas are restored and trees are established, a shade deficit analysis will also be completed to assess progress. This shade deficit analysis should be completed between 2055 and 2065 to measure progress and identify areas that need additional planting.

If water temperatures are not improving after significant riparian restoration, than the East Fork Lewis River Partnership will assess if more investment is needed in other implementation areas that benefit water temperatures, such as streamflow restoration. These include enhancement of cold-water refuge areas, floodplain reconnection, wetland restoration, installation of large wood, and other water resources activities including water rights acquisition, irrigation efficiency, and water use conservation.

Summary of milestones, targets, and timelines

Significant investment is needed in the East fork Lewis River to achieve water quality standards. Ecology's goal is to address priority agricultural parcels by 2031 through technical and financial assistance, and priority noncompliant septic systems in the watershed by 2032 through septic system inspections, maintenance, and repair. The goal is to implement riparian restoration on 100 percent of the mainstem and tributaries by 2035, with the goal to achieve tree maturity by 2055 to 2065. Additionally, Ecology will work with stormwater permittees to develop and implement stormwater activities by 2030, working towards the target of achieving stormwater retrofits on 1 percent of La Center's urban growth areas by 2035. If water quality has not improved, additional stormwater retrofits will be recommended for the City of La Center and throughout the watershed, working towards implementing BMPs on 10 percent of the total impervious surfaces in the watershed by 2065. Ecology will reassess if the watershed is meeting bacteria water quality standards for bacteria in 2035. Temperature effectiveness monitoring will be completed in 2055. The following table summarizes criteria to measure progress, milestones, targets, and timelines for implementation in the watershed. Annual reporting and effectiveness monitoring will be used to assess implementation progress. Ecology believes that actions outlined in this ARP will result in the attainment of water quality standards. If water quality standards are not achieved, than a traditional TMDL study will be required in the watershed.

Table 115. Summary of milestones, targets, and timelines for implementation.

Implementation milestones	Total number	Target date for 100 percent completion	Number of years for implementation starting in 2020	Estimated number per year to achieve milestone	Estimated cost per year to achieve implementation milestone
100% of noncompliant septic systems within 200 feet of stream in watershed	1,328 noncompliant septic systems within 200 feet of stream	2030	10 years	133 noncompliant septic systems	$83,970
Stormwater Management Plan with IDDE, source control, and private facility inspection program	N/A	2025 developed, 2030 implemented	5-10 years	N/A	TBD
100% parcels with agriculture within 200 feet of a stream in priority subwatersheds	689 parcels	2031	11 years	63 parcels	$543,375
100% of noncompliant septic systems in priority subwatersheds	1,995 noncompliant septic systems	2032	12 years	166 noncompliant septic systems	$104,580
100% parcels with agriculture in priority subwatersheds	855 parcels	2033	13 years	66 parcels	$569,250
100% riparian restoration	124.6 river miles or 1,510 acres	2035	15 years	8 river miles or 101 acres	$1,565,500
100% septic systems	6,161	2045	25 years	247 septic systems	$155,257
100% of La Center's UGA with stormwater retrofits	1,677 acres	2065	45 years	48 acres	$3,744,000
10% of total impervious surfaces with stormwater retrofits	1,873 acres	2065	45 years	47 acres	$3,666,000

Chapter 12 – Effectiveness Monitoring and Adaptive Management

Monitoring efforts in EFLR watershed

The Department of Ecology, Clark County Clean Water Division, and other organizations have competed monitoring in the EFLR watershed for many years. Monitoring efforts have been completed to assess watershed health, water quality, habitat conditions, and the status of fish populations. Ecology's goal is to achieve bacteria water quality standards by 2035, and temperature water quality standards by 2055. Effectiveness monitoring will be the primary tool to evaluate if implementation of water quality BMPs outlined in this Alternative Restoration Plan are resulting in improved water quality. Temperature and *E. coli* are the main parameters that Ecology will utilize to measure success. The following chapter summarizes past monitoring efforts completed in the EFLR watershed since 2005. For past information, the *East Fork Lewis River Source Assessment* is the primary technical reference, which summarizes water quality data utilized to establish priorities in this Alternative Restoration Plan. This chapter also includes a timeline for implementing future effectiveness monitoring in the watershed. Additional information on timelines and criteria to measure progress are included in Chapter 11 of this ARP. If water quality standards are not achieved through implementation of this Alternative Restoration Plan, a traditional TMDL study will be required for the watershed to comply with the Clean Water Act. The timelines for determining if the ARP is successful are different for bacteria and temperature. Ecology will determine if progress is being made towards meeting bacteria water quality standards by 2035, and temperature effectiveness monitoring will be completed by 2055 to allow time for riparian shade to establish.

