

Burnt Bridge Creek Advance Restoration Plan

A strategy to achieve water quality standards for bacteria, temperature, dissolved oxygen and pH

By
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Publication 12-03-003: Surface-Water/Groundwater Interactions and Near-StreamGroundwater Quality along Burnt Bridge Creek, Clark County[3]
Publication 10-03-072: Streamflow Summary for Burnt Bridge Creek, 2008 (wa.gov)[4]
Publication 08-03-110: Burnt Bridge Creek Fecal Coliform Bacteria, Dissolved Oxygen, and Temperature Total Maximum Daily Load: Water Quality Study Design (Quality Assurance Project Plan)[5]

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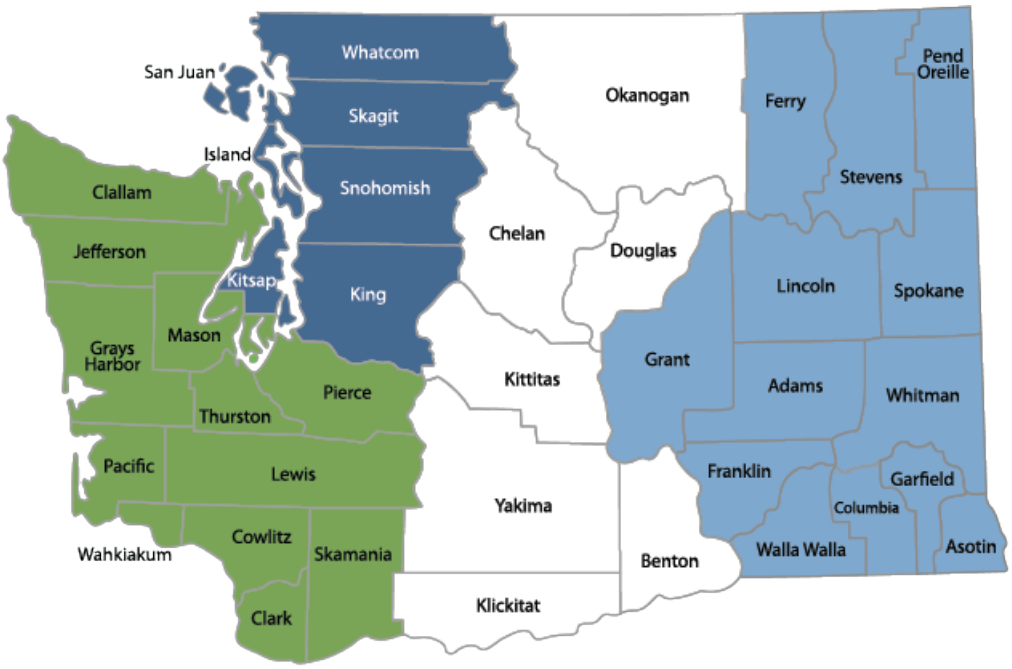
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[1] https://www.ecology.wa.gov/Research-Data/Data-resources/Environmental-Information-Management-database
[2] https://apps.ecology.wa.gov/publications/documents/2003016.pdf
[3] https://apps.ecology.wa.gov/publications/documents/1203003.pdf
[4] https://apps.ecology.wa.gov/publications/documents/1003072.pdf
[5] https://apps.ecology.wa.gov/publications/documents/0803110.pdf
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Department of Ecology's Region Offices

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Region	Counties served	Mailing Address	Phone
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Northwest	Island, King, Kitsap, San Juan, Skagit, Snohomish, Whatcom	PO Box 330316 Shoreline, WA 98133	206-366-7810
Central	Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, Yakima	1250 West Alder Street Union Gap, WA 98903	509-575-2490
Eastern	Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman	4601 North Monroe Spokane, WA 99205	509-329-3400
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- Lower Columbia Estuary Partnership
- Lower Columbia Fish Enhancement Group
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- Columbia Land Trust
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Executive Summary

Background

The Burnt Bridge Creek (BBC) Watershed is located in the City of Vancouver (COV) and was once Tribal land. BBC is part of the Salmon-Washougal Water Resource Inventory Area (WRIA 28) and nestled within the Willamette Valley ecoregion. The creek flows through a highly urbanized landscape from east to west through the city, draining approximately 27.6 square miles. The central riparian corridor of the watershed contains meadowlike open areas under powerlines and greenway spaces, managed to preserve and restore natural conditions, increase habitat and improve water quality. Although much of the watershed is within city limits, Clark County has jurisdiction in northern portions of the watershed, primarily in the Cold Creek subbasin. The Washington State Department of Transportation (WSDOT) has jurisdiction over a network of state roads, which includes Interstate 5 (I-5), Interstate 205 (I-205), and State Route 500 (SR 500).

Only 11 percent of the land in the BBC Watershed is publicly owned. Vancouver is the largest public landowner, with 44 percent of the total public land. Clark County owns 10 percent of public land, WSDOT 3 percent and the United States government owns around 1.4 percent in the Bonneville Power Administration's Ross Complex. The primary land use in the watershed is residential. Approximately 89 percent of the watershed is privately owned. BBC is located within the West Coast Marine Climate Region and experiences mild, cool, wet winters and relatively dry, warm summers. Temperature in the watershed is influenced by both the Coast Range to the west and the Cascade Range to the east. In recent years climate change impacts have created and increased ecological stressors in the Willamette Valley ecoregion, including BBC. These stresses have also negatively affected aquatic life, including salmonid species such as Coho. Salmon is a predominant food source and is also culturally significant for local Tribes.

Advance Restoration Plan

Currently, BBC and its tributaries are on Washington State's impaired waters list (303(d) list) for warm water temperatures and exceedances to bacteria, dissolved oxygen, and pH water quality standards, which drives the need to develop a Total Maximum Daily Load (TMDL) as required by the Clean Water Act (CWA). Ecology has chosen to develop this Advance Restoration Plan (ARP) to expedite the implementation of best management practices (BMPs) and other actions to improve water quality in BBC.

The goal of this ARP is to outline a strategy to implement BMPs that will reduce pollution enough to meet water quality standards in advance of a traditional TMDL plan. This plan identifies causes of water quality impairments and pollutant sources and estimates the pollution reductions needed to meet water quality standards (WQS). The plan describes the actions necessary to reduce sources of pollution, 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 are also included.

Once the ARP is reviewed and accepted by Environmental Protection Agency (EPA), category 5 impaired stream segments on the 303(d) list will be changed to category 5r to recognize that an ARP has been developed for the watershed and is being implemented. The Department of Ecology (Ecology) will periodically evaluate ARPs to determine if this approach is still expected to be more beneficial or practicable in the near term at achieving water quality standards, rather than pursuing a TMDL. If not, the ARP should be re-evaluated to determine whether a higher priority for TMDL development should be assigned to the impaired waterbody. While the ARP is being implemented, the requirement to develop a TMDL remains. Ecology has established criteria to measure progress, which are outlined in Chapter 9.

Effectiveness monitoring, described in Chapter 10, will be the primary tool used to assess progress. Ecology's goal is to achieve bacteria water quality standards by 2041, and meet temperature, dissolved oxygen, and pH water quality standards by 2061.

Burnt Bridge Creek Source Assessment

To support development of this ARP, Ecology published the Burnt Bridge Creek Watershed Fecal Coliform Bacteria, Temperature, Dissolved Oxygen, and pH Source Assessment Report[7]. The BBC Source Assessment is the second Source Assessment completed by Ecology in Southwest Washington to analyze water quality data and identify critical areas for water quality improvement. Priority areas for temperature reduction are located in the middle and upper sections of the watershed. No sites sampled in the watershed met state standards for temperature. The largest average shade deficit is in the upper watershed (average of 62 percent). The average shade deficit in the middle watershed is 39 percent and in the lower watershed is 27 percent. These stream reaches are a high priority for riparian restoration to increase shade and help lower warm water temperatures.

All sample sites also exceeded Water Quality Standards (WQS) for fecal coliform bacteria. Cold Creek, Peterson Channel, and Burton Channel tributary sites, where the highest geometric mean concentrations were found during the dry season, have been identified as priority basins for bacteria reduction. To meet water quality standards, reductions of more than 75 percent are needed at all of the tributary outlet sites and several middle and lower sites between river mile 8.4 and 1.6. All but one sample site location had dissolved oxygen levels that did not meet WQS. Increasing riparian vegetation and shade in the watershed is expected to improve temperature and Dissolved Oxygen (DO) conditions throughout BBC. Occasional excursions both above and below the pH criteria were also noted and did not meet WQS.

Burnt Bridge Creek Partnership

To implement recommendations from the Source Assessment, Ecology launched the Burnt Bridge Creek Partnership in February 2021 to work collaboratively with the City of Vancouver (COV) to develop and implement the BBC ARP. Since the partnership began approximately 25 staff from the COV have participated in implementation workgroups for different priorities in the watershed, which include Sewer Connection and Septic Systems, Riparian Restoration,

[7] https://apps.ecology.wa.gov/publications/SummaryPages/2003016.html

Stormwater and Capital Improvements, Operations and Maintenance, and Public Education and Outreach.

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. The COV has been proactive with partnerships and projects that have benefited water quality in the watershed.

Environmental Justice in Burnt Bridge Creek

Many people in the BBC Watershed experience economic hardship, are exposed to environmental burdens, and face barriers to accessing environmental benefits - like clean recreation waters, and social assets - like employment opportunities and affordable housing. These communities do not have equitable access to a healthy, sustainable, and resilient environment in which to live, play, work, learn, grow, worship, and engage in cultural and subsistence practices.

In the BBC Watershed people with the greatest environmental health disparities live along State Route 500 between Clark College in the west and N Andresen Road in the east. These regions should be a high priority for water quality protection, water cleanup implementation actions, and community education and outreach.

Climate Change in Burnt Bridge Creek

Unregulated and cumulative human caused greenhouse gas emissions are creating significant negative impacts to local communities and ecosystems worldwide in a broad variety of ways. Climate change impacts have been intensifying in recent years, influencing stormwater, urban heat indexes, air pollution, water temperatures, and human health. These changes have altered water chemistry with increased carbon absorption contributing to harmful algae blooms and diminished success rates in restoring riparian habitat. Community members are concerned about the short-term and long-term economic and health impacts of climate change in this region. Ecology plans to be proactive to support communities and ecosystems in adapting to our changing world.

Chapter 1 - Introduction

Burnt Bridge Creek (BBC) originates in wetlands at the east city boundary and flows west through the heart of Vancouver, one of the fastest growing cities in Washington State with a 12.5 percent increase in human population from 2010 through 2020. The community relies on resources contained in this watershed for recreation, connection to nature through green spaces and the protection of water resources. At the same time, the watershed supports aquatic life and has been designated for the beneficial uses of spawning, rearing and migration for salmonid species, with Endangered Species Act (ESA) listed salmon and steelhead identified in some reaches of the stream. The social, economic, and environmental value of the watershed has positioned BBC as a priority waterbody for efforts in salmon recovery, water quality improvement, water resource management, and planning in Southwest Washington. Local stakeholders have formed a partnership to identify water quality improvement strategies throughout the watershed and will support implementation of this Advance Restoration Plan (ARP).

Watershed Background

The BBC Watershed is located in Clark County, Washington and is part of the Salmon-Washougal Water Resource Inventory Area (WRIA 28). The creek flows through a highly urbanized landscape from east to west through the City of Vancouver, draining approximately 27.6 square miles. Figure 1 shows the BBC water quality monitoring sites, subbasins, and river mile segments. BBC travels 12.7 river miles (RM) from its headwaters near Northeast 162nd Avenue westward to its confluence with Vancouver Lake west of Interstate 5.

Vancouver Lake is a large shallow lake, covering approximately 2,300 acres with a mean depth of 3-5 feet. Water quality is limited by high turbidity and bacteria, and high temperatures and nutrient levels that contribute to excessive algae growth and the proliferation of aquatic invasive weeds. Flows from BBC make up about 2 percent of the annual water budget for the 2300-acre shallow lake and 2 – 7 percent of nitrogen and phosphorus entering the lake. Vancouver Lake drains to the Columbia River through Lake River, a 14 mile tidally influenced slough that contributes 76 – 91 percent of nitrogen and phosphorus to the lake. Lake River inputs to Vancouver Lake come from several tributaries with Columbia River mixing.

The BBC valley was initially formed during the massive Missoula floods between 20,000 and 14,000 years ago that shaped much of the landscape in the Columbia River Basin. The oversized valley became mostly marshes and wetlands, which existed through much of its history until the 1800s when farmers drained the marshes for agriculture use and channelized the course of the creek. The natural channel of the creek historically began near present day 18th Street and flowed for approximately five miles before its confluence with Vancouver Lake. The upper watershed wetlands that form the headwaters of BBC were also drained and channelized for agriculture. Due to its origination from wetlands, BBC has a low gradient with approximately 80 percent of the stream gradient less than 0.1 percent with reaches flowing through peat deposits and wetland soils.

Three small tributaries feed into BBC: Peterson Channel, Burton Channel, and Cold Creek. Peterson Channel conveys industrial non-process discharge from a manufacturing company, groundwater and urban stormwater and enters the mainstem immediately downstream of RM 8.8; Burton Channel discharges groundwater and stormwater runoff between RM 8.4 and RM 8.0; and Cold Creek contributes groundwater and urban stormwater into BBC approximately 2 miles upstream of its confluence with Vancouver Lake. Table 1 provides an overview of the BBC Watershed.

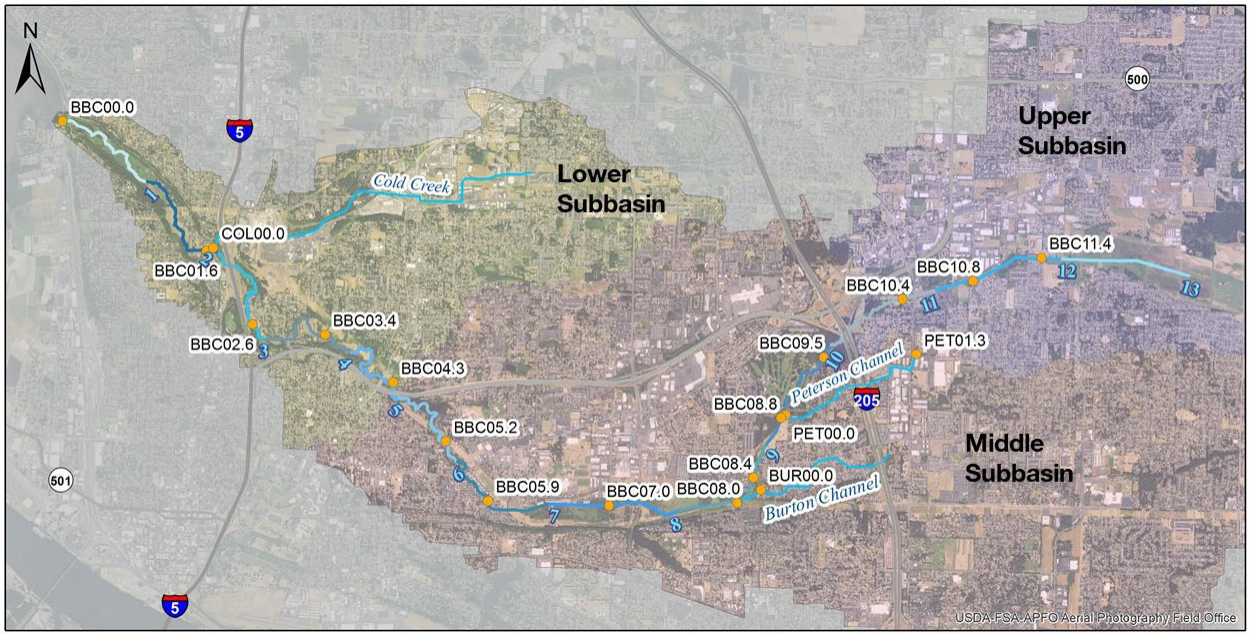


Figure 1. Map of BBC study area with sites, subbasins, and river mile segments.

Table 1.BBC Watershed overview.

Fact	Description
WRIA	28 – Salmon-Washougal.
Counties	Clark.
Population Increase	12.5 percent increase in human population from 2010-2020.
Area	27.6 square miles.
Stream Length	12.7 miles.
Salmon Populations	3 primary populations of Endangered Species Act listed Salmonids.
Water Quality Impairments	State Impaired Waters 303(d) List for bacteria, temperature dissolved oxygen and pH.
Beneficial Uses	Aquatic Life and Recreational Uses.
Jurisdictions	Clark County, City of Vancouver, Washington Department of Transportation, Bonneville Power Administration.
Permits	Phase I Municipal Stormwater, Phase II Municipal Stormwater, Construction Stormwater, Sand and Gravel, Municipal Wastewater.

Fish Presence

The aquatic use of BBC is designated as salmonid spawning, rearing, and migration (WAC 173-201A). According to the Washington Department of Fish and Wildlife (WDFW) SalmonScape database (WDFW 2018a), potential salmon populations in the stream include fall Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), and winter steelhead (*O. mykiss*). Fall Chinook salmon are documented through Lake River but not in Vancouver Lake or the most upstream reaches of BBC. Coho salmon are documented up to the I-5 crossing of the creek but are presumed present upstream of I-5. Winter steelhead are presumed present through Vancouver Lake and BBC.

Figure 2 shows a presence and absence study of salmonids in BBC. Surveys conducted in 2002 and 2003 found a few trout, one possible adult salmon, and less than a dozen juvenile salmonids near pools and riffles with good riparian canopy cover. Other species documented include cutthroat trout (*O. clarkii*), sculpin (Family Cottidae), red-sided shiners (*Richardsonius balteatus*), sticklebacks (Family Gasterosteidae), leopard dace (*Rhinichthys falcatus*), and lamprey larvae (ammocoetes) (Family Petromyzontidae). Surveys in 1997 also documented the presence of suckers (*Catostomus* sp.), mosquitofish (*Gambusia affinis*), bullhead (*Ameiurus* sp.), and peamouth (*Mylocheilus caurinus*). Factors that limit salmonid presence and habitat use in BBC include poor water quality conditions, low biological integrity, fish passage barriers, lack of spawning habitat, and limited riparian vegetation.

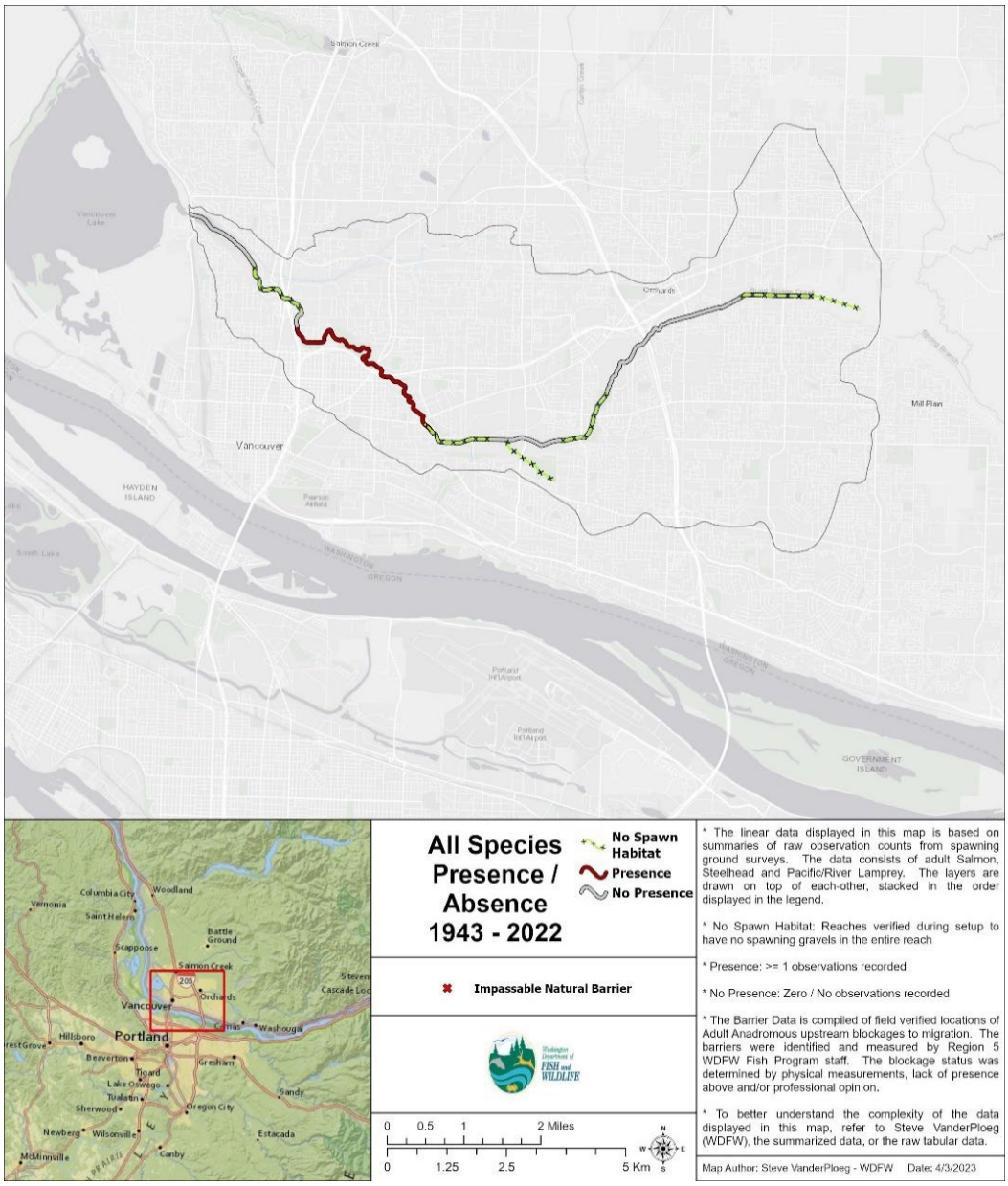


Figure 2. Fish presence and absence in BBC.

State's 303(d) Impaired Waters List

BBC and its tributaries are on Washington State's impaired waters list (303(d) list) for warm water temperatures, bacteria, pH, and dissolved oxygen, which drives the need to develop a TMDL plan, as required by the federal CWA. Ecology has chosen to develop this ARP in advance of developing a traditional TMDL to expedite the implementation of BMPs to improve water quality in BBC. Finding and eliminating sources of fecal coliform bacteria in the watershed is necessary because high levels of bacteria increase risks to public health. High water temperatures, unbalanced pH, and low dissolved oxygen levels also create poor conditions for fish and other wildlife.

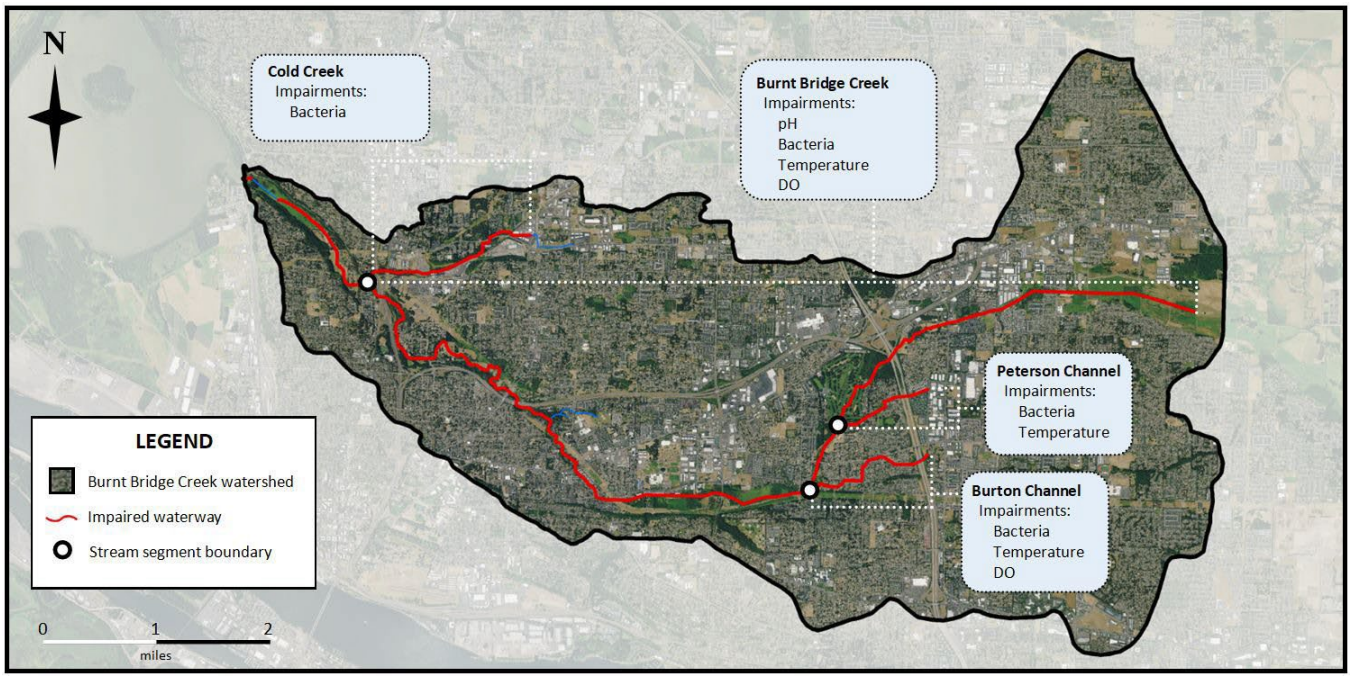


Figure 3. BBC Watershed and 303(d) listings of impaired waters.

Burnt Bridge Creek Partnership

To achieve clean water, Ecology launched the BBC Partnership in February 2021 to work collaboratively with the COV to develop the BBC ARP. Since the Partnership kicked off, approximately 25 staff from the COV have participated in Implementation Workgroups focused on Sewer Connection and Septic Systems, Riparian Restoration and Greenways, Stormwater and Capital Improvements, Operations and Maintenance, and Public Education and Outreach in the watershed. Ecology has also worked with EPA to incorporate their recommendations into this ARP.

BBC Watershed Stakeholder Participation

A consistent flow of activities is being implemented in the BBC Watershed that aligns with water quality and ecosystem recovery goals. Priorities for long-term strategies to improve conditions in the BBC Watershed include addressing water quality impacts from septic systems, stormwater runoff, and increasing riparian restoration in the watershed. Multiple local, regional, state, and federal governments, tribes, nonprofits, and private landowners have been engaged in enhancing the BBC Watershed over the years. BBC Watershed Tribes and stakeholders are summarized in Table 2.

Table 2. Stakeholders in the BBC Watershed.

Organization	Stakeholders
Tribal	Cowlitz Indian Tribe, Grand Ronde Confederate Tribes, and Yakama Nation.
Local and Regional	City of Vancouver, Clark County Public Works, Clark County Community Development, Clark County Public Health, Clark Public Utilities, Clark Conservation District, Clark Regional Wastewater District, Lower Columbia Fish Recovery Board, and Lower Columbia Fish Enhancement Group.
State	Washington Department of Fish and Wildlife, Washington Department of Transportation, Washington Department of Agriculture, Washington Department of Ecology, Washington State Conservation Commission, and Washington State University Clark County Extension.
Federal	US Fish and Wildlife Service, Natural Resources Conservation Service, Bonneville Power Administration, United States Environmental Protection Agency, and NOAA Marine Fisheries Service.
Nonprofit	Friends of Trees, Lower Columbia Estuary Partnership, Bird Alliance of Oregon, Columbia Land Trust, Columbia Springs, and Friends of Clark County.

Burnt Bridge Creek Source Assessment

To support development of this ARP, Ecology's Environmental Assessment Program (EAP) completed a source assessment study and published the Burnt Bridge Creek Source Assessment Report[8] in October 2020. This report analyzed water quality data (fecal coliform bacteria, temperature, dissolved oxygen, and pH) from 2008-2009 and 2011-2018 to develop general recommendations to improve water quality, achieve WQS, and support beneficial uses in the watershed. The source assessment study characterized the watershed by gathering and analyzing data to create a watershed inventory, identify issues of concern, estimate pollutant reductions needed to meet WQS, and identify critical areas to implement water quality improvement projects. Water quality assessment projects completed by Department of Ecology and COV enabled the development of this source assessment, which serves as the technical foundation for the BBC ARP. Together they fulfill EPA's considerations for two federal programs required by the CWA, including Section 319 requirements for watershed plans and recommendations for ARPs.

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 CWA 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

[8] https://apps.ecology.wa.gov/publications/SummaryPages/2003016.html

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[9].

Table 3 outlines Washington State Department of Ecology's regulatory authority related to protecting water quality.

Table 3. Washington State Department of Ecology's water quality regulatory authority.

Statute	Action
Water Pollution Control Act	Enforces the Water Pollution Control Act (Ch. 90.48 RCW). Washington States Department of Ecology has nonpoint source pollution regulatory authority under WPCA.
Clean Water Act and Water Pollution Control Act	Develops and issues National Pollution Discharge Elimination System (NPDES) and State Waste Discharge permits. Conducts 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.

Technical and Financial Assistance

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 implementation of BMPs necessary to protect water quality. Ecology invests heavily in technical and financial assistance and provides multiple opportunities and pathways to proactively address pollution problems before enforcement is pursued. Ecology uses its 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 ARP, businesses and landowners with a direct impact to surface water quality will need to implement BMPs on their property to reduce pollution. Priority for targeted outreach and assistance include homeowners with septic systems, streamside property owners with low riparian vegetation or shade, and residential properties that contribute to urban stormwater pollution. It is the goal of all partners 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

[9] https://apps.ecology.wa.gov/publications/documents/1510015.pdf

attainment of WQS. If WQS are not achieved through implementation of this ARP, the waterbody will be reprioritized for TMDL development.

Chapter 2 – Water Quality Impairments and Pollutant Sources

Watershed Summary

The Burnt Bridge Creek Source Assessment analyzed water quality data collected along 12.7 river miles (RM) of the BBC mainstem and tributaries. To support on-the-ground implementation and planning, the Source Assessment divided the BBC into three sections to summarize water quality information. The three sections of the BBC are the lower (RM 0 – 5), middle (RM 5-10), and upper (RM 10-13) watersheds. These three sections have different land uses, land cover, jurisdictions, permits, and established water quality monitoring stations. Monitoring stations have been identified by their approximate river mile location in the mainstem or tributary (e.g. BBC10.4, PET01.3, BUR00.0, COL00.0).

Upper Watershed

Upper BBC refers to the watershed area upstream of monitoring site BBC09.5 through the headwaters (RM 10-13). The upper subbasin includes the fixed-network sites BBC11.4, BBC10.8, BBC10.4, and downstream to BBC09.5. Headwaters of BBC originate in wetlands near NE 162nd Ave and flow through open undeveloped land with sparce riparian vegetation. Between sampling sites BBC11.4 and BBC10.4, the creek travels through sections of residential and commercial land use then passes below Interstate-205 to BBC09.5 into the Beaver Marsh Natural Area.

Land use in the upper subbasin is mainly residential and undeveloped. Small portions (91 acres) of the upper watershed are forested or cultivated. Along the riparian area, land use is mainly undeveloped, with small pockets of residential and increasingly developed commercial land. Approximately 8 percent of land in the upper watershed is publicly owned and 92 percent is privately owned. There are over 1000 septic systems in the upper subbasin.

The COV and Clark County MS4 permit areas each cover approximately half of the upper subbasin. Upper reaches of the creek are within the COV MS4 permit area. Various construction stormwater and industrial stormwater permits are spread throughout the upper subbasin.

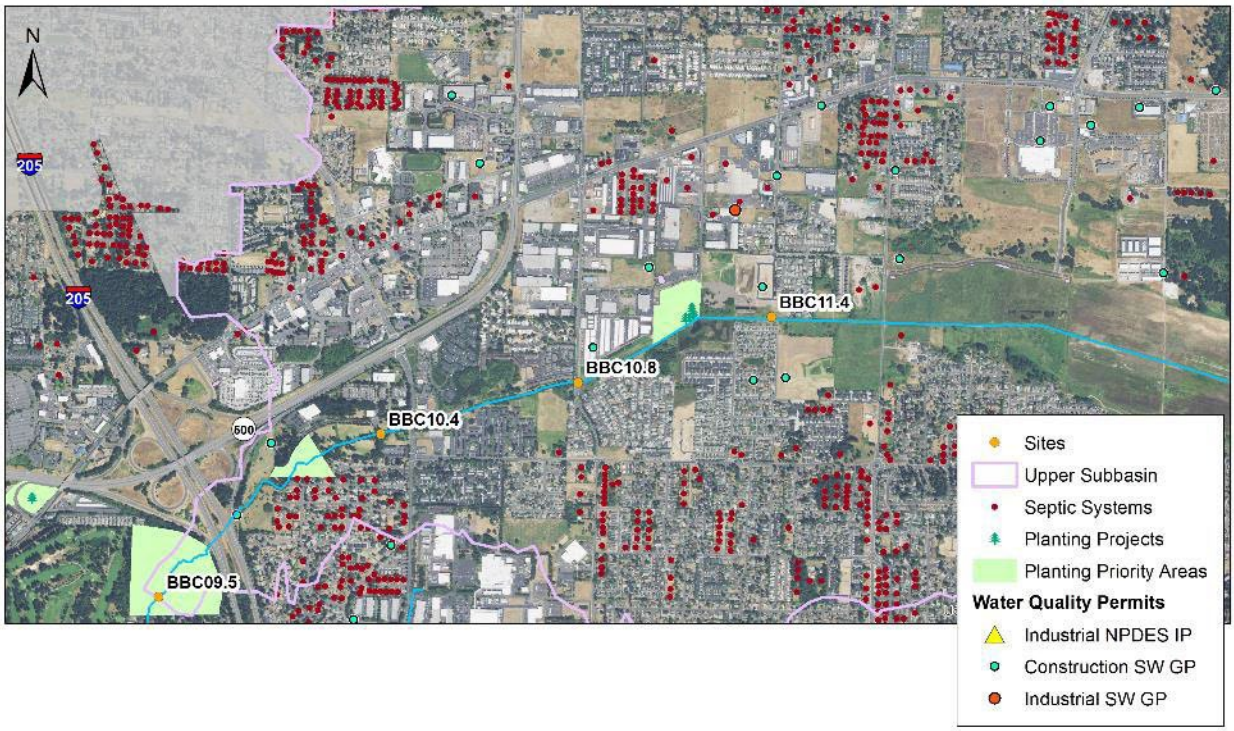


Figure 4. Map of upper BBC subbasin.

Middle Watershed

The middle portion of the BBC Watershed (from RM 5-10) includes sampling sites BBC04.3 through BBC09.5, and tributaries Peterson Channel, and Burton Channel. Southeast of BBC09.5 (Beaver Marsh Natural Area), the stream flows through the Royal Oaks Country Club golf course, receives input from Peterson and Burton Channels, and then flows through sections of developed commercial and residential land use with preserved open spaces in the central portion of the Greenway Project restoration area. The creek flows below State Route 500 before reaching the end of the middle subbasin at BBC04.3.

Just under half (45%) of the land area in the middle BBC subbasin is residential. The middle subbasin has the highest count of septic systems (about 1,798 systems). Other major land use categories include commercial, roads and transportation, undeveloped and natural spaces. Land use along the riparian corridor includes forested and recreational (e.g. golf course), residential and commercial, and an expansive central corridor of open space between BBC05.9 and BBC08.0, where the reach has been transformed with native vegetation, reconnected floodplains, stormwater ponds, and a regional trail system. Publicly owned land makes up about 11 percent of the middle watershed with the COV owning over half of those properties.

Peterson Channel carries groundwater, stormwater runoff, and non-process discharge from the Shin-Etsu Handotai America (SEH) facility through commercial and residential properties to its confluence with BBC below the Royal Oaks golf course at Meadowbrook North. Burton Channel originates near commercial properties, crosses under I-205, and flows through a fully developed residential area before entering BBC at Meadowbrook Marsh. The COV MS4 permit

area covers most of the middle subbasin and the entirety of the creek corridor. A section in the northern portion of the watershed is covered by the Clark County MS4 permit, with the WSDOT permit covering major roadways in this subbasin. In addition to the SEH industrial individual permit for discharges to Peterson Channel, there are multiple industrial and construction stormwater general permits in the northern sections of the middle watershed.

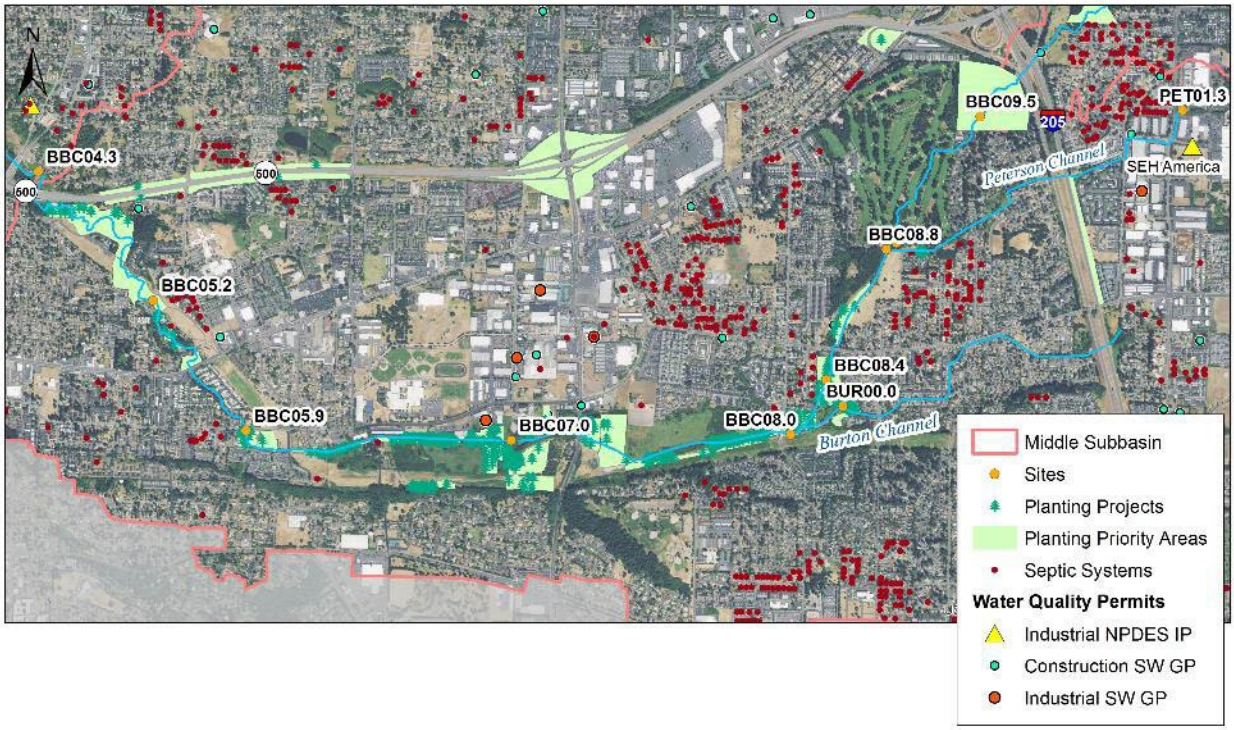


Figure 5. Map of middle BBC subbasin

Lower Watershed

Lower BBC is the section of the watershed downstream of RM 5.0 reaching to the confluence with Vancouver Lake. This portion of the watershed includes Cold Creek and the fixed-network monitoring sites: BBC03.4, BBC02.6, BBC01.6, BBC00.0, and COL00.0.

The lower reaches of BBC flow through parcels with mixed land-use. The major land use categories in the lower BBC Watershed include residential areas (45%), roads and transportation (29%), and undeveloped land (12%). There are approximately 527 septic systems throughout the lower watershed and in the upper Cold Creek basin. Approximately 16 percent of land in the lower watershed is publicly owned with large portions, over 242 acres, owned and managed by the federal Bonneville Power Administration.

The riparian corridor of the lower reaches of the creek is another priority area for vegetation plantings and restoration activities for the COV and partners. Restoration projects targeting the lower subbasin have been implemented in coordination with the Lower Columbia Estuary Partnership. Sections along the lower reaches of the greenway are maintained by the COV and

eight miles of paved trail connect the lower and middle basins, providing recreational opportunities for the community.

