Puyallup-White River Local Integrating Organization

Ecosystem Recovery Plan

SEPTEMBER 2021

Contents

Executive Summary

The Puyallup-White River Local Integrating Organization (PWR LIO) is a collaborative group of tribal, city, and county governments, non-governmental organizations, special purpose districts, and other groups and individuals concerned with protection and restoration of the Puyallup-White River Watershed (the Watershed). It is a subcommittee of the Puyallup River Watershed Council (PRWC).

The PWR LIO Ecosystem Recovery Plan (ERP) was funded by the US EPA through the Puget Sound Partnership to establish Watershed-scale priorities and actions for Puget Sound recovery. It is intended for use by PWR LIO members, jurisdictions, and other interested parties and partners to guide engagement and decision making for ecosystem protection, restoration, and recovery in the Watershed.

The PWR LIO ERP is organized around eight interdependent ecosystem focus areas identified by PWR LIO members. Table ES-1 identifies the focus areas and the PWR LIO's overarching, directional goal for each one.

Table ES-1: ERP Focus Areas and Directional Goals

Focus Area	High-Level Directional Goal
Equity and Human Wellbeing	Build all peoples sense of their oneness with the natural world and commitment to a healthy environment for human and ecological benefits.
Climate Change	Understand and respond to the impacts of climate change.
Salmon	Protect and restore healthy salmon runs adequate to meet ecosystem needs and support harvest while also honoring tribal treaty rights.
Estuaries	Protect and restore estuaries where feasible.
Floodplains	Protect and restore floodplains in support of healthy fish, vibrant farms, and flood hazard reduction.
Forests	Keep forested lands as forest for ecosystem and human benefits, improve the health of forested lands, and increase urban and rural forest cover.
Farms and Agricultural Land	Maintain and expand vibrant, viable agricultural areas and protect soil health to ensure healthy food for people and for open space benefits.
Stormwater and Water Quality	Manage stormwater and prevent pollution in support of clean water for people and fish.

Each focus area has its own section or "chapter" in the ERP. Each chapter contains an overview of the focus area, key pressures acting on the focus area, and a summary of goals, strategies, and other information relevant to the focus area compiled from existing plans and reports. Particular emphasis is paid to identifying how equity and climate change challenges and opportunities cut across all focus areas and to describing watershed success stories and remaining opportunities to work together on priority actions.

Table ES-2 lists priority pressures active on focus areas in the Watershed. Note that many human activities that can threaten or disrupt natural processes ("pressures") also provide important benefits to humans. The goal, therefore, is not to eliminate all pressures, but instead to understand and manage their influence to optimize both ecosystem and human benefits and to protect and restore the natural processes that are critical for maintaining a sustainable and productive ecosystem. For example, thriving agriculture creates many benefits to humans and preserves many important ecosystem functions by maintaining open space and riparian areas; it also can interrupt some natural processes such as flood flows, services provided by riparian forests, and sediment

transport. Thriving agriculture that maximizes both benefits to humans and ecosystem is the goal of the PWR LIO and of many agricultural producers.

ES-2 Priority Pressures

Priority Pressures	Description
Housing & Urban Areas, Commercial & Industrial Areas, Tourism & Recreation Areas, and Runoff from Residential, Commercial and Industrial Lands	Pressure on the natural environment in the form of direct habitat loss and degradation and from changed water dynamics including increased stormwater runoff, uptake of freshwater resources for human consumption, increased coverage by impervious surfaces, and altered peak and low water flows. Addressing these pressures has to do with focusing development away from intact ecologically important lands and encouraging development practices and retrofits that minimize adverse impacts, such as low impact development.
Roads & Railroads (Including Culverts)	Transportation infrastructure in the Watershed has a significant impact on ecosystem function. Vehicle pollution and runoff into freshwater and marine water systems, and impediments to natural ecosystem function such as railroad levees and culverts, are significant stressors. Recent studies have shown increased mortality in coho salmon from car tires, leading to the phenomenon of pre-spawn mortality, or urban runoff mortality syndrome. Addressing these pressures has to do with stormwater management and limiting vehicle pollution.
Freshwater & Marine Levees, Floodgates & Tidegates, and Freshwater & Marine Shoreline Infrastructure, and Dams	These pressures appear in the Watershed generally as shoreline hardening, culverts and other fish passage barriers, altered peak and low flows from land cover change, prevention of flood flows, and loss of shading of shallow water habitat. Addressing these pressures is considered a vital element of restoring natural ecosystem function in the Watershed.
Agricultural & Forestry Effluents	The Watershed is home to a large number of tribal, private, and government-owned forest lands, in addition to significant agricultural activities; addressing these pressures has to do with limiting persistent toxic chemicals in aquatic systems as well as conventional water pollutants.

Strategies in the Watershed are divided into those most relevant to habitat protection and restoration and those most relevant to pollution prevention and treatment. Cross cutting strategies also are identified. Table ES-3 lists the key strategies compiled from existing plans and reports included in the ERP.

Table ES-3: ERP Strategies Compiled from Existing Plans and Reports

Strategy Type	Description
Habitat protection and restoration	• Direct protection of intact floodplain, riparian, estuary, nearshore, and forest areas (e.g., through acquisition and transfer/purchase of development rights); emphasizing protection of larger land areas, or creating connectivity to or expanding other intact areas, or otherwise providing multiple human and environmental benefits. • Support and implement land management plans and regulations, particularly county and city growth management, shoreline master program, flood hazard reduction, and critical areas programs that concentrate growth in urban growth areas, protect intact floodplain habitat, and protect marine nearshore habitat and freshwater habitats such as lakes, wetlands, rivers, and streams.