Department of Ecology monitoring

To assess bacteria and temperature impairments in the watershed, the Department of Ecology completed its first water quality monitoring assessment in 2005-2006. In 2017, additional bacteria monitoring was completed for the *East Fork Lewis River Watershed Bacteria and Temperature Source Assessment*. Both of the Quality Assurance Project Plans (QAPPs) associated with past monitoring efforts are available online. Additionally, a *Surface Water / Groundwater Exchange Report* was published in 2009 to identify locations where the watershed is gaining cold-water inputs. Ecology has also maintained a long-term ambient monitoring station in the middle watershed, near river mile ten at Daybreak Park.

From 2018 to 2020, Ecology completed additional investigative monitoring to support NPS implementation efforts. Monitoring efforts were completed in the wet and dry seasons, and prioritized to the McCormick Creek subwatershed, where the highest bacteria concentrations were measured in *the East Fork Lewis River Source Assessment*. Investigation efforts resulted in the identification and decommissioning of a large manure lagoon associated with a historical dairy operation.

Additional NPS bacteria monitoring was also completed in the lower and middle watershed starting in 2020. Priority areas for investigative monitoring included Brezee, Jenny, McCormick

and Rock Creek North. The study included past monitoring locations included in the *East Fork Lewis River Source Assessment*, and additional monitoring locations were selected to trace sources of pollution further upstream to their potential sources. An additional monitoring site in Bolen Creek, located in the City of La Center, was also included in the study to investigate stormwater sources of pollution. Investigative monitoring was completed using the *Western Washington Nonpoint Source Quality Assurance Project Plan*. Monitoring confirmed that the lower East Fork Lewis River is still exceeding bacteria water quality standards. Monitoring results were published in the *East Fork Lewis River Watershed Bacteria and Nonpoint Source Identification* report.

East Fork Lewis River Watershed Bacteria Monitoring and Nonpoint Source Identification

The 2020 bacteria data collected by Ecology confirmed that the priority areas identified by the 2017 Source Assessment are still exceeding water quality standards. These include McCormick, Brezee, Jenny Creeks, and Rock Creek North. Listed below is a summary of results from the 2021 *East Fork Lewis River Watershed Bacteria Monitoring and Nonpoint Source Identification* Report.

- The highest exceedances were detected at a stormwater conveyance to Brezee Creek that flows through the City of La Center.
- The highest bacteria levels for most of the sites were from a single sampling event on June 15 following heavy rainfall. This highlights the impact of urban stormwater and agricultural runoff on bacteria levels in the watershed.
- High fecal coliform *E. coli* concentrations were found at a previously unmonitored tributary (Bolen Creek) which revealed another tributary of concern in the lower watershed. This tributary drains stormwater sources of pollution from the City of La Center.
- McCormick Creek still had high exceedances, yet there was substantial improvement in bacteria levels at an upstream tributary, compared to results from 2017. This tributary was downstream of a former manure lagoon that was decommissioned in 2019.
- Bacteria concentrations tended to increase moving downstream, from the upper to lower sections of the tributaries. Jenny Creek did not follow this trend, indicating a pollution source near an upstream site.

Ecology's 2020 results confirmed Brezee Creek remains a high priority for bacteria improvement. Clark County also completed water quality monitoring efforts in partnership with the Department of Ecology. Specifically, Clark County collected microbial source tracking (MST) samples, to determine what source of bacteria was present in the watershed. This sampling effort included DNA markers for dogs, humans, cows, and horses.