The MS4 permit areas in the lower BBC subbasin are split between the COV and Clark County, with highway areas covered by WSDOT. There are multiple industrial and construction stormwater general permits and one individual NPDES permit in the lower watershed.

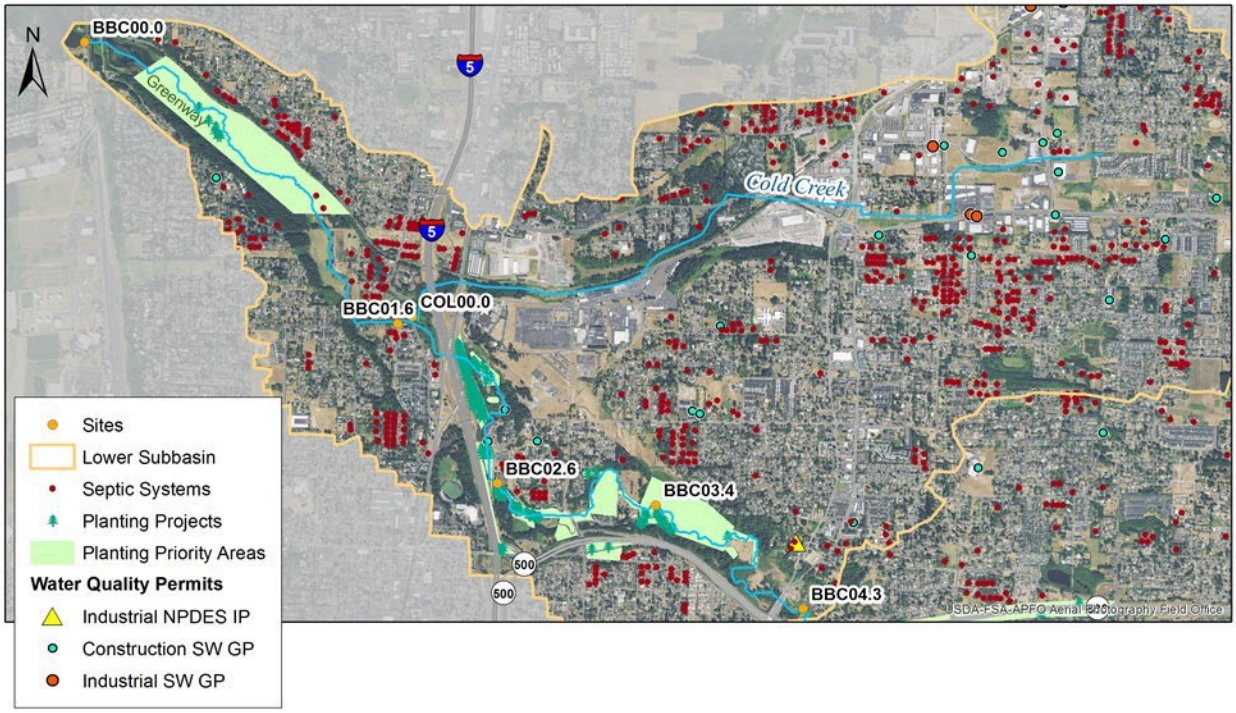


Figure 6. Map of lower BBC subbasin.

Point Source Pollution and Permitted Facilities

Most of the pollution sources in BBC contributing to high bacteria levels and warm water temperatures are nonpoint and the focus of this ARP. However, there are also point sources in the watershed with the potential to impact water quality. Ecology is not recommending any waste load allocations for point sources in this plan, however updated effluent limits for one permitted facility are being considered.

If point sources and permitted facilities with the potential to contribute to water impairment increase in the watershed, a TMDL plan may become necessary to bring the creek into compliance with water quality standards. Ecology will consider any new permitted facilities and point discharges in the watershed when evaluating and measuring progress, completing effectiveness monitoring, and adaptively managing this ARP. More information on Ecology's criteria to measure progress is included in Chapter 9.

Table 4 is a summary of point sources and facilities with discharge permits in the BBC Watershed. These permits are administered by the Department of Ecology and are subject to the agency's regulatory authority.

Table 4. Point source permits in BBC Watershed regulated by the Department of Ecology.

Facility	Permit Number	Type of Discharge
~45	Multiple	Construction SW GP
SEH America Inc	WA0039616	Industrial NPDES IP
Hand Andy No. 8	WA0991068	Industrial NPDES IP
Trus Way Inc	WAR005582	Industrial SW GP
Boc Process Gas Solutions	WAR001186	Industrial SW GP
Fabrication Products Inc Minnehaha St	WAR305409	Industrial SW GP

Nonpoint Source Pollution

Nonpoint source pollution (NPS) is likely the primary source of water quality impairment in the BBC Watershed causing exceedances in bacteria, dissolved oxygen, and pH water quality standards. Potential NPS sources include septic systems, stormwater runoff, pet waste, and unsanctioned houselessness camping in riparian areas or stormwater facilities leaving human waste and litter. To better address nonpoint source pollution Ecology developed the Water Quality Management Plan to Control Nonpoint Sources of Pollution[10]. Ecology also recently created guidance to support water protection through agricultural management practices: Introduction to Voluntary Clean Water Guidance for Agriculture[11].

Priority Subwatersheds

Priority subwatersheds for pollution reduction are tributary basins Peterson Channel, Burton Channel, and Cold Creek. These subwatersheds had significant bacteria exceedances measured in 2008-2009 and 2011-2018. Increasing riparian restoration and canopy cover in the BBC tributary basins should lower water temperatures, improve dissolved oxygen concentrations, and buffer the stream from stormwater runoff carrying sediment and bacteria to the creek. These priority subwatersheds are discussed in more detail below. More information about other priority implementation areas can be found in other sections of this plan.

Peterson Channel

Peterson Channel was originally constructed to drain land for cultivation. Over the years the area transitioned to commercial and manufacturing land uses and the channel was also utilized to convey stormwater runoff from new impervious surfaces. The channel today flows west from NE 112th Avenue, through a culvert below I-205, and then through mixed land use (residential, parks and recreation, and open space) before reaching the mainstem of BBC at Meadowbrook

[10] https://apps.ecology.wa.gov/publications/SummaryPages/2510040.html
[11] https://apps.ecology.wa.gov/publications/documents/2010008.pdf

North. Peterson Channel does not meet water quality standards for temperature and bacteria, with fecal coliform concentrations elevated in both wet and dry seasons.

Water temperature in Peterson channel is influenced by warm water discharge from Shin-Etsu Handotai America (SEH), a manufacturing facility that discharges non-process cooling water through an outfall to a pipe and ditch conveyance system that forms the headwaters of Peterson Channel (PET01.3). SEH is currently permitted to discharge non-process wastewaters to the channel at temperatures up to 21°C (69.8°F) under the National Pollution Discharge Elimination System (NPDES) permit number WA0039616. SEH has established protocols to prevent high temperature discharges into Peterson Channel by stopping the release to the outfall from detention ponds on their site when water temperatures are elevated. The current protocol consists of a gate weir that is manually closed when temperatures are elevated and reopened when below the discharge limit.

Flow in Peterson Channel is significantly augmented by discharge from SEH, which contributes over half (63%) of the flow by adding 2.2 cfs during the dry season and 3.0 cfs during the wet season. Along with this discharge, flow in Peterson Channel is sustained by shallow groundwater and stormwater. Because Peterson Channel is not meeting temperature criteria, the SEH NPDES permit will need to be updated to reduce the maximum allowed temperature for discharges. Current WQS state that the highest 7-DADMax temperature must not exceed 17.5°C (63.5°F) more than once every ten years on average. As of 2026, Ecology is working with SEH to find additional solutions to reducing temperature in their discharge and update their NPDES discharge permit to minimize the risk of increasing temperature in Peterson Channel.

The lack of riparian vegetation along Peterson Channel also contributes to elevated water temperatures. Many of the properties bordering the channel are residential, with homes built close to the stream and little space available to enhance riparian buffers. While some parcels along Peterson Channel have had riparian restoration implemented through collaborative and individual efforts, other property owners still need to be encouraged to increase plant density and restore habitat on their lots.

Burton Channel

Burton Channel originates near commercial properties east of I-205 and flows west through a heavily developed residential area before entering BBC at Meadowbrook Marsh. Burton Channel discharges shallow groundwater and stormwater runoff. Most of the Burton basin is underlain by substrate with very high infiltration rates, and in those areas stormwater is managed through drywells and perforated pipe networks. Burton Channel is the smallest tributary to BBC (averaging 0.1 cfs in dry season and 0.7 cfs in wet season) entering the mainstem near RM 8.0. Burton Channel had the lowest fecal coliform load due to the low flow volume but frequently exceeded bacteria criteria throughout the year. The largest overall fecal coliform reductions (90%) are needed at BUR00.0 during the wet season to meet water quality criteria. Burton Channel exceeded the temperature criterion (7-DADMax <17.5°C) during the dry season.

Cold Creek

The Cold Creek basin is primarily within Clark County's jurisdiction. Cold Creek travels along residential, commercial, industrial, and transportation corridors and crosses through the federal Bonneville Power Administration (BPA) Ross Complex before flowing under I-5 and entering BBC at Hazel Dell Road within WSDOT right of way. Cold Creek contributes groundwater and urban stormwater runoff into the mainstem of BBC approximately 2 miles upstream of its confluence with Vancouver Lake. Cold Creek discharges an average of 1.2 cfs to BBC during the wet season and 0.4 cfs during the dry season. The upstream half of Cold Creek is within Clark County's jurisdiction, and the downstream portion flows primarily within BPA and WSDOT owned properties. The largest dry season fecal coliform reductions (85%) are needed at COL00.0 to meet water quality criteria. Cold Creek met water quality criteria for temperature throughout the entire duration of temperature monitoring.

Water Quality Standards

Washington State WQS are the basis for protecting and regulating the quality of surface waters in Washington State. The standards implement portions of the federal CWA by specifying the designated and potential uses of water bodies in the state (Table 5). The WQS are established to sustain public health, support community enjoyment of the waters, and ensure the propagation and protection of fish, shellfish, and wildlife.

Table 5. Water quality standards in BBC.

Parameter	Use Classification	Criteria
Fecal Coliform Bacteria	Primary Contact Recreation	Geomean: 100 cfu/100 mL 10% not to exceed: 200 cfu/100 mL
E. Coli Bacteria (updated in 2019)	Primary Contact Recreation	Geomean: 100 cfu/100 mL 10% not to exceed: 320 cfu/100 mL
Temperature	Salmonid Spawning, Rearing, and Migration	17.5°C
Dissolved Oxygen	Salmonid Spawning, Rearing, and Migration	10.0 mg/L
pH	Salmonid Spawning, Rearing, and Migration	6.5–8.5 units

New *E. Coli* Bacteria Standards for Recreation

Waterbody impairment listings for bacteria established between 1996 and 2018 were based on using fecal coliform as the indicator species. In January 2019, Ecology revised state surface water quality standards 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 as fecal coliform species are also present in the natural environment and do not necessarily indicate a threat to human health. After December 2020, all water quality assessments completed in Washington State were required to utilize *E. coli* as the primary indicator to demonstrate impairment or attainment of bacteria WQS for recreational use. To support this transition, all future bacteria monitoring should utilize *E. coli* as the primary indicator for water quality assessment. Data gathered for the BBC ARP uses the old fecal coliform criteria. However, *E. coli* is tightly connected to fecal coliform so reductions in fecal coliform will likely reduce *E. coli.*

Source Assessment Results

The BBC Watershed is on the Washington State's Polluted Waters List (303(d) list) for bacteria, dissolved oxygen, temperature, and pH impairments. The following is a summary of impairments targeted in the Burnt Bridge Creek Source Assessment.

Bacteria

Results from the 2008-2009 Ecology study found that all sites exceeded the geometric mean (100 cfu/mL) or percent exceedance criteria (more than 10% of samples greater than 200 cfu/mL) during sampling. Peterson Channel, Cold Creek, and Burton Channel are priority basins for bacteria reduction, as well as the mainstem at BBC08.4, BBC02.6, and BBC01.6. All of these basins had bacteria geometric means over 200 cfu/100mL during the dry season, more than double the state water quality standard for fecal coliform.

The second priority level includes all areas that need bacteria reductions of over 75 percent in the wet or dry seasons to meet water quality standards: Peterson Channel, Burton Channel, and BBC07.0, BBC04.3, BBC03.4, BBC02.6 and BBC01.6 in the wet and dry seasons, Peterson Channel, Cold Creek and BBC08.4 in the dry season.

Overall, the middle and lower watershed are the highest priorities for bacteria reduction efforts. The presence of dry season bacteria can indicate a direct source of bacteria from an illicit discharge or illicit connection, sewer pipes that need maintenance or repair, failing septic systems, or direct access of pets or people to the waterbody. The presence of wet season bacteria may indicate that stormwater runoff is facilitating the movement of bacteria into surface water from a variety of sources.

Table 6. Bacteria priorities in BBC.

Bacteria priorities

• Peterson Channel, Cold Creek, and Burton Channel are important priorities for bacteria reduction.
• The lower and middle watersheds are the highest priorities for bacteria reduction.
• Geometric mean concentrations were generally higher during the dry season than during the wet season. The highest geometric mean concentrations were found at tributary sites during the dry season at Cold Creek, Peterson Channel, and Burton Channel.
• Fecal coliform (FC) loading was higher during the wet season than during the dry season at all sites.
  ○ The highest FC loads were in the lower subbasin at BBC01.6 and BBC02.6 during the wet season.
  ○ The tributary with the highest FC load is Peterson Channel.
• The following sites all require more than a 75% reduction in FC levels to meet water quality criteria based on the results from the statistical rollback analysis:
  ○ All of the tributary outlet sites (PET00.0 during both seasons; BUR00.0 during the wet season; COL00.0 during the dry season).
  ○ Middle subbasin sites (BBC08.4 during the dry season; BBC07.0 during the wet season).
  ○ Lower subbasin sites (BBC04.3, BBC03.4, BBC02.6, and BBC01.6 during the wet season).

Table 7. Wet season fecal coliform bacteria reductions needed in watershed.

Watershed Location and Monitoring Site	Wet Avg Flow (cfs)	Wet Avg Load (b.cfu/day)	Wet FC Reduction (%)
Lower-BBC03.4	14.1	96	83%
Lower-BBC02.6	15.1	758	85%
Lower-COL00.0	1.2	8	58%
Lower-BBC01.6	17.4	1,002	84%
Lower-BBC00.0	16.5	73	24%
Middle-BBC08.8	6.3	99	34%
Middle-PET01.3	--	--	0%
Middle-PET00.0	3.0	57	79%
Middle-BBC08.4	9.2	117	56%
Middle-BUR00.0	0.7	48	90%
Middle-BBC08.0	10.8	173	70%
Middle-BBC07.0	11.6	178	80%
Middle-BBC05.9	14.6	154	71%
Middle-BBC05.2	14.7	125	73%
Middle-BBC04.3	15.3	179	78%
Upper-BBC11.4	4.3	38	24%
Upper-BBC10.8	4.7	23	0%
Upper-BBC10.4	5.5	40	43%
Upper-BBC09.5	6.6	68	46%

Table 8. Dry season fecal coliform bacteria reductions needed in watershed.

Watershed Location and Monitoring Site	Dry Avg Flow (cfs)	Dry Avg Load (b.cfu/day)	Dry FC Reduction (%)
Lower-BBC03.4	5.2	19	30%
Lower-BBC02.6	5.1	31	62%
Lower-COL00.0	0.4	6	85%
Lower-BBC01.6	5.3	30	57%
Lower-BBC00.0	4.9	6	0%
Lower-BBC03.4	5.2	19	30%
Middle-BBC08.8	2.2	4	0%
Middle-PET01.3	--	--	0%
Middle-PET00.0	2.2	23	37%
Middle-BBC08.4	4.0	71	0%
Middle-BUR00.0	0.1	1	0%
Middle-BBC08.0	4.8	43	0%
Middle-BBC07.0	4.8	16	76%
Middle-BBC05.9	4.9	25	81%
Middle-BBC05.2	4.9	21	72%
Middle-BBC04.3	5.2	24	43%
Middle-BBC08.8	2.2	4	0%
Upper-BBC11.4	2.4	5	0%
Upper-BBC10.8	2.5	5	0%
Upper-BBC10.4	2.3	9	37%
Upper-BBC09.5	2.9	5	0%

Bacteria Reductions

Fecal coliform percent reductions needed during wet and dry seasons to meet water quality criteria are highlighted in Table 9. Some potential sources of bacteria pollution include poorly functioning septic systems, contaminated runoff from stormwater and irrigation, wildlife, unsanctioned camping or human presence in riparian areas, and domesticated pet waste. More information on BMPs to improve bacteria conditions is outlined in chapters 4 and 5 of this plan.

Table 9. FC percent reductions needed during wet and dry seasons to meet water quality criteria.

Watershed Sections and Monitoring Site	Dry FC % Reduction	Wet FC % Reduction
Upper-BBC11.4	0%	24%
Upper-BBC10.8	0%	0%
Upper-BBC10.4	37%	43%
Middle-BBC09.5	0%	46%
Middle-BBC08.8	0%	34%
Peterson Channel-PET01.3	0%	0%
Peterson Channel-PET00.0	76%	79%
Middle-BBC08.4	81%	56%
Burton Channel-BUR00.0	72%	90%
Middle-BBC08.0	69%	70%
Middle-BBC07.0	51%	80%
Middle-BBC05.9	28%	71%
Middle-BBC05.2	35%	73%
Lower-BBC04.3	43%	78%
Lower-BBC03.4	30%	83%
Lower-BBC02.6	62%	85%
Cold Creek-COL00.0	85%	58%
Lower-BBC01.6	57%	84%
Lower-BBC00.0	0%	24%

Color Coding Key: Red - High FC, Orange - Medium FC, Yellow - Low FC

Temperature

In the BBC Watershed, RM 0 had the highest maximum water temperatures recorded in the Source Assessment, with 92 percent of days exceeding water quality criteria for temperature. The temperature WQS for BBC is 17.5 degrees Celsius to support salmonid spawning, rearing, and migration. In addition to RM 0, RM 5.9 and 7.0 in the middle watershed had the greatest

number of days above criteria, with RM 7.0 not meeting temperature standards 230 days (48% of days measured), and RM 5.9 not meeting standards for 222 days (47%). Increasing tree canopy in riparian areas will provide important shade, which will help cool down BBC and its tributaries by reducing the amount of sunlight that can warm up the stream. Increasing urban tree canopy in upland areas throughout the watershed also has the potential to help manage stormwater runoff and promote groundwater infiltration, to restore streamflow to the creek.

A shade deficit analysis identified priority stream miles for riparian restoration. Opportunities for riparian restoration are outlined in Chapter 6. Other factors contributing to warm temperatures include climate change, increased water withdrawal, decreased groundwater recharge, and increased impervious surfaces. The following tables summarize temperature priorities and temperature reductions needed to meet water quality standards. Results of a shade deficit analysis are also summarized. Overall, the middle and lower watersheds are the highest priority for temperature reduction. More information can be obtained by reviewing the Burnt Bridge Creek Source Assessment.

Table 10. Temperature priorities in BBC.

Temperature priorities
• All sites exceeded temperature criteria, except for the site at the outlet of Cold Creek. • The overall maximum temperature was observed at BBC00.0. During the temperature monitoring period, 92% of days at BBC00.0 exceeded criteria. • Sites with the highest count of dates with temperature above water quality criteria were in the middle subbasin (BBC07.0 with 230 days and BBC05.9 with 222 days). • In Peterson Channel, discharge from SEH America comprises over half of the flow in the tributary. Maximum temperatures were higher at PET01.3 (near SEH America outfall) than the tributary outlet (PET00.0) by an average of 1.2°C. Temperature differences between the two sites are largest during summer months. • Along the riparian corridor of BBC, approximately 36% of the area is grassland, 19% are built or paved, and 45% is a mix of varying tree heights and densities. • The largest shade deficit (difference between current effective shade and system potential shade) is in the upper subbasin (average of 62%). The average shade deficit in the middle watershed is 39% and in the lower watershed is 27%.

Table 11. Temperature exceedance in BBC Watershed.

Site	Daily Max (°C)	Max – 7-DADMax (°C)	Days Measured	Days Exceedance	% Days Exceedance
BBC11.4	20.8	**20.3**	478	82	17%
BBC10.8	23.2	**22.3**	478	76	16%
BBC10.4	21.8	**21.2**	478	62	13%
BBC09.5	24.0	**23.0**	478	98	21%
BBC08.8	29.2	**28.2**	477	198	42%
PET01.3	26.0	**23.9**	443	202	46%
PET00.0	21.3	**20.3**	477	180	38%
BBC08.4	26.0	**24.8**	477	212	44%
BBC08.0	23.2	**22.1**	138	95	69%
BUR00.0	28.0	**26.6**	236	128	54%
BBC07.0	33.0	**31.3**	477	230	48%
BBC05.9	28.2	**27.2**	476	222	47%
BBC05.2	27.0	**25.5**	476	209	44%
BBC04.3	27.5	**25.9**	476	202	42%
BBC03.4	27.8	**26.3**	477	212	44%
BBC02.6	26.6	**25.3**	480	211	44%
COL00.0	18.9	16.9	265	0	0%
BBC01.6	25.4	**24.0**	479	202	42%
BBC00.0	34.7	**32.7**	207	191	92%

Shade Deficit Analysis

A shade deficit of the mainstem of BBC was completed in the Burnt Bridge Creek Source Assessment to identify priority locations for tree planting projects. Overall, the upper watershed located between RM 10 and 13 had the highest average shade deficits in the watershed, followed by the middle watershed located between RM 5 and 10. The following table summarizes results from the shade deficit analysis. More information is included in the Burnt Bridge Creek Source Assessment Report

Table 12. Summary of average shade deficits in BBC Watershed.

River Mile	Average Potential Shade (%)	Average Effective Shade (%)	Average Shade Deficit (%)
0-1	83%	40%	43%
1-2	97%	66%	31%
2-3	84%	67%	17%
3-4	94%	84%	10%
4-5	93%	57%	36%
5-6	91%	81%	11%
6-7	85%	51%	35%
7-8	94%	12%	83%
8-9	88%	43%	44%
9-10	66%	46%	21%
10-11	92%	66%	26%
11-12	98%	25%	73%
12-13	93%	6%	87%

Table 13. Summary of average shade deficits in BBC for Watershed sections.

Portion of Watershed	Average shade deficit
Upper watershed: RM 10-13	62 percent
Middle watershed: RM 5-10	39 percent
Lower watershed: RM 0-5	27 percent

A shade deficit analysis was not completed for the BBC tributaries, which include Cold Creek, Peterson Channel, and Burton Channel. Completing a survey and analysis of tree canopy in these tributary basins will be important to inform future restoration actions.

Dissolved Oxygen

Most sites, except BBC04.3 and COL00.0, had at least one day of noncompliance with DO concentrations below water quality criteria (< 10 mg/L). Sites with the highest count of noncompliant days are in the upper watershed (BBC09.5– BBC11.4) and middle watershed (BBC07.0 and BBC05.9). The sites with the lowest measured DO were BBC11.4 (0.6 mg/L) and BBC07.0 (0.0 mg/L). Both of these sites also had the overall lowest average DO (4.1 and 1.6 mg/L, respectively). Minimum DO values were generally observed during July, August, or September. Reducing water temperatures, lowering bacteria concentrations and minimizing nutrient inputs will improve dissolved oxygen.

pH

Natural diurnal processes such as respiration, photosynthesis, and decomposition of aquatic plants can change dissolved oxygen concentrations and indirectly raise and lower pH. Elevated water temperature amplifies these chemical and biological processes. Groundwater is a significant source of streamflow in BBC, particularly in the upper watershed, and can naturally contribute to reduced pH and dissolved oxygen in the stream.

Overall, most sites in the BBC Watershed met standards for pH with occasional low measurements in the upper watershed (BBC09.5-BBC11.4) and a few above criteria in the middle and lower basins. RM 0.0 had the most noncompliant days for high pH. BBC08.8, BBC08.0, BBC05.2, and Peterson Channel met criteria for pH. The minimum and maximum pH values in the study were measured in Burton Channel. In areas where the waterbody is not meeting pH standards, potential sources should be investigated.

Efforts to reduce pollutant loading from stormwater to control excess aquatic plant and algae growth in surface water, and increasing riparian tree canopy to reduce stream temperatures, can support healthy pH levels. Another potential source of pollutants that can temporarily influence pH levels in surface water includes runoff that has been contaminated by contact with construction material such as concrete dust. COV should continue to support implementation of construction site BMPs to reduce the risk of runoff that may reach water resources and negatively impact pH levels.

Environmental Health Conditions in the Watershed

Water quality issues like those in the BBC Watershed can negatively impact people's health. Monitoring in BBC has identified common urban water quality concerns like dissolved zinc and copper, current and legacy pesticides such as DDT, bacteria, dissolved oxygen, pH, and temperature. Some of the communities in this area are categorically considered vulnerable populations under state law (RCW 70A.02); they may be at higher risk of experiencing harm from these water quality impairments.

Socioeconomic challenges can create barriers to people's ability to choose safer alternatives to protect themselves from the effects of pollution or waterborne contamination. For example:

- Community members who fish in a local waterbody might not have the funds or desire to purchase commercially available fish.
- Community members who swim in local waterbodies to cool during extreme heat, for fitness, or for pleasure may not have access to a cleaner stream if they cannot afford transportation or if other nearby water bodies are also polluted.
- An unhoused person may be exposed to and contribute to water quality contamination of surface water due to a lack of public utilities such as bathrooms trash receptacles.

According to the Department of Health's Tracking Network, poor socioeconomic factors in the watershed include:

- Adults with no high school diploma
- Population living in poverty
- People whose primary language is not English
- Unaffordable housing

Cumulative Environmental Burdens

Additional environmental health burdens exist in the watershed and combine to exacerbate the risks and impact of pollution on the local community.

Air pollution: This area is designated as one of Washington's 16 communities most impacted by air pollution (carbon monoxide, lead, nitrogen dioxide, ozone, particle pollution and sulfur dioxide). Ecology estimates that 30 deaths a year among adults in this population are associated with being exposed to fine particles in the air. Lung cancer death rates are also higher here than elsewhere in the state. While air pollution is not part of this watershed cleanup plan, it demonstrates an additional environmental stressor the community faces.

PFAS contamination: The community's drinking water system has identified per-and polyfluoroalkyl (PFAS) substances) that exceed the Maximum Contaminant Levels as determined by the Environmental Protection Agency. The drinking water program is required to take action to reduce these levels by 2029. COV is currently planning and designing PFAS treatment system upgrades in several of their water stations.

Some people who drink water containing PFOA above the State Action Level over many years may experience negative health impacts to their liver, thyroid, immune system, cholesterol levels, have high blood pressure during pregnancy, babies with lower birthweights, and be at higher risk of getting certain types of cancers. Expert scientists are investigating potential sources of PFAS and the extent of PFAS in the local groundwater supply. This is an emerging field with a lot of unknowns including the relationship between transfer of PFAS between groundwater and surface water.

Vancouver Watershed Health Assessment

In addition to Ecology's water quality assessment, the COV contracted with Herrera Environmental Consultants to complete the Vancouver Watershed Health Assessment[12] in 2019. That report is consistent with Ecology's Source Assessment and confirms through the mean water quality index scores from 2011-2017 that the lower and middle watersheds are a top priority for water quality improvement efforts. Additionally, this report shows data indicating that phosphorus and nitrogen are of moderate to high concern in the watershed. Common sources of phosphorus and nitrogen in an urban environment include failing or improperly functioning septic systems, stormwater runoff, excessive lawn nutrient applications, pet waste, and certain soaps and detergents used around the home. Because shallow groundwater provides base flow to Burnt Bridge Creek, watershed mineralogy also influences phosphorus levels in the creek. Ecology's sampling from monitoring wells and piezometers

[12] https://www.herrerainc.com/publications/vancouver-watershed-health-assessment/

along the creek has shown phosphorus concentrations significantly above federal recommendations for a healthy stream.

Table 14. Median Annual Water Quality Index Scores for BBC 2011-2017.

Station	Years	FC	DO	pH	TP	TSS	Temp	TN	Turbidity	Overall WQI Score
BBC 10.4	7	73	53	74	78	95	87	1	95	60
BBC 8.8	7	74	86	94	62	79	78	1	92	69
PET 0.0	7	70	78	96	21	90	78	67	97	58
BBC 8.4	7	74	74	97	45	83	80	7	93	53
BUR 0.0	7	60	83	96	81	91	86	1	98	70
BBC 7.0	7	72	71	96	41	77	65	34	87	43
BBC 5.9	7	71	57	96	49	89	74	43	92	43
BBC 5.2	7	69	83	95	49	86	74	40	93	49
BBC 2.6	7	69	84	91	49	84	73	40	93	48
COL 0.0	7	56	90	88	53	88	90	43	91	47
BBC 1.6	7	63	82	91	43	81	72	43	90	45

Annual WQI Score shows significant decreasing trend over time using Kendall's Tau Correlation with an alpha of 0.05.

Low Concern WQI = 80–100
Moderate Concern WQI = 40–79
High Concern WQI = 1–39
DO = dissolved oxygen
FC = fecal coliform
TP = total phosphorus
TSS = total suspended solids Temp = temperature
TN = total nitrogen
WQI = water quality index

Figure 7 shows the median total phosphorus values for 42 samples taken from 2011 to 2017 per station. Median concentrations tend to increase moving downstream, with the notable spike in the main stem downstream of Peterson Channel. Peterson Channel (PET 0.0) was significantly different than all other stations and appears to contribute to the increase in total phosphorus concentrations downstream. Year-round flows in Peterson Channel are supported by high localized groundwater and discharges of industrial cooling water that have been drawn from deeper wells used by SEH America. The US EPA criterion for total phosphorus is less than or equal to 0.040 milligram per liter (mg/L) based on the 25th percentile of medians for 171 streams in the Willamette Valley Ecoregion.

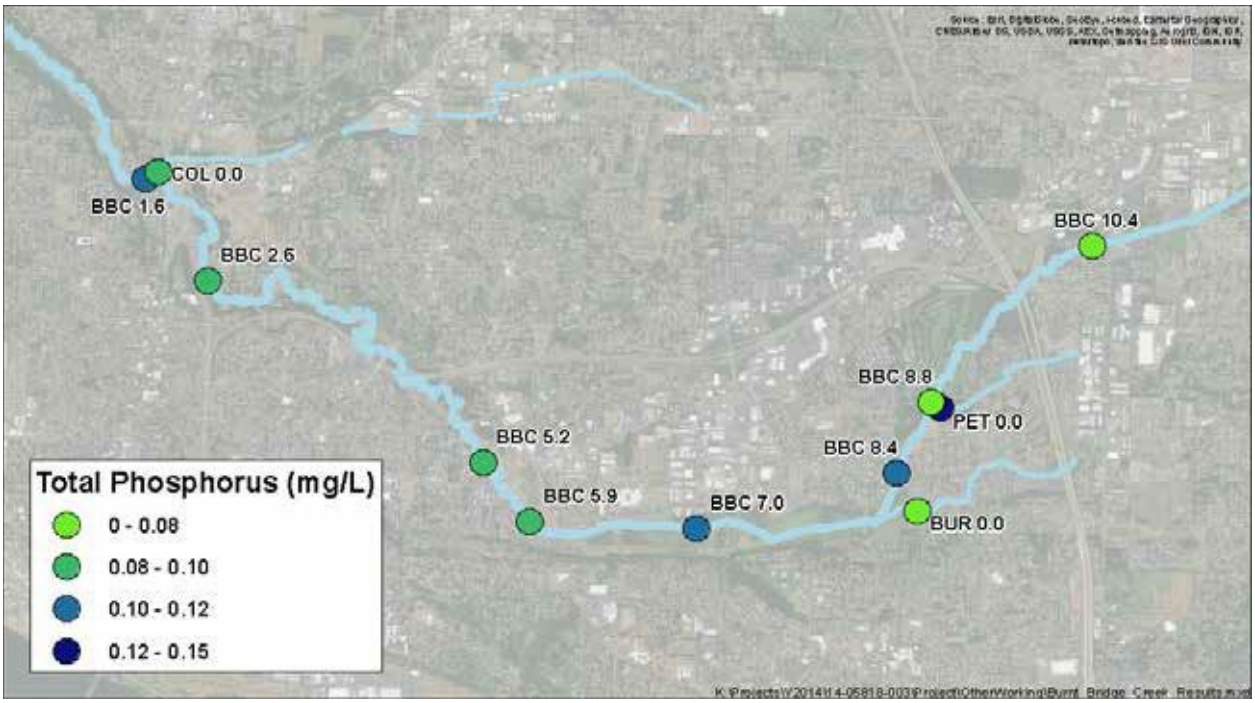


Figure 7. Median Total Phosphorus Along BBC.

Washington State Department of Agriculture

The Washington State Department of Agriculture (WSDA) has been monitoring BBC near RM 1.6 annually for pesticides since 2017. Samples were tested for 150 current and legacy chemicals in 2022 and 32 unique chemicals, with a total of 150 detections, were identified in the stream. Of these, 11 detections were above WSDA assessment criteria which has been set at one half of state and federal water quality criteria. Ten detections (91%) were from DDT and its degradants. When multiple pesticides are detected simultaneously, the harmful effects can combine to negatively impact WQ; multiple pesticides were detected every week BBC was sampled. Between 4 and 18 pesticides were detected at each of the 13 sampling events. WSDA identifies some pesticides as Pesticides of Concern (POC) when they have been detected above WSDA's assessment criteria and above established detection frequencies. BBC had one POC, Imidacloprid. Imidacloprid is commonly used at nurseries and residential properties. Imidacloprid was detected at 12 other monitored sites in 2022 and was a watershed POC at all of them. Strategies that reduce soil erosion and nutrient movement often provide dual benefit of reducing the movement of other compounds, including pesticides.

Meeting Water Quality Standards and Delisting

The goal of this ARP is to identify strategies and BMPs to improve water quality. Ecology believes that implementing the actions outlined in this ARP will result in the achievement of bacteria, temperature, dissolved oxygen, and pH water quality standards. Effectiveness monitoring will be the primary tool used to assess progress towards meeting water quality standards.

Ecology's goal is to work with community partners to fix and/or replace 100 percent of the noncompliant septic systems in the watershed by 2041 through septic system inspections, maintenance, and connection to public sewer. Another goal is to work with private and public property owners to initiate riparian restoration projects on 100 percent of the available mainstem and tributary buffer areas to initiate shade canopy by 2041. Trees will be expected to shade surface waters when reaching their 20- and 30-year growth potential by 2061 and 2071. Additionally, Ecology will work with stormwater permittees to manage stormwater with treatment and/or flow control BMPs on 10 percent of the total impervious surfaces by 2041, with the long-term plan to manage stormwater with treatment and/or flow control BMPs on 20 percent of the total impervious surfaces in the watershed by 2056. More information on these activities is outlined in Chapters 4 through 7. Cost estimates are detailed in Chapter 8, and criteria to measure progress are included in Chapter 9.

In 2041, when septic inspection and outreach activities are completed, Ecology plans to evaluate the periodic reporting and effectiveness monitoring information to determine if bacteria standards are being met, and to determine if a TMDL plan is needed in the watershed for bacteria. Ecology plans to reassess temperature, dissolved oxygen and pH data to see if water quality standards are being met in 2061 and determine if a TMDL plan is needed for those parameters. Land use and landcover information will again be considered during this evaluation to understand how land use change may have resulted in changes in pollution sources and whether new permits have been issued in the watershed that may benefit from the completion of TMDL plan.

If water quality standards are not achieved through implementation actions outlined in this ARP, the implementation plan will be re-evaluated to determine whether a higher priority for TMDL development should be assigned to the waterbody. The timeline for making this determination will be different for bacteria and temperature impairments. Although bacteria pollution may be addressed in the near-term through stormwater activities being implemented by the COV, improving temperatures in the watershed will require a much longer timeline to attain.

Effectiveness monitoring for temperature and *E. coli* will be used to support delisting. When temperature and bacteria numbers improve it is expected that DO and pH will also improve. The following table summarizes the Assessment Unit ID's that will be addressed by this ARP.

Category 5 Waterbody Units Addressed In ARP

Table 15. Waterbody assessment unit IDs addressed in this BBC ARP.

	Listing ID	Assessment Unit ID	Waterbody Name	Pollutant
1	7827	17080003038767	Burnt Bridge Creek	Bacteria
2	7829	17080003039082	Burnt Bridge Creek	Bacteria
3	7833	17080003038767	Burnt Bridge Creek	pH
4	7836	17080003038767	Burnt Bridge Creek	Dissolved Oxygen
5	7837	17080003039082	Burnt Bridge Creek	Temperature
6	7847	17080003038767	Burnt Bridge Creek	Temperature
7	47726	17080003039082	Burnt Bridge Creek	Dissolved Oxygen
8	72118	17080003038585	Burnt Bridge Creek	pH
9	72484	17080003038585	Burnt Bridge Creek	Bacteria
10	72890	17080003038585	Burnt Bridge Creek	Temperature
11	72872	17080003039842	Burton Channel	Temperature
12	74296	17080003039842	Burton Channel	Bacteria
13	78094	17080003039842	Burton Channel	Dissolved Oxygen
14	72477	17080003038368	Cold Creek	Bacteria
15	46972	17080003039841	Peterson Channel	Bacteria
16	48661	17080003039841	Peterson Channel	Temperature

Chapter 3 – Implementation Priorities

To achieve clean water in the BBC, there are four implementation priorities. These include addressing water quality impacts through fixing and/or replacing septic systems and connecting to public sewer, stormwater infiltration and runoff reduction, riparian restoration and education and outreach in the watershed. Addressing nonpoint source impacts from septic systems and stormwater can help ensure waterbodies reach compliance with bacteria and pH water quality standards. Efforts to increase riparian restoration will help make progress towards achieving temperature, dissolved oxygen, pH, and bacteria water quality standards. Ecology's goal is to achieve bacteria water quality standards by 2041, and temperature, dissolved oxygen, and pH water quality standards by 2061. The following is a summary of pollution sources in the watershed to be addressed.

Sewer Connection and Septic Systems

A key implementation priority is to reduce and eliminate water quality impacts from septic systems through removal and connection to the existing public sewer (where available) and to fix and/or replace failing septic systems. To make progress on improving the function of existing septic systems, additional stakeholder outreach to septic system owners is needed to increase inspection, maintenance, repair, and removal; promoting sewer connection wherever feasible. While septic system inspections are required in Washington State, there are opportunities to increase compliance with routine inspection and maintenance in Clark County. Clark County Public Health Department (CCPH) enforcement of septic system inspection and maintenance, with increased inspection frequency, could provide additional information on the location, functional condition, and criticality of septic systems in the BBC Watershed. Property owners are required to inspect their septic systems on a regular frequency (every 1, 2 or 3 years depending on system type). These inspections are typically performed by professionals. CCPH reminds owners when inspections are due, receives inspection reports and takes regulatory action as necessary. If owners do not comply, CCPH has many enforcement tools including compliance orders, property liens and civil penalties. Clark County Public Health recently created a new enforcement method to increase compliance rates.

COV's Sewer Connection Incentive Program (SCIP)[13] provides resources for homeowners to connect to existing public sewer. Even with incentives the cost for homeowners to connect to sewer can still be prohibitive. Securing additional financial resources for this program to offset private connection costs would be beneficial in helping homeowners connect to sewer and decommission septic systems. The City has been awarded grant funding that will be made available to property owners in areas with public sanitary sewer available to help with the cost to connect. This grant funding is anticipated to provide monetary incentives to property owners to eliminate existing septic systems. Property owners with septic systems located in close proximity to BBC will be engaged initially, and the program will extend the offer to

[13] https://www.cityofvancouver.us/government/department/public-works/sewer-connection-incentive-program-scip/

additional parcels located in the watershed as funds allow.