Strategy Type	Description
	• Support and act consistently with watershed scale planning processes designed to better inform habitat protection and restoration priorities such as the Pierce County Biodiversity Network Assessment and the Salmon Habitat Protection and Restoration Strategy for Puyallup and Chambers Watersheds. • Support landowners to help them protect and restore forest and freshwater riparian habitats by incentivizing improvements in forest cover, forest stewardship, and wildfire prevention and mitigation. • Support sustainable forestry and sustainable agricultural practices and provide incentives to help forest and farm landowners maintain or improve forest, freshwater, and floodplain habitat quality and protect water quality through best management practices while increasing the viability of forestry and farming. • Provide education and outreach about how forest, floodplains, and freshwater processes of interdependent systems support ecosystem functions and services (such as abundant salmon) that are important to people to raise support for forest and freshwater protection and restoration efforts.
Pollution prevention and treatment	• Support and implement stormwater management plans and regulations. • Collect and treat urban stormwater to reduce pollutant loading, such as through stormwater retrofit actions and stormwater quality focused street sweeping. • Increase use of green stormwater infrastructure at the regional and residential scales. • Reduce sources of pollution by choosing less-toxic products and materials and encouragement of these choices by county and local governments, businesses, and residents. • Provide education, outreach, and support to landowners, particularly agricultural and livestock landowners, to help them limit pollutant loads to surface water through best management practices (e.g., through technical and financial assistance from conservation districts). • Provide education and outreach about pollution reduction and how water quality supports ecosystem functions and services (such as clean, abundant water) that are important to people to raise support for water quality protection and restoration efforts.
Cross-cutting	• Acknowledge and respond to climate change by incorporating climate change projection and adaptation. • Support Tribal treaty rights and expand knowledge and understanding of Tribal rights and priorities. • Correct environmental injustice by working to improve human health and environmental outcomes in overburdened communities and by bringing new and historically underrepresented voices to the conversation. • Provide multiple benefits across ecosystem focus areas and within communities • Expand the ability and effectiveness of watershed residents to participate in ecosystem planning and decision making about issues important to human health and environmental outcomes in the Watershed – including dismantling historic systems of settler colonialism, white supremacy, and structural racism.

The ERP will be adaptively managed and updated as needed to fill data gaps for strategies, goals, and priority actions and as new data sources are developed. The next phases of work will supplement the ERP with geospatial data and mapping related to the focus areas.

Introduction

From its headwaters at the glaciers of Mount Rainier National Park to its terminus at Commencement Bay, the Puyallup-White River Watershed (Watershed) is the only watershed in the contiguous United States with pristine headwaters in a national park and an estuary in a massive Superfund cleanup site. The Watershed it is under severe distress and pressure from development, climate change, and pollution. It has many communities that have been historically marginalized and affected by these pressures. It is home to the Puyallup and Muckleshoot Indian Tribes and their tribal reservations; contains the only remaining prime agricultural soils in Pierce County; hosts one of the nation's largest ports; and provides essential habitat for Endangered Species Act-listed species such as Chinook salmon, steelhead, bull trout, Southern Resident killer whales, grey whales, marbled murrelets, and Canada lynx. Over the next 15-20 years, it is projected that an additional 400,000 people will move to this area. From upland forests to the estuarine waters, it is the responsibility of all who live, work, and play in the Watershed to preserve and restore it and the natural and human relationships that make this a great place to call home. This document is intended to help direct efforts by the Puyallup-White Local Integrating Organization and its partners to do just that.

The Puyallup River Watershed Council's (PRWC) newly formed Puyallup-White River Local Integrating Organization (PWR LIO) developed this Ecosystem Recovery Plan (ERP) in 2021. The ERP is intended to be used by PWR LIO members, jurisdictions, and other interested parties and partners to guide engagement and decision-making for ecosystem protection, restoration and recovery in the Watershed. It does this by identifying the PWR LIO's shared priorities and by compiling goals, strategies, and other information relevant to those priorities from existing plans and documents.

The ERP is organized around eight interdependent ecosystem focus areas that represent the PWR LIO's shared priorities:

- Equity and Human Wellbeing
- Climate Change
- Salmon
- Estuaries
- Floodplains
- Forests
- Farms and Agricultural Land
- Stormwater and Water Quality

The focus areas are a mix of habitat types (e.g., estuaries), ecosystem services (e.g., water quality), and other areas of interest (e.g., climate change).

Each focus area section consists of an overview of the topic, brief lists of goals and strategies with key plans referenced, and priority actions. The sections also include callout boxes for success stories, equity, and climate change. The purpose of the success stories is to show an accomplishment in the watershed that can be a model for future work. Equity and climate change callout boxes highlight the intersection and interdependence of the focus areas with these crosscutting topics.

The ERP will be adaptively managed and updated as needed to fill data gaps for strategies, goals, and priority actions and as new data sources are developed. Later work will supplement the ERP with geospatial data and mapping related to the focus areas.

Purpose of the Puyallup-White River LIO Ecosystem Recovery Plan

The PWR LIO's Ecosystem Recovery Plan is intended to serve the following purposes:

- Summarize and synthesize current, verifiable knowledge of the Watershed's ecosystems in a concise and usable format, including status and trends, key threats and problems, and ongoing work;
- Identify and describe overall Watershed recovery focus areas and broad goals;
- Identify and prioritize recovery strategies, opportunities, and needs;

- Identify key gaps in information, action, and understanding among agencies and the public; and
- Serve as a guiding document for the PRWC members, PWR LIO partners, and the public.

Development of the Puyallup-White River LIO Ecosystem Recovery Plan

The Puyallup-White River LIO Ecosystem Recovery Plan is intended to guide decision making about ecosystem protection, restoration, and recovery in the watershed by identifying shared priorities and goals.

The ERP was developed in a collaborative effort led by the PRWC through their creation of a new committee that is the PWR LIO. The ERP gathers and summarizes existing information on priorities, goals, strategies, and actions from within the watershed. It draws heavily on the knowledge of participating stakeholders, the 2014 Puyallup River Watershed Assessment (PRWC, 2014), the 2018 Salmon Habitat Protection and Restoration Strategy for Puyallup and Chambers Watershed (Puyallup and Chambers Watersheds Salmon Recovery Lead Entity, 2018), and the Lower White River Biodiversity Management Area (BMA) Stewardship Plan (Dvornich and Burgess, 2016)

The 2014 Puyallup River Watershed Assessment presents historical and current information on the physical, biological, cultural, and economic systems in the Watershed. The watershed assessment:

1. Provides a compilation of existing information on watershed conditions (i.e., how the watershed functions in an ecological and human context) in a single document.
2. Informs the PRWC and its partners in the development of this guiding document for a strategic plan to study, collaborate, and manage the watershed. The PWR LIO ERP is the strategic plan envisioned by the 2014 Watershed Assessment.