Clark County Clean Water Division monitoring

Clark County Clean Water Division completes water quality monitoring in watersheds throughout Clark County, on a five-year rotating basis. The last time the County completed monitoring in the watershed was in 2020, therefore the County is expected to complete

monitoring in the East Fork Lewis River every 5 years, starting in 2025. The County's monitoring efforts will be essential to measuring and evaluating progress in the watershed. The results from water quality monitoring are published in a *Stream Health Report*, which is published every 10 years. The last report was published in 2010, and the most recent report was expected in 2020, with the next report published in 2030. To prepare for the 2020 Stream Health Report, Clark County completed a full water year of monitoring in the watershed from 2018 to 2019, which included multiple sampling sites. In addition to collecting fecal coliform bacteria data, Clark County also collected *E. coli* data throughout the watershed, to support implementation of the new water quality standard for recreational uses. A new watershed story map (clarkwatersheds.org) will interactively publish stream health results and educate the public on water quality.

In addition to stream health reporting, the County also has a long-term index-monitoring site in Rock Creek North. This site was strategically selected to monitor watershed health in the transitional portion of the watershed, where urbanized land uses meet rural landscapes. Clark County intends to collaborate with other organizations to provide monitoring through the new Poop Smart Clark Pollution Identification and Correction program, which is starting in 2021. The plan is to use water quality monitoring, source tracing, and microbial source tracking to understand and target different sources of bacteria, including bacteria from humans, livestock, and dogs. Monitoring will be paired with land use mapping and septic records assessment, to support targeted outreach, source correction, and implementation efforts in the watershed. The County also plans to complete effectiveness monitoring to assess how implementation of water quality BMPs is impacting water quality. *E. coli* and temperature will be the main parameters utilized for effectiveness monitoring efforts. When necessary, microbial source tracking will be utilized to confirm if sources of bacteria are from human, dog, or livestock sources.

Clark County Clean Water Division Microbial Source Tracking Results

Microbial Tracking was completed in the lower East Fork Lewis River watershed in 2020. The following summarizes results from the monitoring effort.

- Jenny Creek sites had a high presence of human DNA, which further supports the hypothesis that human waste may be a serious source of pollution in this area. Reaching out to landowners bordering Jenny Creek to promote septic inspections, maintenance, replacement, and repair is recommended as a next step for Jenny Creek.
- Brezee Creek sampling showed of bacteria from dogs, humans, cows, and horses with a greater prevalence of dog DNA in Brezee Creek sites in the proximity of City of La Center. This shows the necessity of continuing outreach to raise public awareness of animal waste management in order to mitigate these sources of bacteria pollution.
- McCormick Creek had presence of both dog and human DNA, with some horse DNA detected.
- Rock Creek North had a high presence of dog and human DNA, with some horse detected.

In 2021, Clark County established an interlocal agreement with the City of La Center to complete additional microbial source tracking work in Brezee Creek. These efforts confirmed the presence of human and dog sources of bacteria, with levels increasing downstream in La Center's stormwater infrastructure. Additional monitoring, surveying, and illicit discharge detection and elimination work is underway to identify where the major source of bacteria is coming from in Brezee Creek.

Washington Department of Fish and Wildlife monitoring

Washington Department of Fish and Wildlife (WDFW) completed temperature monitoring in the EFLR watershed in 2015, 2016, and 2018, as drought conditions and low streamflow raised concerns for fish. As of 2018, WDFW closed summer fishing in the EFLR from July 16 to September 15 due to warm water temperatures and low streamflow conditions causing stress to fish. WDFW has expressed interest in completing future habitat status and trends monitoring in the watershed. It is unknown if WDFW will complete future temperature monitoring in the watershed.