The Clark Regional Wastewater District also offers a Septic Elimination Program that the District developed to assist existing neighborhoods in making public sanitary sewer available. The purpose of this program is to protect water resources by assisting neighborhoods that may be unable to obtain sanitary sewer through other means or programs that the District offers. You can find additional related resources at the Clark Regional Wastewater documents webpage[14]. Clark Conservation District leads the Poop Smart Clark Pollution Identification and Correction program, which includes outreach, education, and financial assistance for septic system owners in Clark County. The program increases septic inspection compliance rates, promotes proper maintenance, and encourages sewer connection when available. See Chapter 4 for additional information.

Stormwater Management

Stormwater management, and increasing water quality treatment for runoff, is also a priority in the BBC Watershed. During significant precipitation events, rainwater washes the surface of the urban landscape and impervious surfaces such as roofs and paved areas. This stormwater runoff can accumulate and transport pollutants, such as bacteria, nutrients, pesticides and roadway contaminants via stormwater drains to receiving waters and potentially degrade water quality.

There are three municipal separate stormwater system (MS4) NPDES permits in the BBC Watershed: COV (Phase II), Clark County (Phase I), and WSDOT. The majority of the watershed (70% or 13,030 acres), including most of the stream riparian corridor, is covered by the COV MS4 permit (Figure 8). Areas in the northern portions of the watershed are covered by the Clark County MS4 permit, including the Cold Creek basin and a small segment of BBC below the Cold Creek confluence.

[14] https://www.crwwd.com/documents/

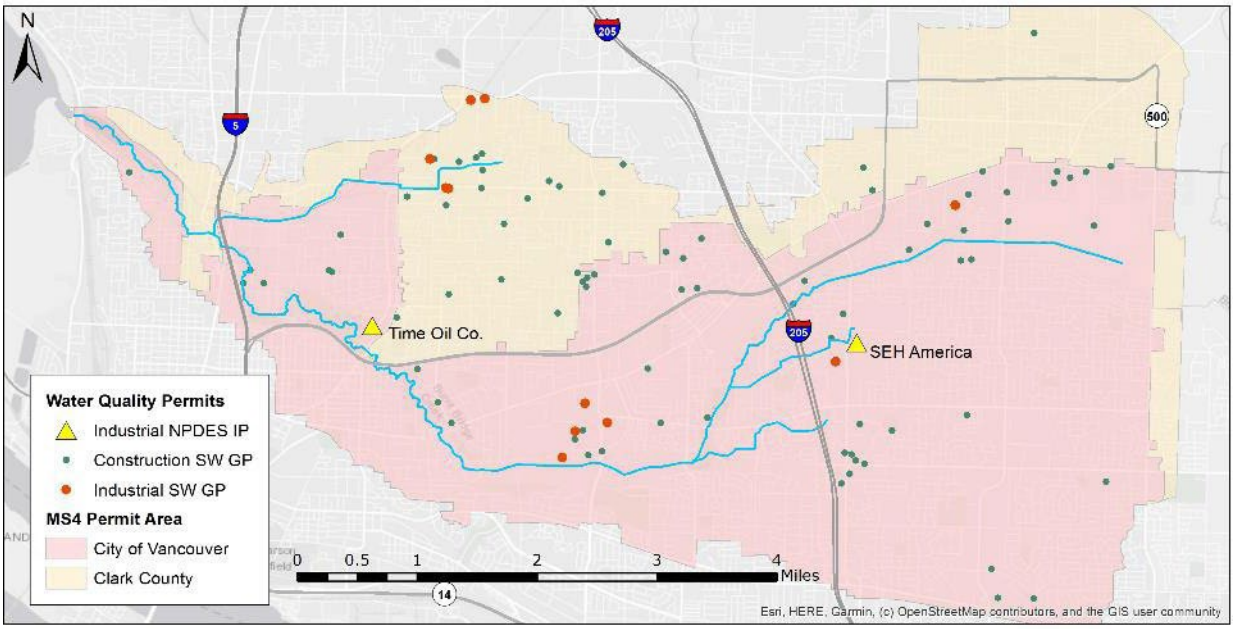


Figure 8. Map of point sources and municipal separate stormwater system (MS4) areas.

The MS4 NPDES Permits require development and documentation of a Stormwater Management Program (SWMP). The permit requires completion and submittal of an Annual Report to document how the permittee is complying with each section of the permit. These are available on the COV Stormwater Management Program Plan website[15] and Clark County Stormwater Management Plan website[16].

In 1977, Clark County and the City of Vancouver signed a resolution to implement a clean water program and formed the Burnt Bridge Creek Surface Water Utility. After incorporating a significant portion of the eastern watershed in 1996, the County transferred management responsibility to the City for the majority of the stream, and sections of the watershed within the new city limits. The COV established a citywide Surface Water Utility in 1994, adopting the Stormwater Ordinance VMC 14.25 in 1997. The utility has jurisdiction over much of the stormwater flowing into BBC. One significant exception is the Cold Creek tributary, which collects the majority of its flow in Clark County's permitted area. At this time the City's Surface Water Utility is well established with an existing utility rate structure, and COV continues to implement the required MS4 NPDES Permit program elements.

WSDOT's permit for stormwater management is consistent with Ecology's Municipal Stormwater Management Manual. WSDOT maintains roads that potentially impact BBC through stormwater runoff, including I-5, I-205, and SR 500. WSDOT has an online outfall map showing 10 stormwater discharges

[15] https://www.cityofvancouver.us/government/department/public-works/water-sewer-and-stormwater/stormwater-management-program-plan/

[16] https://clark.wa.gov/public-works/clark-county-stormwater-management-plan#%3A%7E%3Atext%3DClark%20County%27s%20Stormwater%20Management%20Plan%2CPermit%20issued%20in%20July%202019

leaving their system inside the BBC Watershed, the majority of which are in the middle basin. All three basins in the watershed have a high percentage of road land cover (20%+). Analyzing what proportion of WSDOT runoff is currently untreated and could be retrofitted for water quality treatment could improve outcomes in BBC.

Riparian Restoration

A major clean water priority for BBC is increasing riparian restoration. The creek is highly modified and the headwaters, which were historically wetlands and marshes, were drained and channelized for agriculture in the 1800s. Currently, only 11 percent of the land in the BBC Watershed is publicly owned. COV is the largest public landowner, owning 44 percent of the total public land (less than 5 percent within the watershed). Clark County owns 10 percent of public land, WSDOT at 3 percent and the Bonneville Power Administration owns approximately 1 percent.

The BBC Watershed would benefit from additional land acquisition for restoration and management to improve water quality. Efforts to implement projects that increase riparian tree canopy, reconstruct wetlands and restore a sinuous stream path are needed to lower water temperatures and improve dissolved oxygen levels. Riparian vegetation can also serve as a filtration buffer absorbing bacteria and nutrients from urban runoff. Other surface water enhancement projects such as wetland restoration, floodplain reconnection, induced meandering, cold-water refuge enhancement, and water conservation are also important.

Achieving clean water in BBC 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.

Education And Outreach

Community education and outreach in the BBC Watershed are important priorities for harnessing public support and participation to improve water quality. This includes education about the effects of nonpoint source pollution on aquatic ecosystems and human health. Increased outreach to private landowners to encourage implementation of water quality BMPs on streamside properties is critical. These outreach efforts should be prioritized for the following audiences:

- Residents with septic systems that are past due for inspection and maintenance on properties adjacent to BBC and its tributaries. Septic system owners in areas where there are known bacteria issues and public sanitary sewer available are a priority for outreach and information regarding financial resources to assist with connection.
- Public and private landowners with riparian properties adjacent to the highest shade deficits on the BBC mainstem and tributaries. Outreach to these landowners to promote tree planting and riparian restoration is a priority. Encouraging pet waste exclusion and reducing weed & feed in buffers can also reduce bacteria and nutrient loading.
- Camps of unhoused people along BBC can be engaged to minimize negative impacts to

riparian vegetation and water quality from trash and biohazards. Recognizing these communities are already overburdened with social vulnerabilities and exposure to pollution like bacteria in surface waters, collaborative access to sanitary facilities is key.
- Pet owners within the watershed. Partner with community-based organizations to add educational signs and pet waste stations in strategic locations throughout the watershed. Consider exclusion signage or fencing within a 100' buffer to the creek. Engage dog walkers and other commercial service providers on water quality messaging.
- Homeowners Associations (HOAs) with private stormwater facilities, multi-family campuses and residents with impervious surfaces where they live could help improve water quality by implementing pollution prevention and source control activities.

The COV and other local watershed partners are currently implementing many of these recommendations. The COV has been actively pursuing land acquisition to install riparian buffers, creating riparian buffers through contracts with non-profit partners, proactively implementing their stormwater management program plan, and extending sanitary sewer to city properties. Ecology recommends continuing these implementation and restoration activities.

Implementation Goals

Overarching goal

- Achieve clean water, meet water quality standards, enhance and protect aquatic ecosystems, and support all beneficial uses in BBC Watershed.

Sewer connection and septic systems goal

- Eliminate septic system impacts on water quality in the watershed.
- Connect to municipal sewer and eliminate onsite septic systems whenever possible.

Stormwater management goal

- Attain a high level of water quality treatment for stormwater runoff in the watershed.
- Prevent stormwater pollutants from reaching surface water.

Riparian restoration goal

- Reach full potential system shade of riparian tree canopy cover.
- Implement 215 ft buffers where feasible in the Riparian Management Area.
- Acquire and restore riparian land whenever possible.

Public education and outreach goal

- Educate communities about the effects of nonpoint source pollution on aquatic ecosystems and human health.
- Foster community support and participation to improve water quality.

Chapter 4 – Sewer Connection and Septic Systems

Introduction

Septic systems providing inadequate treatment are one potential source of bacteria and nutrients in the BBC Watershed. In 2023, there were an estimated 3,325 septic systems in the watershed, and 21 percent, or approximately 700 septic systems were considered noncompliant and overdue for inspection. Clark County Public Health has identified 10 noncompliant septic systems 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 BBC Watershed.

Table 16. Septic system priorities in BBC Watershed.

Watershed Location	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
Lower Watershed (RM 0-5)	527	226	5
Middle Watershed (RM 5-10)	1798	170	1
Upper Watershed (RM 10-13)	1000	304	4
Total septic systems in watershed	3,325	700	10

Clark County Public Health (CCPH) has jurisdiction and regulatory authority over septic systems in the BBC 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 and nutrients that can affect surface water and groundwater quality. Fixing, replacing, and removing septic systems following sewer connection will help eliminate sources of bacteria in the BBC Watershed and help achieve clean water for people, fish, and wildlife.

Septic maintenance is only one part of the equation. If septic systems are sited in areas without adequate separation to groundwater, in excessively draining soils or substrates with limited capacity for adsorption, septic systems may provide inadequate treatment with bacteria, nutrients and other contaminants entering groundwater. Surface waters under the influence of groundwater can also contribute to lateral movement of untreated wastewater from septic systems into waterbodies. The following table describes key septic system numbers in the BBC Watershed.

Table 17. Septic system numbers in the BBC Watershed.

Septic system facts
• 3325 septic systems in BBC Watershed • 347 parcels within 1500 feet of a stream channel in the BBC Watershed have septic systems and have City public sewer available for connection • 100 parcels within 1500 feet of a stream channel in the BBC Watershed have septic systems and are located in the Clark Regional Wastewater District • Around 700 septic systems (21%) need inspections in the watershed • $550 is the average maintenance cost every 5 years • $150 is the average inspection cost • The average cost to connect septic to sewer is approximately $25,000

Clark County Public Health's Role in Sewer Connection

The COV works closely with CCPH, which is the organization that has primary jurisdiction over septic systems in Clark County. If a septic system is failing, CCPH will work with the homeowner to address the system failure. If minor repairs cannot address the root cause of the failure, then CCPH will require connection to municipal sewer if the residence is within 200 feet of a sewer line. However, CCPH does have language in their code for relief from this requirement based on cost to connect versus cost to repair/replace. CCPH has the final authority to determine if septic system repair or replacement is allowed, or if a landowner has to connect to sewer.

Clark Regional Wastewater District

Clark Regional Wastewater District is one of the largest sewer districts in the state of Washington and overlaps with parts of the northern BBC Watershed. The District provides customer focused, professional wastewater services to more than 109,000 people. Clark Regional Wastewater District has a Septic Elimination Program[17] that helps septic owners connect to sewer when available. The District's septic elimination program was developed in 2008 to address the long-standing challenge of aging septic systems in urban neighborhoods. The septic elimination program aims to mitigate long-term environmental risks and provide homeowners a more affordable opportunity to connect to public sewer.

City of Vancouver Sewer Connection Incentive Program

COV Sewer Connection Incentive Program (SCIP) was developed in 1998. The purpose of this program is to improve water quality by incentivizing residents to connect to readily available public sewer infrastructure. SCIP is a part of COV's capital improvements program and is primarily focused on sewer extension. Initial priorities for the SCIP program were providing sewers in areas around drinking water stations and areas near surface water.

[17] https://www.crwwd.com/projects/sep/

It is estimated that 99 percent of areas in BBC have public sewer available. It is expected that there are only a few parcels that do not have sewer available due to parcels initially being vacant or other challenges. At the beginning of the program, priority was given to areas that had a high density of septic systems. Overall, significant progress has been made providing sewer in the COV, but that does not mean that all homes that have direct access to public sewer have taken the opportunity to connect. If a homeowner has a septic system in the COV, and sewer becomes available, sewer connection is voluntary.

The COV shared a SCIP map showing completed, current, and future SCIP areas. All of the "active" and "future" areas on this map are anticipated to be complete by 2026. This does not include the areas labeled for development. COV currently allocates approximately $3 million dollars a year in the capital budget for the SCIP program.

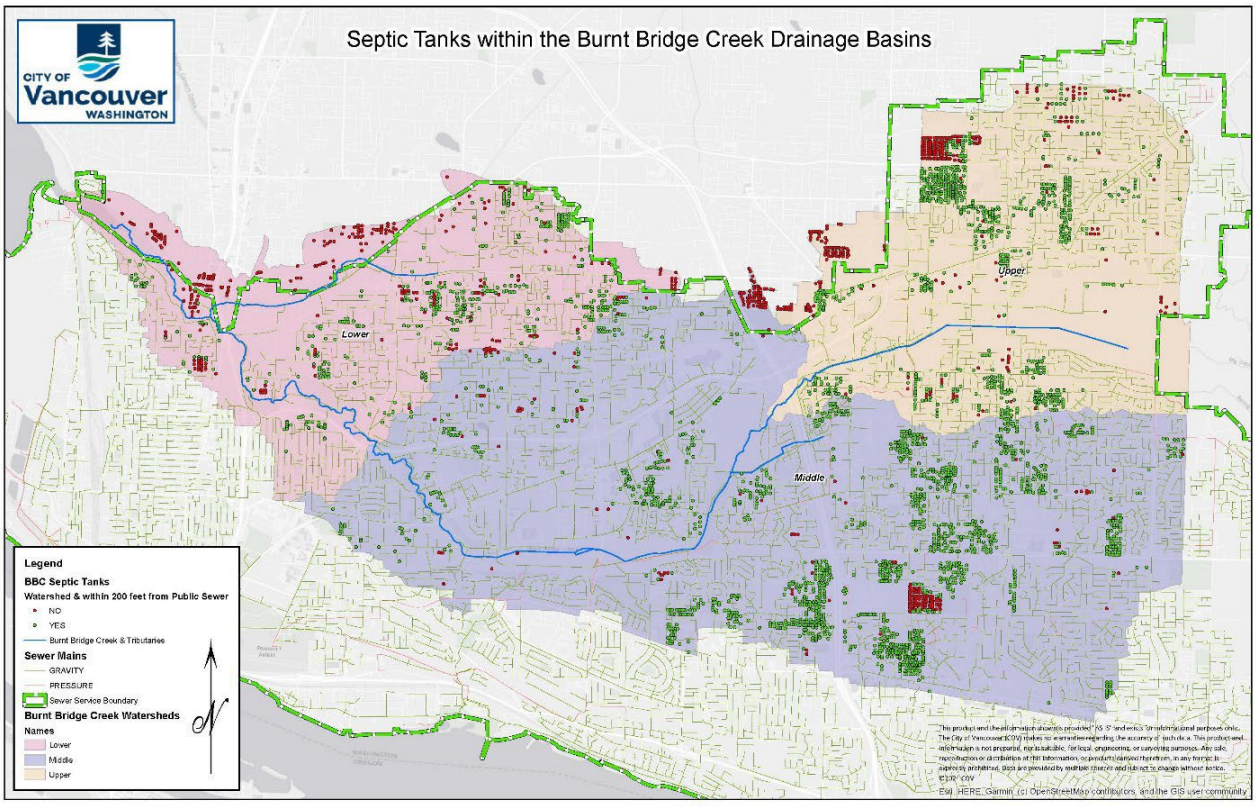


Figure 9. Map of SCIP projects showing complete, active, and future projects in BBC Watershed.

Septic System Inspections and Maintenance

If a homeowner does not connect to sewer and continues to utilize their septic system, COV recommends following CCPH requirements for routine septic system inspection and maintenance. COV relies on CCPH to conduct necessary outreach to septic system owners for inspection and maintenance compliance through mailers, workshops, or other educational methods. CCPH has jurisdiction and enforcement authority for septic systems that are past due for inspections or maintenance and has achieved a 70% compliance rate. Historically, CCPH has

sent past due operations and maintenance notification letters to septic owners and has collaborated with Washington State University (WSU) Extension to host workshops that teach septic owners how to care for their systems. CCPH works with Clark CD to support the Poop Smart Clark Pollution Identification and Correction program, which provides financial assistance to septic owners to incentivize inspections and maintenance. Implementing this program in the BBC Watershed will help increase outreach, technical, and financial assistance to septic owners. Also, on January 1, 2025, Clark County implemented a non-compliance fee for properties that are one year or more past due for inspection.

Identifying septic system age and condition, and any systems that are past due for inspections and maintenance may be a good first step for prioritizing septic system outreach and education. Strengthening established partnerships and increased funding for programs to maintain proactive outreach is one of the main water quality needs in the watershed.

Washington State Department of Health (DOH) requires that septic system inspections be completed every 3 years for conventional systems and annually for all other systems 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 the COV and Clark County. Efforts to require and enforce septic system inspections and maintenance are the first steps to improve water quality. Completing routine maintenance and pumping reduces risk to water resources.

SCIP Education and Outreach

Historically, outreach within the COV SCIP program has been completed to support sewer extension projects when a new sewer line is being constructed. City staff from the SCIP program will host meetings with property owners at the beginning of a project. CCPH is invited to participate and provide information on septic system maintenance and repair, while COV informs homeowners of the opportunity to connect to sewer. If staff from CCPH are not available to attend the meeting brochures on septic system use and maintenance are made available for the homeowners.

COV's long-term goal is to eliminate septic systems and continue to provide incentives to residents to connect to sewer. The SCIP program sends out letters when new public sewer is ready for connection, and again a few months before the guaranteed cost will no longer be available. This is typically about 18 to 20 months following initial availability. The letters also provide information on financing. Further messaging related to sewer connection and septic systems could encourage homeowners to connect to sewer and to provide information on financing. However, if septic owners cannot connect to sewer, or choose not to, education to residents should focus on continuing to inspect and maintain their systems in accordance with local requirements implemented by CCPH.

Priority Areas

According to COV, there is capacity within the sewer system and at the wastewater treatment plant to convey and treat more sanitary waste if additional homes were to connect to sewer. When considering hydrogeological conditions, COV initially focused sewer extension in areas around city water stations, which provide drinking water to COV residents. These neighborhoods were prioritized because surface and groundwater monitoring had shown high concentrations of bacteria. Another priority for focusing sewer connection has been in areas where there are hydric soils and high water tables that are not conducive to septic systems functioning properly.

The Natural Resources Conservation Service maps identify pockets of hydric soils in the Kevanna Park neighborhood located east of the I-205 and south of BBC that may not be able to provide adequate water quality treatment. This neighborhood is located between the mainstem BBC and Peterson Channel. Studies have shown that groundwater in this area generally moves from northeast to southwest, therefore it is likely that septic systems in this neighborhood could contribute pollutant loading to Peterson Channel, Burton Channel, and the mainstem BBC between river miles 8 and 9. These locations are high priorities for bacteria reduction in the watershed and are opportunities for sewer connection outreach.

Sewer Connection Incentive Programs

The COV provides a 20-year financing program for anyone eliminating a septic system by connecting to public sewer. Once public sewer is available, COV provides an incentive for residents to connect within the first 2 years when cost for the sewer main fee is fixed. However, after 2 years the cost will increase to the actual per lot project cost or the fee guarantee that is current at the time of connection, whichever is less. Due to the elapsed time since sewers were constructed, many of the neighborhoods have passed the 2-year incentive period. It may be expensive for septic owners to connect, but they will not be charged more than the cost to build the sewer. When conducting outreach to promote sewer connection, it is essential to have accurate pricing information for different homes across the watershed. It is possible that individual neighborhoods had multiple SCIP projects, and there could be different costs to connect within the same neighborhood.

One of the key messages related to septic systems and sewer connection is that it is less expensive to connect to sewer sooner than later as costs become higher over time. The COV estimates that the average sewer connection cost may be close to $25,000 dollars. The costs that make up this total are associated with the following fees:

1. Sewer main fee (main line and lateral to connect to main)
2. Fee to decommission septic system
3. System development charge (cost to maintain the infrastructure of the system)
4. Plumbing permit
5. Septic permit

It is estimated that $15,000 of the total fee is for construction of the sewer main.

To help alleviate the financial burden that homeowners face when connecting to sewer, COV may be able to utilize grant assistance programs to help private landowners pay for public sewer connection.

https://www.crwwd.com/documents/On average, it costs around $150 to complete a septic system inspection and $550 for maintenance. New septic systems can cost around $24,000 to replace. 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 8.

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[18], 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, Community Development Block Grant 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. Clark County Public Health may be able to leverage this program with other resources to support septic system operation and repairs.

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, nonpoint source pollution investigation, financial and technical assistance, public education and outreach, and implementation of water quality BMPs for source correction. Priorities for PIC

[18] https://www.craft3.org/

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 DOH 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.

Clark Conservation District and Poop Smart Clark - PIC

Clark Conservation District leads the Poop Smart Clark Pollution Identification and Correction program, which promotes and incentivizes septic maintenance through education, outreach, and financial assistance. Poop Smart Clark reimburses septic system owners in Clark County up to $1,130 for inspections and maintenance, directly addressing the financial barrier to maintaining compliant systems. Additionally, Poop Smart Clark provides cost share for major septic repairs, replacements, and sewer connections to correct failing systems in priority areas for water quality improvements, including the BBC Watershed. Since expanding the program area to include BBC in October 2024, Poop Smart Clark reimbursed 51 septic system owners in this watershed, 55% of whom were overdue for an inspection and 64% of which required maintenance.

Clark Conservation District, in partnership with Clark County Public Works, CCPH, and WSU Extension developed the Poop Smart Clark PIC program in 2021. This collaborative program was funded through Ecology's grant program, the Washington State Conservation Commission, USDA Natural Resources Conservation Service (NRCS), and the Lower Columbia Fish Recover Board to address multiple sources of bacteria in Clark County including livestock, human, and canine sources.

Work within this program includes monitoring, source identification, technical assistance, outreach, education, and implementation of livestock and septic BMPs. Tasks associated with the PIC program include completing water quality monitoring, a land use assessment, and

septic system records assessment. Education and outreach efforts including tabling at events, mailers, and door-to-door outreach have helped promote implementation of septic and agricultural projects. The project partners also collaborate on the Canines for Clean Water campaign to promote proper disposal of dog waste. To support septic system correction, a new septic system inspection and maintenance rebate program was developed, as well as financial assistance to support septic system repair and replacement.

To achieve outreach, Poop Smart Clark developed a 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.

Poop Smart Clark has successfully increased septic inspection compliance throughout the county. Future efforts will continue to address bacterial pollution from septic systems,

livestock, and canine sources, with a focus on priority watersheds for bacteria reduction, such as BBC.

Septic System Regulatory Enforcement

Septic systems are regulated through Clark County Public Health which enforces septic system rules and regulations to protect water resources. The COV does not regulate septic systems but does have an active capital program to extend sanitary sewer lines to unserved properties within their service area. Connecting to the public sewer is not mandated by the City and is up to property owners and enforcement efforts by Clark County Public Health.

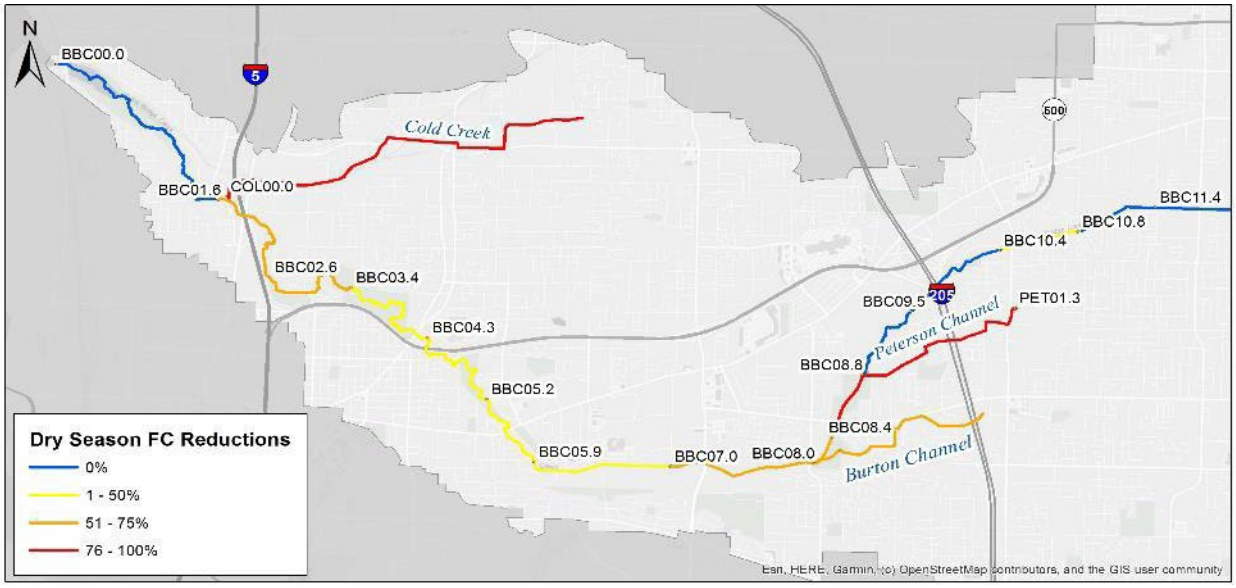


Figure 10. Maps of Fecal coliform reductions needed to meet water quality criteria during the dry season.

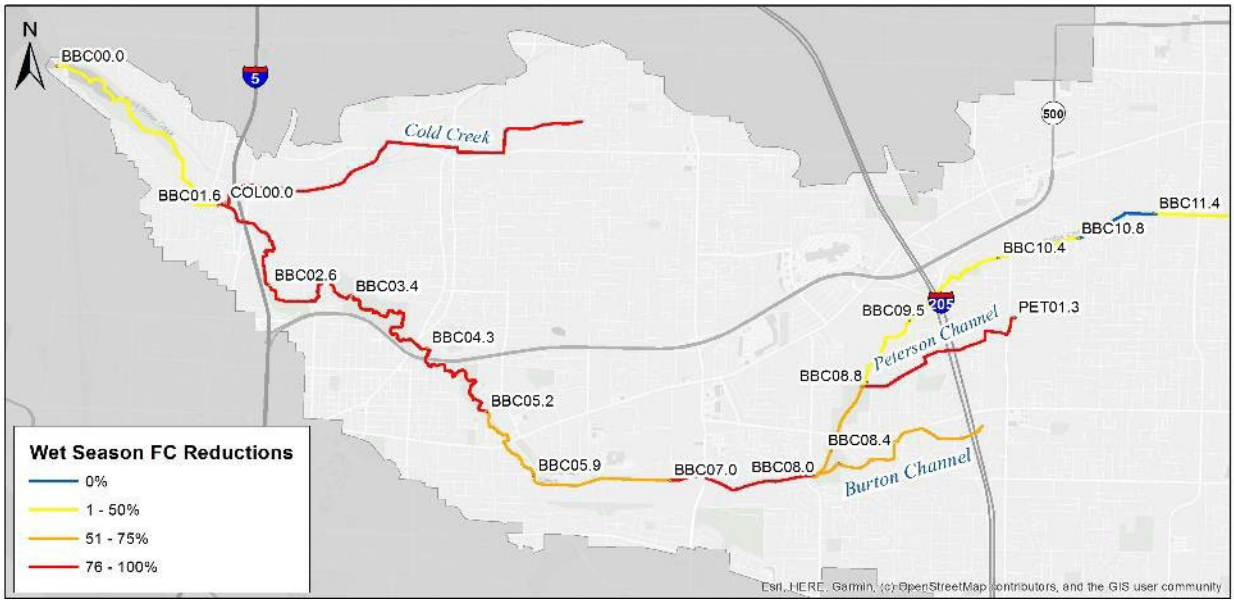


Figure 11. Maps of Fecal coliform reductions needed to meet water quality criteria during the wet season.

Septic System BMP Implementation

To achieve clean water in BBC, meet WQS for bacteria, and support recreational uses, it is necessary to fix, replace, or eliminate failing septic systems to improve water quality. The following implementation tables outline septic system implementation goals, and additional septic system actions needed to achieve clean water in the BBC Watershed. 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 or remove any failing septic systems. To achieve this goal, local organizations should prioritize septic system BMP implementation efforts in the lower and middle watersheds where known bacteria problems exist.

Table 18. Septic system BMP implementation goals.

Implementation Goals
• Eliminate septic system impacts on water quality in the BBC. • 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 lower and middle watershed sections including Peterson Channel, Cold Creek, and Burton Channel. • Prioritize septic system outreach and BMP implementation in the lower and middle watershed (river miles 0 to 10) 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. • When septic systems need to be replaced, enforce sewer connection when available.

Septic Systems – Implementation Actions

Table 19. Septic system implementation actions. Priority 1-3 (1 equals top priority).

SS1	Areas for sewer and septic BMP implementation	Priority 1-3	Stakeholders	Implementation Status
SS1.1	Prioritize sewer and septic system implementation of BMPs to areas with known bacteria problems in the lower and middle watershed. Initial implementation efforts should be targeted to Peterson Channel, Cold Creek, Burton Channel, and river miles 8.4, 2.6, and 1.6. All of these locations have geometric means over 200fu/100ml. Phase 2 implementation should be targeted to river miles 7, 4.3, and 3.4, which need bacteria reductions of over 75% to meet water quality standards.	1	Clark County Public Health City of Vancouver Clark Conservation District Clark Regional Wastewater District	Active and Ongoing

SS1.2	Delineate drainages and sewered areas that may be contributing to lower and middle basin bacteria trends. Identify specific neighborhoods, sewer lining projects, and parcels with potential to impact water quality.	1	Clark County Public Health City of Vancouver Clark Regional Wastewater District	Active and Ongoing
SS2	**Septic systems – inspections and maintenance**			
SS2.1	Complete a septic systems record assessment to confirm which septic systems are draining to priority areas for water quality. These include Person Channel, Cold Creek, and Burton Channel and river miles 8.4, 2.6, and 1.6. All of these locations have fecal coliform geometric means over 200fu/100ml. Phase 2 implementation should be targeted to river miles 7, 4.3, and 3.4, which need bacteria reductions of over 75% to meet water quality standards	1	Clark County Public Health	Not Implemented
SS2.2	Complete a septic system records assessment to identify age, condition, and criticality of septic systems. Identify which septic owners are past due for septic system inspections and maintenance.	1	Clark County Public Health	Not Implemented
SS2.3	Achieve 100 percent septic system inspection and maintenance compliance in the BBC Watershed.	1	Clark County Public Health	Active and Ongoing
SS2.4	Continue conducting outreach and implement a past due operation and maintenance communication effort, with the goal to send mailers to landowners that are past due for septic systems inspection and maintenance. During this effort follow up with door knocking and encourage septic owners to connect to sewer utilizing available financing programs.	1	Clark County Public Health Clark Conservation District	Active and Ongoing
SS2.5	Continue utilizing Poop Smart Clark to implement a septic system rebate program for septic system inspections and maintenance.	2	Clark County Public Health Clark Conservation District	Active and Ongoing

SS2.6	Establish memorandum of understanding between COV, CCPH, Clark Conservation District, and Clark Regional Wastewater District to support and fund septic system inspections, maintenance, and sewer connection in the BBC Watershed; include enforcement mechanisms. The Cold Creek subwatershed is the primary location where Clark County is responsible for septic and sewer related implementation.	1	Clark County Public Health City of Vancouver Clark Conservation District Clark Regional Wastewater District	Not Implemented
SS3	**Sewer connection**			
SS3.1	Encourage all septic system owners who are within 200 feet of a sewer line to connect to sewer.	1	City of Vancouver Clark Regional Wastewater District	Active and Ongoing SCIP Program funded through COV and expanding through ECY Grant 2025
SS3.2	Ensure sewer availability and connection requirements are reviewed for all septic owners who are seeking permits for septic replacement. Provide technical assistance to landowners to decommission septic systems, and financial assistance for landowners to connect to sewer.	1	Clark County Public Health City of Vancouver Clark Regional Wastewater District Clark Conservation District	Active and Ongoing SCIP Program funded through COV and expanding through ECY Grant 2025
SS3.3	Encourage septic owners to participate in financing programs to assist with sewer connection costs. Identify and develop additional financial assistance opportunities, which may include applying for grants to help landowners connect to sewer, implementing a rebate or cost-share program, or developing other tax incentives to encourage homeowners to connect to sewer.	1	Clark County Public Health City of Vancouver Clark Conservation District Clark Regional Wastewater District	Active and Ongoing SCIP Program funded through COV and expanding through ECY Grant 2025 Clark CD – Poop Smart Clark funded through ECY Grant 2025 and Washington State Conservation Commission

SS3.4	Encourage all septic owners to connect to new sewer within 2 years of when it becomes available to take advantage of time-limited financing options.	1	City of Vancouver	Active and Ongoing SCIP Program funded through COV and expanding through ECY Grant 2025
SS3.5	Continue extending sewer into neighborhoods located in priority areas for water quality that do not have sewer available. These include unsewered areas that contribute to Peterson, Burton, and Cold Creek, and river miles 8.4, 2.6, and 1.6.	1	City of Vancouver Clark Regional Wastewater District	Active and Ongoing SCIP Program funded through COV and expanding through ECY Grant 2025
SS4	**Sewer operations and maintenance (O&M)**			
SS4.1	Continue sewer televising and inspection to identify, inventory, and map sewer repair needs, focusing on identifying cracks, leaks or holes in sewer pipes, presence of roots, and issues with manholes. Document priority assets and geographic locations for O&M.	2	City of Vancouver Clark Regional Wastewater District	Active and Ongoing
SS4.2	When necessary, utilize smoke and dye testing to investigate locations with infiltration and inflow, and illicit connections. Identify pipelining candidate project areas.	2	City of Vancouver Clark Regional Wastewater District	Active and Ongoing
SS4.3	Map and develop an inventory of operations and maintenance needs for public sewers in locations contributing to priority areas for water quality improvement. Prioritize implementation of sewer operations and maintenance activities in areas that contribute to those locations.	2	City of Vancouver Clark Regional Wastewater District	Active and Ongoing

SS4.4	Prioritize sewer repairs and capital investments in areas with known bacteria issues in the middle and lower watershed, focusing on sewer assets that are located within 200 feet of the stream, and infrastructure that is located in areas with hydrogeological conditions that may promote pollutant loading, including areas with a high-water table or with excessively well-drained soils.	2	City of Vancouver Clark Regional Wastewater District	Active and Ongoing
SS4.5	Consider opportunities to include "proximity to known water quality concerns" in COV's criticality matrix when prioritizing infrastructure for maintenance, repairs, and capital improvements.	2	City of Vancouver	Active and Ongoing
SS5	**Sewer capital improvements**			
SS5.1	Prioritize sewer capital improvement projects in areas where there are known bacteria issues, specifically focusing on capital projects that will address infiltration and inflow issues, prevent or alleviate backflow or overflow issues, help fix issues with manholes, and improve the lining of sewer systems, especially where laterals and sewer mains connect.	2	City of Vancouver Clark Regional Wastewater District	Active and Ongoing
SS6	**Sewer and septic public education and outreach**			
SS6.1	Develop public education and outreach tools to educate septic owners about the opportunity to connect to sewer, as well as finance options.	2	Clark County Public Health City of Vancouver Clark Regional Wastewater District Clark Conservation District	Active and Ongoing

SS6.2	Complete analysis to understand how much sewer connection would cost for different SCIP projects to provide accurate education and outreach messaging to septic owners.	2	Clark County Public Health City of Vancouver	Active and Ongoing
SS6.3	Provide education on the lifecycle costs of connecting to sewer versus inspecting, maintaining, and replacing a septic system.	2	Clark County Public Health City of Vancouver	Active and Ongoing
SS6.4	Increase education and outreach related to best practices to dispose of fats, oils, and grease in order to help maintain COV's sewer system and prevent sewer clogging. Prioritize outreach to restaurants and other food service businesses.	2	City of Vancouver	Active and Ongoing
SS6.5	Collaborate with Washington State University Extension, CCPH, and Poop Smart Clark to host septic workshops for residents in the BBC Watershed.	2	Clark County Public Health Clark Conservation District	Not Implemented
SS7	**Other**			
SS7.1	Consider opportunities to provide RV pump out programs to manage sanitary waste from unhoused populations.	2	Clark County Public Health City of Vancouver Clark Regional Wastewater District	Not Implemented
SS7.2	Calculate expected bacteria load reductions from septic system decommissioning and sewer connection projects and report to Ecology and EPA.	2	Clark Conservation District	Not Implemented
SS7.3	As a component of the overarching implementation plan effectiveness monitoring, select priority areas for water quality sampling after elimination of numerous priority septic tanks to measure how septic removal and sewer connection impacts water quality.	2	City of Vancouver	Not Implemented

SS7.4	Track implementation of sewer and septic related activities and report progress to Ecology periodically.	2	Clark County Public Health City of Vancouver Clark Regional Wastewater District Clark Conservation District	Not Implemented

Funding and Partnerships for Septic System BMP Implementation

The Department of Ecology provides funding for septic system BMP 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 20. Ecology funding for septic system BMP 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; connection to public sewer; and homeowner education and outreach on the topic of septic system operation and maintenance.

Information on BMP costs can be obtained by contacting Ecology's grant project managers and financial managers. More information on estimated costs to address septic system sources of bacteria are outlined in Chapter 8.

To achieve WQS in the BBC, 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 21. Septic system BMP implementing organizations and partners.

Implementation	Stakeholders
Primary organizations	Clark County Public Health, Clark County Public Works, City of Vancouver, Clark Regional Wastewater District, Clark Conservation District, and Washington State University Extension
Partners	Department of Ecology, Craft3 Regional Loan Program, Discovery Clean Water Alliance, United States Department of Agriculture, and Washington Department of Health.

Chapter 5 – Stormwater Management

Introduction

Surface water runoff is one of the primary sources of bacteria and nutrient pollution in the BBC Watershed. During significant precipitation events, surface water washes across the landscape and impervious surfaces such as roofs and paved areas, saturates soils, and raises water tables. This runoff can accumulate and transport pollutants such as bacteria, herbicides, and automobile toxics via stormwater drains to receiving waters and degrade water quality.

To manage runoff in the urban environment stormwater management plans are implemented annually in each jurisdiction to meet permit requirements and local regulations. Key initial priorities for stormwater management in the BBC Watershed include illicit discharge detection and elimination (IDDE) programs, bacteria source identification and control activities, and comprehensive stormwater management planning.

Priority stormwater implementation efforts to improve bacteria conditions should be focused in the middle and lower watershed, prioritizing Burton Channel, Cold Creek, and Peterson Channel, as well as river miles (RM) 8.4, 2.6, and 1.6 for having dry season bacteria exceedances over 200 cfu/100ml. As a secondary priority, implement stormwater activities and retrofits in areas that need bacteria reductions over 75 percent to meet water quality standards. These include Peterson Channel in the wet and dry seasons, Burton Channel in the wet season, Cold Creek and RM 8.4 in the dry season, and RM 7, 4.3, 3.4, 2.6, and 1.6 in the wet season. The following table outlines stormwater impervious acres in the BBC Watershed.