The 2018 Salmon Habitat Protection and Restoration Strategy identifies priorities, strategies, and geographic priority areas to support protection and restoration of salmon habitat in the watershed and the Puget Sound region. The Strategy was developed by the Puyallup and Chambers Watersheds Salmon Recovery Lead Entity (the Lead Entity), which includes a Citizens' Advisory Committee (CAC) and a Technical Advisory Group (TAG). Members of the Lead Entity have participated in the development of the ERP so that salmon recovery is integrated into ecosystem recovery.

In 2004, the Pierce County Biodiversity Network Assessment was created. It identifies core habitat areas that contain the highest level of species richness and representation remaining across a landscape known as the Pierce County Biodiversity Network. The Biodiversity Network identifies 16 biologically rich areas and connecting corridors that cover 267,784 acres of land. The habitat types represented in the Biodiversity Network include lowland riparian areas and wetlands, oak savannas and prairies, old-growth forests, and alpine meadows. It makes recommendations for Biodiversity Management Area (BMA) plans for all 16 Areas. The 2016 Lower White River Biodiversity Management Area (BMA) Stewardship Plan presents the conservation targets, threats, and strategies for biodiversity for the Lower White River BMA and is a result of the initial work done in 2004.

In addition to local watershed residents, the following organizations participated in development of the ERP:

- City of Tacoma
- City of Sumner
- Tacoma-Pierce County Health Department
- Pierce Conservation District
- Pierce County
- WSU Washington Stormwater Center
- Puyallup Watershed Initiative
- Forterra
- Rainier Audubon Society
- Tahoma Audubon Society
- Port of Tacoma
- Puyallup Tribe of Indians
- WA Dept of Fish and Wildlife
- Metro Parks Tacoma
- WA Dept of Ecology
- Pierce County Council

Audience for the Puyallup-White River LIO Ecosystem Recovery Plan

This document fulfills the requirement from the Puget Sound Partnership that Local Integrating Organizations prepare and maintain an ecosystem recovery plan in a style and format that allows all LIOs to contribute to Puget Sound recovery. The PWR LIO ERP will allow the PRWC, PWR LIO members, and partners to identify their shared priorities for the watershed in a formal document. It will be shared with external audiences to inform the shared ecosystem protection and restoration priorities and strategies and local priorities for funding. While the ERP is not necessarily written for the general public, it may be useful as a mechanism to educate people about the many more detailed plans and strategies it draws from. In the next phase, a companion website and mapping tool will be created and geared towards a general audience in a more user-friendly and searchable digital format.

Funding for the Puyallup-White River LIO Ecosystem Recovery Plan

Work on the PWR LIO ERP was made possible by funding from Pierce County, the Pierce Conservation District, and through a series of grants under the US EPA National Estuary Program.

Puyallup-White River Geography and History of the Puyallup River Watershed Council

This section briefly describes the Watershed's geography and the history of the PRWC and the PWR LIO. The PWR LIO boundaries include Water Resources Inventory Area (WRIA) 10 (the Puyallup-White River) and a portion of the northern tip of WRIA 12 north of the Tacoma Narrows bridge. Additional information on the watershed geography and history can be found in the 2014 Puyallup River Watershed Assessment. Additional information on the PRWC and the PWR LIO can be found at their organization webpages: PRWC; PWR LIO.

Watershed Geography

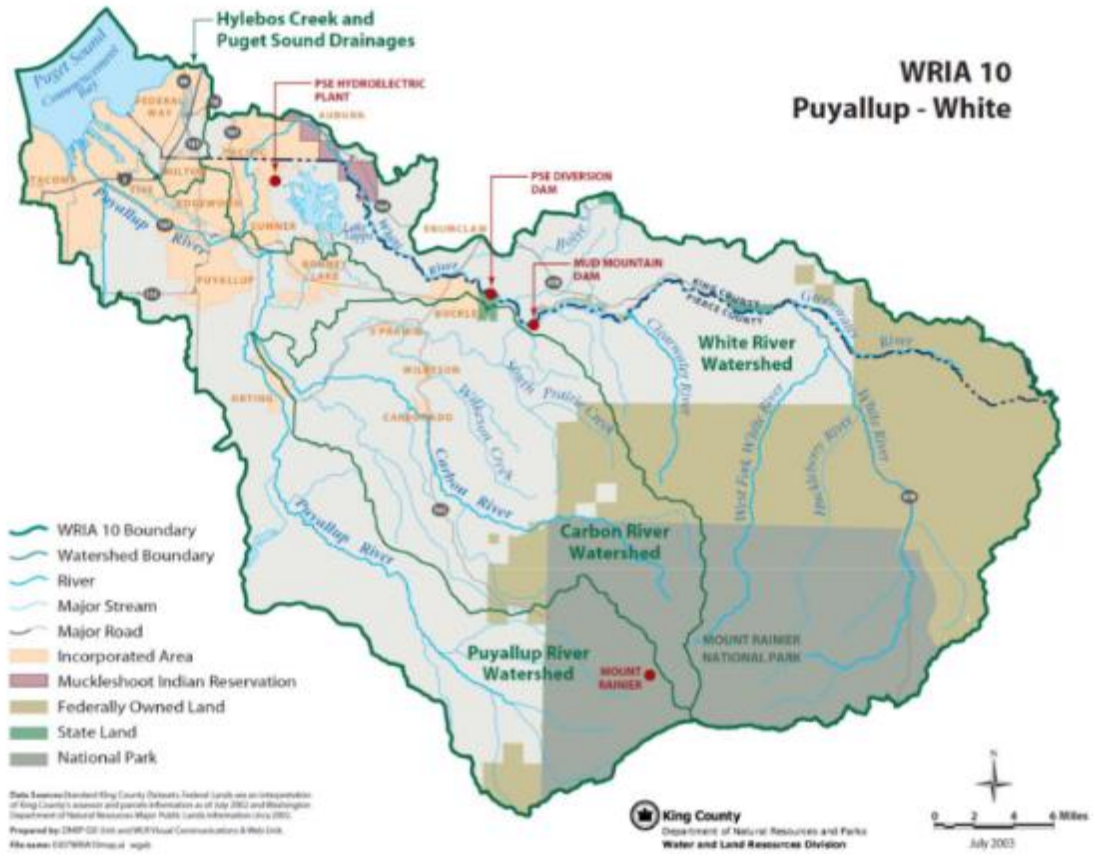


Figure 1. Puyallup-White River Watershed boundaries and major river basins (Photo Source)