Lower Columbia Estuary Partnership monitoring

The Lower Columbia Estuary Partnership (LCEP) has also completed temperature monitoring and modeling on the mainstem EFLR watershed near the Ridgefield Pits restoration project, which is located in the middle watershed between rive miles 8 and 10. This section of the watershed has some of the warmest water temperatures measured in the watershed. The long-term goal is to restore and enhance cold-water areas in this section of the watershed to benefit fish. Additionally, LCEP will complete a full thermal refuge assessment of the river beginning in 2020. The thermal assessment information will identify areas of the watershed that are gaining cold-water inputs, and it will help prioritize locations for future restoration to help reduce warm water temperature. The results from the assessment will also be used to update the *Lower East Fork Lewis River Habitat Restoration Plan*, which is one of the Lower Columbia Fish Recovery Board's (LCFRB) strategic plans that guides implementation of salmon recovery projects in the watershed.

Lower Columbia Fish Recovery Board monitoring

LCFRB developed the *East Fork Lewis River Habitat Pilot Study* to assess land use and land cover change in the watershed since 2004. Because of this study, the East Fork Lewis River Partnership now has significant information on land use and land cover as of 2018, which provides a baseline to assess future land use change. The report also identifies major stressors in the watershed that are impacting watershed health, habitat conditions, and salmon recovery. The report evaluates implementation progress and restoration success in the watershed and establishes recommendations for future management. To support additional evaluation, LCFRB plans to collaborate with WDFW to complete landscape-scale habitat status and trends monitoring, using 1-meter scale land cover information. This effort will provide more detailed information on land use change in the watershed, including the status of riparian land cover. The information will be used to further prioritize and target critical areas for preservation, restoration, and implementation.

LCFRB's timeline for implementing the additional landscape-scale monitoring and updating the *Lower East Fork Lewis River Habitat Restoration Plan* with LCEP's thermal assessment results is unknown.

Effectiveness monitoring

Formal effectiveness monitoring to assess bacteria and temperature conditions in the watershed will be implemented at different intervals.

Bacteria

For bacteria, effectiveness monitoring will be implemented through Pollution Identification and Correction efforts when sources of bacteria are identified and removed from the watershed, and when water quality BMPs are implemented. This monitoring will being in 2021 through at least 2025 and will be uploaded to Ecology's Environmental Information Management System (EIM). Additionally, Clark County Clean Water Division implements regular monitoring in the watershed every five years. The last year that the watershed was monitoring for bacteria was in 2020. The next years that Clark County will implement monitoring are 2025, 2030, and 2035. Steam Health Reports, which summarize water quality data, are expected for 2020, 2030, and 2040. Information collected through Pollution Identification and Correction efforts and through Clark County's routine monitoring, will be used to adaptively manage this plan.

Ecology will formally reassess the watershed in a two phases. The first effectiveness monitoring study will be implemented in 2035. The main parameter for this study will be *E. coli* to determine if implementation of the Alternative Restoration Plan is resulting in improved water quality. Ecology will be focusing on priority locations for bacteria reduction determined by the original 2005-2006, and 2017 studies. Effectiveness monitoring will also consider the latest information from PIC efforts and from Clark County sampling. If monitoring completed by partners demonstrates that there are lingering bacteria issues in the watershed, Ecology will include investigative sampling locations and bacteria hot spots identified through pollution identification and correction efforts in the 2035 monitoring to attempt to find sources. Once effectiveness monitoring is complete, Ecology will review the results with EPA to determine if the ARP is resulting in its intended outcome or if a traditional TMDL is needed for the watershed.

Ecology will also consider if there are new point source of bacteria pollution when completing effectiveness monitoring and evaluating success. Changes in land use and land cover will also be considered. Ecology believes that implementation of this ARP will result in improved water quality and attainment of bacteria water quality standards. If water quality standards are achieved, Ecology's focus will shift from addressing bacteria water quality impairments to antidegradation. It is expected that Clark County will continue its routine water quality monitoring every five years, even after water quality standards are attained.