Table 22. Stormwater impervious surfaces in the BBC Watershed by jurisdiction.

Impervious Surface Jurisdiction	Acres	Percent of total impervious acres
City of Vancouver (tax parcels)	62.02	2.35%
Institutional (Schools / Colleges)	201.12	7.62%
Clark County	59.94	2.27%
Washington Department of Transportation	219.08	8.30%
Private Property	2,097.84	79.46%
Total impervious surfaces	2,640.00	100%

Addressing runoff impacts in the BBC Watershed will require ongoing coordination with local jurisdictions, including the COV, Clark County and WSDOT. The following list summarizes stormwater facts in the BBC.

Table 23. Stormwater facts in the BBC Watershed.

Stormwater facts.
• City of Vancouver operates under the Phase II Municipal Stormwater Permit • Clark County operates under the Phase I Municipal Stormwater Permit • WSDOT implements the Highway Runoff Manual under an NPDES Stormwater Permit • 45% impervious land cover in watershed • 2,640 acres of impervious surfaces • 732 structures within 200' of the waterway • 12.5% population increase in the city from 2010 through 2020

Western Washington Municipal Stormwater Permit

The Western Washington Municipal Stormwater Permits (MS4 Permits) require local governments to manage and control stormwater runoff so that it does not pollute downstream waters. In the BBC Watershed, there are three municipal stormwater permittees, each covered by a different MS4 Permit. Clark County has coverage under the Phase I Municipal Stormwater Permit, which regulates discharges from the most highly populated jurisdictions of the state.

The COV has coverage under the Phase II Municipal Stormwater Permit, which regulates discharges from jurisdictions in urban areas, or those with over 10,000 residents. WSDOT has coverage under the WSDOT Municipal Stormwater Permit for stormwater discharges from state roads and other WDOT managed properties. The Bonneville Power Administration controls over 242 acres of the watershed and as a federal agency is not subject to the state stormwater requirements.

The Municipal Stormwater Permits require implementation of programs to protect receiving water quality. Stormwater program elements include stormwater planning, mapping and documentation, illicit discharge detection and elimination, operations and maintenance, runoff and flow controls for development, source control for existing development, stormwater management for existing development, public education and outreach, and others.

The COV Municipal Stormwater Permit (MS4 Permit) covers approximately 70 percent or 13,030 acres of the BBC Watershed. In addition to the MS4 permit, there are two facilities covered by Industrial NPDES Individual Permits, and eleven facilities covered by the Industrial Stormwater General Permit in the watershed. At the time of the Ecology Source Assessment, there were approximately 45 sites covered by the Construction Stormwater General Permit. The construction stormwater and sand and gravel permits are focused on erosion and sediment control, proper storage of materials, avoiding illicit discharges, and regulating the discharge of suspended solids and pollutants that can cause pH levels unsafe for aquatic species.

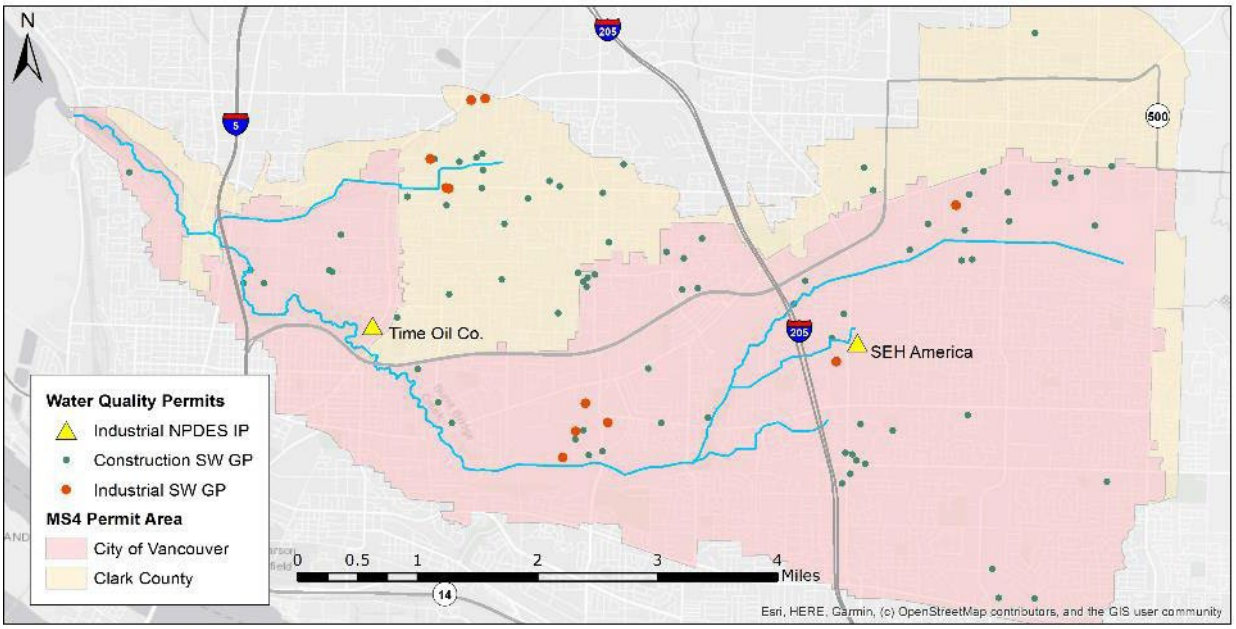


Figure 12. Map of point sources and municipal separate stormwater system (MS4) areas.

Stormwater Jurisdictions and Permits

City of Vancouver

Ecology issued the first MS4 NPDES Phase II Stormwater Permit[19] to the COV in 2007. Reissued approximately every five years, the current permit became effective in 2024. Under the Phase II permit, COV must develop programs to manage stormwater before it discharges to surface water. Permit requirements fall under eight basic categories: stormwater planning, public education and outreach, public involvement and participation, MS4 mapping and documentation, IDDE, the control of runoff from development, stormwater management for existing development, operations and maintenance, and source control for existing development.

The MS4 NPDES Permits require development and documentation of a Stormwater Management Plan (SWMP). The permit requires completion and submittal of an Annual Report to document how the permittee is complying with each section of the permit. These are available on the COV Stormwater Management Plan website[20]. Ecology also has a compliance assurance program[21] to evaluate permittee compliance and assess the clarity and effectiveness of our permit language and requirements.

The COV established a citywide Surface Water Utility in 1996. The utility manages a majority of the

[19] https://ecology.wa.gov/regulations-permits/permits-certifications/stormwater-general-permits/municipal-stormwater-general-permits/western-washington-phase-ii-municipal-stormwater

[20] https://www.cityofvancouver.us/wp-content/uploads/2024/12/2025-Vancouver-Stormwater-Management-Program-Plan.pdf

[21] https://ecology.wa.gov/regulations-permits/compliance-enforcement/municipal-stormwater-compliance-assurance-program

stormwater basins contributing flow to BBC. One significant exception is the Cold Creek tributary, which collects the majority of its flow in Clark County's permitted area. The COV Surface Water Utility is well established with an existing surface water utility rate structure to support stormwater management within city limits.

Washington Department of Transportation

The WSDOT implements its Stormwater Management Program Plan[22] in all Phase I and Phase II areas. WSDOT tracks permit implementation data, including a features inventory with 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 manual, WSDOT has identified BMPs for waterbodies with TMDLs and category 5 listings. WSDOT also has a Stormwater Retrofit Program and Prioritization Web Map[23]. The primary purpose of this web map is for WSDOT planning for prioritizing standalone and opportunistic stormwater retrofit projects for project scoping. WSDOT-maintained roads that potentially impact BBC through stormwater runoff include I-5, I-205, and State Highway 500. WSDOT has active and monitored wetland mitigation sites in the watershed. WSDOT's TMDL Lead may be contacted to request data or to explore partnership opportunities.

Clark County

The Clark County Stormwater Management Plan[24] 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 BBC ARP in detail. Areas in the northern portion of the watershed are covered by the Clark County MS4 permit, including the headwaters of Cold Creek and a small segment of BBC below Cold Creek.

The primary stormwater infrastructure managed by Clark County in the BBC Watershed is composed of roads and ditches. Between 2001 and 2016, impervious surfaces from road infrastructure have increased by 96 acres in the watershed. In the past, Clark County has conducted 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 program reports, Clark County has over 110,000 dogs with the potential to contribute more than 13,000 tons of pet waste in Clark County watersheds each year that can reach surface waters through stormwater runoff. Managing pet waste is a priority for stormwater source control activities in BBC. Installation of pet waste facilities is one BMP to reduce bacteria pollution from Clark County's pets. More about Clark County's Clean Water Program can be found at Clark County Clean Water Program[25].

[22] https://wsdot.wa.gov/construction-planning/protecting-environment/managing-stormwater-state-highways
[23] https://experience.arcgis.com/experience/eb79642c00d74acaa72841bcf3ba22ab/page/About
[24] https://clark.wa.gov/public-works/clark-county-stormwater-management-plan
[25] https://clark.wa.gov/public-works/clean-water-projects

Implementation: Assessments, Activities, and Retrofits

The COV has leveraged many Stormwater Financial Assistance Program grants to implement stormwater improvements in the BBC Watershed. Grants have provided essential funding for stormwater management projects within the city as there is a 5 percent limit on utility rate increases, controlling the primary source of funding for municipal stormwater. Currently, COV has approximately 4 grants for stormwater retrofit implementation. These include projects for assessment and studies, stormwater activities, and facility retrofit projects. COV has also received grants through the Lower Columbia Fish Recovery Board, to evaluate stormwater outfall conditions in BBC. The project inspected and documented overall conditions, developed a list of outfalls to prioritize for improvements, provided recommendations for instream habitat improvements, and conceptual designs to improve drainage areas contributing to the outfalls.

COV has been completing stormwater assessments in the BBC Watershed on a subbasin-by-subbasin basis. Peterson Channel has benefited from significant stormwater water quality improvement projects through a series of grants. Four SFAP grants funded road retrofits, low impact development infrastructure, and monitoring. However, there are still areas in the Peterson Channel basin that provide opportunities for stormwater retrofits, including areas that receive runoff from the WSDOT I-205 drainage. Incorporating retrofit opportunities, identified through the subbasin assessments, into COV's long-term Capital Improvement Plans (CIP) for stormwater projects will support future funding requests.

When Ecology reissued the MS4 Permits in 2024, the Stormwater Management for Existing Development (SMED) program requirement was added to the Phase II MS4 Permit. The SMED program requires COV to invest in stormwater facility retrofits or other tailored stormwater management actions (such as enhanced IDDE or O&M operations) to control or reduce stormwater discharges from a specified number or acres based on the jurisdiction's population. For the COV 25 acres need to receive additional stormwater treatment in this 5-year permit cycle. The SMED program encourages permittees to implement the actions identified by their Stormwater Management Action Plan (SMAP)[26], which was a new planning requirement in the 2019 Permit. Together the SMAP and SMED programs set minimum levels of planning and investment efforts in reducing pollutant discharges from MS4 systems.

Illicit Discharge Detection and Elimination

Illicit Discharge Detection and Elimination (IDDE) activities are required through the COV's stormwater permit. IDDE implementation has historically prioritized inspecting businesses to evaluate potential risk for pollutants to contaminate stormwater runoff. COV also has focused IDDE efforts in drinking water resource protection areas, and on businesses storing or managing hazardous material. COV utilizes established IDDE guidance manuals to identify indicators of illicit discharges. They also incorporated IDDE methodology into the outfall condition assessment funded by LCFRB.

Each year, COV focuses on inspecting half of all outfalls, covering all city outfalls in a two-year

[26] https://apps.ecology.wa.gov/publications/documents/2410027.pdf

cycle. Visual outfall screening utilizes IDDE protocols and incorporates this data in an asset management system. To implement IDDE programming, the COV completes dry weather visual screening of outfalls, but water quality monitoring and source tracing is rarely needed to track potential sources upstream in the stormwater system as visual indicators are not often found. Field screening methods and procedures are followed in accordance with the IDDE Guidance Manual. Cross connections have typically been found by visible or odor indicators, or through the COV's infrastructure televising program.

On average, COV estimates it responds to and investigates 100 to 150 complaints each year. Some have been related to illicit discharges and cross connections which are subsequently eliminated, along with any unauthorized discharges discovered, as required under the City's MS4 Permit. The stormwater team works with the sewer and building departments throughout the correction and enforcement process. Although there is no financial assistance available to correct an illicit connection, the sewer department has occasionally been able to provide financial support to landowners when the sanitary sewer is found to be connected to the MS4.

If stormwater discharges that transport bacteria over natural background levels are found from sources within WSDOT's right-of-way and control, WSDOT will apply WSDOT Municipal Stormwater Permit best management practices (BMPs) from their Stormwater Management Program (SWMP) to eliminate the bacteria source. For run-on sources of bacteria identified by WSDOT that are from outside of WSDOT's right-of-way, WSDOT will notify Ecology and work cooperatively with Ecology, the local jurisdiction, and other parties involved for their resolution.

There is an opportunity to align and prioritize IDDE implementation in areas with greater bacteria issues; however, the COV does not currently prioritize areas with bacteria pollution issues for IDDE work but has conducted microbial source tracking monitoring to identify specific bacteria sources (such as human, dog, avian, cow) in stream reaches. Bacteria in stormwater discharges from nonpoint sources in urban areas does not constitute an illicit discharge. Therefore, proactive efforts to remove sources of bacteria are implemented through Source Control requirements described below.

Source Control

With recent source control requirements included in the current Phase II Municipal Stormwater Permit, COV is expanding the Water Resource Protection program focus from prioritizing only businesses with hazardous materials to assessing every property with a parking lot as a potential source of pollution. In developing the source control program, COV has focused on the source control inventory of sites and purchased software to implement tracking and inspection.

To support the project, the COV conducted a windshield survey of properties with the "potential to pollute" to document any pollution issues observed in the field. Approximately 8,200 businesses were included in the windshield survey when staff looked for sources of pollution and focused on industry types identified in the Stormwater Management Manual for Western Washington with the highest risk for pollution. Businesses managing grease, or with exterior storage on site, have been identified as a high priority for inspection. Businesses and

land use that have the potential to contribute bacteria and nutrients should also be prioritized for source control inspections.

An evaluation of stormwater monitoring data from the National Stormwater Quality Database characterized associated pollution from specific urban land uses. The mean concentrations of FC bacteria (MPN/100 mL) discharge via stormwater by land use category indicated that residential land use had the highest observed FC concentrations followed by the average of all land uses combined, then by commercial, open space, industrial, and freeways land use/land code. Potential sources of bacteria in residential settings include:

- Power washing
- Excessive irrigation and overspray
- Car washing
- Pool or hot tub filter backwash
- Domestic pets
- Recreational vehicles
- Trashcans
- Domestic pet waste (exacerbated by excessive irrigation)
- Illicit graywater connections
- Domestic sanitary sewer overflows from Fats, Oils & Grease (FOG)

Bacteria can be directly deposited into waterways or transported by stormwater conveyances. Bacteria may persist outside of the originating host much longer in sediment, biofilms, and organic litter than in the water column. Therefore, sediment and organic litter entrained or mobilized by stormwater represents an important source of bacteria pollution. Further, naturalized bacteria populations may increase as an environmental source from biofilms, organic matter, or sediments. The National Stormwater Quality Database provides a review and summary of pollution sources that may originate from both point- and nonpoint sources, some of which occur the BBC Watershed:

- Encampments
- Outhouse or porta-potties
- Dumpsters
- Recreational vehicles—RVs, campers, or illegal dumping
- Garbage trucks
- Outdoor dining
- Restaurant grease bins
- Restaurant or bar washdown areas
- Green waste, compost, or mulch
- Animal-related business (veterinarians, dog daycares, pet stores) and facilities (animal shelters, dog kennels)

Private Stormwater Facilities

COV has a private stormwater facilities inspection program and has developed an inventory of these facilities. It is estimated that there are approximately 1,400 private water quality treatment or flow control structures throughout the jurisdiction and that 50 percent of these structures are deficient and do not meet engineering or performance standards. COV is providing technical assistance to private facility owners through site visits, contractor education, providing engineering drawings, and by completing annual inspections for any facility with a direct discharge to surface waters or the MS4. The City has developed a protocol which prioritizes facilities for inspections and technical assistance based on deficiency severity and maintenance needs.

The COV is currently working with homeowner associations (HOAs) and multifamily property managers to implement phased maintenance on private facilities. Overall, HOAs are more complex to work with compared to multifamily properties due to challenges with routine rotations of leadership within the HOA. If there is not a contracted property manager associated with the facility, then outreach is normally completed by HOA boards, but this is often difficult due to board turnover. The City can compile a list of private stormwater catch basins that discharge to the creek and provide a discount card for cleaning to remove resident bacteria in sumps. Additionally, the City can investigate private stormwater facilities that attract geese and other waterfowl to encourage planting of native shoreline plants that discourage geese from roosting and pooping in surface waters and on hard surfaces that discharge to the creek.

The long-term vision for COV is to connect private stormwater facility education with source control education, and to engage with HOAs early in their establishment. When private facilities are not maintained or repaired, the City has enforcement mechanisms in place to require correction. However, there are no financial resources available to assist HOAs, and HOAs are responsible for maintenance and repairs on their private property. Increasing enforcement efforts on private facilities in residential areas may result in better compliance with requirements, improved maintenance, and decreased deficiencies.

Stormwater Operations and Maintenance Activities and Locations

The COV's stormwater Operations and Maintenance (O&M) team consists of 26 staff, with 11 additional members on the Greenway Sensitive Lands (GSL) team. Activities completed by stormwater O&M staff include street sweeping, vactoring, flushing, and infrastructure televising. Keeping sweepers functional and on the road is one of the biggest challenges for COV's O&M program. Staff also complete annual facility maintenance, outfall inspections, and maintenance repairs.

Implementation of sediment and erosion control practices at City projects are also completed through stormwater O&M staff. The GSL/O&M teams are also primarily responsible for maintenance and stewardship on the BBC Greenway, including tree planting, mowing, irrigation, and invasive species management.

A key objective of the stormwater O&M and GSL teams is to meet the terms and conditions of the MS4 Permit by completing inspections on a significant number of assets and implementing a wide array of operational BMPs. While the COV does not prioritize specific geographic locations for implementation of O&M, they focus on completing maintenance on certain asset types. One opportunity to have a greater impact for improving water quality is to prioritize implementation of maintenance activities in geographic areas with known water quality issues. Prioritizing locations with low dissolved oxygen, high bacteria levels, and pH exceedances is a good first step to aligning O&M with water quality issues and align with new Phase II NPDES Stormwater Permit requirements. Most of these areas are located in the middle and lower watershed, and in Peterson Channel, Cold Creek, and Burton Channel.

Traditionally the City's stormwater maintenance program has focused on slow draining areas and areas with dry wells. For example, one specific area is the Hearthwood neighborhood where the majority of stormwater runoff is infiltrated into perforated pipes and dry wells. The original assets are now reaching the end of their useful life, and while repairs have been made, some assets are starting to fail. Although the City maintains, sweeps, flushes and cleans the assets, replacement will eventually be needed. As this area has excessively draining soils, there may be an opportunity to implement water quality treatment BMPs to prevent pollutant loading to groundwater. The City's long-term goal is to complete a study of the Hearthwood neighborhood to develop a retrofit plan. These targeted activities can support other efforts to improve water quality throughout the watershed.

Balancing Retrofits and Maintenance

One challenge going forward is balancing the installation of new stormwater facility retrofits with sufficient staffing levels to conduct stormwater maintenance. To achieve this balance, COV is focusing on implementing the right BMP, in the right place, for the right purpose. Incorporating anticipated maintenance needs into retrofit planning may help the COV better prepare for future stormwater O&M. Rate Studies have been conducted, and future rate increases will be needed to meet required maintenance for stormwater facilities and BMP's.

Public Education and Outreach

COV has signed an interlocal agreement with the Stormwater Partners of Southwest Washington to implement regional education and outreach programming. This is the first formal funding structure for the Partners and while it's focused on municipal permit requirements, leveraging these resources and dovetailing jurisdictions will create a more seamless message and integrated customer experience. The Work Plan for the Partners includes the permit requirements as well as complimentary programming with non-governmental organizations across the region like the Follow the Water campaign.

Other outreach and education efforts include EPA funding for a "Wash Right" campaign focused on the proper use of disinfectants and power washing practices targeted at the downtown area. COV also completed a farmer's market education effort and has collaborated with the Parks Department's special events team to incorporate educational information into farmer's

market vendor handbooks. The goal is to develop a centralized spill kit for Esther Short Park and

Columbia Tech to help manage spills associated with events and food trucks. More detailed information on COV's education and outreach is included in Chapter 7 – Public Education and Outreach.

Pet Waste

For pet waste management, COV provides educational signage and maintains pet waste stations in community parks and throughout the BBC greenway trail system. Messaging for this effort is supported by the regional Canines for Clean Water program to educate pet owners on proper practices for pet waste disposal. The Canines for Clean Water Program is administered by Clark County.

Impervious Surfaces

The COV collects a stormwater drainage fee that is based on impervious and hard surfaces. The City calculates impervious surfaces in GIS, with the exception of single family residential properties which are charged a set fee. This information can be used to prioritize the most densely impervious subbasins for implementation of stormwater activities and facility retrofits. Completing an analysis of the impervious area densities in drainage areas that contribute to priority areas for water quality may help identify neighborhoods, roads, and commercial areas for implementation of stormwater best management practices.

Schools and Artificial Turf

One challenge that Vancouver and other communities are facing is the conversion of sports fields from natural turf grass fields to artificial turf. It is not clear if these areas have adequate water quality treatment installed. Materials used to make artificial turf are often associated with emerging contaminants of concern like micro plastics, PFAS and 6PPD, which have been identified as harmful pollutants in our ecosystems, negatively impacting water quality, aquatic life and human health. Ecology and local jurisdictions would like to see school districts implementing adequate structural and operational BMPs to manage stormwater runoff from

artificial turf to protect water resources.

Table 24. Impervious surfaces in BBC Watershed by river mile section.

Impervious Surface Jurisdiction	Impervious acres in lower watershed (RM 0-5)	Impervious acres in middle watershed (RM 5-10)	Impervious acres in upper watershed (RM 10-13)
City of Vancouver	7.06	52.46	2.5
Institutional (Schools / Colleges)	22.18	165.27	13.67
Clark County	42.54	14.69	2.71
Washington Department of Transportation	48.54	136.21	34.33
Private Property	227.82	1,490.94	379.08
Total impervious surfaces	348.14	1,859.57	432.29

Table 25. Impervious surfaces in BBC Watershed by tributary

Impervious Surface Jurisdiction	Impervious acres Cold Creek	Impervious Acres Burton Channel	Impervious Acres Peterson Channel
City of Vancouver	0	0.57	0
Institutional (Schools / Colleges)	0	0	0
Clark County	17.07	0	0
Washington Department of Transportation	1.35	1.16	1.22
Private Property	7.55	0.26	3.26
Total impervious surfaces	25.97	1.99	4.48

City of Vancouver Stormwater Implementation

The following projects have been recently implemented in the BBC Watershed.

- **NE Fourth Plain Blvd East Orchards (North)**- The COV is improving the water quality in BBC through the installation of filter media cartridges and bioretention facilities along the north side of NE Fourth Plain Blvd corridor between 127th and 131st Avenues. This project will provide treatment for total suspended solids (TSS), bacteria, fertilizers, heavy metals such as copper and zinc, dissolved phosphorus, and oil/grease. Infiltration for this project will improve the water quality of BBC subsurface baseflow in addition to protecting the COV's drinking water aquifers[27]. Total cost for this project is $964,900.
- **NE Fourth Plain Blvd East Orchards (South)**- The COV is improving water quality in BBC through the installation of filter media cartridges and bioretention facilities along the south side of NE Fourth Plain Blvd corridor between 127th and 131st Avenue. This

[27] https://www.cityofvancouver.us/government/department/public-works/drinking-water/drinking-water-source/

project will provide treatment for total suspended solids (TSS), bacteria, fertilizers, heavy metals such as copper and zinc, dissolved phosphorus, and oil/grease. Infiltration for this project will improve the water quality of BBC subsurface baseflow in addition to protecting the COV's drinking water aquifers. Total cost for this project is $933,800.

- **NE Ross Street LID Retrofits**-NE Ross Street LID Retrofits improved the water quality of BBC by implementing low impact development (LID) BMPs such as bioretention facilities. This project provided treatment for TSS, bacteria, fertilizers, dissolved zinc, dissolved copper, and total phosphorus. This project also reduced direct discharge to BBC by increasing stormwater infiltration. The total cost for this project was $984,000.
- **Burton Channel Green Retrofit Project-** Burton Channel Green Retrofit Project implements bioretention and filter catch basin BMPs to improve the water quality of Burton Channel which is a contributing channel to BBC. This project provided conceptual designs for water quality treatment through filtering TSS, bacteria, fertilizers, dissolved zinc, dissolved copper, and total phosphorus. Infiltration facilities were constructed to provide flow control treatment. Total cost of Burton Channel Green Retrofit Project is $198,000.
- **Fourth Plain Central-** Fourth Plain Central Subbasin is a 787-acre catchment area that drains directly into BBC via two outfalls. The subbasin is located between SR-500, E Fourth Plain Blvd, Falk Rd, and NE Andresen Rd. The COV is improving the water quality of BBC by implementing filter catch basins and bioretention facilities along Fourth Plain Central. This project provides water quality treatment by filtering TSS, bacteria, fertilizers, dissolved zinc, dissolved copper, and total phosphorus. Infiltration facilities will be implemented to provide flow control treatment. Total cost of this project is $2,165,000.
- **Burnt Bridge Creek Outfall Survey**- The COV conducted an impact assessment for the stormwater outfalls that drain directly into BBC. The impact assessment evaluated 95 stormwater outfalls and identified 11 stormwater outfall sites where restoration and/or water quality retrofits can be targeted to improve riparian conditions and aquatic life. The total cost of the project is $149,940.

Stormwater Management Implementation

To achieve clean water in BBC, and meet WQS, it is necessary to address water quality impacts from stormwater. The following implementation tables outline goals and actions to achieve a high level of stormwater management in the watershed through the implementation of IDDE and bacteria source control activities. To achieve this goal, local organizations should prioritize stormwater treatment efforts in lower and middle watersheds where known bacteria problems exist, and in subwatersheds where impervious land cover exceeds 10 percent. Technical and financial assistance should be provided to develop and implement stormwater best practices in the most critical water quality areas.

Table 26. Stormwater BMP implementation goals.

Implementation goals
• Prioritize stormwater BMP implementation in the lower and middle watershed and subwatersheds of Peterson Channel, Burton Channel and Cold Creek with impervious surfaces over 10 percent. • Achieve a high level of stormwater management in BBC 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 BBC 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 IDDE programs, minimizing stormwater impacts on water in BBC. • Ensure permitted jurisdictions, WSDOT (Phase I), COV (Phase 2), and Clark County (Phase I) prioritize the BBC for implementation of stormwater BMPs, programs, and projects.

Stormwater – Implementation Actions

Table 27. Stormwater BMP implementation actions. Priority 1-3 (1 equals top priority).

SWM1	Areas for stormwater BMP implementation	Priority 1-3	Stakeholders	Implementation Status
SWM1.1	Prioritize stormwater BMP implementation efforts to improve bacteria conditions in the middle and lower watershed, prioritizing Burton Channel, Cold Creek, and Peterson Channel, as well as river miles (RM) 8.4, 2.6, and 1.6 for having dry season fecal coliform bacteria exceedances over 200 cfu/100ml. As a secondary priority implement stormwater activities, and retrofits in areas that need bacteria reductions over 75% to meet water quality standards. These include Peterson Channel in the wet and dry seasons, Burton Channel in the wet season, Cold Creek and river mile 8.4 in the dry season, and river miles 7, 4.3, 3.4, 2.6, and 1.6 in the wet season.	1	City of Vancouver Clark County WSDOT	Active and Ongoing BBC is a SMAP priority City of Vancouver is exceeding stormwater expectations
SWM1.2	Focus nutrient source control efforts to river miles 5.9, 7, 9.5, and 11.4. Prioritize stormwater BMP implementation to improve dissolved oxygen conditions at these locations.	1	City of Vancouver Clark County	Not Implemented BBC is a SMAP priority
SWM1.3	Prioritize and enforce construction stormwater BMP implementation in Burton Channel and at areas contributing to river mile 0 to improve pH.	2	City of Vancouver Clark County	Not Implemented BBC is a SMAP priority

SWM1.4	Prioritize implementation of stormwater infiltration BMPs at river miles 0, 5.9, and 7 to help reduce the highest temperatures in BBC, by promoting groundwater recharge and increasing streamflow. Efforts to reduce imperviousness and increase urban green space may also help reduce thermal loading from impervious surfaces.	1	City of Vancouver Clark County	Not Implemented BBC is a SMAP priority
SWM2	**Stormwater retrofits and capital improvements**			
SWM2.1	Incorporate proximity to impaired surface water into COV's criticality matrix when prioritizing stormwater retrofits in asset management and capital improvement programs.	1	City of Vancouver Clark County	Active and Ongoing BBC is a SMAP priority
SWM2.2	Implement structural and non-structural stormwater BMPs to manage runoff from impervious surfaces. Prioritize implementation of BMPs on pollutant generating surfaces, directly discharging to BBC from pollutant generating land use types, businesses, and activities.	1	City of Vancouver Clark County	Active and Ongoing BBC is a SMAP priority
SWM2.3	Complete mapping to delineate drainage areas contributing to priority areas for water quality in BBC. Conduct land use, landcover and jurisdiction analysis of drainages to identify and prioritize stormwater retrofit opportunities.	1	City of Vancouver Clark County	Active and Ongoing BBC is a SMAP priority
SWM2.4	Incorporate results from the subasin studies completed in Burton Chanel and Peterson Channel into COV's Capital Improvement Program. Prioritize implementation of projects that will help improve water quality in priority areas of BBC.	1	City of Vancouver Clark County	Active and Ongoing BBC is a SMAP priority

SWM2.5	Collaborate with Clark County to complete a basin study of Cold Creek to identify retrofit opportunities to improve water quality.	1	City of Vancouver Clark County	Not Implemented BBC is a SMAP priority
SWM2.6	Continue SMAP impervious surface assessment of drainage areas contributing to priority areas for water quality. Prioritize neighborhoods, and roads with the greatest percentage of impervious area for implementation of stormwater retrofits. Identify roads, commercial and industrial areas, schools, sidewalks, public buildings, and parking lots that present opportunities for stormwater retrofits.	1	City of Vancouver Clark County	Active and Ongoing BBC is a SMAP priority
SWM2.7	Preserve and restore natural areas to promote infiltration, restore streamflow, and increase groundwater recharge, to help provide sources of cool groundwater inputs to BBC.	1	City of Vancouver Clark County	Active and Ongoing BBC is a SMAP priority
SWM2.8	Collaborate with Clark County and WSDOT to implement stormwater retrofits in the BBC Watershed. When possible, identify publicly owned priorities and road right-of-ways to implement stormwater best management practices.	1	City of Vancouver Department of Ecology	Not Implemented BBC is a SMAP priority
SWM2.9	Implement stormwater BMPs that promote steady infiltration. Avoid detention and ponding BMPs that can contribute to warm water temperatures.	2	City of Vancouver Clark County	Active and Ongoing BBC is a SMAP priority

SWM2.10	Continue permit-required audit of local codes, ordinances, and standards to identify opportunities to improve local codes to encourage adoption of low impact development in new development and redevelopment projects. When possible, reduce building setbacks, and parking lots sizes, and increase vegetation area and root zone requirements.	2	City of Vancouver Clark County	Active and Ongoing BBC is a SMAP priority
SWM2.11	Conduct outreach to require HOAs to implement retrofits of private facilities that are deficient and do not meet engineering or performance standards. Approximately 50 percent of the 1,400 facilities are deficient and not meeting standards. Continue to provide technical assistance to private facility owners through site visits, and by completing annual inspections. Prioritize facilities in drainage areas contributing to known water quality impairments. Continue enforcement of private facility maintenance and retrofit requirements in residential areas.	1	City of Vancouver Clark County	Active and Ongoing BBC is a SMAP priority
SWM2.12	Develop and enforce operational and structural stormwater requirements for schools, sports complexes, businesses, and private landowners that have installed artificial turf to replace natural areas.	1	City of Vancouver Clark County	Not Implemented

SWM3	Illicit discharge detection and elimination			
SWM3.1	Continue to implement IDDE in subwatersheds that have known bacteria impairments, focusing first on areas with dry season impairments, which include Burton Channel, Peterson Channel, and Cold Creek, river miles 8.4, 2.6 and 1.6.	1	City of Vancouver Clark County	Active and Ongoing BBC is a SMAP priority
SWM3.2	Continue to conduct dry weather screening for illicit connections using the most recent Illicit Connection and Illicit Discharge Field Screening and Source Tracing Guidance Manual.	2	City of Vancouver Clark County	Active and Ongoing BBC is a SMAP priority
SWM3.3	Implement monitoring and source tracing in areas with known bacteria issues to identify and trace pollution issues in BBC. This may include pollution identification and correction efforts and microbial source tracking upstream from outfalls, into COV's infrastructure and manholes.	2	City of Vancouver Clark County	Active and Ongoing BBC is a SMAP priority
SWM3.4	Prioritize implementation of infrastructure televising, smoke testing, and dye testing in Burton Channel, Peterson Channel, and Cold Creek, and at river miles 8.4, 2.6 and 1.6.	3	City of Vancouver Clark County	Not Implemented BBC is a SMAP priority
SWM3.5	Develop interlocal agreement between COV and Clark County to complete IDDE work in Cold Creek subbasin. Develop an interlocal agreement to hold WSDOT accountable to complete IDDE work on infrastructure owned by WSDOT.	1	City of Vancouver Clark County WSDOT	Not Implemented BBC is a SMAP priority

SWM4	Source control			
SWM4.1	Continue implementation of source control requirements in the BBC Watershed. Develop a source control inventory that prioritizes businesses and land uses that have the greatest potential to contribute bacteria and nutrients to BBC.	1	City of Vancouver Clark County	Active and Ongoing BBC is a SMAP priority
SWM4.2	Focus implementation of pet waste BMPs at parks, along trails and greenways, and other public areas in subwatersheds with wet and dry season bacteria issues. Prioritize the placement of pet waste facilities in public parks and along trails and greenways. Where possible, implement native shorelines and vegetation to deter geese from surface water.	1	City of Vancouver Clark County	Active and Ongoing BBC is a SMAP priority
SWM4.3	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.	1	City of Vancouver Clark County	Active and Ongoing BBC is a SMAP priority

SWM4.4	Educate the community on best practices for local yard waste disposal such as picking up clippings and organic materials and promote operational yard debris diversion and disposal options to prevent bacteria and nutrient loading to surface waters.	1	City of Vancouver Clark County	Active and Ongoing BBC is a SMAP priority
SWM4.5	Prioritize street sweeping efforts in Burton Channel and areas contributing to river mile 0. Reduce sediment-loading contributing to pH issues in Burton Channel.	2	City of Vancouver	Active and Ongoing BBC is a SMAP priority
SWM4.6	Work with Royal Oaks Golf Club to implement operational and structural source control efforts to reduce nutrient loading and herbicide application.	1	City of Vancouver	Active and Ongoing BBC is a SMAP priority
SWM5	**Public education and outreach**			
SWM5.1	Collaborate with Clark County and the WSDOT, and the Stormwater Partners for Southwest Washington, to develop and implement stormwater education activities in the BBC Watershed.	1	City of Vancouver Department of Ecology	Active and Ongoing BBC is a SMAP priority
SWM5.2	Prioritize the placement of dog waste stations in the BBC Watershed. Utilize Canines for Clean Water for public education and outreach. Establish relationships with business that provide pet waste removal services. Partnerships with local veterinarians, groomers, pet boarding, shelters, pet stores, and dog licensing should also be explored to educate on water quality.	1	City of Vancouver Clark County	Active and Ongoing BBC is a SMAP priority

SWM5.3	Prioritize stormwater source control outreach for bacteria and nutrient pollution to areas with known water quality problems. This includes the middle and lower watershed for bacteria pollution, and the middle and upper watershed for dissolved oxygen impairments. Provide source control education and outreach focused on BMPs to reduce bacteria pollution from solid waste and septic systems and increase education on best practices for fertilizer and pesticide application and lawn care to improve dissolved oxygen levels and balance pH.	1	City of Vancouver Clark County	Not Implemented BBC is a SMAP priority
SWM5.4	Prioritize pollution prevention education that focuses on bacteria and nutrient reduction practices for pet waste, lawn care, and humans.	1	City of Vancouver Clark County	Active and Ongoing BBC is a SMAP priority
SWM5.5	Continue to implement the Wash Right Campaign, Pollution Prevention at Home, and construction site pollution prevention programs in the BBC Watershed. Continue to implement spill response education, outreach, and resources for COV's Special Events team, including resources for COV's farmer's market.	1	City of Vancouver Clark County	Active and Ongoing BBC is a SMAP priority
SWM5.6	Continue to develop education and outreach programs for HOAs focused on private stormwater facility maintenance, and best practices for pesticide and fertilizer application, and other pollution prevention activities.	1	City of Vancouver Clark County	Active and Ongoing BBC is a SMAP priority

SWM5.7	Increase placement of stormwater medallions on catch basins and increase labeling and signage in neighborhoods to help COV residents learn what they can do to protect clean water, and how individual actions on private property and at the neighborhood level are connected to the creek.	2	City of Vancouver	Not Implemented BBC is a SMAP priority
SWM5.8	Educate the public on IDDE, source control, and how to submit an Statewide Environmental Reports Tracking System (ERTS) complaint if they observe a pollution issue.	2	City of Vancouver Clark County	Active and Ongoing BBC is a SMAP priority
SWM5.9	Provide required education to contractors and plumbers on proper installation of stormwater and wastewater infrastructure, to prevent challenges with cross connections. Collaborate with the Southwest Washington Contractor's association or other partners to develop and implement education.	1	City of Vancouver Clark County	Not Implemented BBC is a SMAP priority

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 28. 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 BBC, 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 8. The following organizations are working on stormwater related issues in the watershed.

Table 29. Stormwater implementation organizations and partners.

Implementation	Stakeholders
Primary organizations	Clark County Clean Water Division, Washington Department of Transportation, City of Vancouver.
Partners	Clark Conservation District, Washington State University, Stormwater Partners for Southwest Washington, Clark County Public Health, and Washington State Department of Ecology.

Chapter 6 – Riparian Restoration

Introduction

The riparian corridor of BBC encompasses areas located within 100 to 150 meters of the creek. Approximately 36 percent of the riparian area is pastureland, 19 percent is developed, and 45 percent is a mix of riparian forest with varying tree heights and densities. The COV has invested a significant amount of time and money into protecting and conserving land in riparian areas by establishing the BBC Greenway, which is an 8-mile conservation area located downstream of I-205.

Overall, the system potential tree height for BBC Watershed is 41 meters or approximately 135 feet, based on 100-year average values. The overhang potential of trees, which is related to the amount of shade a tree can produce, is 4.1 meters or approximately 13.5 feet.
The system potential riparian forest density that could be achieved in the stream corridor, where soil and hydrologic conditions allow, is 85 percent. Some stream reaches cross through substrates that historically supported only wetland and meadow ecosystems.

Listed below is a summary of vegetation height and density in the BBC riparian corridor.

Table 30. Vegetation or land use in the BBC riparian corridor.

Vegetation or Land Use Type	Vegetation Height (m)	Vegetation Density	Fraction of Overall Area
Water	0	-	4%
Developed and paved	0	-	19%
Pasture	0.2	75%	36%
Golf course, scattered trees	22	25%	4%
Extra small trees	4	25-75%	1%
Small trees	10	25-75%	11%
Medium and large trees, low density	14-19	25%	2%
Medium and large trees, medium density	14-19	50%	6%
Medium and large trees, dense	14-19	75%	19%
Extra-large trees, very dense	27	85%	2%

Shade Deficit Analysis

Shade deficit is the difference between the amount of shade possible, i.e. system potential shade and the actual shade at a location, i.e. system effective shade. A shade deficit analysis of the mainstem of BBC was completed in the Burnt Bridge Creek Source Assessment to identify priority locations for tree planting projects. Overall, the upper watershed located between RM 10 to 13 had the highest average shade deficits in the watershed, followed by the middle watershed located between RM 5 to 10. The following table summarizes results from the shade deficit analysis.