The Puyallup River and its two main tributaries, the White River and Carbon River, are recognized as the ancestral land and current location of the Puyallup and Muckleshoot Tribes and their reservations. These waters drain a watershed of approximately 1,053 square miles (670,000 acres) beginning in the glaciers on Mount Rainier at an elevation of 14,411 feet and ending in the Puget Sound. The Watershed includes the cities of Tacoma, Fife, Milton, Federal Way, Pacific, Edgewood, Puyallup, Sumner, Bonney Lake, Buckley, Orting, Wilkeson, Carbonado, Algona, Enumclaw, South Prairie, Auburn, and other large areas of unincorporated Pierce and King Counties. The Puyallup Tribe of Indians owns the riverbed within the 1873 survey boundary from approximately River Mile (RM) 1.4 to RM 7.2.

The mainstem of the Puyallup River flows 46 miles from Mount Rainier to Commencement Bay. The river forms two forks: the North Puyallup River originates at the toes of the Puyallup Glaciers and the South Puyallup River originates at the Tahoma Glacier, merging to become the mainstem of the Puyallup River on the western end of Mount Rainier National Park. The river's watershed is the youngest in the Puget Sound region, having been formed from a series of lahars about 5,600 years ago. A key man-made feature of the Puyallup River is the Electron Diversion Dam (details below in callout box). Located along the Puyallup River approximately 25 miles southeast of Tacoma in the western foothills of Mount Rainier, the Electron Diversion Dam diverts a portion of the Puyallup River, generating approximately 22 megawatts (30,000 hp) of electricity. The lower reaches of the Puyallup and White Rivers were historically straightened with levees and revetments for flood control purposes.

The White River forms the county line separating King and Pierce counties at the confluence of the Greenwater River and White River at the White River's RM 45.8 in the town of Greenwater, near the City of Auburn. Mud Mountain Dam on the White River at RM 29.6 provides storage of up to 106,000 acre-feet of water to reduce flooding on the White and Lower Puyallup Rivers. Mud Mountain Dam is home to the nation's largest fish passage facility. Completed in 2020 by the Army Corps of Engineers, it allows transport of 60,000 salmon per day to the upper watershed.

The Carbon River drains an area of 230 square miles. It originates on the north face of Mt. Rainier at the Carbon Glacier. It flows 33 miles downstream, joining the Puyallup River at RM 17.4. The lower 8.4 miles of the Carbon River are in the Orting valley in unincorporated Pierce County, except for the left bank of the lower 3.5 miles, which flows along the city of Orting. Above RM 11.0, the river is contained within steep canyon walls until it reaches the community of Fairfax at RM 17.5.

The Greenwater River lies in northeastern Pierce County and enters the White River at RM 44.6. The headwaters of the Greenwater River are on Castle Mountain in the Cascades (elevation of 6700 feet), and it flows northwest for 21 miles to the community of Greenwater. The drainage basin is approximately 75 square miles. The Greenwater River forms the boundary between King County (north of the river) and Pierce County (south of the river) upstream of its confluence with the White River. Lake Tapps is a reservoir created from a diversion dam on the White River near Buckley. The owners of the reservoir, Cascade Water Alliance, has signed agreements with Muckleshoot Indian Tribe and the Puyallup Tribe of Indians to ensure instream flows for fish.

Boise Creek flows from north to south, beginning in the hills north and slightly east of Enumclaw in King County and enters the White River near the State Route 410 Bridge on the right bank, just north of Buckley on the county line between King and Pierce Counties. It has a drainage area of approximately 15 square miles.

South Prairie Creek lies in the center of the Puyallup-White River Basin, east of the City of Orting. South Prairie Creek has a drainage basin of 90 square miles and ranges in elevation from 285 feet above sea level to 5,933 feet at the summit of Pitcher Mountain.

In addition to all of WRIA 10, the PWR LIO includes the northern tip of WRIA 12 (Chambers-Clover Watershed) north of the Tacoma Narrows Bridge. The western boundary of WRIA 12 is in the middle of The Narrows, but it does not cross into the Key Peninsula. The WRIA 12 portion of the PWR LIO includes the nearshore areas north of the Tacoma Narrows Bridge, around Point Defiance and along the west side of Commencement Bay.

Table 1. Total square miles of each subbasin within the Watershed (From PRWC 2014)

Subbasin Name	Subbasin Area (square miles)
Puyallup Watershed	1,040
White River Basin	475
Carbon River Basin	230
South Prairie Creek Basin	90
Greenwater River Basin	75

Subbasin Name	Subbasin Area (square miles)
Nearshore/Commencement Bay drainages	~ 50
Portion of WRIA12	~ 2

The Puyallup River Watershed Council and the PWR LIO

The PRWC was formed in 1996 to address nonpoint source pollution in the Puyallup Watershed. During an intensive revitalization process in 2012, it merged with the Puyallup Watershed Foundation and was organized as an IRS 501(c)(3) nonprofit organization governed by a Board of Directors.

The PRWC works to restore, protect, and enhance the environmental, economic, and cultural health of the watershed from Mount Rainier to Commencement Bay. It is a forum for residents and representatives of businesses, governments, and other groups to collaboratively achieve clean water, healthy habitats, and thriving communities. In addition to the Board of Directors, at the time of this ERP there are several active committees that comprise the PRWC. Current committees include Communications, Executive, Local Integrating Organization, Salmon Homecoming, Science Symposium, and Swan Creek Implementation. PRWC committees may change over time.