Temperature

For temperature, riparian restoration and streamflow restoration projects need to be implemented by 2035. These projects may take a longer period to reduce water temperatures; therefore, Ecology is planning to formally reassess the watershed to evaluate progress towards

meeting temperature standards in 2055. This will allow time for trees to reach their site potential tree height to provide shade to the river. If necessary, a shade deficit analysis will be completed between 2055 and 2065 to evaluate how effective shade has changed over time. Until 2055, Ecology will utilize monitoring results from Clark County's routine monitoring efforts to track water temperatures. Ecology will also work with partners that are implementing salmon recovery projects to track water temperatures. This includes the thermal refuge assessment, which is currently underway by the Lower Columbia Estuary Partnership, as well as the Ridgefield Pits Restoration project, which includes extensive temperature monitoring and modeling. Ecology believes that implementation of this ARP will result in improved water quality and attainment of temperature water quality standards. If water quality standards are not attained through this ARP, a traditional TMDL study will be required for the watershed. Ecology will work with EPA to evaluate effectiveness monitoring results and to determine if a traditional TMDL is necessary for temperature.

Formal effectiveness monitoring reports will be published in 2035 and in 2055 to summarize implementation efforts and effectiveness monitoring results. When WQS are met, the Department of Ecology will delist category 5-alt waters in accordance with Policy 1-11. The following table summarizes past, present and future monitoring efforts in the East Fork Lewis River watershed

Table 116. Monitoring schedule in the EFLR.

Monitoring Project	Organization	Year
Initial Sampling for Source Assessment	Department of Ecology	2005-2006 & 2017
Surface / Groundwater Exchange	Department of Ecology	2009
Ambient Monitoring at Daybreak Bridge (Middle watershed)	Department of Ecology	Ongoing
Streamflow Gauge at Heisson Bridge (Upper Watershed)	United States Geological Survey	Ongoing
Temperature Monitoring	Department of Fish and Wildlife	2015, 2016, 2018
NPS Investigative Monitoring	Department of Ecology	Ongoing
Temperature Monitoring and Modeling, Thermal Assessment	Lower Columbia Estuary Partnership	Ongoing
Clark County Routine Monitoring	Clark County Clean Water Division	Every Five Years - 2020, 2025, 2030, 2035, 2040, 2045, 2050
Clark County Stream Health Report	Clark County Clean Water Division	2010,2020, 2030, 2040, 2050
Pollution Identification and Correction Monitoring	Poop Smart Clark	2020-2035
Effectiveness Monitoring – Bacteria	Department of Ecology	2035
Effectiveness Monitoring – Temperature	Department of Ecology	2055
Shade Deficit Analysis	Undetermined	2055-2065

Adaptive management and implementation tracking

The EFLR Partnership was launched in 2018. The Partnership met regularly through 2020 and will continue to meet biannually to share information, provide project and program updates, and revisit water quality implementation goals. EFLR Partnership provide a forum to share lessons learned, to provide updates on monitoring and implementation, and to suggest new projects and programs to be included in the *East Fork Lewis River Alternative Restoration Plan* to achieve clean water. Retaining the partnership will be essential to long-term implementation and adaptive management of this ARP.

In addition to the East Fork Lewis River Partnership, a smaller group focused on pollution identification and correction efforts will meet more regularly to coordinate septic and agricultural implementation, discuss monitoring results, and track implementation progress. This group is expected to meet monthly beginning in 2021 through 2025.

Annual reporting

To document implementation progress, the Department of Ecology will publish a concise annual report highlighting implementation efforts and successes in the watershed. To develop this report, a survey will be sent to EFLR partners each year, to gather information on project and program implementation status, metrics, and outcomes. Implementation tracking will also be completed through Ecology's Water Quality Combined Funding Program. A mechanism for landowners to report voluntary implementation on private property will also be developed. All annual reports will be published on the EFLR Partnership website. Metrics collected annually will be compared to the Criteria to Measure Progress that are established in Chapter 11.

Annual reporting and project tracking specific to implementation of septic, stormwater management, and agriculture BMPs will occur until bacteria effectiveness monitoring is completed in 2035. Project tracking for implementation of riparian and streamflow restoration projects will continue through 2055, when temperature effectiveness monitoring is completed.