Table 31. Average shade deficits in BBC Watershed

Portion of Watershed	Average shade deficit
Upper watershed: RM 10-13	62 percent
Middle watershed: RM 5-10	39 percent
Lower watershed: RM 0-5	27 percent

There are three different priority areas for increasing riparian shade, lowering water temperatures, and improving dissolved oxygen levels in the watershed. All the river miles with shade deficits over 30 percent are priorities for restoration.

Table 32. Priorities for increasing shade and improving water quality

Priority area #1	River miles with shade deficits over 50 percent • RM12-13 = 87% shade deficit • RM 7-8 = 83% shade deficit • RM11-12 = 73% shade deficit
Priority area #2	River miles with shade deficits over 30 percent • RM 8-9 = 44% • RM 0-1 = 43% • RM 4-5 = 36% • RM 6-7 = 35% • RM 1-2 = 31%
Priority area #3	• River miles 0.0 for the highest water temperature and river miles 5.9 and 7.0 for most number of days above temperature criteria. • River miles 9.5 to 11.4, 7.0, and 5.9 for the most noncompliant days for dissolved oxygen.

A shade deficit analysis was not completed for the BBC tributaries: Cold Creek, Peterson Channel, and Burton Channel. Completing a shade deficit analysis or survey for these tributaries will be important to support future restoration and improvement of water quality.

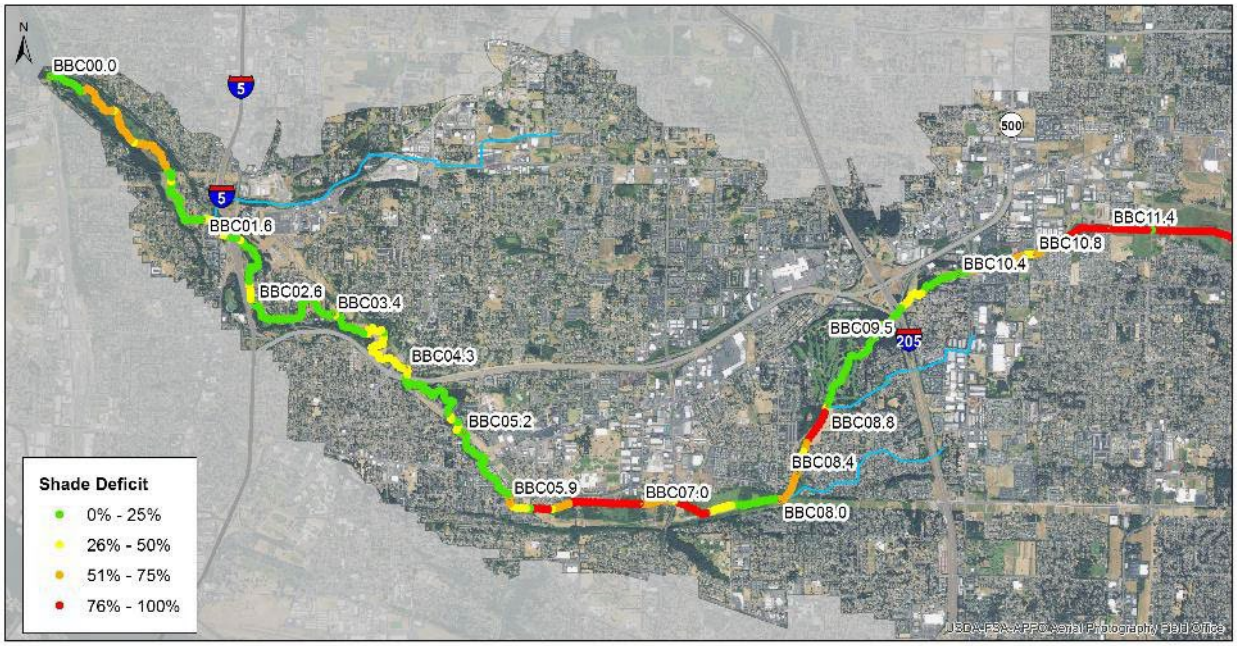


Figure 13. Map of shade deficit along BBC.

Riparian Restoration Efforts

The Burnt Bridge Creek Greenway Trail

The COV has created an 8-mile recreational trail and greenway along the BBC mainstem. The COV's Greenway restoration project created significant riparian shade and habitat in the BBC Watershed, while continuing to serve as a critical infrastructure corridor for public utilities including stormwater, wastewater, drinking water, and electric utilities. As of 2021, it is estimated that 600,000 trees and shrubs have been planted in the greenway and 10,000 cubic yards of invasive species have been removed. Restoration of the greenway began in 2005. A 3-mile stretch in the middle watershed was transformed through the BBC Greenway Improvement Project. This $11 million investment added water quality treatment through stormwater ponds and restored wetlands in the riparian corridor. Priority areas for future tree planting projects have been mapped by the COV and can be referenced in the Source Assessment Report. Current restoration efforts are focused on the COV owned property downstream of river mile 1.6, between Alki Road and the Stewart Glen trailhead. Funding for ongoing management and restoration within the Greenway is provided through the COV's stormwater utility.

Lower Columbia Estuary Partnership

The Lower Columbia Estuary Partnership (LCEP)[28] restores and protects habitat between Bonneville Dam and the mouth of the Columbia River and has implemented several restoration

[28] https://www.estuarypartnership.org/

projects on BBC. With European settlement in the 1880s, and even into the 1990s, the region lost more than 50 percent of its floodplain habitats which were predominantly drained and cultivated for agriculture or developed. Since 2000, the Estuary Partnership and its regional partners have restored or protected more than 28,387 acres along the Columbia River and its tributaries, supporting iconic salmon runs, migrating waterfowl, and other wildlife. These restoration projects also protect nearby landowners from flooding, sequester carbon to mitigate climate change effects, and often improve recreation opportunities.

LCEP has been working in partnership with the COV to restore riparian and floodplain habitat in the BBC Watershed. Grant funding from Ecology and the Lower Columbia Fish Recovery Board (LCFRB) will advance an additional 40-acre restoration project in the lower basin through the design and permit processes to a shovel-ready state by the end of 2026. The project is expected to improve water quality and fish habitat just upstream of the creek's confluence with Vancouver Lake.

Friends of Trees

Friends of Trees[29] is a non-profit organization dedicated to inspiring community stewardship of the urban forest by bringing people together in the Portland-Vancouver area to plant, care for and learn about city trees. Friends of Trees has been planting trees in the COV since the early 2000's. The Friends of Trees model does more than simply plant a tree at a Vancouver resident's house. They plant the right tree, the right way, in the right location with community support. Friends of Trees also engages with that property owner several times throughout the process, enabling staff and volunteers to share the benefits of trees and educate them about the importance of trees. Friends of Trees also offers the property owner an opportunity to engage hands-on with the community asset, the tree that will be planted in front of their home. This often leads to stronger community connections and civic involvement, and knowledge of the benefits, how to care for and grow a healthy urban forest. Through its grassroots efforts, Friends of Trees forms partnerships with local governments, businesses and property owners, and recruits and trains volunteers to keep urban forests flourishing. Friends of Trees focuses its planting efforts adding trees to transportation corridors and residential yards. Friends of Trees plants more than 500 trees and prunes more than 200 street trees annually throughout the COV.

Watershed Alliance of Southwest Washington

The Watershed Alliance had a successful history working with private landowners in the BBC Watershed through the Project Restore Program through 2025 when the organization closed its doors due to lack of funding. Project Restore was a public and private partnership funded by the COV to improve water quality in BBC, by assisting creek side property owners to remove invasive plants, improve bank stability, and increase tree canopy and native vegetation on their properties.

The goal of the program was to improve water quality in BBC and its tributaries within the COV

[29] https://friendsoftrees.org/

limits by creating and maintaining a healthy riparian corridor along the entire length of the creek. Their strategy focused on establishing and maintaining relationships with private landowners, including those in residential, commercial, industrial zoned areas. The COV has an ongoing program managed by the Greenway and Sensitive Lands Team to restore the riparian areas on publicly owned properties along BBC. Project Restore was designed to fill the gap with an effort to restore native vegetation on private properties.

In addition to project Restore, the Watershed Alliance implemented the Backyard Habitat Certification program, which provides incentives to private landowners to restore native habitat on their properties. This program is now jointly run by Columbia Land Trust and Bird Alliance of Oregon and will continue to be administered in Clark County.

The Watershed Alliance also implemented a small grant program with funding for neighborhood improvement projects, such as tree plantings. Additionally, they hosted tree planting events and litter cleanups, conducted outreach to neighborhood associations and school groups, and hosted community-wide planting events. To date, the Watershed Alliance planted over 83,000 native trees and shrubs and cleared invasive species while engaging over 8,000 volunteers in the restoration efforts. It is the hope of stakeholders that riparian restoration programs that were once facilitated by the Watershed Alliance will be brought to life again in the future.

Clark Conservation District

Clark Conservation District works with individuals and communities to conserve and manage natural resources through education and voluntary conservation practices. Through its pilot

Urban Forestry Program, Clark CD planted over 550 trees in county parks, right of ways, and on private lands throughout the BBC watershed in early 2025. This success has led to additional funding for tree plantings and riparian restoration projects in the Cougar Creek watershed in partnership with Friends of Trees. More broadly, Clark CD's riparian programming supports water quality, fish and wildlife habitat, and promotes native plants through personalized technical and financial assistance. Clark CD’s very successful Free Tree Program provided over 4,400 free plants to streamside residents in 2024 and 2025, with plans to distribute another 5,000 plants by 2027. These efforts increase shade cover, reduce water temperature, and support overall water quality on public and private land in the BBC Watershed and other Clark County watersheds.

Ecology Funding for Implementation

The Department of Ecology has funded multiple water quality projects in the BBC Watershed through the Water Quality Combined Funding Program. With Ecology’s support, the following nonpoint source projects have been undertaken in the BBC Watershed since 2019. These projects have all enhanced or preserved riparian buffers that address temperature impairments in the watershed.

- **Burnt Bridge Creek Stormwater OSPREY Project (2019-2021)** – The Lower Columbia Estuary Partnership (LCEP) established a native riparian forest on three acres of BBC floodplain, while providing comprehensive stormwater education to 24 classes from

nearby schools. LCEP engaged students and parents in native tree plantings at the site. The goal was to restore the site to the healthy, self-sustaining, bottomland hardwood and wetland forest, by planting 6,000 native trees and shrubs. The project increased student and parent knowledge of stormwater and clean water interactions and built a stewardship ethic that facilitates long-term protection and sustainability of the site through direct citizen engagement and behavior change. The total project cost was $147,178.67.

- **Lower Columbia River Estuary Enhancement Project (2019-2021)** – LCEP is improving water quality in tributaries of BBC by restoring approximately three acres of riparian area and reducing temperature and stormwater runoff in the watershed. The project also included 20-25 public outreach events involving community volunteers and students in site preparation, riparian plantings, vegetative monitoring, and maintenance. The total project cost was $264,000. Additional phases of this project have been implemented through other funding sources.
- **Burnt Bridge Creek Water Quality, Education, and Restoration Project (2023-2025)** - In addition to the projects already completed, LCEP recently initiated an additional riparian restoration project on COV property near Alki Road, in the lower BBC Watershed. This project added an additional 7,200 plants to three acres of floodplain habitat in the lower watershed, downstream of river mile 1.6. This project will help restore the floodplain area between Alki road and Stewart Glen trailhead, which is a priority restoration area for the COV.
- **Burnt Bridge Creek Property Acquisition** – The COV has recently conducted three land acquisition projects in the BBC Watershed. All three of these projects have preserved riparian acres along BBC for restoration to maximize water quality benefit.

Clark Public Utilities District

Clark Public Utilities District[30] (CPUD) has a small jurisdiction in the BBC Watershed. Cold Creek is the primary waterway within this jurisdiction. Much like its name, Cold Creek is cooler in temperature than other waterways in the watershed. Flowing through a highly urbanized area, natural vegetation is significantly lacking along the tributary. BBC would benefit from riparian restoration efforts in this basin. To date CPUD has not implemented any riparian restoration projects in the watershed.

Washington Department of Transportation

WSDOT[31] has six mitigation sites within BBC Watershed. One is active, four are closed, and the Arnold Park site was turned over to the COV for long-term management. These sites were established over the last twenty years to compensate for wetland and riparian impacts of various projects along the SR 500 corridor. They encompass 34 acres of currently protected wetland and riparian habitat in the BBC floodplain. Overall, mitigation performed by WSDOT includes 16 acres of wetland creation, restoration and enhancement (mostly scrub-shrub or

[30] https://www.clarkpublicutilities.com/
[31] https://wsdot.wa.gov/

forested wetland), and 18 acres of woody wetland buffer and riparian corridor preservation and restoration. These projects provide water quality and habitat functions, including stream shading, biofiltration, and storage.

City of Vancouver

City of Vancouver's[32] goal is to improve and increase tree canopy throughout the watershed as part of a comprehensive watershed approach to improve the watershed which includes both the riparian zone (lowland zone) and the rest of the watershed (upland zone). COV recognizes the major watershed benefits of a healthy urban forest. A thriving urban forest provides a clean and sustainable environment that assists in improving water quality regardless of where the trees are located in yards, along streets and riparian zones. Capitalizing on the shared, common mission, the COV integrated Urban Forestry into the city's Surface Water Management efforts to advance a more comprehensive watershed approach. The City of Vancouver's Urban Forestry program[33] aims to maximize the environmental, social, and economic benefits that trees provide to COV residents and visitors. Through this program, the COV has set a goal to reach 28 percent tree canopy citywide by 2047. In 2023, there were approximately 6,604 acres of tree canopy, over 29,998 total land acres. COV's Urban Forestry Program manages urban tree canopy as a cohesive system. The program focuses on tree preservation, reforestation, and stewardship in the community, with the goal to create community stewards of the forest and natural environment. Increasing urban tree canopy is also one of COV 's green infrastructure strategies to help manage stormwater runoff in BBC. By planting trees, COV hopes to reduce peak stormwater flows, alleviate community flooding, and reduce water pollution.

For residential planting, COV focuses on planting street and yard trees with property owner support and participation. The COV collaborates with Friends of Trees to implement tree-planting projects in residential areas focusing on transportation corridors and road rights-of-ways. In upland areas, COV focuses plantings on public property such as parks and schools. The City also collaborates with private property owners, business, and churches to plant trees in upland areas.

One challenge within the urban forestry program is completing long-term maintenance of trees planted on private property, specifically in overburdened communities. The COV currently completes maintenance on private property plantings for five years. In year six, the private property owner becomes responsible for maintenance of the established trees. Developing resources to support long-term maintenance is necessary to support survival and long-term health of the growing urban tree canopy.

The COV has different tree canopy targets for different zoning designations. To promote reforestation and protect existing trees planting, COV has a tree vegetation and soil conservation ordinance. The City also encourages developers to preserve trees where feasible, and if trees are impacted during construction projects, the COV requires replanting to achieve a

[32] https://www.cityofvancouver.us/

[33] https://www.cityofvancouver.us/government/department/public-works/urban-forestry/

tree density per acre requirement. If the tree plantings cannot be achieved on site, the City charges a cost of $850 per tree unit not planted on the development site, which is paid into a COV managed tree fund.

One of the Urban Forestry Program's biggest projects in 2021 was to complete a tree canopy assessment study, which is completed every 5 to 10 years. The results of the report and data indicated that the COV had 19 percent urban tree canopy cover and 32 percent possible planting area, not including any surface water bodies within the COV. An updated tree canopy study will be completed in 2026 with additional analyses related to stormwater management and water quality improvement through increased tree planting and preservation.

In 2023 Vancouver adopted an updated Urban Forestry Management Plan. The 2007 Urban Forestry Management Plan helped guide Vancouver to make strategic improvements over the last 15 years with support from both internal City stakeholders as well as the greater community. The updated 2023 Urban Forestry Management Plan identifies strategic actions to work towards in the next 5 years, 10 years and beyond with community input and support, including:

- Identify and create plans to address inequities in our tree canopy
- Review tree data, plans, policies and other available data
- Plan for an equitable, climate resilient tree canopy in the future
- Provide a roadmap to achieve a shared vision for the future of Vancouver's trees

The purpose of the updated 2023 Urban Forestry Management Plan was to recommend direction and actions for Vancouver to optimize the benefits of trees by envisioning an equitable, climate adaptive, integrated, and sustainable approach to managing the city's urban forest resources over the next twenty-five years. The Urban Forestry Management Plan includes: a comprehensive analysis of the current state of Vancouver's urban forest; a discussion of existing management structures and policies; a summary of community outreach activities and feedback; a vision for the future; and goals and action items to support the realization of the vision. The final plan and technical report are available on Urban Forestry's website.

Future Land Acquisition

One of the biggest challenges with restoring the remaining riparian areas in BBC and achieving urban forestry canopy goals is that most properties bordering the stream are privately owned. Limited funding for property acquisition, increasing property prices, and dwindling availability of undeveloped land are key factors restricting riparian conservation efforts. Acquiring and conserving additional property within the BBC Greenway corridor and in upland areas would enable the COV to expand its conservation areas and tree planting projects. The primary source of funding available to support land acquisition is generated by local utilities, which are paid by ratepayers. COV's City Council adopted a 5 percent cap on rate increases for utilities, which limits the funding available for stormwater, water, sewer, greenways, and land acquisition.

As of now, the COV does not have a strategic property acquisition plan for acquiring additional properties for conservation. Any land acquisition occurs opportunistically as properties and funding become available. Developing a strategic land acquisition plan or vision for the COV, specific to water quality protection, may help support future acquisition of critical areas for conservation and restoration.

Instream Restoration

COV has not completed a watershed wide assessment or planning exercise to identify areas that are priorities for instream restoration, streambank stabilization, floodplain reconnection, or wetland restoration. The COV is interested in pursuing these types of projects to help address water quality impairments, but recognizes this would require a multi-year assessment, design, engineering, and permitting process. To implement a larger planning process, COV would most likely rely on partnerships and grant funding to complete the assessment and design work necessary to identify and implement instream restoration projects.

COV has completed a stormwater outfall assessment, which identified opportunities to improve stream habitat and restore vegetation around stormwater outfalls. Developing a more comprehensive strategy for improving instream conditions may be an important next step to reduce water temperatures in BBC. Most of the opportunities for these types of projects are located downstream of I-205, and specifically downstream of river mile 8. Privately owned wetlands located in the upper watershed may also provide opportunities for landowners and partners to implement riparian restoration activities that go beyond tree planting and shade to help lower water temperatures.

Bonneville Power Administration (BPA)

Much of the BBC Greenway is located underneath BPA's electricity transmission lines. Under these transmission lines, COV is not allowed to plant trees taller than 10 feet. This 10-foot maximum tree height applies to areas 150 feet from the center conductor, which is 75 feet on each side of conductor infrastructure. The presence of electrical utilities in the greenway creates barriers for full restoration and prevents the ability to achieve system potential tree height on the greenway to maximize effective shade. The tallest native plant COV has planted in the greenway is Red Osier Dogwood, which can achieve a height of 20 feet; however, the BBC Source Assessment estimates that the maximum tree height that can be achieved in the watershed is approximately 135 feet. The paved walking path in the greenway also provides some constraint for planting minimum recommended buffer widths in the watershed, which are 215 ft. Ideally BPA would provide funds for riparian restoration to help mitigate for elevated temperatures impairing water quality in BBC through the BPA corridor. The BBC Partnership may utilize collaborative efforts to work with BPA in mitigating impacts while continuing to protect the utility infrastructure.

The Bonneville Power Administration also owns more than 242 acres of land along Cold Creek, east of I-5 and the confluence with Burnt Bridge Creek. There may be opportunities in this area for restoration and riparian improvements. Ideally, BPA would fund restoration improvements to mitigate for temperature impacts at their Ross Complex, the largest industrial service hub. Collaborative efforts will need to include Clark County where they have jurisdiction over most of

the Cold Creek watershed.

Public Private Partnerships

As of now, COV is not receiving any funding from SEH America or Bonneville Power Administration, which are entities that have impacts on water temperature and the ability to mitigate negative water quality impacts in the BBC Watershed. The BPA powerlines align with BBC's riparian corridor for long stretches. Plant height restrictions under BPA powerlines limit tree species utilized in greenway restoration efforts.

In the past, the Port of Vancouver has contributed funding for planting street trees on development projects. Opportunities to establish public-private partnerships for tree planting may help generate more funding to support restoration in the future.

Maintenance Challenges

Another long-term challenge within the urban forestry and greenways programs is balancing the implementation of new plantings with increased maintenance needs. The primary focus of COV's Urban Forestry and Greenways maintenance crews are pruning young trees, root zone management, treating invasive species, and irrigation to ensure survival.

To reduce maintenance needs, COV uses mulch in their site preparation for weed suppression. The use of mulch also helps promote water retention and reduces the need to spray herbicide. Once the mulch breaks down, COV eventually introduces vegetative cover to planted areas.

Another challenge COV is facing in the Greenway is managing impacts from unsanctioned houseless encampments. Some encampments have damaged tree plantings and limited recovery in restored areas. COV wants to ensure the public views the greenway as a beautiful natural area, and there are some public concerns about blight, litter, and safety in the Greenway. Vancouver's municipal code prohibits camping and outside habitation within 200 feet of mainstem BBC, Burton Channel, Peterson Channel and the Burnt Bridge Creek drainage area from East Fourth Plain Boulevard to Vancouver Lake. Cleaning up garbage from the houseless population and replanting trees and shrubs has increased restoration maintenance costs.

Education and Outreach

COV fosters robust community education and outreach efforts through the Vancouver Water Resources Education Center, Urban Forestry, various organized outdoor and environmental volunteer programs, and in collaboration with the Lower Columbia Estuary Partnership, Columbia Springs, Friends of Trees, and other nonprofit organizations. More information on education and outreach for Urban Forestry is included in the Public Education and Outreach Summary.

Upper Watershed

In the upper watershed, opportunities to enhance riparian areas adjacent to BBC should be explored, as well as the utilization of wetland areas to facilitate groundwater recharge. The

COV has accepted ownership and maintenance of several wetland mitigation sites in the upper watershed, which were developed to mitigate impacts of private development projects. One resource in this basin is a privately owned mitigation bank; the 113-acre Wetland Terrace Mitigation Bank is approved for mitigation use in Clark County. The bank's goal is to establish, rehabilitate, and enhance wetland functions, as well as improve channel complexity to BBC. Just downstream of this site, an undeveloped, light-industrial zoned area includes significant wetland acreage. The area has hydric soil characteristics and a high-water table that makes the area undevelopable. The land is currently held in private ownership, and some developers are looking at this area for wetland enhancement and mitigation.

Middle Watershed

Within the middle basin, Peterson Channel is a high priority for temperature reduction. This channel is impacted by warm water discharge from SEH America and from the lack of riparian vegetation on privately owned properties bordering the channel. While some parcels along Peterson Channel have been planted through Project Restore, others have not. These private parcels are harder to plant because the homes are close to the creek and parcels are mostly built out, with little space available to incorporate buffers for the stream.

In the middle watershed, there have been multiple volunteer tree plantings at Meadowbrook North, which is located near the confluence of Peterson Channel and BBC. Currently the open meadow is informally used as a neighborhood dog park, and the riparian buffer area has been planted. Meadowbrook North was previously considered for an extensive restoration project and in collaboration with SEH the City met with Ecology to determine if the creation of thermal mitigation wetlands could be permitted to establish temperature offsets downstream of their outfall. Ecology was unable to approve mitigation downstream in the watershed and the plan was not moved forward. SEH has pursued other options to reduce temperature in their discharges to Peterson Channel.

Upstream of Meadowbrook is the Royal Oaks Country Club and golf course. Royal Oaks developed an environmental stewardship plan that outlines the structural and operational BMPs implemented at the golf course and how they are applying fertilizer and herbicides to minimize migration into water resources. The BBC mainstem flows through the golf course and Peterson Channel flows near the southern border to its confluence with BBC. Exploring restoration opportunities on properties downstream from I-205 could potentially be used to identify projects that help manage WSDOT's stormwater from I-205.

Lower Watershed

In the lower watershed, before its confluence with Vancouver Lake, the creek fans out and deposits sediment carried in the stream from erosional processes upstream. Erosional and depositional changes along the course of the stream in the lower reach can present challenges for tree survivability but also opportunities to improve the stream's complexity and connection to the floodplain. The lower watershed also has constraints from built infrastructure, including BPA power lines, the paved BBC trail, and sewer infrastructure in the riparian area and crossing

the creek. The confluence of Cold Creek with BBC is within a large WSDOT wetland mitigation area next to Hazel Dell Avenue. A significant length of the stream crosses through BPA's Ross Industrial Complex, which is federally owned, providing barriers to water quality improvement efforts by other organizations. Cold Creek is within Clark County's jurisdiction; therefore, COV is unable to plan or implement projects in that basin.

Currently, the COV is focusing plantings on river miles 0 to 1.6 between the Stewart Glen Trailhead and Alki Road. The north side of the property is harder to access, but approximately 200 to 300 feet of trees are being planted with 75-foot buffer widths on the north side of BBC. There is approximately 2,000 feet of shoreline on the south side available for planting. COV is working in collaboration with the Lower Columbia Estuary Partnership in the floodplain of the lower reach to address erosion challenges and to stabilize shorelines during seasonal flooding at this site.

Although the middle and upper watershed have higher shade deficits, restoring the riparian area between river mile 0 to 1.6 presents a significant opportunity for COV to not only plant trees, but to also implement instream restoration activities that would help maximize benefits for stream temperatures. To implement a larger scope of work in this area, assessment, design, and engineering has been undertaken by the Lower Columbia Estuary Partnership utilizing grant funds. Completing a more robust assessment to identify instream restoration opportunities within the floodplain may help maximize benefits to water temperature.

Land Conservation

Clark County Legacy Lands Program

Clark County's Legacy Lands Program[34] 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 several acres of conservation areas in the BBC Watershed. 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 the COV and the Columbia Land Trust on conservation and acquisition projects.

[34] https://clark.wa.gov/public-works/legacy-lands-program

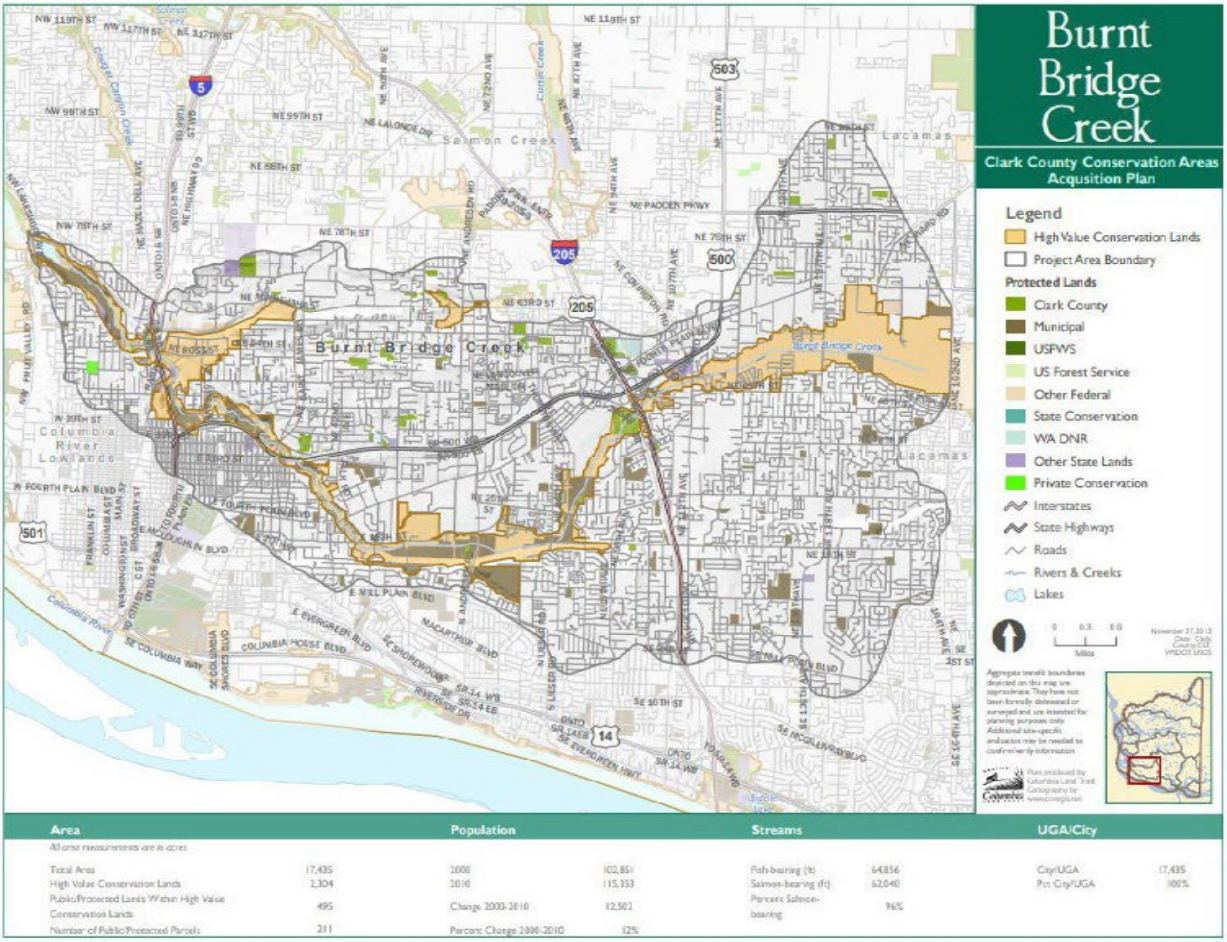


Figure 14. High value conservation lands along BBC.

Columbia Land Trust

The Columbia Land Trust[35] 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 Columbia Land Trust has supported Clark County and COV in looking into acquisition projects in the watershed.

Additionally, the Land Trust has also collaborated with the Portland Audubon Society (now the Bird Alliance of Oregon) 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 could potentially be utilized in the BBC Watershed to promote private lands riparian restoration projects.

Clark Conservation District Small Forest Land Stewardship

The Regional Conservation Partnership Program 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 between 2019 and 2020 through this 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

[35] https://www.columbialandtrust.org/

Riparian Restoration Implementation

Ecology recommends fully forested riparian areas that are one site potential tree height at 200 years in width. In western Washington, the standard recommended buffer width is 215 ft (65.5 meters) on both sides of the stream. In cases where implementing the recommended 215 ft buffer is not feasible, Ecology recommends implementing alternative riparian management zones that will provide sufficient shade and help reduce nonpoint source pollutants.

Examples of situations where it may not be feasible to implement Ecology's preferred recommendation to fully restore the Riparian Management Zone (RMZ) include but are not limited to the presence of structures and infrastructure (e.g., roads, railways, pipelines, powerlines and other utilities), property lines, topography constraints, and small parcels.

Riparian Restoration Recommendations

- Establish fully forested riparian zones 215 ft. in width wherever possible.
- Where it is not feasible to restore full riparian habitat functions (i.e., a fully forested riparian area of 215 ft. in width), implement an alternative riparian zone. Alternative options are described below.
- For agricultural lands where a 215 ft. riparian zone is not feasible, implement the alternative riparian zone widths and applicable best management practices outlined in the Voluntary Clean Water Guidance for Agriculture[36] including additional recommendations for implementing alterative riparian management zones.
- Protect existing riparian areas and enhance them to as needed to meet width recommendations or improve health and functions.
- For locations with the absence of forest potential due to stream adjacent wetlands, follow Ecology's guidance for protecting and managing wetlands Wetlands in Washington State - Volume 2[37].

Alternative riparian restoration option

The following are recommended minimum riparian zone widths that should be implemented if a fully restored riparian zone is deemed infeasible. Core zones are areas closest to the streambank and should be fully forested and restored and/or protected to provide shade and reduce nonpoint source pollution from adjacent land uses. Core zone widths are based bank full width and their hydrologic category (ephemeral, intermittent or perennial) and are measured from the ordinary high-water mark.

[36] https://apps.ecology.wa.gov/publications/documents/2610045.pdf
[37] https://apps.ecology.wa.gov/publications/documents/0506008.pdf

Table 33. Alternative Riparian Restoration Widths

Stream Category	Ephemeral	Intermittent and Perennial	Intermittent and Perennial	Intermittent and Perennial	Intermittent and Perennial
Bank full Width	All widths	<5 ft.	5-30 ft.	30-150 ft.	>150 ft.
Core Zone Width	35 ft.	65 ft.	80 ft.	100 ft.	125 ft.

To achieve clean water in BBC, meet WQS for temperature, and support aquatic life uses, it is necessary to restore riparian areas and implement restoration projects that increase riparian shade. The following implementation tables outline goals and actions for riparian forest and native vegetation restoration in BBC Watershed. The long-term vision is to achieve system potential riparian vegetation of 85 percent tree canopy cover in BBC by achieving site potential tree height in riparian areas where soil and hydrologic conditions allow. Some reaches of the stream cross through substrates that historically supported wetland and meadow ecosystems and may be revegetated with select native species to maximize shade cover to the stream. To achieve this temperature reduction goal, riparian restoration projects should be targeted to areas with the highest shade deficits, starting with the middle and upper watershed.

Riparian Restoration – Implementation Actions

Table 34. Riparian restoration implementation actions. Priority 1-3 (1 equals top priority).

RR1	Priority areas for riparian restoration and greenways implementation	Priority 1-3	Stakeholders	Implementation Status
RR1.1	Prioritize restoration of urban forest and greenways in areas with the highest average shade deficits. This includes the upper watershed located between river miles 10 and 13, and middle watershed located between river miles 5 and 10.	1	City of Vancouver Clark Conservation District Lower Columbia Estuary Partnership	Active and Ongoing ECY led a stakeholder watershed tour to discuss riparian restoration challenges and solutions

RR1.2	Prioritize initial phase implementation to areas with shade deficits over 50 percent. These areas are located in the upper and middle watershed and specifically include the following locations and shade deficits: RM 12-13 = 87%, RM 7-8 = 83% and 11-12 = 73%.	1	City of Vancouver Clark Conservation District Lower Columbia Estuary Partnership	Active and Ongoing
RR1.3	Prioritize second phase implementation to areas with shade deficits over 30 percent. These areas are located in the middle and lower watershed and include the following locations and shade deficits: RM 8-9 = 44%, RM 0-1 = 43%, RM 4-5 = 36%, RM 6-7 = 35%, and RM 1-2 = 31%.	1	City of Vancouver Clark Conservation District Clark County Lower Columbia Estuary Partnership	Active and Ongoing
RR1.4	Target implementation to the lower and middle watershed, specifically to basin areas contributing to river miles 0, 5.9, and 7.0 to help reduce warm water temperatures in the watershed.	1	City of Vancouver Clark Conservation District Lower Columbia Estuary Partnership	Active and Ongoing
RR1.5	Target implementation to basin areas contributing to river miles 9.5 to 11.4, and at 7.0, and 5.9 to help improve dissolved oxygen levels. These are located in the middle and upper watershed.	1	City of Vancouver Clark Conservation District Lower Columbia Estuary Partnership	Active and Ongoing
RR2	**Greenways and sensitive lands**			

RR2.1	Increase tree canopy in the BBC Greenway to help lower water temperatures. Currently, approximately 45 percent of the greenway is a mix of varying tree heights and densities. Prioritize phase 1 implementation to areas with shade deficits over 50 percent and phase 2 implementation to areas with shade deficits over 30 percent.	1	City of Vancouver Clark Conservation District Lower Columbia Estuary Partnership	Active and Ongoing
RR2.2	Focus property acquisition efforts upstream of river mile 8 and I-205 to extend the BBC Greenway into the upper watershed. Identify properties within the lower 8 miles that present opportunities for Project Restore, conservation easements, or future acquisition.	1	City of Vancouver	Active and Ongoing COV recently purchased multiple properties for restoration and preservation
RR2.3	Identify and document locations to facilitate discussion with the Bonneville Power Administration where installation of trees taller than 10 feet, or implementation of floodplain reconnection or wetland enhancement projects under or near utility lines may be allowed.	1	City of Vancouver Ecology Clark County Bonneville Power Administration	Not Implemented
RR2.4	Where feasible, achieve a system potential tree height of 41 meters, or approximately 135 feet tall in the watershed. Achieve the maximum overhang potential of trees in riparian areas, which is 4.1 meters or approximately 13.5 feet tall.	1	City of Vancouver Clark Conservation District Lower Columbia Estuary Partnership	Active and Ongoing

RR2.5	Complete a shade deficit analysis of BBC tributaries including Burton Channel, Peterson Channel, and Cold Creek to identify opportunities for riparian restoration. Most properties on tributaries are privately owned.	2	City of Vancouver Clark Conservation District	Not Implemented
RR2.6	Identify wetland areas in the watershed for wetland enhancement and restoration. If possible, work with private property owners to acquire properties or place a conservation easement on wetland areas for protection and restoration purposes.	1	City of Vancouver Clark Conservation District Lower Columbia Estuary Partnership	Active and Ongoing
RR2.7	Increase riparian buffer widths in areas where the stream has less than 215 feet of riparian buffer implemented. Maximize buffer widths whenever possible.	1	City of Vancouver Clark Conservation District Lower Columbia Estuary Partnership	Active and Ongoing ECY led a stakeholder watershed tour to discuss riparian restoration challenges and solutions
RR3	**Riparian Restoration**			
RR3.1	Provide small grants to neighborhood associations to plant trees on private property.	2	City of Vancouver Clark Conservation District	Active and Ongoing
RR3.2	Complete the Vancouver Tree Canopy Assessment at least every 10 years to assess COV's progress on preserving and restoring urban tree canopy. An Assessment was published in 2021, and anticipated again in 2026, with periodic reassessments in perpetuity.	1	City of Vancouver	Active and Ongoing

RR3.3	Continue to plant trees in COV parks. Prioritize implementation to parks that are hydrologically connected to outfalls that are contributing to water quality issues. According to COV's Urban Forestry Program, The following parks may provide opportunities for tree planting: David Douglas; West Minnehaha; Bagley; The Downs; Centerpointe; Oakbrook, Burton Ridge; St Helens; Evergreen Park; Sam Brown; Orchards; and Brickyard.	3	City of Vancouver	Active and Ongoing
RR3.4	Prioritize implementation of urban forestry efforts on residential properties, which make up 44 percent of the watershed. Target parcels for private property plantings and street trees using data from the tree canopy assessment and TreePlotter software. Focus implementation on properties that are hydrologically connected to outfalls that influence priority water quality areas in the BBC Watershed.	1	City of Vancouver Friends of Trees Clark Conservation District	Active and Ongoing
RR3.5	Implement planting projects for street trees on streets with the lowest tree canopy based on COV's Tree Canopy Assessment and TreePlotter software. Focus implementation on streets that are hydrologically connected to outfalls that influence priority water quality areas in the BBC Watershed.	3	City of Vancouver Clark Conservation District	Active and Ongoing

RR3.6	Identify and prioritize commercial properties and parking lot areas with low tree canopy for implementation. Focus planting on commercial properties and parking lots that are hydrologically connected to outfalls that influence priority water quality areas in the BBC Watershed.	3	City of Vancouver	Not Implemented
RR3.7	Identify and prioritize tree-planting opportunities on public properties including parks, open surface stormwater facilities, schools, sports fields, and WSDOT owned property, and other upland areas of the watershed outside of the riparian areas. Focus implementation on properties that are hydrologically connected to outfalls that influence priority water quality areas in the BBC Watershed.	2	City of Vancouver WSDOT Clark County	Active and Ongoing
RR3.8	Identify and prioritize low canopy areas in upland portions of the watershed for implementation. These include parks and schools. Focus implementation on properties that are hydrologically connected to outfalls that influence priority areas in the BBC Watershed.	2	City of Vancouver Clark Conservation District Lower Columbia Estuary Partnership	Not Implemented
RR3.9	Identify areas that are hydrologically connected to BBC and prioritize urban forestry implementation to these areas to promote groundwater recharge and streamflow restoration.	2	City of Vancouver Clark Conservation District Lower Columbia Estuary Partnership	Not Implemented

RR3.10	Identify publicly owned utility easements that present opportunities for restoration, and where feasible implement riparian restoration projects to help reduce water temperatures and buffer pollution in runoff.	2	City of Vancouver Lower Columbia Estuary Partnership	Not Implemented
RR4	**Other**			
RR4.1	Update local codes and ordinances to increase the required landscaped area percentage or to cap impervious surface area percentages in new development and redevelopment. Update code to expand the root space required for new trees and onsite infiltration. Continue identifying barriers to incorporate low impact development and green infrastructure into local codes in accordance with Stormwater Permit.	1	City of Vancouver	Active and Ongoing
RR4.2	Develop a preventative maintenance program for street trees implemented by COV, rather than relying on adjacent private landowners to implement street tree maintenance.	2	City of Vancouver	Active and Ongoing
RR4.3	Increase funding for Parks and Surface Water property acquisition programs to purchase and preserve more property for conservation and restoration.	2	City of Vancouver	Not Implemented
RR4.4	Consider increasing tree fees and tree mitigation requirements to increase funding available for COV's urban forestry program.	2	City of Vancouver	Active and Ongoing

RR4.5	Develop public private partnerships with Bonneville Power Administration, SEH America, and other businesses to develop new sources of private funding for tree planting.	1	City of Vancouver	Not Implemented
RR4.6	Identify unauthorized water withdrawals on BBC that are being withdrawn without a water right and provide education and outreach, and enforcement action to stop the withdrawal.	2	City of Vancouver	Not Implemented
RR4.7	Remove riprap and bank armoring that has been implemented without authorization or a permit, and where feasible identify opportunities to reconnect the floodplain.	2	City of Vancouver	Not Implemented
RR4.8	Identify and remove any manmade ponds or impoundments on Burnt Bridge Creek that are impacting water flow, causing eutrophication, or affecting water quality.	1	City of Vancouver	Active and Ongoing
RR4.9	Collaborate with the Royal Oaks Golf Course to identify conservation, restoration, and tree planting opportunities on their property. Provide education on structural and operational BMPs to reduce pollutant loading to BBC.	1	City of Vancouver	Not Implemented
RR4.10	Educate local elected officials on the benefits of increasing the COV's utility rates to help generate more funding for Stormwater infrastructure, urban forestry, and land acquisition.	1	City of Vancouver	Active and Ongoing
RR4.11	Complete outreach to landowners to promote tree planting in the BBC Watershed. Mailers, door-to-door outreach, and social media may help increase	1	City of Vancouver Clark Conservation District	Active and Ongoing

	involvement in Vancouver's tree planting programs on private property.			
RR4.12	Develop a strategic land acquisition plan for the BBC Watershed focused on identifying high priority, critical conservation areas for future acquisition to protect water quality. Include shoreline management and critical areas, as well as critical aquifer recharge areas.	1	City of Vancouver	Active and Ongoing COV recently purchased multiple properties for restoration and preservation
RR4.13	Work directly with SEH America to mitigate temperature impacts in BBC. Work with BPA to support adjustments to their powerline planting rules in support of restoration efforts in BBC.	1	City of Vancouver Ecology	Not Implemented ECY Permit Update

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 35. 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 implementing 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 should 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.