In December 2018, the PRWC was recognized by the Puget Sound Partnership as the sponsor for the PWR LIO. The PWR LIO serves as a local coordinating organization for efforts related to Puget Sound recovery in the Watershed, including development of the Puyallup-White River watershed portions of the Puget Sound Action Agenda.

Focus Areas

PWR LIO members identified eight ecosystem focus areas for this ecosystem recovery plan. Focus areas were identified based on existing priorities in the watershed as demonstrated by ongoing work and investments (e.g., salmon recovery and Floodplains for the Future work) and reflect members' ideas about the most important issues for human wellbeing and the future sustainability of ecosystem functions and services in the watershed, knowing that the more diverse the ecosystem, the healthier, more resilient, and more flexible it is.

Focus areas were identified in a series of meetings of the PWR LIO. Members analyzed maps of the watershed and identified what was important to them about the watershed. The PWR LIO considered existing priorities based on ongoing program investments, pressures and threats, and Puget Sound-scale recovery goals represented by the Puget Sound Partnership's Vital Signs. Initially, this resulted in more than twenty potential focus areas. LIO members further discussed the focus areas and narrowed them down by considering connections to Puget Sound Partnership Vital Signs and Indicators, existing Watershed priorities as indicated by ongoing investments in projects and coordination and need/opportunity. Ultimately the PWR LIO settled on the following eight focus areas:

- Equity and Human Wellbeing
- Climate Change
- Salmon
- Estuaries
- Floodplains
- Forests
- Farms and Agricultural Land
- Stormwater and Water Quality

The PWR LIO then met to establish a high-level directional goal for each focus area. The directional goals describe the types of changes the PWR LIO wants to achieve. Table 2 lists the high-level directional goal for each focus area. The PWR LIO recognizes the following:

- The role education plays in order to achieve these goals for all focus areas; and
- 'Equity and Human Wellbeing' and 'Climate Change' are overarching issues that impact all other focus areas. In consideration of that, the PWR LIO's ERP embeds 'Call Out Boxes' within all other focus area chapters. The purpose of these Call Out boxes is to highlight the connection 'Equity and Human Wellbeing' and 'Climate Change' has within those ecosystems across the watershed.

Table 2: Focus Areas and High-Level Directional Goals

Focus Area	High-Level Directional Goal
Equity and Human Wellbeing	Build all peoples sense of their oneness with the natural world and commitment to a healthy environment for human and ecological benefits.
Climate Change	Understand and respond to the impacts of climate change.
Salmon	Protect and restore healthy salmon runs adequate to meet ecosystem needs and support harvest while also honoring tribal treaty rights.
Estuaries	Protect and restore estuaries where feasible.
Floodplains	Protect and restore floodplains in support of healthy fish, vibrant farms, and flood hazard reduction.
Forests	Keep forested lands as forest for ecosystem and human benefits, improve the health of forested lands, and increase urban and rural forest cover.
Farms and Agricultural Land	Maintain and expand vibrant, viable agricultural areas and protect soil health to ensure healthy food for people and for open space benefits.

Focus Area	High-Level Directional Goal
Stormwater and Water Quality	Manage stormwater and prevent pollution in support of clean water for people and fish.

Future Development and Mapping of Focus Area Attributes

The focus areas and high-level goals establish the overall scope and direction for ecosystem recovery work in the Watershed. Over time, the PWR LIO will further define each focus area using specific measurable attributes (e.g., forest cover) and set targets for these attributes while understanding that there are complex interrelationships. Attributes are characteristics that can serve as indicators of the structure and function (i.e., health) of ecosystem focus areas. They can tell us the status and trends of ecosystem focus areas and can help us understand whether the ecosystem is getting better, getting worse, or staying the same. Recovery activities aimed at specific ecosystem focus areas can be measured and evaluated through attributes.

Attributes will be analyzed and mapped to understand their current status and targets will be established for recovery progress for each attribute where possible.

Pressures and Stressors in the Watershed

Pressures are human attitudes, social systems, and activities that give rise to stress in the ecosystem, such as development, transportation corridors (highways and railroads), and pollution. **Stressors** are the proximate causes of change in the environment that the pressure affects. For example, the pressure of development can give rise to a variety of stressors such as shoreline armoring and altered land cover. Similarly, the stressor of pollutants from runoff can be caused by the pressure of roads; the stressor of shading of shallow water habitat can be caused by the pressure of docks; and the stressor of fish passage barriers can be caused by the pressure of dams. Pressures and stressors are roughly equivalent to **limiting factors**, which is a term used in salmon recovery planning. Similar to salmon limiting factors, pressures and stressors interrupt natural processes and reduce the distribution, abundance, and viability of native species. As defined by the Puget Sound Partnership, pressures and stressors focus entirely on human social systems and activities, whereas limiting factor analyses often include natural processes (such as drought or flood).

Preparing a list of priority human pressures on the ecosystem is a complex task because many activities that can threaten or disrupt natural processes ("pressures") also provide important benefits to humans. The goal, therefore, is not to eliminate all pressures, but instead to understand and manage their influence to optimize both ecosystem and human benefits and to protect and restore the natural processes that are critical for maintaining a sustainable and productive ecosystem. Ideally, development would consider and avoid high functioning open space that is rich in biodiversity. Biodiversity Management Areas (BMAs) provide the opportunity for responsible development that maintains ecosystem services. For example, development creates spaces for homes and associated commercial and transportation infrastructure. Responsible development provides many economic benefits to individual and communities. There are no disconnected actions. Development, even responsible development, changes land cover from natural covers such as forests to modified cover such as cleared surfaces, buildings, and roads, it also disrupts natural processes such as stormwater transport and infiltration and sediment delivery and transport. Similarly, thriving agriculture creates many benefits to humans and preserves many important ecosystem functions by maintaining open space and riparian areas; it also can interrupt some natural processes such as flood flows, services provided by riparian forests, and sediment transport. Responsible development and thriving agriculture are goals for the PRWC. These natural processes provide ecosystem relationships, goods and services vital to the Watershed economy and to healthy, thriving human communities, including:

- Clean and abundant water and air for human use and consumption;
- Natural resource-based industries such as fishing, shellfish aquaculture and harvest, agriculture, and forestry;
- Cultural and traditional uses guaranteed in treaties to Tribal Nations;
- Recreation and tourism values; and
- Aesthetic values and other culturally and economically important services.