Effectiveness monitoring reports

If water quality standards were not attained by 2055, temperature monitoring may be conducted a second time in 2065 depending on status of riparian restoration, streamflow restoration, and stormwater management efforts. Results from the 2035 and 2055 effectiveness monitoring efforts will be published in formal effectiveness monitoring reports. Ecology and the East Fork Lewis River Partnership will consider interim results from Clark County's monitoring efforts, which are scheduled to be completed every five years starting in 2025 through 2055. Effectiveness monitoring results will determine how the Partnership will move forward with implementation. These results will ultimately determine if the Alternative Restoration Plan has been successful of if a traditional TMDL study is needed for the watershed.

Tracking salmon recovery efforts

In addition to Ecology's planning and adaptive management, the Lower Columbia Fish Recovery Board has also implemented extensive program evaluation in the watershed, to measure and monitoring implementation of the *East Fork Lewis River Salmon Recovery Plan* and the *Lower*

East Fork Habitat Restoration Plan. Recommendations from LCFRB's planning efforts will continually be incorporated and considered in the Alternative Restoration Planning and adaptive management process to ensure that salmon recovery and water quality planning and implementation efforts are aligned.

Conclusion

The long-term goal of this Alternative Restoration Plan is to achieve clean water, meet water quality standards, and support beneficial uses for recreation and aquatic life. When category 5-alt waters are delisted, the EFLR Partnership focus will shift its focus from water quality improvement to antidegradation.

Table 117. Summary of East Fork Lewis River publications.

Project	Description	Agency	Year
East Fork Lewis River Subbasin Plan	Establishes salmon recovery priorities for the watershed	LCFRB	2004
Quality Assurance Project Plan East Fork Lewis River Temperature and Fecal Coliform Bacteria Total Maximum Daily Load Study	Establishes monitoring plan for watershed for bacteria and temperature	Ecology	2005
Streamflow Summary for Gaging Stations on the East Fork Lewis River, 2005-2006	Establishes monitoring plan for watershed for streamflow	Ecology	2005
WRIA 27/28 Salmon-Washougal & Lewis Watershed Management Plan	Establishes water quantity allocations for the watershed.	LCFRB	2006
Surface Water/Groundwater Exchange Along the East Fork Lewis River	Identifies portions of stream that are gaining and losing streamflow. Prioritizes locations of cold-water inputs.	Ecology	2009
Lower East Fork Lewis River Habitat Restoration Plan	Establishes Salmon recovery priorities for the watershed	LCFRB	2009
East Fork Lewis River Recovery Plan	Establishes Salmon recovery priorities for the watershed	LCFRB	2010
East Fork Lewis River Stormwater Needs Assessment Reports:	Identifies stormwater improvements for East Fork Lewis River watershed	Clark County	2010
2010 Stream Health Report	Summarizes water quality data collected from 2000-2010	Clark County	2010
Quality Assurance Project Plan East Fork Lewis River Fecal Coliform Bacteria and Temperature Source Assessment	Establishes monitoring plan for watershed for bacteria and temperature	Ecology	2017
East Fork Lewis River Watershed Bacteria and Temperature Source Assessment	Identifies priority areas for water quality improvement	Ecology	2018
Quality Assurance Project Plan Monitoring Fecal Coliform Bacteria in Western Washington Water Bodies	Identifies locations for additional investigative bacteria monitoring	Ecology	2020
Lower Columbia Salmon Recovery Plan Partner Program Implementation Review: East Fork Lewis River Habitat Pilot Study	Evaluates land use change since 2004 and identifies key stressors to watershed health and salmon recovery.	LCFRB	2020
2020 Stream Health Report	Summarizes water quality data collected from 2000-2010	Clark County	2020
East Fork Lewis River Alternative Restoration Plan	Establishes implementation plan to improve water quality.	Ecology	2020
East Fork Lewis River Annual Reports	Summarizes annual implementation in the watershed.	Ecology	2018 to 2055
East Fork Lewis River Effectiveness Monitoring Report	Evaluates progress made towards achieving water quality standards	Ecology	203, 2055
Evaluate if water quality standards were met or whether a traditional TMDL is required	Determine if ARP has resulted in attainment of water quality standards or if a traditional TMDL is needed.	Ecology and EPA	2035, 2055