Best Management Practice	Description
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 and/or 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 costs can be obtained by contacting Ecology's grant project managers and financial managers. The USDA NRCS also serves as a trusted resource for BMP cost estimation. The Lower Columbia Fish Recovery Board and the Washington State Recreation and Conservation Organization can provide support in preparing implementation cost estimates. To achieve WQS in BBC, 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 8. The following organizations are working to restore riparian areas in the BBC Watershed.

Table 36. Riparian restoration implementation organizations and partners.

Implementation	Stakeholders
Primary organizations	City of Vancouver, Clark County, WSDOT, and Clark Public Utility.
Partners	Lower Columbia Estuary Partnership, Clark Conservation District, Washington State University Extension, Washington State Conservation Commission, United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), USDA Farm Service Agency, Washington State Department of Agriculture, Friends of Trees, and Washington State Department of Ecology.

Chapter 7 – Public Education and Outreach

Introduction

Public education and outreach efforts are critical to protecting the watershed. These efforts help ensure watershed cleanup represents the local communities' priorities and values. They also raise awareness, create stewardship opportunities, and can change people's behaviors to improve water quality. It is important to educate people who live, work, recreate, and visit the BBC Watershed on how their individual and collective actions impact water quality. Targeted education and outreach efforts are needed to promote voluntary implementation of water quality BMPs.

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

- **Homeowners with septic systems adjacent to the BBC** and its tributaries that are past due for inspection, maintenance, repair or connection to public sewer to reduce bacteria and nutrient non- point pollution.
- **Public and private landowners with riparian properties** adjacent to the highest shade deficits on the BBC mainstem and tributaries. Outreach to these landowners to promote tree planting, riparian restoration, and streamflow restoration activities is needed to reduce temperatures and increase dissolved oxygen.
- **Businesses with properties adjacent to BBC** and its tributaries that need BMP's to lower water temperatures and reduce non-point source pollution
- **Students in the watershed** inspiring the next generation into action while educating parents about ways to engage in BMPs to reduce residential non-point bacteria, nutrient, and toxics pollution.

Public Education and Outreach Goals

The long-term goal for public education and outreach efforts in the BBC Watershed is to inspire behavior change and voluntary adoption of BMPs to protect 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 our communities and ecosystems. Public education and outreach efforts that encourage environmental stewardship and promote specific behavior changes can ultimately help reduce bacteria, lower water temperatures, and support all beneficial uses in the BBC 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 BBC Watershed. Efforts to coordinate messaging across different outreach programs can help amplify clean water messaging and lead to greater outcomes for water quality protection. Additional goals

and actions for public education and outreach are recommended at the end of this chapter and throughout the ARP.

City of Vancouver Public Education and Outreach Activities

The COV has established strong public education and outreach programs to raise awareness, inspire behavior change, and promote stewardship for the environment and water quality. To implement water quality education and outreach activities, COV has had partnerships with Friends of Trees, Columbia Springs, Watershed Alliance of Southwest Washington, Lower Columbia Estuary Partnership, Clark Conservation District, schools, neighborhoods, church groups, and businesses. They have also worked with the Lower Columbia Nature Network, the Washington Service Corps, AmeriCorps, and the WSU Master Gardener program.

Urban Forestry

One of COV's focus areas for education and outreach efforts is through the Urban Forestry program. Community based outreach has elements that target all members of the public but this program is prioritized to inform property owners who want to plant or remove trees, tree and landscape professionals, and community volunteers. Since most trees in Vancouver are on private property, volunteer support is vital for planting new trees and caring for existing ones. To recognize this work, COV hosts an annual awards ceremony honoring volunteers and community partners. Each year, COV engages with thousands of volunteers through the Urban Forestry Program.

Urban forestry education and outreach are guided by a two-year work plan, with progress summarized in an annual report. COV tracks performance measures to see how effective the program is and to understand whether education and outreach are leading to positive changes in the community.

Urban Forestry Outreach Methods

COV's Urban Forestry program has many communication channels, including website content, social media, brochures, flyers, posters, and video in multiple languages to share information and provide technical support. The program also organizes many community events throughout the year, including Arbor Day, Arbor Month, the Old Apple Tree Festival, and the Heritage Tree Program. Other activities include Tree Talk workshops, pop-up arboretums with educational signs, heritage tree tours, and guided biking and walking tree tours.

Each year, COV offers neighborhood tree steward training by recruiting community members to act as liaisons between their communities and the city. AmeriCorps members and seasonal interns support education and outreach efforts. In addition, the appointed Urban Forestry Commission provides input on the city's program. This commission helps connect with volunteers, share new ideas, and create videos and content for social media.

Vancouver Water Resources Education Center and Partnerships

The COV Water Resources Education Center has been open since 1996 as a hub for free community engagement on water resources and connections to residents' daily lives. This Center hosts K-12 field trips, workshops and special events focused on water quality education. The center hosts a number of adult education and volunteer events including beach and greenway cleanups. They also support outreach along BBC Greenway, and host streamside chats to facilitate learning about macroinvertebrate health, native plant species, and local wildlife. The Center formerly coordinated with multiple partners who host the annual Columbia River Watershed Festival, which was an opportunity for the greater COV community of 4th graders to celebrate the region's water resources. The annual Sturgeon Festival (a celebration of Columbia River ecosystems), World Water Day, Critter Count, Second Saturdays, Science in the Park, Reading in the Wild, and community nature walks are other celebrations that help connect community members with our ecosystems and the importance of maintaining clean water.

The Water Resources Education Center publishes a monthly newsletter highlighting events and activities. They also publish an annual report, provided with the year-end NPDES reporting, summarizing activities and key metrics for the Water Resources Education Center. Extensive renovations and improvements are currently underway at the Center and its exhibits to enhance the visitor experience and illustrate the key role of residents in protecting water quality. Updated content and activities help visitors learn not only about watershed health and the importance of tree canopy but also where their drinking water comes from and how their choices can protect the delicate balance of water resources, all for no cost to visitors.

Student Watershed Monitoring Network

The Water Resources Education Center also facilitates the student watershed monitoring network in partnership with Clark County. The student watershed monitoring network works with schools to provide a robust water quality curriculum for K-12 students/teachers, and to complete student watershed monitoring activities near schools. Students gather to present on their projects through a Watershed Congress. The data collected by the student watershed monitoring network classrooms is collected and managed using the FieldScope application, which allows students to share data. The Lower Columbia Fish Recovery Board and Clark County support the FieldScope program, and COV is always interested in new partnerships to help support and advance this popular program.

Partnerships and Collaboration

The Water Resources Education Center collaborates with Clark County and nonprofit organizations to complete stewardship and outreach efforts to implement the Backyard Habitat Certification program. They also work with the Columbia Springs Education Center to support their work to host summer camps and other environmentally themed activities. These collaborative efforts are critically important in building and maintaining strong community partnerships to collectively improve water quality.

Coordination with Clark County Public Works is also ongoing through a regional partnership to provide education and outreach focused on toxics reduction and solid waste disposal. The COV's Public Works Operations and Solid Waste teams coordinate a wide range of litter abatement programs and facilitate proper disposal, with public trash receptacles along the BBC walking trails. Litter removal and pet waste station maintenance is provided by Operations crews. The COV's Volunteer Program hosts cleanups such as Adopt-A-Park, with regular pickups throughout the watershed. Many other volunteer events are overseen and funded through Solid Waste and nonprofits. Public Works staff work in partnership with Vancouver's Homeless Assistance Response Team (HART) to clean up encampments and provide sanitation services.

Stormwater Education and Outreach

Western Washington Phase II Municipal Stormwater Permit (MS4) requires an education and outreach component to reach areas served by the MS4. The program design is to be based on local water quality concerns and target related audience characteristics to identify high priority audiences, subject areas, and/or BMPs. Based on the target audience's demographic, the Permittee shall consider delivering its selected messages in multiple languages appropriate to the target audiences. The education and outreach program should cover these three primary goals:

- Build general awareness about methods to address and reduce impacts from stormwater runoff.
- Effect behavior changes to reduce or eliminate behaviors and practices that cause or contribute to adverse stormwater impacts.
- Create stewardship opportunities that encourage community engagement in addressing the impacts from stormwater runoff.

Pollution Prevention Education

One of the focus areas for stormwater outreach has been implementing pollution prevention education, focusing specifically on small quantity waste generators. COV contracts to provide waste audits and technical assistance focused on pollution prevention and resource control. COV has also been working on a safe pest control program for multi-family properties, in partnership with Clark County Green Neighbors, Washington State University Extension, Clark Public Utilities, and the Energy Trust.

Additionally, COV had a stormwater activity grant, which included webinars on construction site pollution prevention. COV is collaborating with the Washington Stormwater Center, American Society of Civil Engineers, and the Builders Industry Association to implement the education. Pollution prevention outreach was also completed with the COV's Farmer's Market and permitted food trucks. COV is working internally on the special events team for spill response education through various special events around town. One goal is to develop a centralized spill kit for Esther Short Park and Columbia Tech to help manage spills associated with events.

Pollution prevention education has been identified as the most cost-effective way to prevent non-point pollution. Pollution prevention efforts in the BBC Watershed will help lower bacteria, toxics, and nutrient inputs, improving water quality.

Wash Right Campaign

Recently, an existing "Wash Right" campaign was adapted through an Environmental Protection Agency grant, focused on power washing, disinfectants, and car washing. The focus for the grant was downtown COV, where storm drains connect to the Columbia River.

Developing Messages for Urban Property Owners

One challenge for regional collaboration efforts for education and outreach is that some of the messaging for rural Clark County residents may not be appropriate for urban sites, nor meet City codes for urban property owners within city boundaries. Additionally, as people move to COV, new residents may not recognize distinct differences between city and county programs. City residents may not identify with countywide organizations that do work within both jurisdictions. Developing education and outreach programs that resonate with both rural and urban landowners will be important for long-term success.

Ecology's Community Engagement Plan

Our Community Engagement Plan[38] describes how we seek to engage with communities so that everyone impacted by our work can have a say in how decisions are made. The Plan identifies ways we can support meaningful engagement with communities by promoting access and addressing barriers. The Plan especially focuses on effectively engaging with communities that face multiple, combined environmental harms and risks to human health.

The Community Engagement Plan (Plan), updated in 2026 is the Department of Ecology's guidance for meaningfully involving the public in the work we do. It is required under state law in the Healthy Environment for All (HEAL) Act. The Plan lays out the processes and best practices we will follow so that all people in Washington have a chance to shape decisions that affect their environment, health, and communities.

Some communities in Washington face greater environmental challenges than others— such as polluted air, unsafe water, or nearby industrial activity. The Plan explains how we will engage directly with these communities to understand their experiences, incorporate their input, and work to address their needs. This is an important part of Ecology's efforts to advance environmental justice in our state.

Inclusion Accessibility and Engagement

The COV has completed significant work to integrate equity into its programs. One key step was to focus on accessibility of documents and providing language translation services. The current stormwater permit requires COV to implement community-based social-marketing (CBSM)

practices and to utilize demographic data to understand the diversity of residents and ensure education efforts are reaching all audiences living in the watershed. CBSM also encourages utilizing surveys before and after implementation to assess behavior change and the effectiveness of targeted education. COV has been working on its CBSM and engagement efforts and is currently developing a city-level equity index map to help inform education and

[38] https://apps.ecology.wa.gov/publications/SummaryPages/2601008.html

outreach efforts. COV continues to develop opportunities for participation and communication to eliminate barriers and engage non-English speakers. The COV collaborates with community development organizations to help facilitate targeted, culturally appropriate, outreach and education.

Equity is a key consideration for prioritizing resources to promote water quality improvement efforts. In the middle portions of the watershed, which also contain stream segments with impaired water quality, increased support may be necessary to successfully implement projects in the basin. There are concerns that overburdened communities may have more difficulty with maintaining tree plantings on their properties, having the resources to manage the costs associated with connecting to sewer or maintaining septic systems. Identifying these community members, and providing technical and financial support, will be essential to long-term success. Additionally, in neighborhoods with a high percent of rental properties, participation in environmental programs can be limited. Owners of rental property may be reluctant to invest in environmental activities and engage in water quality protective household waste management, lawn care and landscaping practices.

The City has initiated an Equitable Development Planning approach to strategically invest in programs and policies that create vibrant, healthy, safe communities that increases access to opportunities and reduces or eliminates disparities. Using a data-driven and place-based approach to partnerships in the local community, the City hopes to address specific needs in the BBC corridor. The City has recently updated their Comprehensive Plan, integrating housing, land use, equity and environmental protection as part of the 20-year vision. A significant change to the zoning approach will increase density and create a greater mix of land uses throughout the watershed. This plan creates a detailed strategy to implement the goals of City Council around creating a healthier community for all people, adapting to a changing climate and providing housing for our most vulnerable community members. For public projects, the City created its own “Equity Index” to reflect key demographic indicators to convey information about impacts of change on vulnerable households with a focus on avoiding displacement.

Sewer Connection and Septic Systems

For septic related programs and public education efforts, COV and Clark County Public Health meet to coordinate and share information. Currently, COV and CCPH promote sewer connection when public sewer is available and a property owner requests a permit for septic repair, or a bank requires sewer connection as a qualifying condition for a mortgage loan. Since CCPH has primary jurisdiction over septic systems, COV relies on CCPH to conduct outreach to septic system owners for inspection and maintenance compliance through mailers, workshops, and other educational methods.

CCPH Septic Outreach

CCPH sends past due operations and maintenance notification letters to septic owners and collaborates with WSU Extension to host workshops that teach septic owners how to care for their systems. CCPH is

working with Poop Smart Clark to develop a new inspection and maintenance rebate program to provide financial assistance to septic owners. Implementing this program in the BBC Watershed may help increase outreach, technical, and financial assistance to septic owners. Currently, the Poop Smart Clark program is helping to identify septic system age and condition, and those that are past due for inspection and maintenance. Increased funding for existing partnerships that provide proactive outreach to septic system owners would support efforts to reduce bacteria and nutrient concentrations in the watershed.

Sewer Connection and Incentive Program (SCIP)

Community outreach has been a key element to inform property owners about construction, connection and associated costs when a new sewer line is being built in their neighborhood. Early in this process, staff from the SCIP program will send out information packets and meet with property owners. CCPH has attended these meetings to provide information on septic system maintenance and repair, while COV makes homeowners aware of the opportunity and financing available to connect to sewer.

Although COV's goal is to encourage more people to connect to sewer there has been no process for additional outreach regarding connection after the 2-year guaranteed cost period has expired. Periodic messaging related to sewer connection and septic systems would encourage homeowners to connect to sewer when the need arises and to provide current information on financing. However, if septic owners cannot or choose not to connect to public sewer, outreach to residents should remind and encourage owners to inspect and maintain their systems in accordance with local requirements implemented by CCPH.

Challenges

Working with Homeowners Associations (HOAs)

While COV has had success implementing various educational programs with businesses and multi-family properties, outreach and technical assistance for private landowners and homeowner's associations (HOAs) with private stormwater facilities remains a challenge. COV is hoping to improve maintenance and effective operation of private facilities by coordinating earlier, during formation of the HOA as homes are constructed and occupied, to provide clarity on roles and responsibilities increase awareness of maintenance requirements. Opportunities to educate HOA's about water quality impacts and best management practices using pesticides and fertilizers may also help with the COV's pollution prevention efforts reducing toxics and nutrients to improve water quality.

Watershed Approach

Expanding beyond the riparian corridor and embracing a watershed approach to community outreach will be needed to improve water quality in the creek by efforts throughout the watershed. For example, increasing understanding about the connection between what enters catch basins in neighborhoods and impacts downstream water quality in BBC may help promote environmental stewardship at an individual level. Placing stormwater only medallions on catch basins, and watershed/water quality signage in neighborhoods, can help COV residents learn

what they can do to protect clean water, and how individual actions on private property can protect water quality in BBC.

Development Pressure

The COV and areas of the BBC Watershed are experiencing significant development pressure. The 2011 Tree Canopy Assessment identified 381 acres (3 percent) of tree canopy loss due to private development in the BBC Watershed between 2003 and 2010. Reflecting success for active planting efforts by the Urban Forestry program, a 2021 Urban Tree Canopy Assessment showed a 2.9 percent increase in tree canopy in the Burnt Bridge Creek Watershed between 2010 and 2020. Continued improvement is expected to be seen but current staffing levels are not adequate to meet increased review and inspection for new development projects, and existing resources for education, outreach, and other technical assistance activities are limited. With only 11 percent of the land in the BBC Watershed under public ownership, the City remains reliant on private landowner willingness to plant new trees, maintain existing trees and landscapes, and manage pesticide and fertilizer use.

Clark County Education and Outreach Activities

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 BBC.

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 with the potential of 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 Canines for Clean Water[39] webpage 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. Relationships with businesses that provide pet waste removal services should also be formed 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

[39] https://www.stormwaterpartners.com/canines-clean-water

to protect watershed health.

Social Media and Online Engagement

Clark County Public Works utilizes several forms of social media to increase outreach. Targeted, short messages for bacteria reduction, septic systems, pet waste, 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 to targeted BBC Watershed residents.

Mass Media

Clark County Public Works implemented a mass media outreach effort through a local television station and refreshed the video messaging in 2025. Meteorologists delivered stormwater public service announcements on various topics including pet waste and native plants. Messages from the BBC ARP 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[40] 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 affecting 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 BBC. 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 BBC ARP 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. The City of Vancouver joined an interlocal agreement with the County in 2025 to formally fund the Stormwater Partners of Southwest Washington in conjunction with all of the NPDES municipal stormwater permittees in the area.

Student Watershed Monitoring Network

In partnership with COV'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. School districts

[40] https://www.stormwaterpartners.com/

within the BBC Watershed 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, Clark County Public Works 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 BBC, especially when working with K-12 audiences.

Enviroscape

Public Works also 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 BBC Watershed, 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 CCPH, in partnership with Public Works, to provide timely messaging of upcoming events and activities, including a community event calendar. Clean water workshops and outreach events in the BBC 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 CCPH. Outreach to businesses in the BBC Watershed 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

Public Works staff produce interpretive displays and publications on various topics including pet waste management, natural gardening, pollution prevention techniques, watershed education, and others. Signs to educate residents and visitors on water quality in the BBC Watershed should be developed.

Implementing Partner Organizations

Follow the Water

Follow the Water[41] is a new campaign in Oregon and SW Washington. Follow the Water is the work of a voluntary collaborative partnership of over 60 organizations, from federal, state and local governments, watershed councils, Soil and Water Conservation Districts, and water related non-profits. Follow the Water works together to bring insights about water, science, stories, and positive actions taken by diverse voices in communities.

Clark Public Utilities District

Clark Public Utilities (CPU)[42] 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 BBC Watershed. CPU also works with inmate crews to implement restoration projects.

Washington State University Extension – Small Acreage Program

Washington State University Extension[43] 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. Department of Ecology will continue to collaborate with Clark County and WSU Extension to support Small Acreage outreach and promotion efforts. Implementation of additional WSU Small Acreage workshops specifically tailored to the BBC Watershed would be beneficial in reducing non-point pollution and improving water quality. Two workshop topics that would be fitting for the BBC Watershed are WSU's BMPs Workshop and Well and Septic Workshop.

Best Management Practices Workshop

WSU hosts BMPs Workshops, which cover composting and management, and streamside planting with native plants. WSU should commit to hosting at least one annual BMPs Workshop in the BBC Watershed. The BMPs Workshop should be advertised to landowners in the BBC Watershed through WSU's direct mailings and social media. When appropriate, consider opportunities to include Ecology in the BMP Workshop curriculum.

[41] https://followthewater.info/
[42] https://www.clarkpublicutilities.com/
[43] https://extension.wsu.edu/

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.

WSU and Clark County Public Health should commit to hosting at least one, and ideally multiple, Well and Septic workshops in the BBC Watershed. The Well and Septic workshop should be advertised to landowners in the BBC through WSU's direct mailings and social media. Offering courses online may help increase public attendance.

Clark Conservation District

Clark Conservation District[44] is a grant funded and non-regulatory agency established in 1942 to conserve soil and water by working with individuals and communities in Clark County. Clark Conservation District helps private and public landowners manage natural resources through education, customized site visits, and financial assistance to install conservation practices. The Conservation District offers a variety of programs, classes, and workshops, including the free Watershed Stewardship series, stormwater and habitat classes, agricultural workshops, and an annual native plant sale. Additionally, the Conservation District has a riparian restoration team as well as a forester and agricultural experts on staff to assist public and private landowners with conservation planning and implementation. They developed and lead the Poop Smart Clark Program, which provides reimbursement for septic system inspection, repair, and replacement as well as funding for a variety of livestock and riparian-related BMPs.

Watershed Alliance of Southwest Washington

Through the end of 2025 the Watershed Alliance of Southwest Washington worked to educate and engage community members in Southwest Washington to be active watershed stewards. Projects and work on BBC included education covering why we plant native plants on the creek and the connection between water health and stormwater. Programs included public education through workshops, environmental events, hands-on stewardship opportunities, and working with private landowners to implement BMPs on their properties.

Lower Columbia Estuary Partnership

The Lower Columbia Estuary Partnership (LCEP)[45] 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

[44] https://www.clarkcd.org/
[45] https://www.estuarypartnership.org/

many watershed topics. In the BBC Watershed, LCEP has engaged student groups in restoration and stewardship activities, including volunteer events for riparian restoration and tree planting at BBC restoration sites.

Columbia Springs

Columbia Springs[46] has been in operation for 20 years, reaching well over 250,000 guests and taught a generation of Clark County residents about watersheds, biology, restoration, and engineering. The Columbia Springs community continues to grow each year to reach a wider audience of students and volunteers. Columbia Springs programs are sources of excellent educational and volunteer opportunities. Columbia Springs is an important watershed partner for environmental water quality education and volunteer activation.

Columbia Land Trust and Bird Alliance of Oregon

Columbia Land Trust and Bird Alliance of Oregon teamed up to design a unique program that supports urban and suburban homeowners in their efforts to create habitat within their residential or community green spaces. The intent of the Backyard Habitat CertificationProgram[47] is simple: it provides technical assistance, financial incentives, encouragement, and recognition to people who want to create climate-resilient habitat that support people, wildlife, water quality, and our ecosystems. This unique program supports the creation and expansion of urban natural habitats. These habitats contribute to broader conservation efforts by strengthening and expanding wildlife corridors and creating connectivity between public and private lands. The Backyard Habitat Certification Program is available to residents within the BBC Watershed.

Public Outreach for Culturally or Linguistically Specific Populations

Public outreach strategies and engagement messages can be tailored for audiences with common cultural backgrounds or language needs, resulting in increased interest and behavior change from these groups. Partner organizations should talk with local community members and use local demographic data to help support efforts to target cultural and linguistically specific communities for outreach, education, and engagement.

Culturally Specific Populations in the Watershed

Working with local partners can help ensure that cultural groups in the community are identified and that their interests and needs are represented. Educational materials and outreach activities can be adapted to ensure effectiveness by maintaining cultural relevance, appropriate tone, and clear intent. At nine percent, the Hispanic population has the largest ethnically distinct population in Clark County. Building environmental outreach resources to engage the Hispanic community may be supported through establishing relationships with the following groups:

- Fourth Plain Forward

[46] https://www.columbiasprings.org/
[47] https://backyardhabitats.org/

- The Hispanic Metropolitan Chamber of Commerce
- Vancouver Metro League of United Latin American Citizens Council 47026
- The Southwest WA League of United Latin American Citizens Council 47013
- LatinoBuilt

Additionally, building resources to engage other underrepresented communities in Clark County is also a priority.

Communicating with Limited-English Proficiency Communities

Guidance for public agency communication with limited-English proficiency can be found in the Safe Harbors standard, a US Department of Justice guidance document. This standard indicates that the authoring organization should provide written translations of vital documents into relevant languages when 5 % or 1,000 persons, whichever is less, of the population speak English less than very well. For these audiences, outreach materials should be translated, and language interpreters should be provided.

In the BBC Watershed, these language groups include:

- Spanish language
- Russian language
- Mandarin language

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 sub-watershed level, demographic analysis should be conducted using local knowledge such as talking with community leaders and community-based organizations about the language and cultural needs of the community. Local language needs should also be reassessed when new American Community Survey data becomes available from the US Census Bureau. Recruiting volunteers that speak Hispanic or other frequently spoken languages in the region and translating outreach materials are also priorities to reach all community members.

Public Education and Outreach Implementation

To achieve clean water in BBC, meet WQS for bacteria, temperature, pH, and dissolved oxygen, it is important to increase public awareness about community waterways, provide stewardship opportunities, and inspire ecosystem consciousness behavior change to improve water quality. The following implementation tables outline goals and actions for public education and outreach in the BBC Watershed. 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 BBC Watershed.

Public Education and Outreach - Implementation Actions

Table 37. Implementation Actions for Public Education and Outreach in BBC. Priority 1-3 (1 equals top priority).

ED1	Target Audiences	Priority 1-3	Stakeholders	Implementation Status
ED1.1	Support CCPH outreach and education to homeowners with septic systems on properties adjacent to BBC and its tributaries. Septic system owners located within 200 feet of where there are known bacteria issues are a priority for outreach and encouraged to connect to public sewer when available. Priority areas for bacteria reduction are those along Peterson Channel, Cold Creek, and Burton Channel, as well as those approximate to river miles (RM) 8.4, 2.6, and 1.6 for having dry season bacteria exceedances over 200 cfu/100ml.	1	City of Vancouver Clark Conservation District Clark Regional Wastewater District	Active and Ongoing

ED1.2	Prioritize outreach and education to public and private landowners with riparian properties adjacent to the highest shade deficits on BBC mainstem and tributaries. River miles 0, 5.9, and 7 had the highest water temperatures and the greatest number of days not meeting water quality criteria. The following river miles have shade deficits over 30 percent. RM12-13 = 87% RM 7-8 = 83% RM11-12 = 73% RM 8-9 = 44% RM 0-1 = 43% RM 4-5 = 36% RM 6-7 = 35% RM 1-2 = 31%	1	City of Vancouver Clark Conservation District	Not Implemented

ED1.3	Prioritize stormwater source control education and outreach efforts to the following locations. Peterson Channel, Cold Creek, and Burton Channel are the top priorities for bacteria reduction, as well as river miles (RM) 8.4, 2.6, and 1.6 for having dry season fecal coliform bacteria exceedances over 200 cfu/100ml. Locations that need bacteria reductions over 75 percent to meet water quality standards. These include Peterson Channel in the wet and dry seasons, Burton Channel in the wet season, Cold Creek and river mile 8.4 in the dry season, and river miles 7, 4.3, 3.4, 2.6, and 1.6 in the wet season. Locations with the most noncompliant days for dissolved oxygen are located in the upper watershed from RM 9.5 to 11.4, and in the middle watershed at river miles 7.0 and 5.9. River mile 0 had the most noncompliant days for pH. The minimum and maximum pH values measured were located in Burton Channel.	1	City of Vancouver Clark County	Not Implemented
ED2	**Riparian Restoration**			
ED2.1	Achieve system potential tree height and overhang potential in the watershed in all areas feasible. This is a tree height of 41 meters or approximately 135 feet with an overhang potential of 4.1 meters or 13.5 feet. Achieve 250ft buffer widths on all BBC riparian areas when possible.	1	City of Vancouver Clark Conservation District Lower Columbia Estuary Partnership	Not Implemented

ED2.2	Achieve the 28 percent tree canopy target established by Vancouver's Urban Forestry Management Plan, working towards an 85 percent system potential vegetation target in the BBC Watershed.	1	City of Vancouver Clark Conservation District	Not Implemented
ED2.3	Increase the total percentage of forested landcover in the BBC riparian areas, which is currently 45 percent.	1	City of Vancouver Clark Conservation District Lower Columbia Estuary Partnership	Active and Ongoing
ED2.4	Prioritize outreach to private landowners in riparian areas to promote tree planting projects. Prioritize outreach to private landowners in upland areas.	1	City of Vancouver Clark Conservation District Friends of Trees	Active and Ongoing
ED2.5	Prioritize riparian restoration outreach to the upper watershed, upstream of river mile 8 for future property acquisition and/or the implementation of conservation easements for riparian restoration.	1	City of Vancouver Clark Conservation District	Not Implemented
ED2.6	Update road-stream crossing signs in BBC to raise public awareness.	2	City of Vancouver	Not Implemented
ED2.7	Increase tree canopy on private property, which makes up 89 percent of the watershed. Provide technical and financial assistance to landowners to plant and maintain trees.	1	City of Vancouver Clark Conservation District	Active and Ongoing

ED2.8	Partner with schools to develop new education programs on the benefits of trees, including developing new environmental stewardship and hands on volunteer opportunities for tree planting.		City of Vancouver Clark Conservation District Lower Columbia Estuary Partnership	Not Implemented
ED2.9	Collaborate with COV's Parks and Recreation Naturespaces program to reduce turf, especially artificial turf and increase native plantings on city parcels.	1	City of Vancouver Clark Conservation District	Active and Ongoing
ED2.10	Increase tree canopy on all property types including businesses, single-family, multi-family, faith based, schools, and commercial properties. Track implement progress over time.	2	City of Vancouver Clark Conservation District	Active and Ongoing
ED2.11	Maintain, update, and develop promotional and technical information about COV's Urban Forestry Program. This includes completing a two-year workplan, an annual report, maintaining the website, monthly newsletter, articles for community newsletters, periodic media releases, brochures, flyers, posters, and videos. Provide educational resources in multiple languages.	3	City of Vancouver	Active and Ongoing
ED2.12	Host events and watershed festivals to promote the benefits of riparian restoration and recognize organizations in the community for community stewardship and advocacy.	2	City of Vancouver Clark Conservation District Lower Columbia Estuary Partnership	Active and Ongoing

ED2.13	Plant urban tree canopy in upland areas, which includes COV Parks. Priority parks for urban forestry implementation include David Douglas; West Minnehaha; Bagley; The Downs; Centerpointe; Oakbrook, Burton Ridge; St Helens; Evergreen Park; Sam Brown; and Orchards.	3	City of Vancouver	Active and Ongoing
ED2.14	Provide education and outreach to private developers and contractors on best practices for tree preservation, and how to incorporate trees into development projects. Where possible, educate developers on how to maximize landscaped areas and root zone areas, and reduce imperviousness in development projects. Educate private developers on opportunities to co-locate vegetation and stormwater requirements, and how to reduce parking spaces, and building setbacks to maximize green space.	1	City of Vancouver Clark County	Not Implemented
ED2.15	Continue handing out Stormwater and Tree Brochure for new single family residence development. Building Inspectors handout as part of final inspection. This brochure targets newly developed single-family residences and informs them on the importance of their onsite trees and stormwater facilities and how to care for them to protect watershed health.	2	City of Vancouver	Active and Ongoing

ED2.16	Complete maintenance of planted areas in BBC Watershed, working towards a tree survival rate of 85 percent. Continue to provide technical assistance to private landowners to maintain plantings, and to manage invasive species in riparian areas.	2	City of Vancouver	Active and Ongoing
ED2.17	Educate property owners and maintenance companies on landscape BMP's: mulch, plant, reduce fertilizer and pesticides, pick up pet waste etc. Target dissolved oxygen areas due to fertilizer and pesticide use to change behavior.	1	City of Vancouver Clark County Clark Conservation District. Stormwater Partners of Southwest Washington	Not Implemented
ED3	**Stormwater**			
ED3.1	Collaborate with Clark County, and the Stormwater Partners for Southwest Washington to develop and implement stormwater education activities in the BBC Watershed.	1	City of Vancouver Clark Conservation District Clark County	Active and Ongoing
ED3.2	Promote dog waste facilities in the BBC Watershed. Utilize Canines for Clean Water education for public education and outreach. Establish relationships with businesses that provide pet waste removal services 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.	1	City of Vancouver Clark County	Active and Ongoing

ED3.3	Prioritize stormwater source control outreach for bacteria and nutrient pollution to areas with known water quality problems. This includes the middle and lower watershed for bacteria pollution, and the middle and upper watershed for dissolved oxygen impairments. Provide source control education and outreach focused on BMPs to reduce bacteria pollution from pets and livestock, and from septic systems, and increase education on best practices for fertilizer and pesticide application and lawn care to improve dissolved oxygen levels.	1	City of Vancouver Clark Conservation District Clark County	Active and Ongoing
ED3.4	Continue to develop education and outreach programs for HOA's focused on private stormwater facility maintenance, and best practices for pesticide and fertilizer application, and other pollution prevention activities. When possible, coordinate with HOA's earlier in the process once homes are constructed and occupied to increase effectiveness and responsiveness to education and outreach.	1	City of Vancouver Clark County Stormwater Partners of Southwest Washington	Active and Ongoing
ED3.5	Increase stormwater marking on catch basins and increase signage in neighborhoods to help COV residents learn what they can do to protect clean water, and how individual actions on private property and at the neighborhood level are connected to the creek.	1	City of Vancouver Clark County Stormwater Partners of Southwest Washington	Active and Ongoing
ED3.6	Educate the public on IDDE, source control and pollution prevention, and how to submit an ERTS complaint if they observe a pollution issue.	2	City of Vancouver Clark County	Active and Ongoing

ED4	Sewer Connection and Septic Systems			
ED4.1	Collaborate with Clark County Public Health and Clark Regional Wastewater District to develop and implement new outreach materials for septic system maintenance and sewer connection.	1	City of Vancouver Clark Conservation District Clark County	Not Implemented
ED4.2	Commit to hosting an annual Septic workshop in the BBC Watershed in partnership with WSU Extension, and other partners.	1	Clark County Public Health Clark Conservation District	Not Implemented
ED4.3	Conduct a septic system records assessment. Identify septic system age and condition, and any systems that are past due for inspections and maintenance as a first step for prioritizing septic system outreach and education. Prioritize septic systems in closest proximity to known water quality issues for initial outreach.	1	Clark County Public Health Clark Conservation District	Not Implemented
ED4.4	Complete outreach to septic system owners that have not connected to sewer who are located in priority drainages for water quality. Septic owners located in neighborhoods near Peterson, Burton, and Cold Creeks, and river miles 8.4, 2.6, and 1.6 are priorities for implementation.	1	City of Vancouver Clark Regional Wastewater District Clark Conservation District Clark County	Active and Ongoing

ED4.5	Develop financial assistance programs for homeowners who want to connect to sewer. These may include applying for a grant to help landowners connect to sewer, implementing a rebate or cost-share program, waiving permit fees or systems development charges or developing other tax incentives to encourage homeowners to connect to sewer.	1	City of Vancouver Clark Regional Wastewater District	Active and Ongoing SCIP Program funded through COV and expanding through ECY Grant 2025
ED4.6	Develop public education and outreach tools to educate septic owners about the opportunity to connect to sewer, as well as financing options.	1	City of Vancouver Clark Regional Wastewater District	Active and Ongoing SCIP Program funded through COV and expanding through ECY Grant 2025
ED4.7	Complete analysis to understand how much sewer connection would cost for different SCIP projects to provide accurate education and outreach messaging to septic owners.	1	City of Vancouver	Active and Ongoing SCIP Program funded through COV and expanding through ECY Grant 2025
ED4.8	Work with CCPH to provide education on the lifecycle costs of connecting to sewer versus inspecting, maintaining, and replacing a septic system.	1	City of Vancouver Clark County Clark Regional Wastewater District	Not Implemented
ED4.9	Increase education and outreach related to best practices to dispose fats, oils, and grease in order to help maintain COV's sewer system and prevent sewer clogging and overflows. Prioritize outreach to restaurants, other food service businesses and multi-family residences in critical sewerage areas.	1	City of Vancouver Clark County	Active and Ongoing

ED5	Other			
ED5.1	Develop Meso-American and Latino culturally appropriate educational materials. Provide language translation services for limited-English proficient community members in Spanish, Russian, and Mandarin. Collaborate with community development organizations to reach underserved community members.	1	City of Vancouver Clark County	Not Implemented
ED5.2	Partner with non-profits, volunteer organizations, schools, neighborhoods, church groups, and businesses, for outreach purposes.	1	City of Vancouver Clark County	Active and Ongoing
ED5.3	Continue to offer environmental education programs through the Water Resources Education Center while focusing on improving the visitor experience and updating exhibits and education programing to benefit the full community. In the interim continue to develop new educational content for social media, including educational videos that support hybrid learning and connecting youth and adults with information on how they can support healthy aquatic ecosystems in our community.	1	City of Vancouver	Active and Ongoing
ED5.4	Provide education on best practices for herbicide and fertilizer application for tree care and lawn maintenance. Prioritize education and outreach to areas with dissolved oxygen impairments.	1	City of Vancouver Clark Conservation District Clark County	Active and Ongoing Clark County WYLS ECY Grant 2025

ED5.5	Continue to implement City litter abatement activities coordinated among and by Public Works Operations and Solid Waste teams. Evaluate continuation of the Litter Stewards volunteer litter removal program or similar nonprofit partnership opportunities as funding becomes available. Consider opportunities to prioritize implementation in areas on the greenway where there have been impacts to riparian vegetation. Continue to incorporate sanitation education into the program, including providing portable toilets to known camp areas.	1	City of Vancouver	Active and Ongoing
ED5.6	Continue to operate the Vancouver Water Resources Education Center and the student watershed-monitoring network to educate and engage K-12 students on water quality and actions we all can take to improve non-point pollution priorities.	1	City of Vancouver	Active and Ongoing
ED5.7	Develop new signage to educate residents and visitors in the watershed on what they can do to protect water quality. Implement signage on the Greenway, in parks, at road stream crossings and on bike paths and trails.	2	City of Vancouver Clark County	Active and Ongoing
ED5.8	Develop technical resources to help support implementation of water quality best management practices and maintenance in overburdened communities. Ensure education and outreach materials are accessible and translated into non-English languages.	1	City of Vancouver Clark County	Not Implemented

ED5.9	Engage individuals, neighborhood associations, schools, community groups, and other organizations to build and support stewardship of urban natural resources. Complete this engagement through workshops and presentations, online educational activities, neighborhood tree stewards training, TreeTalk workshops, and hosting AmeriCorps members and seasonal interns to support outreach and educational programs.	1	City of Vancouver Clark County	Active and Ongoing
ED5.10	Work with and engage thousands of volunteers throughout the year.	1	City of Vancouver Clark County	Active and Ongoing
ED5.11	When feasible, collect performance measure data to understand individual behavior change, and collect data on tree planting and volunteer demographics.	2	City of Vancouver Clark County	Active and Ongoing
ED5.12	Work with ECY to identify any landowners completing unauthorized water withdrawals off BBC. Develop water conservation education and encourage lawn care practices that help promote infiltration and streamflow restoration to BBC.	2	City of Vancouver Clark County	Not Implemented
ED5.13	Identify any landowners that have implemented riprap or bank armoring without a permit. Provide education on how to restore natural shorelines and the benefits to water quality.	2	City of Vancouver Clark County	Not Implemented

ED5.14	Identify any landowners that have installed manmade ponds or impoundments on BBC and how these alterations can impact temperature, flow, and eutrophication in the creek. Provide technical assistance to remove impoundments.	2	City of Vancouver Clark County	Not Implemented
ED5.15	Collaborate with the Royal Oakes Golf Course to identify conservation, restoration, and tree planting opportunities on their property. Provide education on structural and operational BMPs to reduce pollutant loading to BBC including best practices for lawn care and fertilizer application.	1	City of Vancouver Clark County	Not Implemented
ED5.16	Identify any private landowners with erosion issues on private property adjacent to the creek and identify opportunities for streambank stabilization and riparian restoration.	2	City of Vancouver Clark Conservation District Clark County	Active and Ongoing

Funding and partnerships for public education and outreach

Table 38. Public education and outreach funding and implementing organizations and partners.