The list of priority pressures for the Watershed draws on three sources of information.

1. The Salmon Habitat Protection and Restoration Strategy for Puyallup and Chambers Watershed, (Lead Entity, 2018) identifies priorities and strategies to support protection and restoration of salmon habitat in both watersheds and, ultimately, the Puget Sound region. The Strategy was developed by the Puyallup and Chambers Watersheds Salmon Recovery Lead Entity (the Lead Entity), which includes a Citizens Advisory Committee (CAC) and a Technical Advisory Group (TAG), and draws on Phase I Puget Sound Chinook Monitoring and Adaptive Management (M&AM) Framework for the discussion on pressures (Lead Entity and PSP, 2014).

2. The Puyallup River Watershed Assessment (PRWC, 2014) presents historical and current information on the physical, biological, cultural, and economic landscape in the Watershed. There are two main purposes of this watershed assessment: (1) To provide a compilation of existing information on watershed conditions (i.e., how the watershed functions in an ecological and human context) in a single document; and (2) To inform the PRWC and its partners in the development of this guiding document for a strategic plan to manage the watershed.

3. The Puget Sound Pressures Assessment (McManus et. al. 2014) used a combination of structured expert elicitation and geospatial analysis to rank the potential impact of human stressors. These stressors are cross walked with their sources to generate lists of pressures.

Analysis of these sources resulted in the following priority pressure groups:

- Housing & Urban Areas, Commercial & Industrial Areas, Tourism & Recreation Areas, and Runoff from Residential, Commercial and Industrial Lands: these pressures are grouped because they generally represent pressure on the natural environment in the form of direct habitat loss and degradation and from changed water dynamics including increased stormwater runoff, uptake of freshwater resources for human consumption, increased coverage by impervious surfaces, and altered peak and low water flows.
- Roads & Railroads (Including Culverts): transportation infrastructure in the Watershed has a significant impact on ecosystem function. Vehicle pollution and runoff into freshwater and marine water systems, and impediments to natural ecosystem function such as railroad levees and culverts, are significant stressors. Recent studies have shown increased mortality in coho salmon from car tires, leading to the phenomenon of pre-spawn mortality, or urban runoff mortality syndrome.
- Freshwater & Marine Levees, Floodgates & Tidegates, and Freshwater & Marine Shoreline Infrastructure, and Dams: this group of pressures shares several related stressors, including shoreline hardening, culverts and other fish passage barriers, altered peak and low flows from land cover change, prevention of flood flows, and loss of shading of shallow water habitat. Addressing these pressures is considered a vital element of restoring natural ecosystem function in the Watershed.
- Agricultural & Forestry Effluents: given the large number of tribal, private, and government-owned forest lands, in addition to significant agricultural activities, these pressures are concerned with limiting persistent toxic chemicals in aquatic systems as well as conventional water pollutants.

Note that, as described above, the goal is not to eliminate all pressures, but instead to understand and manage their influence to optimize both ecosystem and human benefits and to protect and restore the natural processes that are critical for maintaining a sustainable and productive ecosystem and support human health and a thriving human economy.