Funding Sources	Water Quality Combined Funding Program, City of Vancouver's Stormwater Utility, Washington State Grants, Business sponsorships
Implementation Partners	**Primary Partners:** City of Vancouver, Clark County, Clark Conservation District, Lower Columbia Estuary Partnership **Other Partners:** Friends of Trees, Schools, Neighborhoods, Columbia Springs, Lower Columbia Nature Network, WSU, Naturally Beautiful Backyards, Bird Alliance of Oregon, Columbia Land Trust, Clark Regional Wastewater District, Stormwater Partners of Southwest Washington, Clark County Public Health

Chapter 8 – Implementation Cost Estimates

Introduction

This chapter provides implementation cost estimates to achieve water quality goals outlined in this ARP, and addresses NPS pollution challenges in the BBC Watershed. Cost estimates may differ based on geographic location and do not account for inflation over time.

This activity was completed to satisfy EPA requirements for ARPs and Nine Minimum Element Plans outlined by Section 319 grant funding guidelines. Cost estimates incorporated into this chapter represent 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 sources, costs would be lower.

Overall, stormwater management is the most expensive implementation priority with an estimate of over $58 million investment needed to address water quality impacts from stormwater. NPS prevention, by inspection and elimination of noncompliant septic systems in the watershed, is the second most costly implementation category, with around $18 million needed to achieve septic impact reduction goals. These septic cost estimates cover existing infrastructure that community members are typically responsible for. Addressing priority riparian restoration and expanding land acquisition efforts will likely cost at least $46 million, with water quality monitoring estimated to exceed $5 million. The total investment needed to protect water quality in BBC Watershed is an estimated $126 million.

Achieving this water quality recovery 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 utilized, 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 recent cost sources. 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, 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 BBC 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 BBC Watershed. More detailed cost estimates and alternative cost scenarios are provided throughout this chapter.

Table 39. Summary of cost estimates to implement water quality BMPs in priority areas of the BBC Watershed.

Implementation Activity	Description	Total cost estimate
Septic Systems	*Estimated cost to address NPS pollution from 700 noncompliant septic systems within the BBC Watershed.*	
Septic system inspection	Complete inspections on 700 priority septic systems in the watershed at a cost of $150 per system every 3 years, for 10 years.	$346,500
Septic system maintenance	Complete maintenance on 700 priority septic systems in the watershed at a cost of $550 per system every 5 years, for 10 years.	$770,000
Septic system replacements	Replace 700 septic systems in watershed at a cost of $24,000 per system every 25 years.	$16,800,000
Septic system total	Complete inspection, maintenance, and replacement of 700 systems. Final cost could be lower if eligible septic systems connect to sewer. Final cost will be higher to address all of the septic systems in the watershed.	$17,916,500
Stormwater	*Estimated cost to implement stormwater facility retrofits on 528 acres of imperviousness at a total cost of $78,000 per acre, including 10 years of maintenance, and completion of priority stormwater activities.*	
Stormwater facility retrofits	Retrofit 528 acres of imperviousness at $78,000 per acre (approximately 20% of total impervious surfaces in watershed).	$41,184,000
Stormwater maintenance	Complete annual maintenance on 528 acres of impervious surfaces at $3,200 per acre for 10 years.	$16,896,000

Stormwater facility upgrades to address Climate Change	Complete stormwater facility upgrades to mitigate for Climate Change impacts.	TBD
Stormwater total	Estimated stormwater facility and activity costs.	$58,080,000
Riparian restoration	*Estimated cost to implement riparian restoration on 16.8 stream miles of BBC mainstem and tributaries at a total cost of $35,000 acre. Costs for land acquisition of priority conservation areas are also included.*	
Riparian Restoration	Restore 16.8 stream miles, or approximately 876 acres of riparian areas with 215-foot buffers, adding over 1,752,000 trees to the watershed at an average cost of $35,000 per acre.	$30,660,000
Land acquisition	Acquire 26 acres of streamside habitat for riparian restoration every 3 years for the next 15 years.	$15,740,055
Riparian Restoration replanting to address Climate Change	Complete riparian restoration replanting to mitigate for Climate Change impacts.	TBD
Riparian Restoration total	Riparian restoration and land acquisition estimated costs	$46,400,055
Water quality monitoring	*Estimated cost to implement monitoring programs in the BBC Watershed.*	
Water Quality Monitoring	Complete water quality monitoring in BBC Watershed from 2023 to 2038	$5,793,570
Water quality monitoring total	Water quality monitoring estimated costs.	$5,793,570
TOTAL	*Implementation of water quality BMPs in priority locations.*	$126,183,925

Septic System Cost Estimates

As of 2023, there are 3,325 known septic systems in the BBC Watershed. Some of these septic systems are along the three primary tributaries Peterson Channel, Burton Channel, and Cold Creek, which along with the mainstem, do not meet WQS for bacteria. Of these 3,325 septic systems, approximately 700 have not been inspected and are considered noncompliant. Around 10 noncompliant septic systems are also located within 200 feet of a BBC waterbody and may have direct impacts on water quality.

Table 40. Septic system priorities in BBC Watershed.

Watershed Location	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
Lower Watershed (RM 0-5)	527	226	5
Middle Watershed (RM 5-10)	1798	170	1
Upper Watershed (RM 10-13)	1000	304	4
Total septic systems in watershed	3,325	700	10

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 $150 per system. This number does not include costs for labor, or education and outreach to work with landowners and promote septic system inspections. Most types of septic systems should be inspected every three years. To inspect the 700 non-compliant septic systems, the total cost is approximately $346,500 over 10 years, or $34,650 annually, if 33 percent of septic systems are inspected each year.

Table 41. Septic system inspection cost estimates for noncompliant systems.

Watershed Location	Number of Parcels with noncompliant Septic Systems	Total cost estimate - Inspections $150 every 3 years	Annual cost estimate (33% of systems per year)	10-year cost estimates (all systems inspected on 3-year rotation)
Lower Watershed (RM 0-5)	226	$33,900	$11,187	$111,870
Middle Watershed (RM 5-10)	170	$25,500	$8,415	$84,150
Upper Watershed (RM 10-13)	304	$45,600	$15,048	$150,480
Total septic systems in watershed	700	$105,000	$34,650	$346,500

Over 10 years, the total cost to inspect the total 3,325 systems in priority waterbodies on a 3-year rotational basis is approximately $1,645,875.

Table 42. Septic system inspection cost estimates.

Watershed Location	Number of Parcels with Septic Systems	Total cost estimate $150 per system every 3 years	Annual cost estimate (33% of systems per year)	10-year cost estimates (all systems inspected on 3-year rotation)
Lower Watershed (RM 0-5)	527	$79,050	$26,087	$260,865
Middle Watershed (RM 5-10)	1798	$269,700	$89,001	$890,010
Upper Watershed (RM 10-13)	1000	$150,000	$49,500	$495,000
Total septic systems in watershed	3,325	$498,750	$164,588	$1,645,875

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 routine septic system maintenance, including tank pumping, is around $550. According to the EPA, septic systems should be maintained every three to five years. Typically, individual landowners pay septic system maintenance costs. While some property owners complete timely inspections and maintenance on their own, other landowners require various levels of education and outreach to remind and encourage septic system care. The $550 cost estimate for maintenance does not include labor costs for education and outreach to landowners. To complete maintenance on the 700 noncompliant septic systems, the total cost is approximately $385,000 or $77,000 annually, if 20 percent of all septic systems are maintained each year. The estimated cost to achieve septic maintenance on 700 systems over 10 years is $770,000.

Table 43. Septic system maintenance cost estimates for noncompliant systems.

Watershed Location	Number of Parcels with noncompliant Septic Systems	Total cost estimate Maintenance $550 every 5 years	Annual cost estimate (20% of systems a year)	10-year cost estimates
Lower Watershed (RM 0-5)	226	$124,300	$24,860	$248,600
Middle Watershed (RM 5-10)	170	$93,500	$18,700	$187,000
Upper Watershed (RM 10-13)	304	$167,200	$33,440	$334,400
Total septic systems in watershed	700	$385,000	$77,000	$770,000

Over 10 years, the total cost to maintain the 3,325 septic systems in BBC Watershed is

approximately $3,677,500. While some landowners will pay maintenance costs and comply with the recommended maintenance schedules without public support, 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 44. Septic system maintenance cost estimates.

Watershed Location	Number of Parcels with Septic Systems	Total cost estimate Maintenance is $550 every 5 years	Annual cost estimate (20% of systems a year)	10-year cost estimate (all systems maintained on 5-year basis)
Lower Watershed (RM 0-5)	527	$289,850	$57,970	$579,700
Middle Watershed (RM 5-10)	1798	$998,900	$199,780	$1,997,800
Upper Watershed (RM 10-13)	1000	$550,000	$110,000	$1,100,000
Total septic systems in watershed	3,325	$1,838,750	$367,750	$3,677,500

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 and public sewer is not available for connection. As of 2020, the Department of Ecology's Water Quality Combined Funding Program estimates that replacing a residential septic system may cost up to $24,000. According to the EPA, the average lifespan of septic system is 15 to 40 years. If replacing the 700 non-compliant septic systems in the BBC Watershed, the estimated cost is $16,800,000. Annual replacement costs over 25 years to address 700 septic systems would cost around $672,000.

Table 45. Septic system replacement cost estimates for noncompliant systems.

Watershed Location	Number of Parcels with noncompliant Septic Systems	Total replacement cost estimate $24,000 every 25 years.	Annual replacement cost estimate
Lower Watershed (RM 0-5)	226	$5,424,000	$216,960
Middle Watershed (RM 5-10)	170	$4,080,000	$163,200
Upper Watershed (RM 10-13)	304	$7,296,000	$291,840
Total noncompliant septic systems in watershed	700	$16,800,000	$672,000

To replace the total 3,325 septic systems in the watershed, it would cost around $79,800,000, which is approximately $3,192,000 annually.

Table 46. Septic system replacement cost estimates.

Watershed Location	Number of Parcels with Septic Systems	Total replacement cost estimate $24,000 every 25 years.	Annual replacement cost estimate
Lower Watershed (RM 0-5)	527	$12,648,000	$505,920
Middle Watershed (RM 5-10)	1798	$43,152,000	$1,726,080
Upper Watershed (RM 10-13)	1000	$24,000,000	$960,000
Total septic systems in watershed	3,325	$79,800,000	$3,192,000

Sewer Connection Cost Estimates

Many homes with septic systems are eligible for sewer connection based on their proximity to public sewer conveyance infrastructure. An estimated 3,197 septic systems are eligible to connect to sewer in the BBC Watershed according to the COV.

By encouraging septic owners to connect to existing public sewer there are opportunities to improve water quality and experience long-term cost savings from decreasing the number of septic systems needing inspections, maintenance, and replacement in the watershed.

It is estimated that it may cost up to $25,000 to connect single-family properties to sewer. This estimate is based on the COV's Sewer Connection Incentive Program, and accounts for the cost for the sewer line, system development charge, plumber costs, and administration fees. Connecting 700 noncompliant septic systems to sewer is estimated to cost $17,500,000.

Table 47. Sewer connection cost estimates for noncompliant septic systems.

Watershed Location	Number of Parcels with noncompliant Septic Systems	Total cost estimate Sewer connection costs an estimated $25,000
Lower Watershed (RM 0-5)	226	$5,650,000
Middle Watershed (RM 5-10)	170	$4,250,000
Upper Watershed (RM 10-13)	304	$7,600,000
TOTAL	700	$17,500,000

To connect the total 3,197 septic systems to municipal sewer services, the estimated cost is approximately $79,925,000.

Table 48. Sewer connection cost estimates in BBC Watershed.

Watershed Location	Number of septic systems eligible for connections	Total cost estimate Sewer connection costs an estimated $25,000
Lower Watershed (RM 0-5)	514	$12,850,000
Middle Watershed (RM 5-10)	1790	$44,750,000
Upper Watershed (RM 10-13)	893	$22,325,000
TOTAL	3,197	$79,925,000

Future Project Budget Development

These cost estimates were developed in 2024 using spatial analysis and data from 2017 to 2020. Numbers were also estimated using recommendations from EPA and cost information from COV sewer programs and Clark County Public Health. 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.

Stormwater Treatment Cost Estimates

The BBC Watershed has an estimated 2,640 acres of impervious surfaces. Approximately 2,098 acres of the 2,640 acres are private property, which can be more challenging to implement stormwater projects on. Addressing stormwater runoff in the watershed is a priority, especially in the middle watershed.

Prioritizing stormwater treatment of 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 treatment on 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 areas undergoing redevelopment.

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

Total stormwater investment needed in the BBC is estimated at approximately $58 million for facility retrofits, annual maintenance, and completion of necessary stormwater BMPs on 20% of

all impervious surfaces.

Stormwater Facility Retrofit Cost Estimates

According to the 2010 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 or on average $49,000. 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 produced in 2010; therefore, the estimates for 2025 to 2050 are likely significantly more costly.

Table 49. Stormwater retrofit cost estimates in BBC Watershed.

Impervious Surface Type	Acres	Total cost estimate to retrofit at $78,000 per acre
City of Vancouver	62.02	$4,837,560
Institutional (Schools / Colleges)	201.12	$15,687,360
Clark County	59.94	$4,675,320
Washington Department of Transportation	219.08	$17,088,240
Private Property	2,097.84	$163,631,520
Total impervious surfaces	2,640.00	$205,920,000

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 Region 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 50. Average cost of stormwater BMPs from Ecology's Water Quality Combined Funding.

BMP	Sample size	Average cost per acre
Water quality treatment	51 projects	$25,535
Water quality treatment 2 to 10 acres	25 projects	$140,877
Water quality treatment less than 2 acres	8	$616,286
Emerging stormwater treatment technologies (TAPE)	18	$43,290
Emerging stormwater treatment technologies (TAPE) if project is 2 to 10 acres	6	$164,581
Emerging stormwater treatment technologies (TAPE) if project is less than 2 acres	2	$328,540
Permeable pavement	7 projects	$238,677

Source: Ecology's Stormwater Financial Assistance Program, 2021.

Stormwater Maintenance Cost Estimates

The Puget Sound Stormwater Retrofit Report Cost Estimate Appendix A estimated that annual maintenance costs are $300 to $3,200 per acre. The estimated total annual maintenance cost to maintain 528 acres in BBC is $1.6 million depending on maintenance frequency and the total acres maintained.

Table 51. Stormwater maintenance cost estimates.

Impervious Surface Type	Acres	Total average annual cost estimate at $3,200 per acre	Total cost estimate for 10 years
City of Vancouver	62.02	$198,464	$1,984,640
Institutional (Schools / Colleges)	201.12	$643,584	$6,435,840
Clark County	59.94	$191,808	$1,918,080
Washington Department of Transportation	219.08	$701,056	$7,010,560
Private Property	2,097.84	$6,713,088	$67,130,880
Total impervious surfaces	2,640.00	$8,448,000	$84,480,000

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

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 per acre and rural land cost was estimated at $430,000 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 are estimated at $2,178,000 per acre of BMP. The annual operating cost for bioretention facilities is estimated at $82,764 per acre of BMP, with a facility lifecycle of 30 years.
Detention ponds (flow control): Capital costs for detention ponds are estimated at $300,000 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 52. Clark County stormwater implementation cost estimates.

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[48]

City of Vancouver Stormwater Cost Estimates

The following is a summary of stormwater activity cost estimates prepared by the COV. These cost estimates provide a local example of the cost of stormwater projects in COV in 2023.

Table 53. COV stormwater activity costs in BBC Watershed.

Stormwater Activity	Minimum Total Cost Estimate
NE Fourth Blvd East Orchard (North)	$964,900
NE Fourth Blvd East Orchard (South)	$933,800
NE Ross Street LID Retrofits	$984,000
Burton Channel Green Retrofit Project	$198,000
Fourth Plain Central	$2,165,000
Burnt Bridge Creek Outfall Survey	$149,940
TOTAL	$5,395,640

Source: City of Vancouver 2023.

[48] https://clark.wa.gov/sites/default/files/dept/files/public-works/Stormwater/Capital_Projects/_App%20O%20FINAL%20Estimated%20Costs.pdf

Future Project Budget Development

These cost estimates were developed using a report published in 2010, a Clark County report from 2017, COV data from 2023, 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 an assessment on 12.7 stream miles of the BBC mainstem from the mouth to the headwaters. Along the riparian corridor of BBC, in areas located within 100 to 150 meters of the creek, approximately 36 percent of the riparian area is grassland, 19 percent is developed, and 45 percent is a mix of riparian forest with varying tree heights and densities.

One river mile (approximately 5,280 feet) with 215 feet of riparian buffer, makes up an area of 1,135,200 square feet, which is approximately 26.06 acres of riparian area per river mile. To achieve 215 feet of riparian buffer on the BBC mainstem, approximately 662 acres of riparian area needs to be planted. Additionally, a desktop analysis determined that approximately 4.1 miles of BBC tributaries need riparian restoration. To implement 215-foot riparian buffers on 4.1 miles of tributaries, approximately 214 acres of riparian restoration is needed for a total implementation need of 876 acres of riparian restoration in the watershed.

However, a 215 ft buffer in a highly urbanized environment will not be possible in most cases. Examples of situations where it may not be feasible to implement Ecology's preferred recommendation to restore the RMZ to a fully forested state include but are not limited to the presence of structures and infrastructure (e.g., roads, railways, pipelines, powerlines and other utilities), property lines, topography constraints, economic hardship, small parcels, and the majority of the property (89%) is privately owned.

Riparian Restoration Cost Estimates

Ecology's Water Quality Combined Funding Program estimated that the average cost to complete riparian restoration is approximately $25,000 per acre, based on 33 previously funded grant agreements across the state from State Fiscal Years 2016 to 2019 and Vancouver metro costs in 2023. Cost per acre varies based on specific site conditions and project scale. Costs range from approximately $3,500 to $35,000, 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.

If all riparian land was open for restoration to 215-foot buffers, the total estimated cost on the BBC mainstem is approximately $23,170,000 based on the total cost per acre. The cost to achieve riparian restoration on tributaries is estimated at $7,490,000. In total, up to a $30,660,000 investment may be needed to achieve 876 acres of riparian restoration in the watershed. These cost estimates represent the funding needed to implement riparian

restoration projects using public resources. If landowners choose to implement riparian restoration efforts on their own, costs may be significantly lower depending on the costs of trees, site preparation, and any contracted labor.

Table 54. Riparian restoration cost estimates in BBC Watershed.

Riparian restoration	River miles	Acres	Estimated number of trees (2,000 per acre)	Total cost estimate ($35K per acre)
Riparian restoration mainstem	12.7	662	1,324,000	$23,170,000
Riparian restoration tributaries	4.1	214	428,000	$7,490,000
TOTAL	16.8	876	1,752,000	$30,660,000

*Note: $35,000 per acre estimate includes invasive species removal, planting, and 1-2 years of maintenance provided through evaluation of average costs for 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 Appendix O of the 2017 Whipple Creek Watershed-Scale Stormwater Plan Report[49] Costs to restore riparian areas is estimated at $700,000 per mile of stream, which is approximately $77,000 per acre. The cost includes estimated costs to acquire land or easements, complete outreach, and implement a four-year maintenance program for plant establishment. In 2023, riparian restoration cost approximately $15,960 per acre, this figure does not include land acquisition. 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

The COV recently purchased priority parcels along BBC that will be restored and protected, increasing riparian habitat in the watershed and benefiting water quality. BBC is a highly urbanized waterway and the cost to access and purchase parcels is not only challenging but also very expensive. Two recent land acquisition projects that Ecology supported through grant funding cost $3,148,011. This money bought approximately 26 acres in total in 2021 and 2022. If 26 acres were available and acquired every 3 years for the next 15 years, 130 acres could be conserved for restoration along or near BBC at an estimated cost of $15,740,055 by 2041.

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.

[49] https://clark.wa.gov/sites/default/files/dept/files/public-works/Stormwater/Capital_Projects/_App%20O%20FINAL%20Estimated%20Costs.pdf

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 through education and outreach to implement planting projects on their own. Developing local tax incentive programs or subsidies may also help increase private landowner riparian restoration efforts and lower long-term costs.

Monitoring Cost Estimates

Ecology and local partners have been monitoring in the BBC Watershed for many years. Ecology's TMDL assessment monitoring began in 2008 with investigative monitoring completed as recently as 2020. A summary of monitoring costs is included in table 57. As of 2023, the Department of Ecology has invested $62,265 in targeted water quality monitoring in the BBC 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.

The COV also invests monitoring resources in the watershed, costing an estimated $262,000 annually. The city has been monitoring water quality in the watershed annually since 2011. Monthly sampling includes priority TMDL parameters bacteria, temperature, dissolved oxygen and pH as well as an expanded suite of conventional parameters.

Future effectiveness monitoring cost details will be determined at time of monitoring. Cost estimates are based on the assumption that evaluation for BMP effectiveness in the watershed will need to be completed again starting in 2041. The estimated cost for future effectiveness monitoring annually could be $105,000. The total conservative cost estimate for monitoring investment in BBC between 2026 and 2041 is approximately $1,575,000.

Table 55. Water quality monitoring costs and cost estimates in the BBC Watershed.

Water Quality Monitoring	Number of Samples	Cost per sample	Total cost estimate
2008-2009 Ecology Water Quality Sampling	737	$11-77	$62,265
2023 Annual City of Vancouver Stormwater Management	1320	$32	$92,541
2024-2028 City of Vancouver Water Quality Sampling	Varies	Varies	$1,100,000
2018-2023 WSDA	69	$867-1147	$72,733
Total annual effectiveness monitoring	TBD	TBD	$382,087
Total estimated future effectiveness monitoring over the next 15 years	TBD	TBD	$5,793,570

Source: 2008 QAPPs, 2023 and 2024 City of Vancouver, 2023 WSDA.

Future Project Budget Development

These cost estimates were developed using information from Ecology's 2008 Quality Assurance Project Plan for BBC, information from the COV and WSDA. 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 9 – Criteria to Measure Progress

The following chapter includes details of how Ecology and the BBC Partnership will evaluate ARP implementation progress in the watershed. This chapter also includes milestones, targets, and timelines for long-term planned activities. 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 bacteria (*E. coli*) are the key water quality indicators Ecology will utilize to evaluate success. Ecology will use results from periodic reporting and effectiveness monitoring to adaptively manage actions outlined in this plan and determine if the ARP has been successful in bringing the creek into compliance with water quality standards.

Septic Systems Milestones, Targets, and Timelines

To achieve water quality standards for bacteria in BBC, one of the highest priorities is to address noncompliant septic systems in the watershed and connect to sanitary sewer when available. Noncompliant septic systems are those that are past due for maintenance, which includes inspection and routine tank pumping. Septic system inspection and maintenance are necessary to ensure septic systems are functioning properly to protect water quality. If systems are not providing adequate treatment, then system maintenance, repair, or connection to the municipal sanitary sewer system may be needed.

Short-Term Milestones for Septic Inspection and Maintenance

The short-term goal is to provide technical and financial assistance for septic system inspections, maintenance, repair, replacement, or connection to public sewer for the 700 noncompliant septic systems in the BBC Watershed by 2041. Inspection and maintenance will cost approximately $441,000. To achieve this goal, 20 percent of these septic systems (approximately 140) should be addressed by 2029, and 40 percent (280 septic systems) should be addressed by 2032.The ultimate goal is to achieve 60 percent of septic system compliance by 2035, and 80 percent by 2038, with 100 percent implementation on noncompliant septic systems by 2041.

Table 56. Milestones, targets, and timelines for noncompliant septic systems.

Watershed Location	Number of parcels with noncompliant septic systems	80 percent	60 percent	40 percent	20 percent
Lower Watershed (RM 0-5)	226	180.8	135.6	90.4	45.2
Middle Watershed (RM 5-10)	170	136	102	68	34
Upper Watershed (RM 10-13)	304	243.2	182.4	121.6	60.8
Total in BBC Watershed	700	560	420	280	140
Estimated cost for inspection and maintenance in full watershed	$441,000	$352,800	$264,600	$176,400	$88,200
Target Implementation Year	**2041**	**2038**	**2035**	**2032**	**2029**

*Noncompliant septic systems are those past due for inspection and maintenance as determined by Clark County Public Health in 2023.

*Estimated cost for an inspection is $130 and standard maintenance is $500. The total cost for both activities is $630 per system.

Septic System Inspection and Maintenance Effectiveness Monitoring

Clark County Public Health, the COV and potentially Clark Conservation District will report progress on septic system compliance and sewer connection to the Department of Ecology. Water quality monitoring, including microbial source tracking, source tracing, and pollution identification and correction (PIC) methodology will be utilized to confirm sources of human bacteria and target septic related outreach to property owners. Once bacteria targets have been achieved, water quality effectiveness monitoring will be the primary tool used to assess progress towards meeting water quality standards. *E. coli* bacteria will be the monitoring parameter used to assess progress towards meeting bacteria standards and achieving water quality standards.

Implementation of BMPs for septic systems and sewer connection will be adaptively managed based on results from water quality monitoring. If water quality standards are achieved in priority areas of the watershed, implementation will shift to other areas that are not meeting standards until all segments of BBC comply with bacteria standards.

Partners will prioritize outreach to property owners with noncompliant septic systems in the watershed that are within 200 feet of the stream. In total, there are 700 noncompliant septic

systems in the watershed. Approximately 10 of those are within 200 feet of a waterway.

Long-Term Milestones for Septic Inspection and Elimination

If 100 percent of the noncompliant septic systems have been addressed and water quality challenges persist, then the focus will expand to all septic systems in the watershed. In total, the BBC Watershed has an estimated 3,325 septic systems. Around 21 percent are considered out of compliance with inspection and maintenance requirements. To achieve clean water, routine septic system inspections, maintenance, repair, and removal will need to be ongoing in the watershed until all properties with septic systems that have municipal sewer service available have connected.

Clark County recommends most septic systems be inspected every 3 years, with specialty systems requiring more frequent inspections, and maintenance completed every 5 years. Replacement of septic systems is needed every 15 to 40 years with connection to the public sewer system the preferred alternative.

If water quality is not improving after significant progress in septic inspection and maintenance activities the BBC Partnership will increase efforts to address sources of bacteria from pets and stormwater runoff.

Septic Elimination Effectiveness Monitoring

The COV implements an annual water quality monitoring program in the BBC Watershed. The last water year of monitoring was completed in 2025 and is ongoing. The watershed will have effectiveness monitoring implemented by the COV and Ecology until water quality standards are attained. Implementation of BMPs for septic to sewer conversion will be adaptively managed based on results from the COVs water quality monitoring.

Stormwater Management Milestones, Targets, and Timelines

To achieve water quality standards in BBC, increasing the use of stormwater management BMPs is critical. Additional stormwater projects are needed to provide water quality treatment for existing impervious surfaces to reduce pollutant loading, slow and cool urban stormwater runoff. New private development must comply with stormwater management requirements under existing stormwater permits. Continued and increased stormwater maintenance on existing infrastructure is also necessary to improve water quality in BBC.

Short-Term Milestones for Stormwater Management

To achieve the goal of treating impervious surfaces in the watershed, Ecology recommends implementing new stormwater BMPs on 10 percent of total untreated impervious surface area in the BBC Watershed by 2041. Approximately 528 acres or 20 percent of impervious surfaces in the watershed are publicly owned by the COV, Clark County, WSDOT, and numerous schools and colleges. Publicly owned properties with impervious surfaces have a higher access potential for stormwater BMP implementation.

Ecology is confident in stormwater partners ability to achieve 10 percent implementation by 2041 through strengthened partnerships and community activation through collaborative efforts. The ultimate goal is to achieve a 20 percent reduction of untreated impervious surface

area by 2056.

Table 57. Milestones, targets, and timelines for stormwater implementation.

Impervious Surface Type	Acres	80%	65%	50%	30%	15%
Publicly Owned	528	422.4	343.2	264	158.4	79.2
Estimated average cost for retrofit	$11,616,000	$9,292,800	$7,550,400	$5,808,000	$3,484,800	$1,742,400
Target Implementation Year	**2056**	**2051**	**2046**	**2041**	**2036**	**2031**

Long-Term Milestones for Stormwater Management

The long-term goal is to implement stormwater BMPs on 20 percent of the total impervious surfaces in the BBC Watershed by 2056. Currently, the watershed has an estimated 2640 acres of impervious surfaces with 2,098 acres under private ownership. To implement stormwater BMPs on 20 percent of the total impervious area in the watershed, approximately 528 acres would need to be retrofitted at an estimated average cost of $11.6 million. This implementation will be achieved through activities completed by the COV, Clark County, WSDOT, and other watershed partners and community. If water quality is not improving after significant stormwater management efforts, then the Burnt Bridge Creek Partnership will assess if more investment is needed in other implementation areas to address sources of pollutants.

Stormwater Effectiveness Monitoring

The COV implements an annual water quality monitoring program in the BBC Watershed. The last water year of monitoring was completed in 2025 and is ongoing. The watershed will have effectiveness monitoring implemented by the COV and Ecology until water quality standards are attained. Implementation of BMPs for stormwater treatment will be adaptively managed based on results from annual and periodic water quality monitoring efforts.

Riparian Restoration Milestones, Targets, and Timelines

To achieve temperature water quality standards in BBC, and support the aquatic ecosystem, the highest priority is to expand riparian restoration efforts and increase riparian shade. The long-term goal is to achieve system potential shade and reach 85 percent tree canopy cover where feasible. Projects to restore riparian areas and increase tree canopy are needed to increase effective shade and help lower water temperatures. Implementation of restoration projects in all available riparian areas needs to be initiated by 2041, with the expectation that trees will reach maturity within 20 to 30 years, by 2061 to 2071.

The maximum restoration potential would require fully vegetating 215-foot buffers on 876 acres along 16.8 stream miles for an estimated cost of over $30 million, not including land acquisition costs. To achieve the planting target, 20 percent of riparian area needs to have vegetation projects with initial plantings installed by 2029, with forty percent of buffer acres

planted by 2032, 60 percent by 2035, 80 percent by 2038 and 100 percent implementation by 2041.

Table 58. Milestones, targets, and timelines for riparian restoration by river mile.

Riparian restoration	River miles	80 percent	60 percent	40 percent	20 percent
Riparian restoration mainstem	12.7	10.16	7.62	5.08	2.54
Riparian restoration tributaries	4.1	3.28	2.46	1.64	0.82
TOTAL	16.8	13.44	10.08	6.72	3.36
Target Implementation Year	**2041**	**2038**	**2035**	**2032**	**2029**

Table 59. Milestones, targets, and timelines for riparian restoration by acre.

Riparian restoration	Acres	80 percent	60 percent	40 percent	20 percent
Riparian restoration mainstem	662	529.6	397.2	264.8	132.4
Riparian restoration tributaries	214	171.2	128.4	85.6	42.8
TOTAL	876	700.8	525.6	350.4	175.2
Estimated cost for riparian restoration at $35,000 per acre	$30,660,000	$24,528,000	$18,396,000	$12,264,000	$6,132,000
Target Implementation Year	**2041**	**2038**	**2035**	**2032**	**2029**

Riparian Restoration Effectiveness Monitoring

BBC is a priority for water quality improvement and significant restoration projects have already been completed in the watershed. Ecology is confident that restoration partners will be able to achieve goals outlined in this ARP. The most significant barriers to implementation will be private landowner participation, limited space available on developed properties to create

adequate riparian buffers, and the high cost of restoration. Additional outreach and education to private landowners will be necessary to achieve riparian restoration goals in most of the watershed.

Restoration practitioners, which include COV, Clark County, Clark Conservation District, Clark Public Utilities, Lower Columbia Estuary Partnership, and other non-profit groups utilizing grant funding for projects, will report progress on riparian restoration and tree planting periodically to the Department of Ecology. If water temperatures are not improving after significant riparian restoration, then the BBC Partnership will assess if more investment is needed in other implementation areas that benefit water temperatures, such as streamflow restoration. These can include enhancement of cold-water refuge areas, floodplain reconnection, wetland restoration, installation of large wood, and other riparian enhancement activities.

Summary of Milestones, Targets, and Timelines

Significant investment is needed in BBC Watershed to achieve water quality standards. Ecology's goal is to address noncompliant septic systems in the watershed by 2041 through septic system inspections, maintenance, and connection to sanitary sewer. It is Ecology's goal to implement maximum riparian restoration on 100 percent of the available mainstem and tributary buffer areas by 2041, with the expectation of achieving tree maturity between 2061 and 2071. Additionally, Ecology will work with stormwater permittees to support design and construction of water quality treatment projects for 10 percent of total impervious surfaces in

the watershed by 2041, working towards implementing BMPs on 20 percent of the total impervious surface area in the watershed by 2056. Temperature monitoring will be completed annually by the COV. Ecology will reassess if the watershed is on target for meeting water quality standards for bacteria in 2041 and temperature criteria in 2061.

The following table summarizes Ecology's criteria to measure progress, milestones, targets, and timelines for ARP implementation in the watershed. Periodic 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.

Table 60. 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 2026	Estimated number per year to achieve milestone	Estimated cost per year to achieve implementation milestone
100% of noncompliant septic systems in the watershed fixed and/or replaced	700 noncompliant septic systems	2041	15 years	47 noncompliant septic systems fixed and/or replaced	$25,666 and/or $1,120,000
100% septic systems with sewer available connected to sanitary sewer	3197 septic systems eligible for sewer connection	2051	25 years	128 sewer connections	$3,200,000
20% of total impervious surfaces treated through stormwater retrofits	528 acres	2056	30 years	17.6 acres	$387,200
100% of available riparian buffer has restoration initiated	16.8 river miles or 876 acres	2041	15 years	1.12 river miles or 52.14acres	$2,044,000

Chapter 10 – Effectiveness Monitoring and Adaptive Management

Monitoring Efforts in the BBC Watershed

The Department of Ecology, COV, Clark County, WSDA and WDFW have undertaken various monitoring projects in the BBC Watershed over many years. Monitoring efforts have been designed to assess watershed health, water quality, habitat conditions, and the status of fish populations. Ecology's goal for this implementation plan is to achieve water quality standards for bacteria by 2041, and meet temperature, pH, and dissolved oxygen criteria by 2061. Effectiveness monitoring will be the primary tool to evaluate if implementation of water quality BMPs outlined in this ARP are successful in improving water quality for temperature, DO, pH, and bacteria. The following chapter summarizes monitoring efforts completed in the BBC Watershed since 2008. Ecology's 2020 BBC Source Assessment was the primary technical reference used to establish priorities in this ARP.

This chapter also includes a timeline for implementing future effectiveness monitoring in the watershed by Ecology. Ecology will evaluate whether timely progress towards meeting water quality standards has been achieved by 2041 for bacteria, and by 2061 for temperature, pH, and dissolved oxygen. The COV plans to continue annual monitoring of water quality in the BBC Watershed, providing data to support the assessment of long-term changes in bacteria, temperature, pH, dissolved oxygen and stream health.

Department of Ecology Monitoring

To assess water quality impairments in the watershed, the Department of Ecology completed its first water quality monitoring assessment of BBC in 2008-2009. A Quality Assurance Project Plan (QAPP) associated with the monitoring effort was published in 2008 and is available online. Results from the water quality monitoring study supported modeling and analyses undertaken to complete the 2020 BBC Source Assessment Report, which is also available online.

Burnt Bridge Creek Watershed Source Assessment

Data collected by Ecology confirmed that several areas, identified in the 2020 Source Assessment, continue to exceed water quality standards. Elevated bacteria concentrations have been measured at all sampling sites, including the three primary tributaries – Cold Creek, Burton Channel and Peterson Channel. High stream temperatures have also been measured throughout the watershed and stream reaches with large shade deficits in the riparian corridor have been identified to guide restoration activities to increase tree canopy. Low dissolved oxygen was recorded in upper and middle sections of BBC; and though most sites had at least one day with a pH excursion most measurements were within the pH criteria. The lowest pH values along the BBC mainstem were in the upper watershed, with exceedances above criteria occasionally measured in the middle and lower basins. The mainstem site with the highest observed pH that did not meet criteria was BBC00.0.

City of Vancouver Monitoring

The City has established a long-term monitoring program, collecting monthly water quality data at sampling stations across the watershed. Continuous temperature data loggers are installed at eight monitoring locations during the critical season. Field measurements and grab samples for laboratory analyses are taken during base flow and qualifying storm events throughout the year. Field and sampling procedures, data quality assessment, data analysis, and comparisons can be found in annual BBC Water Quality Monitoring Reports on the City's Stormwater Management Program Plan webpage[50]. The Water Year 2024 Report included a trend analysis for data collected from 2011 – 2024. Water quality data is submitted to Ecology's Environmental Information Management (EIM) system.

Lower Columbia Urban Streams Monitoring

The Stormwater Action Monitoring (SAM) Program is funded through annual permit fees from agencies covered under the Western Washington NPDES Municipal Stormwater Permit. In the southwest region of the state monitoring is conducted by Clark County under an Interagency Agreement with Ecology. The Lower Columbia Urban Streams[51] monitoring program aligns with similar monitoring efforts in the Puget Sound region to conduct annual stream health monitoring and track changes over time in urban and urbanizing areas where stormwater is influencing water quality.

Each year the program visits five long-term trend sites, one reference site, and three to four status sites. Status sites are monitored on a five-year rotating basis, selected from 16 small streams in permitted jurisdictions of the southwest region. BBC (identified as BBC050) is one of the streams selected for long term monitoring and trend evaluation with monitoring conducted annually in the central basin at COV site BBC05.9. In addition to water quality, sediment chemistry, stream and riparian habitat information, benthic macroinvertebrates and water level data are collected.