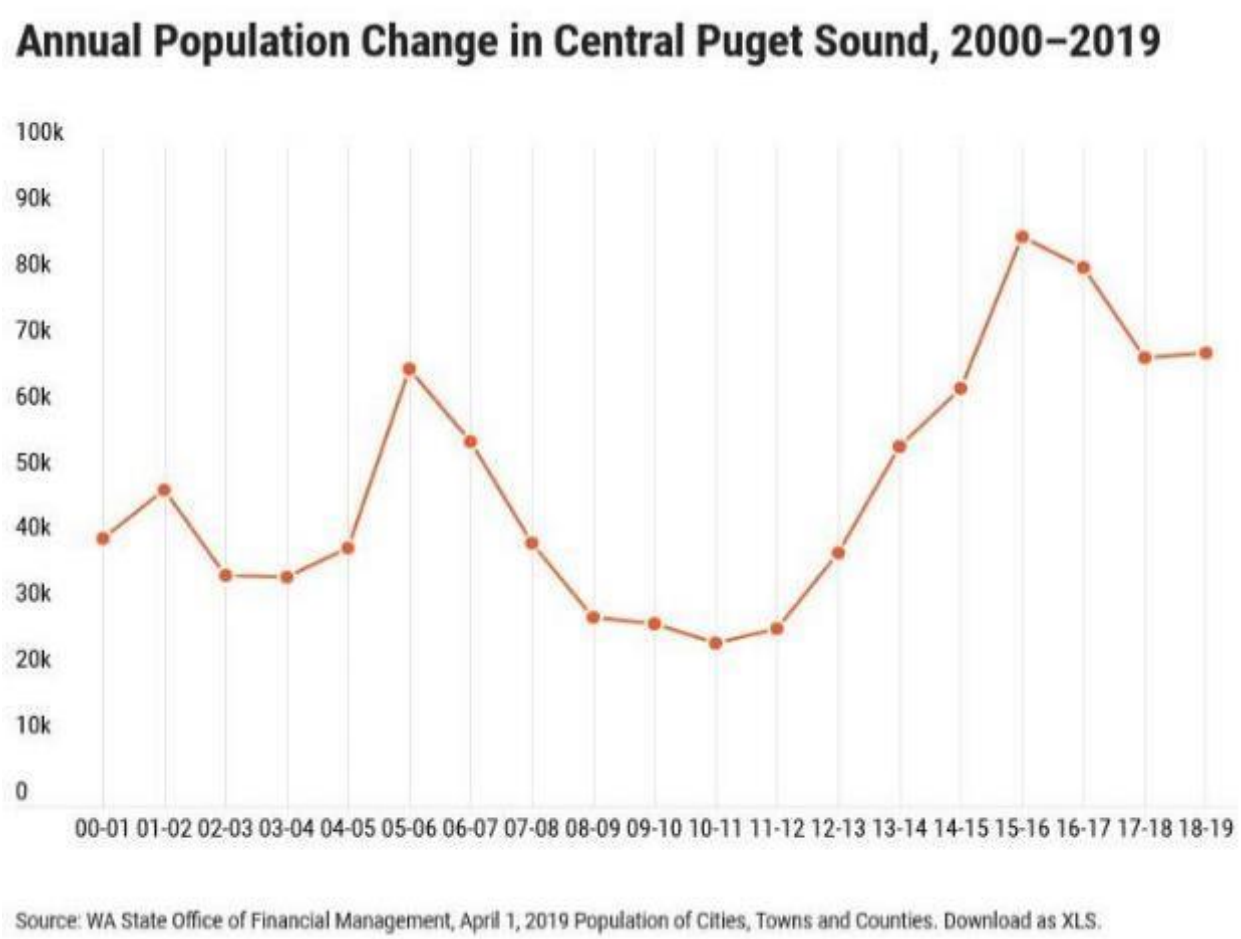


Figure 2. Annual population change in Central Puget Sound

The cumulative impact of these pressures is not just a degraded ecosystem, but also the degraded health and wellbeing of human communities. Loss of trees in the urban and rural environment not only leads to reduced water quality for endangered salmon populations; it also impacts air quality and increases urban temperatures that can result in higher rates of asthma and other lung disorders. Loss of agricultural land to development pressures not only results in higher rates of stormwater runoff and pollution; it also limits access to fresh and healthy food, which can result in poorer education rates in local schools. Negative human impacts from ecosystem pressures are disproportionately experienced in already overburdened communities including communities of color (WA Environmental Justice Task Force). This is why equity is one of the ERP focus areas, and environmental justice is a large part of that. Responsible development and management of human impacts on the environment can improve the health of the ecosystem and human communities that are part of it and should be prioritized in areas and communities where these pressures are currently felt most strongly.

Anticipated population growth and climate change globally and in the watershed amplifies pressures. Strategies and actions to address pressures will need to be highly collaborative and consider anticipated population growth and climate change to be successful.

Strategies

The ERP is a compilation of existing goals and plans for the Watershed. Many of the documents described here list very specific strategies oriented at the particular aspect of ecosystem recovery they are examining. For example, there are specific strategies that the WRIA 10 Lead Entity has prioritized for salmon recovery in the Watershed. Similarly, the Floodplains for the Future (FFTF) effort has identified specific strategies it will seek to advance multiple benefits for flood hazard reduction, farms, and fish.

While strategies are specific to their originating document and area of focus, they also often reiterate similar themes and approaches. Rather than repeating the details of all the specific strategies from all of the existing plans, the ERP provides a general framework of strategy types organized in two groups: habitat protection and restoration, and pollution prevention and treatment.

This general strategy framework is not intended to replace existing, more specific strategies from reference documents. Rather, it is intended to help LIO members and project sponsors effectively collaborate and connect their specific ideas, strategies and actions to the ERP and to provide some basic scaffolding for how one might seek to bring about positive changes in the ecosystem. The individual focus area chapters highlight strategies of particular interest from existing plans and link to the supporting documents so more detailed strategy information can be easily accessed.

Within each of the general strategy types (habitat protection and restoration and pollution prevention and treatment), the PWR LIO encourages and supports efforts that:

- Acknowledge and respond to climate change by incorporating climate change projection and adaptation;
- Support Tribal treaty rights and expand knowledge and understanding of Tribal rights and priorities;
- Correct environmental injustice by working to improve human health and environmental outcomes in overburdened communities and by bringing new and historically underrepresented voices to the conversation;
- Provide multiple benefits across ecosystem focus areas and within communities; and
- Expand the ability and effectiveness of watershed residents to participate in ecosystem planning and decision making about issues important to human health and environmental outcomes in the Watershed – including dismantling historic systems of settler colonialism, white supremacy, and structural racism.

Habitat Protection and Restoration

General strategies for habitat protection and restoration include:

- Direct protection of intact floodplain, riparian, estuary, nearshore, and forest areas (e.g., through acquisition and transfer/purchase of development rights); emphasizing protection of larger land areas, or creating connectivity to or expanding other intact areas, or otherwise providing multiple human and environmental benefits.
- Supporting and implement land management plans and regulations, particularly county and city growth management, shoreline master program, flood hazard reduction, and critical areas programs that concentrate growth in urban growth areas, protect intact floodplain habitat, and protect marine nearshore habitat and freshwater habitats such as lakes, wetlands, rivers, and streams.
- Supporting and acting consistently with watershed scale planning processes designed to better inform habitat protection and restoration priorities such as the Pierce County Biodiversity Network Assessment.
- Supporting landowners to help them protect and restore forest and freshwater riparian habitats by incentivizing improvements in forest cover, forest stewardship, and wildfire prevention and mitigation.
- Supporting sustainable forestry and sustainable agricultural practices and provide incentives to help forest and farm landowners maintain or improve forest, freshwater, and floodplain habitat quality and protect water quality through best management practices while increasing the viability of forestry and farming.

- Providing education and outreach about how forest, floodplains, and freshwater processes of interdependent systems support ecosystem functions and services (such as abundant salmon) that are important to people to raise support for forest and freshwater protection and restoration efforts.

Pollution Prevention and Treatment

General strategies for pollution prevention and treatment include:

- Supporting and implementing stormwater management plans and regulations;
- Collecting and treating urban stormwater to reduce pollutant loading, such as through stormwater retrofit actions and stormwater quality focused street sweeping;
- Increased use of green stormwater infrastructure at the regional and residential scales;
- Reducing sources of pollution by choosing less-toxic products and materials and encouragement of these choices by county and local governments, businesses, and residents;
- Providing education, outreach, and support to landowners, particularly agricultural and livestock landowners, to help them limit pollutant loads to surface water through best management practices (e.g., through technical and financial assistance from conservation districts); and
- Providing education and outreach about pollution reduction and how water quality supports ecosystem functions and services (such as clean, abundant water) that are important to people to raise support for water quality protection and restoration efforts.