Washington Department of Fish and Wildlife Monitoring

WDFW has conducted stream surveys for salmonids and some lamprey species in the BBC Watershed. In recent surveys no Chinook, chum, steelhead, or Pacific lamprey were detected. Live coho and coho redds have been previously found, but in very low numbers. BBC is a highly urbanized stream with poor water quality, lacking in suitable spawning habitat, and less than favorable conditions for salmonids and other aquatic life. New habitat restoration projects, additional stormwater treatment BMPs, and efforts to increase septic to sewer connections will improve water quality and increase salmonid and lamprey habitat in the BBC Watershed.

[50] https://www.cityofvancouver.us/government/department/public-works/water-sewer-and-stormwater/stormwater-management-program-plan/

[51] https://ecology.wa.gov/regulations-permits/reporting-requirements/stormwater-monitoring/stormwater-action-monitoring/sam-status-and-trends/lower-columbia-urban-streams

Washington State Department of Agriculture Monitoring

The WSDA has been monitoring BBC for pesticides since 2017. Samples are tested for approximately 150 current and legacy chemicals. Multiple herbicides and insecticides have been detected above WSDA assessment criteria (one half of state and federal water quality criteria) and are identified as Pesticides of Concern for the BBC Watershed in annual fact sheets.

Effectiveness Monitoring

Ecology and project partners plan to create an effectiveness monitoring plan to measure the effectiveness of ARP implementation and inform the selection of adaptive management strategies. The effectiveness monitoring plan will be used to determine progress toward achieving ARP goals and to provide a flexible framework to accommodate future management strategies.

Bacteria

For bacteria, effectiveness monitoring will be undertaken by Ecology through Pollution Identification and Correction (PIC) efforts when sources of bacteria have been identified and water quality BMPs are implemented. Information collected through PIC efforts and through annual water quality monitoring will be used to determine strategies for adaptive management.

Ecology will formally reassess the watershed in two phases. The first effectiveness monitoring study will be initiated in 2041 to determine if implementation of the ARP is resulting in reducing bacteria in the watershed. Ecology will be focusing on priority locations identified in the original 2008-2009 study. This monitoring study will be conducted by Ecology's Environmental Assessment Program (EAP). The monitoring plan will also be informed by PIC efforts and results from COV sampling. If interim monitoring data demonstrates that there are lingering bacteria issues in the watershed, Ecology will include investigative sampling locations and bacteria hot spots in the 2041 monitoring plan to identify existing and new sources of bacteria. Once effectiveness monitoring is complete, Ecology will review the results with EPA to determine if the ARP is achieving desired results or if a traditional TMDL plan is needed.

Ecology believes that implementation of this ARP will result in improved water quality and attainment of bacteria water quality standards. When water quality criteria are met, Ecology's focus will shift from addressing bacteria impairments to water quality protection and antidegradation.

Temperature, Dissolved Oxygen, pH

Riparian restoration projects need to be implemented by 2041 to reach criteria targets for temp, DO, and pH. It takes many years for riparian canopy cover to mature and provide adequate shade to reduce water temperatures, increase DO, and restore healthy pH levels. Overcoming the long-term effect of increased air temperature in the region requires early implementation of temperature BMPs throughout the watershed. Ecology is planning to formally reassess the watershed in 2041 and evaluate progress towards meeting temperature

standards by 2061. If stream temperature targets have not been achieved by shading from trees that have reached site potential tree height, a new shade deficit analysis will be completed between 2061 and 2071 to evaluate how effective shade has changed over time.

Ecology's effectiveness monitoring will be conducted by EAP staff. Until 2061, Ecology will utilize monitoring results from the COV's annual monitoring efforts to track water temperatures, DO, and pH. Ecology will also work with partners that are implementing salmon recovery projects to track water temperatures when data are available. Ecology believes that implementation of this ARP will result in improved water quality and attainment of temperature, DO and pH water quality standards. Ecology will work with EPA to evaluate effectiveness monitoring results and to determine if a traditional TMDL plan is necessary.

Formal monitoring reports will be published in 2041 and in 2061 to summarize implementation efforts and effectiveness monitoring results. When state water quality criteria are met, the Department of Ecology will delist BBC category 5r waters in accordance with Policy 1-11. The following table summarizes present and future monitoring efforts in the BBC Watershed.

Table 61. Monitoring schedule in the BBC.

Monitoring Project	Organization	Year
Stormwater Management Water Quality Monitoring	City of Vancouver	Annual
NPS Investigative Monitoring	Department of Ecology	Ongoing
Pollution Identification and Correction Monitoring	Department of Ecology	TBD
Effectiveness Monitoring – Bacteria and pH	Department of Ecology	2041
Effectiveness Monitoring – Temperature and Dissolved Oxygen	Department of Ecology	2061

Adaptive Management and Implementation Tracking

The BBC Partnership was formed in 2021. The Partnership plans to meet annually to share information, provide project and program updates, and revisit water quality implementation goals. Maintaining and expanding the partnership will be important to long-term implementation and adaptive management of this ARP.

Periodic Reporting

To document implementation progress, the Department of Ecology will publish a concise periodic report highlighting implementation efforts and successes in the watershed. To develop this report a survey will be sent to BBC partners to gather information on project and program implementation status, metrics, and outcomes. Implementation tracking for grant funded activities will be completed through Ecology's Water Quality Combined Funding Program. All periodic reports will be published on the BBC Partnership website. Metrics collected annually

will be compared to the Criteria to Measure Progress that are established in Chapter 9.

Periodic reporting and project tracking specific to implementation of septic, stormwater management, and riparian restoration BMPs will occur until bacteria effectiveness monitoring is completed in 2041. Project tracking for implementation of riparian projects will continue through 2061, when temperature, dissolved oxygen, and pH effectiveness monitoring have been completed.

Effectiveness Monitoring Reports

Results from the 2041 and 2061 effectiveness monitoring efforts will be published in formal effectiveness monitoring reports. Leading up to future state effectiveness monitoring, Ecology and the BBC Partnership will utilize results from the COVs monitoring efforts to inform decisions on how the Partnership will move forward with implementation. These results will ultimately determine if the ARP has been successful or if a traditional TMDL plan is needed for the watershed.

Conclusion

The long-term goal of this ARP is to achieve clean water, meet water quality standards in Burnt Bridge Creek, and enhance aquatic ecosystems for the benefit of diverse biological organisms and human communities. When water quality standards are met, the BBC Partnership will shift its focus from water quality improvement to water protection and antidegradation in the watershed.

Summary of BBC Publications

Table 62. Summary of BBC reports and related scientific publications

Project	Description	Agency	Year
Climate Change and Freshwater Harmful Algal Blooms	Identifies climate change carbon as a freshwater pollutant	EPA	2025
Water and Nutrient Budgets for Vancouver Lake	Identifies nutrient inputs into the lake from tributaries	USGS	2010, 2012
International Stormwater BMP Database	Publicly accessible repository for BMP performance monitoring study, design, and cost information	The Water Research Foundation	2020
WRIA 27/28 Salmon-Washougal & Lewis Watershed Management Plan	Establishes water quantity allocations for the watershed	LCFRB	2006
Surface Water/Groundwater Interactions and Near-Stream	Evaluation of how groundwater influences in-stream temperatures and water quality.	Ecology	2012
Groundwater Quality along Burnt Bridge Creek, Clark County Integrated Scientific Assessment Report Vancouver Watershed Health Assessment	Summarizes watershed health in the City of Vancouver	City of Vancouver	2019
Water Year 2024 Trend Analysis Report Burnt Bridge Creek Water Quality Monitoring Program	Identifies priority areas for water quality improvement	City of Vancouver	2025
2018 Monitoring Report Burnt Bridge Creek Ambient Water Quality Monitoring Project	Identifies priority areas for water quality improvement	City of Vancouver	2019
Burnt Bridge Creek Fecal Coliform Bacteria, Dissolved Oxygen, and Temperature Total Maximum Daily Load	Establishes monitoring plan for watershed for bacteria, temperature, dissolved oxygen and	Ecology	2008

Water Quality Study Design (Quality Assurance Project Plan)	pH.		
Burnt Bridge Creek Watershed Fecal Coliform Bacteria, Temperature, Dissolved Oxygen, and pH Source Assessment Report	Identifies priority areas for water quality improvement	Ecology	2020
Natural Areas Acquisition Plan Legacy Lands Program	Identifies priority conservation lands	Clark County Public Works	2021
Burnt Bridge Creek Summary of 2022 Surface Water Monitoring Program Results	Highlights pesticide pollution	WSDA	2024
Burnt Bridge Creek Advanced Restoration Plan	Establishes implementation plan to improve water quality	Ecology	2025
Burnt Bridge Creek Periodic Reports	Summarizes annual implementation in the watershed	Ecology	2026 to 2061
Burnt Bridge Creek Effectiveness Monitoring Report	Evaluates progress made towards achieving water quality standards	Ecology	2041, 2061
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	2041, 2061

Acronyms and Abbreviations

BPA - Bonneville Power Administration
BBC – Burnt Bridge Creek
COV – City of Vancouver
WSDOT – Washington State Department of Transportation
I-5 - Interstate 5
I-205 - Interstate 205
SR 500 - State Road 500
BMPs – Best Management Practices
TMDL - Total Maximum Daily Load
CWA – Clean Water Act
ARP – Advance Restoration Plan
EPA – Environmental Protection Agency
WQS – Water Quality Standards
ESA – Endangered Species Act
WRIA - Water Resource Inventory Area
RM – River Miles
WDFW – Washington State Department of Fish and Wildlife
NPDES - National Pollution Discharge Elimination System
WSDA – Washington State Department of Agriculture
SCIP - Sewer Connection Incentive Program
CCPH – Clark County Public Health Department
MS4 - Municipal Separate Storm Sewer Systems
DO – Dissolved Oxygen
SWMP - Stormwater Management Program
HOA's – Homeowners Association
DOH - Washington State Department of Health
USDA – United States Department of Agriculture
PIC - Pollution Identification and Correction
NPS – Nonpoint Source Pollution
WSU – Washington State University
SEH – Shin-Etsu Handotai America
IDDE - Illicit Discharge Detection and Elimination
CIP - Capital Improvement Plans
SMAP – Stormwater Management Action Plan
LCEP - Lower Columbia Estuary Partnership
CPUD – Clark Public Utility District
NRCS - Natural Resources Conservation Service
SFY – State Fiscal Year
FFY – Federal Fiscal Year
QAPP - Quality Assurance Project Plan
EAP – Environmental Assessment Program

Appendix A. Public Participation

Background

Ecology held an initial 30-day public comment period for this ARP from June 2nd through July 2nd, 2026. During this period, Ecology fielded questions from stakeholders related to the ARP. Ecology held an online informational webinar on June 15th at 5:30pm local time, featuring a 30-minute presentation about the ARP followed by a question-and-answer session. Ecology received comments from 5 partners, totaling roughly 22 comments overall. Many of these comments inquired about similar themes with respect to this ARP's design and implementation. Individual questions and comments – and Ecology's responses – are included subsequently, and they constitute the remainder of this Appendix.

Public Comments Received and Ecology Responses

Bracchi, Peter
Comment ID: 1A

Burnt Bridge Creek Cleanup Costs and Source-Control Considerations. The ARP discusses litter, source control, restoration, and actions needed to improve water quality within the Burnt Bridge Creek watershed. I encourage Ecology and project partners to consider whether the plan adequately documents the recurring cleanup burden associated with long-term encampments and related debris within the Burnt Bridge Creek corridor. According to City of Vancouver Public Records Act records, the Burnt Bridge Creek and trail corridor category accounted for 81 cleanup events between March 9, 2021 and February 12, 2026. During that period, approximately 581.70 tons of material were removed at a reconstructed total cost of approximately $631,616.37. The cleanup records indicate a recurring source-control and restoration issue within the watershed. The material removed was not limited to ordinary litter. City cleanup records and encampment-cleanup contract documents show activities involving garbage, abandoned property, tents, tarps, furniture, mattresses, shopping carts, biohazards, contaminated materials, human waste, syringes, needles, fire debris, hazardous materials, and other waste requiring specialized cleanup and disposal. I am not suggesting that all removed material entered Burnt Bridge Creek. However, the scale, frequency, and cost of these cleanup activities demonstrate a continuing pollution-prevention and restoration challenge within the watershed. The ARP should include a discussion of recurring encampment-related cleanup burdens, associated waste streams, restoration impacts, and source-control considerations within the Burnt Bridge Creek watershed, together with any monitoring or adaptive-management measures deemed appropriate. Future cleanup events, cleanup costs, waste tonnage removed, restoration expenditures, and significant restoration barriers within the Burnt Bridge Creek corridor should be documented and periodically provided to Ecology and the ARP Program Manager as part of ongoing implementation, monitoring, and adaptive management of the watershed.

Ecology Response:

We recognize the complexity and environmental challenges surrounding the issue of homelessness in the Vancouver area - an issue with environmental and social impacts. Ecology is working with local jurisdictions on implementing stormwater protections and building and strengthening Pollution Identification and Correction (PIC) programs, which are able to respond to pollution from a variety of sources including encampments. Ultimately our response to this issue is shaped by many considerations, including staff safety, environmental impacts, and a deference to the established responsibilities of other state and local entities.

Bracchi, Peter

Comment ID: 1B

Use the Andresen Road Camp History to Strengthen ARP Implementation My first comment documents the substantial public expense associated with removing garbage, abandoned property, biohazards, and other harmful materials from Burnt Bridge Creek. Those costs show that pollution and damage along the creek cannot be treated simply as a litter problem. The city-managed Andresen Road encampment provides an important example of why the Alternative Restoration Plan must focus on preventing damage, protecting restoration investments, and clearly assigning responsibility for future action. For approximately two years, the city operated or allowed a large managed encampment on public land beside Burnt Bridge Creek. The camp remained until its closure in July 2025. At closure, nearly 10 tons of garbage were removed, and the city identified risks that included soil, surface-water, and groundwater contamination, along with destruction of vegetation and trees. The purpose of including this history is not to criticize the decision to provide emergency shelter.

It is to ensure that the ARP learns from a documented event that affected the creek corridor and required a costly public cleanup. Burnt Bridge Creek was already a Category 5 impaired waterbody when the camp was established. The creek was first listed as impaired in 2004, Ecology began the TMDL study process in 2008, the Source Assessment was completed in 2020, the Partnership formed in 2021, and the draft ARP was released in 2026. The draft now proposes bacteria compliance by 2041 and compliance for temperature, dissolved oxygen, and pH by 2061. With restoration goals extending decades into the future, the success of the ARP will depend on protecting the creek from new and recurring damage while restoration work is underway. The draft ARP acknowledges that camping, human waste, garbage, and encampments can pollute the creek, damage restoration plantings, and increase maintenance costs. However, the primary responses currently identified—litter cleanup, sanitation education, and portable toilets—remain largely reactive. They address conditions after they occur but do not fully address how sensitive creek areas and restoration investments will be protected. The Andresen Road camp and the cleanup expenses documented in the first comment should be used as an implementation lesson for the final ARP. Suggested Improvements to the Final ARP

The final ARP should:

1. Briefly document the Andresen Road camp, its closure, the nearly 10 tons of material removed, and the environmental risks identified by the City.
2. Recognize that encampment impacts may include harmful materials, human waste, vegetation destruction, soil disturbance, erosion, and risks to surface water and groundwater—not only litter.
3. Identify which agency is responsible for responding when camping, dumping, vegetation removal, or other activities threaten the creek or completed restoration work.
4. Establish procedures and timelines for preventing damage, responding to reported conditions, and confirming that corrective action was completed.
5. Track and report future cleanup, repair, and restoration-replacement costs associated with these impacts so Ecology and the ARP program manager can evaluate whether current strategies are effective.
6. Require that publicly funded restoration areas be actively monitored and protected from repeated damage.

Burnt Bridge Creek has been impaired for more than twenty years, and the ARP proposes a restoration process that may continue for several more decades. The Andresen Road camp demonstrates that successful restoration will require more than cleaning up damage after it occurs. Including this history and these implementation measures would strengthen the ARP, protect public restoration investments, and improve the likelihood that the plan achieves its intended water-quality outcomes.

Ecology Response:
We recognize the complexity and environmental challenges surrounding the issue of homelessness in the Vancouver area - an issue with environmental and social impacts. Ecology is working with local jurisdictions on implementing stormwater protections and building and strengthening Pollution Identification and Correction (PIC) programs, which are able to respond to pollution from a variety of sources including encampments. Ultimately our response to this issue is shaped by many considerations, including staff safety, environmental impacts, and a deference to the established responsibilities of other state and local entities.

Bracchi, Peter
Comment ID: 1C

Field Verification Is Necessary to Support the ARP's Goals, Implementation, and Long-Term Success Relationship to the Goals of the Alternative Restoration Plan The purpose of the Burnt Bridge Creek Alternative Restoration Plan should extend beyond describing general watershed conditions. To successfully improve water quality and watershed health, the ARP must identify appropriate restoration actions, establish implementation priorities, monitor results, and adapt future work when conditions change or restoration efforts are unsuccessful. Achieving these goals requires an accurate understanding of actual conditions on the ground. This comment does not request that Ecology investigate every isolated historical incident or revisit every past enforcement decision. It requests that Ecology use the existing knowledge of the City's specialized field staff to verify representative Greenway conditions, identify restoration needs that may not appear in broad studies, and ensure that the ARP's proposed actions and monitoring program are based on actual site conditions. Limitations of Broad Tree-Density and Existing-Conditions Analysis The ARP relies on reports, mapping, technical analysis, and broad measurements such as tree density. These tools are valuable for understanding the watershed at a landscape scale, but they cannot fully identify localized environmental damage or determine whether restoration is needed at individual sites. Along the Burnt Bridge Creek Greenway, damage often occurs as a series of smaller, dispersed impacts beneath an otherwise intact tree canopy. These impacts can include: Individual trees cut for firewood or construction. Bark removed from living trees. Saplings, understory vegetation, and planted trees destroyed. Soils compacted or disturbed. Roots exposed. Slopes damaged. Small areas repeatedly cleared or occupied. Previously restored or planted areas degraded. A broad tree-density analysis may continue to classify an area as adequately forested while missing individual damaged trees, small cleared areas, loss of future tree growth, and repeated disturbance that prevents natural regeneration. Existing Specialized Field Knowledge The City's Greenway and Sensitive Lands Group maintains the Burnt Bridge Creek Greenway and other similar environmentally sensitive areas. This specialized group has direct field knowledge of the corridor, recurring problem locations, maintenance needs, previous cleanup work, and areas that may require environmental follow-up. The group also tracks conditions observed in the field and sends messages, photographs, and maps to Mr. Potter for review and resolution. This existing process provides Ecology with an efficient starting point for identifying representative locations where field verification would improve the ARP. Requested Initial Technical Field Review Before the ARP is finalized, I request that Ecology conduct an initial technical field review with Mr. Potter and appropriate members of the Greenway and Sensitive Lands Group. The purpose of this visit should be to: Ground-truth the information and assumptions used in the ARP. Review representative locations already known to specialized Greenway staff. Identify localized damage that may not appear in tree-density studies, aerial imagery, or general mapping. Review areas where removal of camps, garbage, or abandoned property occurred but ecological restoration may remain incomplete. Determine whether damaged trees, vegetation, soils, slopes, wetlands, springs, or creekside areas require restoration or monitoring. Confirm whether proposed ARPactions and monitoring measures are adequate to address the conditions observed. Identify practical

implementation needs that should be incorporated into the final ARP or its future work plans. Ecology's direct participation is important because Ecology is responsible for reviewing and guiding the restoration-planning process. Direct observation would allow Ecology to independently understand the difference between general watershed conditions and smaller site-specific damage that may affect restoration success. Follow-Up Field Review for ARP Participants Following the initial technical visit, Ecology and the City should identify a manageable number of representative sites for a separate field review involving key ARP reviewers, decision-makers, technical staff, and those responsible for implementation. A focused two- or three-hour field review would not need to cover the entire Greenway. Its purpose would be to allow key ARP participants to directly see and understand the relationship between localized tree destruction, vegetation loss, disturbed soils, erosion, stream shade, water quality, water temperature, and the long-term success of restoration efforts. Requested Documentation and ARP Follow-Through The initial technical field review should result in a basic written record identifying: The locations visited. The conditions observed. Any identified restoration or monitoring needs. Whether each issue will be addressed through the ARP or another City program. The department or group responsible for follow-up. How completion and long-term success will be tracked. A restoration plan developed without adequate field verification risks overlooking smaller, repeated impacts that collectively affect the health of the Burnt Bridge Creek Greenway. Using the knowledge of the Greenway and Sensitive Lands Group, conducting a documented Ecology field review, and allowing key ARP participants to observe representative sites would directly support the ARP's goals and improve the accuracy, credibility, implementation, and long-term success of the plan.

Ecology Response:
The ARP identifies restoration actions, establishes implementation priorities and a monitoring plan. Ecology will be tracking the implementation of the restoration actions, including monitoring changes in tree density and shade through our adaptive management and effectiveness monitoring. Monitoring efforts have been designed to assess watershed health, water quality, habitat conditions, and the status of fish populations. Ecology’s goal for this implementation plan is to achieve water quality standards for bacteria by 2041, and meet temperature, pH, and dissolved oxygen criteria by 2061. Ecology will meet with City of Vancouver Greenway and Sensitive Lands Group staff to look at houseless population impacts along BBC.

Bracchi, Peter
Comment ID: 1D

Investigate Potential Cold-Water Spring Influence Between BBC05.2, BBC04.3, and BBC03.4 I request that the Burnt Bridge Creek Alternative Restoration Plan include a targeted field investigation of perennial cold-water spring and seep inputs in the reach between BBC05.2, BBC04.3, and BBC03.4, including the Arnold Park / Hidden Falls area and the Bosco Farm / Bosco Farms spring area. Ecology's existing fixed-network sampling map identifies the main monitoring points in this part of the creek, but those sample stations are not the same as a detailed GPS inventory of individual spring inputs, seep faces, small tributary flows, or localized cold-water refuges. This matters because cold-water inputs can be localized and may not be fully captured by broad reach-scale sample stations. Ecology's groundwater study already supports the need for this investigation. It found that lower Burnt Bridge Creek receives water from seeps and small springs associated with perched aquifers and canyon-wall discharge. The same study documented a significant gaining reach between the P4 and P5 area, approximately the BBC04.3 to BBC05.2 reach, during summer low-flow conditions. Based on years of boots-on-the-ground field observation, I have documented perennial spring/flow systems in this corridor, including Arnold Park / Hidden Falls and the Bosco Farm area. These appear to be persistent freshwater inputs below the approximate 200-foot contour, with flow continuing

through dry periods. These features may provide localized cooling, thermal refuge, or baseflow support that is important to understand before finalizing restoration priorities. I am asking Ecology to field-verify whether these perennial inputs have a measurable temperature, flow, or habitat benefit. The investigation should include GPS mapping of spring/seep entry points, summer low-flow temperature measurements, short-term continuous temperature loggers upstream and downstream of the inputs, simple flow estimates, and comparison with existing BBC03.4, BBC04.3, and BBC05.2 monitoring data. See Attachment LIDAR map - SR500 and ST Johns/St James interchange is a the Bottom Middle of the map The ARP should specifically identify, protect, and where possible enhance cold-water inputs and cold-water refuges in this reach. Restoration should not rely only on general shade modeling or broad sample stations if important unmapped cold-water sources exist between them.

Ecology Response:
To achieve clean water in BBC, meet WQS for temperature, and support aquatic life uses, it is necessary to restore riparian areas and implement restoration projects that increase riparian shade. The long-term vision is to achieve system potential riparian vegetation of 85 percent tree canopy cover in BBC by achieving site potential tree height in riparian areas where soil and hydrologic conditions allow. Cold water seep inputs are a benefit to water quality. Additional habitat restoration will also help protect cold water seep inputs. Ecology field staff will investigate cold spring inputs and prioritize these locations if land ownership and implementing partners agree.

Bracchi, Peter
Comment ID: 1E

Comment on Draft Burnt Bridge Creek Advance Restoration Plan – No Net Loss and Long-Term 303(d) Impairment by Peter Bracchi I ask Ecology to directly address whether Burnt Bridge Creek is meeting the practical standard of no net loss of ecological functions. Ecology's no-net-loss guidance identifies the 303(d) list as a potential water-quality indicator for tracking shoreline ecological conditions. That guidance also explains that conditions should be measured against a baseline and tracked over time to determine whether ecological functions are being maintained or whether stronger action is needed. Burnt Bridge Creek has an official impairment history going back at least to 1996, and Ecology's current listing pages show Category 5 listings for bacteria, dissolved oxygen, and temperature beginning in 2004 and continuing through the current assessment cycle. Ecology's 2008 study design also confirms that the 2004 303(d) listings for Burnt Bridge Creek were being addressed for fecal coliform, dissolved oxygen, and temperature. The draft ARP states that Burnt Bridge Creek and its tributaries are on the 303(d) list for warm water temperature, bacteria, pH, and dissolved oxygen. It further states that once EPA accepts the ARP, Category 5 segments would change to Category 5r, but the obligation to achieve standards remains. The draft ARP sets a goal of meeting bacteria standards by 2041 and temperature, dissolved oxygen, and pH standards by 2061. That means Burnt Bridge Creek could remain on an impairment-recovery timeline of roughly 45 years from the earliest verified 1996 listing history to the 2041 bacteria goal, and roughly 65 years to the 2061 temperature, dissolved oxygen, and pH goal. Even using 2004 as the starting point for the modern Category 5 record, the timeline is still about 37 years to the bacteria goal and 57 years to the other goals. This long duration is a serious warning indicator

that the watershed is not yet demonstrating a successful no-net-loss outcome and needs stronger measurable

accountability. For that reason, the final ARP should explicitly address no net loss and include measurable indicators and interim benchmarks, not just distant end dates. At minimum, Ecology should track and publicly

report: 1. 303(d)/5r status by parameter and reach. 2. Temperature exceedances and progress toward temperature compliance. 3. Dissolved oxygen and pH compliance. 4. Riparian canopy, shade deficit, and restoration progress. 5. Stormwater retrofit implementation and impervious-surface treatment progress. 6. Septic correction and sewer-connection progress. 7. Protection and restoration of wetlands, floodplain, and

groundwater/cold-water inputs that support stream temperature and baseflow. The ARP should also include corrective triggers. If periodic monitoring continues to show widespread exceedances, implementation delay, or continued loss of ecological function, Ecology should be required to strengthen restoration actions and reevaluate whether the ARP is sufficient rather than waiting until 2041 or 2061 to determine that stronger action was needed. In short, Burnt Bridge Creek's long-standing impaired status should be treated as a no-net-loss warning sign. The final ARP should say so directly and should commit to measurable indicators, interim benchmarks, and corrective actions sufficient to show that ecological functions are being protected and restored over time, not simply deferred to a future date. That draft is grounded in Ecology's no-net-loss handbook, the Burnt Bridge Creek listing pages, the 2008 TMDL study design, and the draft ARP's own timeline and implementation language.
Reference links
• Ecology No Net Loss Handbook, Chapter 4
https://apps.ecology.wa.gov/publications/parts/1106010part4.pdf
• Ecology Assessment & 303(d) List overview https://ecology.wa.gov/water-shorelines/water-quality/water-improvement/assessment 303d-list
• Burnt Bridge Creek Draft ARP (May 2026)
https://apps.ecology.wa.gov/publications/documents/2610049.pdf
• Burnt Bridge Creek Listing ID 7827 – Bacteria
https://apps.ecology.wa.gov/ApprovedWQA/ApprovedPages/ViewApprovedListing.aspx?ListingId=7836
• Burnt Bridge Creek Listing ID 7836 – Dissolved Oxygen
https://apps.ecology.wa.gov/ApprovedWQA/ApprovedPages/ViewApprovedListing.aspx?ListingId=7836
• Burnt Bridge Creek Listing ID 7837 – Temperature
https://apps.ecology.wa.gov/ApprovedWQA/ApprovedPages/ViewApprovedListing.aspx?ListingId=7837
• Burnt Bridge Creek 2008 TMDL Study Design
https://apps.ecology.wa.gov/publications/documents/0803110.pdf

Ecology Response:
Ecology choose the targeted year goals as outlined in the ARP to provide adequate time for BMP's to be implemented and for water quality impairments to improve in response. We are studying water quality over time to measure improvements in the watershed and actively manage the ARP to better improve water quality standards. Ecology is responding to water quality degradation with the ARP, addressing several stretches of BBC that do not currently meet water quality standards. The BBC Partnership was formed in 2021. The Partnership plans to meet annually to share information, provide project and program updates, and revisit water quality implementation goals. Maintaining and expanding the partnership will be important to long-term implementation and adaptive management of this ARP.

Nickelson, Abigail
Comment ID: 2A

WSDA appreciates the opportunity to provide comments to the Washington State Department of Ecology (Ecology) on the proposed Burnt Bridge Creek (BBC) Advanced Restoration Plan (ARP).

As a State Lead Agency (SLA), WSDA has delegated authority from EPA to implement the Federal Insecticide Fungicide and Rodenticide Act (FIFRA). Our Agricultural Environmental Services (AES) Division regulates and enforces the registration, distribution, use, and disposal of pesticides to protect human health and the environment in Washington State. The AES Division also administers the Natural Resources and Agricultural Sciences (NRAS) program. NRAS scientific programs research the occurrence of pesticides in surface waters and groundwater, agricultural land use practices, soil health, and pesticide use patterns across various crop types. In addition to research projects, NRAS pesticide stewardship staff scientists work with communities

across the state to gain insight into mitigation practices and coordinate projects with conservation districts, university researchers and other agencies. WSDA has been monitoring for pesticides at BBC since 2017. The comments below are intended to address misstatements using WSDA data.

WSDA proposes the following revisions and recommendations to the data summary describing 2022 pesticide monitoring data in BBC:

1.

Original: “When multiple pesticides are detected simultaneously, the harmful effects can combine to lower dissolved oxygen;” Page 41

Proposed: “When multiple pesticides are detected simultaneously, the harmful effects can combine;”

Recommendation: Remove “to lower dissolved oxygen” from this sentence. Additive toxicity for compounds with the same mode of action is well known and can have a direct effect on organisms. However, multiple pesticides in the water do not directly contribute to lower dissolved oxygen. The sentence as currently written suggests that compounds in the water directly affect dissolved oxygen levels and that is beyond the scope of the data.

2.

Original: “Multiple pesticides combined negatively impact water quality by reducing aquatic plant and macroinvertebrate populations, creating aquatic ecosystem imbalances, and lower dissolved oxygen levels.” Page 41

Recommendation: Remove this sentence. The indirect effects claimed in this sentence are beyond the scope of the data. While the levels of pesticides in the water were measured, plant abundance, macroinvertebrate abundance, and ecosystem diversity were not. A toxic unit analysis on these data shows that additive toxicity, for compounds below criteria individually, was below the acute threshold for plants, fish and invertebrates.

3.

Original: “When multiple pesticides are detected simultaneously the harmful effects can combine and contribute to die-off in aquatic plants, lower dissolved oxygen levels, and reduce macroinvertebrate populations.” Page 164

Recommendation: Remove this sentence. See #2 above.

4.
Original: “Two noted chemicals of the seven Pesticides of Concern in BBC are Imidacloprid and Diuron.” Page 41
Proposed: “One chemical was found to be a Pesticide of Concern in BBC, imidacloprid.”
Recommendation: Remove “seven.” This is incorrect, as of the 2022 dataset, BBC had one Pesticide of Concern, imidacloprid.
In addition, remove references to diuron as a Pesticide of Concern in this sentence and the following paragraph. EPA updated the Aquatic Life Benchmark in 2025 to reflect an arithmetic error. With this update, the benchmark for plants changed from 0.13 µg/L to 13 µg/L. This correction has changed WSDA’s Assessment Criteria. All mentions of diuron being a pesticide of concern at BBC for 2022 should be removed. WSDA is in the process of updating all factsheets and reports. To see the corrected diuron benchmark, and the year it was updated, visit EPA’s webpage for the Aquatic Life Benchmarks at: https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/aquatic-life-benchmarks-and-ecological-risk.

5.
Proposed Addition: “Strategies that reduce soil erosion and nutrient movement often provide dual benefit of reducing the movement of other compounds, including pesticides.”
Add this sentence to the end of data summary on Page 41. Nutrients and soil erosion/sediment are subject to the same physical laws that all other chemicals are, which includes pesticides. Practices to minimize the movement of nutrients and soil erosion can reduce the levels of those things as well as pesticides. EPA has produced a document reviewing the measurable reduction in pesticide drift and runoff as a part of an effort to reduce pesticide exposure to endangered species by way of mitigation practices. The document is titled Ecological Mitigation Support Document v2.1 and can be found at https://www.epa.gov/system/files/documents/2025-04/ecological-mitigation-support-document-v.2-1.pdf. Many of these practices are similar or the same as those offered by USDA’s Natural Resource Conservation Service and many other conservation entities.
Along with these proposed revisions and recommendations, WSDA is happy to offer a detailed written or presented data summary for the purpose of supporting revisions of this document. Given that WSDA data used in this document is published information, Ecology should reference any WSDA materials used to complete this report. Describing all known data for BBC is important to understanding the overall health of the watershed. Again, we appreciate the opportunity to comment and we look forward to more discussion and work on these complex topics.

Ecology Response:
The recommended edits were incorporated into the plan. For suggestion 5, we added “strategies that reduce soil erosion and nutrient movement often provide dual benefit of reducing the movement of other compounds, including pesticides”, but elected not to include the additional information for brevity.

Bush, Tony
Comment ID: 3A

Comment: (p. 68) For consistency with other paragraphs about jurisdictional stormwater programs, it may be worth linking to WSDOT's webpage in the paragraph about WSDOT's MS4 permit and contacts: https://wsdot.wa.gov/construction-planning/protecting-environment/managing-stormwater-state-highways It also may be worth mentioning our Stormwater Retrofit Program and Prioritization Web Map. This Folio describes the program and the three main approaches (project-triggered, opportunistic, stand-alone).

Ecology Response:
Edit suggestions accepted. Web links will be added to the document.

Rice, Aaron
Comment ID: 4A

Chapters 3, 4, 7, 8, 9. The City's priority on septic systems is elimination through connection to public sewer where available. The City supports and encourages connection to public sewer regardless of age or condition of the septic system.

Ecology Response:
Edit suggestions with language promoting septic to sewer connection were accepted.

Rice, Aaron
Comment ID: 4B

Chapter 5, 8, 9. Please identify the data source used for the impervious surface analysis used to establish cost estimates and milestones. We are unable to verify the impervious surface numbers.

Ecology Response:
Devan Rostorfer (former Ecology Staff) made an information data request in 2021 with Annette Griffy with the City of Vancouver. This data included impervious surface information used in the ARP. The impervious surface data used in the ARP will not change COV stormwater permit.

Rice, Aaron
Comment ID: 4C

The estimated costs associated with implementation activities are not realistic.

Ecology Response:
Cost estimates based on information available at the time this document was developed. These costs are meant to be relative estimates, and we understand actual costs may be higher or lower. Cost estimates do not account for Climate change impacts, Education and outreach, Administration and project management, Engineering and design, and Inflation.

Rice, Aaron
Comment ID: 4D

Chapters 3, 6, 7, 8, 9. Although Ecology's goals include full restoration on 100 percent of riparian buffer, only 11 percent of acres in the watershed is publicly owned with less than five percent under City of Vancouver management. Buffer widths will also be significantly limited by the highly urbanized landscape and pressure from additional development.

Ecology Response:

Ecology recognizes that the BBC Watershed is highly urbanized with most of the land being privately owned, and we appreciate the challenge of fully restoring riparian buffers along BBC and its tributaries. We believe it's important to outline the restoration needed to meet water quality standards even if meeting those restoration goals will be difficult

Rice, Aaron
Comment ID: 4E

Table 5. Dissolved Oxygen criteria for Burnt Bridge Creek has been set at 10.0 mg/L to protect salmonid spawning, rearing and migration.

Ecology Response:

Updated to reflect current criteria

Rice, Aaron
Comment ID: 4F

Chapter 6. Very few areas along the Burnt Bridge Creek riparian corridor have suitable substrate and hydrology to support a fully forested Riparian Management Zone. Implementing the recommendations for agricultural parcels from the Clean Water Guidance for Agriculture will also have limited application in the watershed. The tables and narratives for agroforestry/silvopasture currently copied into Chapter 6 could be referenced with a link to the Guidance or moved into an appendix. We agree that riparian restoration efforts should maximize shade to the stream using appropriate vegetation for site conditions wherever possible.

Ecology Response:

Ecology recognizes that the BBC Watershed is highly urbanized with most of the land being privately owned. Fully restoring riparian buffers along BBC and its tributaries will be challenging. The goal of restoring habitat on 100% of riparian zones may not be achieved with the given limitations. However, Ecology would like to work with stakeholders to get as close as possible to the 100% riparian restoration goal.

Rice, Aaron
Comment ID: 4G

Chapter 6 Maintenance Challenges. Vancouver's municipal code (VMC 8.22.040) prohibits camping and outside habitation within 200 feet of BBC, Burton Channel, Peterson Channel and the Burnt Bridge Creek drainage area from East Fourth Plain Boulevard to Vancouver Lake.

Ecology Response:

Ecology added additional language about unsanctioned camping along BBC and tributaries.

Rice, Aaron
Comment ID: 4H

The document as a whole could benefit from consolidation. There are 35 pages of Implementation Actions in four separate tables that could be moved to an appendix; the narrative sections could be more cohesive without being separated by large tables.

Ecology Response:
Ecology recognizes the benefit of concise documents and plans to condense information in future ARP's. In response to this comment Ecology consolidated Clean Water Guidance for Agriculture into a link and also accepted COV edits.

Hawes, Sean
Comment ID: 5A

Page 26 & 46 Onsite sewage systems are emphasized as the source of human-based baterial pollution. Page 84 reflects other sources of human-based bacterial pollution. Please clarify consistent references to encompass all potential human wastewater infrastructure as non-point sources in the Burnt Bridge Creek watershed.

Ecology Response:
Edit suggestion not accepted.

Hawes, Sean
Comment ID: 5B

Page 58 Plan states: "Fix and/or replace 100 percent of the noncompliant septic systems in the watershed by 2041 through septic system inspections, maintenance, and connection to public sewer" How is this measured? How is an OSS fixed and/or replaced through an inspection? Clarify language to distinguish what the goal rate is between inspection compliance and maintenance/repairs/failure compliance. CCPH recommends a 90% inspection compliance rate for properties within 200' of the creek and 85% for the full watershed.

Ecology Response:
Ecology would like to maintain a 100% septic system compliance goal in the ARP. Ecology also recognizes that the 100% goal will be difficult to achieve and that less than 100% is more likely.

Hawes, Sean
Comment ID: 5C

Page 79 & 81 Plan states: "Achieve 100 percent septic system inspection and maintenance compliance and correct or replace any failing septic systems" Clearly distinguish a goal between inspection compliance and maintenance/repairs/replacement compliance. CCPH recommends a 90% inspection compliance rate for properties within 200' of the creek and 85% for the full watershed.

Ecology Response:
Ecology would like to maintain a 100% septic system compliance goal in the ARP. Ecology also recognizes that the 100% goal will be difficult to achieve and that less than 100% is more likely.

Hawes, Sean
Comment ID: 5D

Page 60 & 83 reference CCPH as a partner to promote connection to public sewer. The OSS program at CCPH does not routinely encourage conversion to public sewer but focuses on technical assistance and financial aid to support property owners in the appropriate operation and maintenance of their onsite sewer. Mandated connection to sewer is limited to failure of an OSS and replacement can be conditionally permitted by CCPH. Our authority is limited under Clark County Code 24.17.080, provided here for your reference.

Ecology Response:
Edit suggestions accepted and the document was updated to reflect them. Ecology removed language suggesting CCPH promotes septic to sewer connection.

Hawes, Sean
Comment ID: 5E

Page 87 & 88 Plan indicates CCPH will perform water quality sampling and report to ECY and EPA. CCPH does not perform any surface water sampling. Clarify if City of Vancouver or others will provide this sampling and reporting activity.

Ecology Response:
Organizations doing this work was updated.