Role of Education

Environmental education is a process that allows individuals to explore environmental issues/ relationships, engage in problem solving, and take action to improve the environment. As a result, individuals develop a deeper understanding of environmental issues and have the skills to make informed and responsible decisions. Civic engagement education is a process that helps people understand how and where decisions that affect issues that are important to them are made. The LIO supports education and outreach and civic engagement efforts and strategies across all focus areas.

How to Use This Document

The PWR LIO will use the ERP to facilitate broad conversations about the work needed to protect and restore the Watershed, to inform selection of projects to endorse and advocate for, and to support applications for grant and other funding. An initial set of priorities is included in the ERP for each focus area, and additional priorities may be identified through annual check ins and the adaptive management process described later in the document.

The PWR LIO encourages and welcomes the opportunity to endorse and advocate for projects that are consistent with the ERP but may not be specifically mentioned or included. The PWR LIO is particularly interested in projects that improve resilience to climate change, address environmental injustice, protect and restore floodplain and riparian habitat, better control stormwater, and increase agricultural resiliency in the context of preserving habitat values associated with open space. Project sponsors interested in endorsement should provide a brief description of their project identifying how it furthers or implements one of the priorities identified in the ERP to the LIO coordinator. The PWR LIO Technical Team will consider project endorsement requests as they arise.

Currently the PWR LIO (like other LIOs) controls very little project funding; however, the PWR LIO is hopeful that this will change over time and, as it does, the PWR LIO anticipates using the ERP to inform funding decisions. Further iterations of this ERP will describe a funding decision process in more detail.

Equity and Human Wellbeing

Equality means that everyone gets the same thing. Equity, however, means that everyone gets what they *need*. While contextual, equity is about fairness or justice in the way people are treated. Historically, different communities have been treated differently with respect to the application of environmental and other laws and have experienced different impacts. The Government Alliance on Race and Equity (GARE) defined race equity as when "race can no longer be used to predict life outcome and outcomes for all groups are improved." Remedying differences is called environmental justice. The WA Environmental Justice Task Force and the EPA use the same definition for environmental justice: "the fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies."

The PRWC, serving as the Puyallup White River Local Integrating Organization, cares deeply about bringing greater equity and environmental justice to The Watershed, and see the implementation of this Ecosystem Recovery Plan as a means to help ensure our goals for a more equitable community are met. People of color and those on the lower end of the socio-economic spectrum suffer disproportionately from the negative effects of pollution and environmental degradation. While it's no simple task, it's not enough to simply restore ecosystem functions that have been degraded as our community has grown. We must make sure that as we recover our natural systems the people that have been hurt the most by the destruction of these systems and the pollution that comes with it are the ones we help first. As such, every strategy and priority action in this ERP should have an equity lens on it as partners throughout the Watershed work through the planning, design, and implementation of projects that this ERP encourages.

Different groups and populations have different levels of opportunity; therefore, providing everyone with the same things will not lead to the same outcomes (TPCHD, 2016). According to the US EPA's webpage on environmental justice, "equity represents a belief that there are some things which people should have, that there are basic needs that should be fulfilled, that burdens and rewards should not be spread too divergently across the community, and that policy should be directed with impartiality, fairness and justice towards these ends."

Equity can be considered within the following four categories:

1. Procedural Equity: inclusive, accessible, authentic engagement and representation in decision-making processes regarding programs and policies.
2. Distributional Equity: programs and policies result in fair distributions of benefits and burdens across all segments of a community, prioritizing those with highest need.
3. Structural Equity: decisions are made with a recognition of historical, cultural and institutional dynamics and structures that have routinely advantaged privileged groups in society.
4. Transgenerational Equity: decisions consider generational impacts and do not result in unfair burdens on future generations.

Within the field of ecosystem management and environmental recovery, lack of equity results in communities not having access to the nature they need or to the ecosystem services they depend on (such as fishing). The objective of the PWR LIO in including equity and human wellbeing as a focus area of the ERP is to make sure that the ecosystem supports the wellbeing of all people in the watershed. The PWR LIO seeks to provide a framework to create relationships across social scientists, community members, environmental managers, and policy makers working on ecosystem recovery to identify shared goals and collaborative strategies and establish long-lasting partnerships.

One lens by which leadership around the Puyallup-White River watershed has sought to better understand equity and human wellbeing is through a focus on public health. To drive efforts to address public health disparities across the watershed, the Tacoma Pierce County Health Department (TPCHD) identified Health Equity Communities of Focus. This allows departmental action to concentrate efforts and resources on communities with opportunity for health improvement. Within the watershed, the Department's efforts are focused on the following

communities: East Tacoma, South Tacoma, and White River. These areas include the ancestral home of the Puyallup Tribe of Indians and the Muckleshoot Tribe, diverse communities of color, and other marginalized individuals. The Health Department provides up-to-date publicly accessible health equity maps on the following topics:

- Chronic Disease
- Communicable Disease
- Education
- Income
- Maternal & Child Health
- Mental & Behavioral Health
- Neighborhood
- Other Root Causes

The 2015 Health Equity Assessment (TPCHD, 2016) for the TPCHD notes that clear trends can be extracted from these data. For example, neighbors living less than a mile apart can have up to 8 years difference in life expectancy. Black infants die at a rate twice as high as white infants. People making less than $25,000 per year are 2.5 times as likely to have diabetes as those making more than $75,000 per year. The Center for Disease Control (CDC) also leans into these trends by defining the social determinants of health as the following: economic stability, education, social and community context, health and healthcare, and neighborhood and built environment. While members of the PWR LIO are involved in aspects of these social determinants across the watershed, the ERP addresses the neighborhood and built environment of communities, specifically natural environment, such as green space, exposure to toxic substances in the water and air, flood risk, and weather impacts (e.g., climate change). Pierce County has also invested in the development of a Pierce County Health Equity Index (Figure 3), which will further emphasize where equitable solutions should be developed. It provides a breakdown to show where people have access to healthcare, where asthma is prevalent, and where cancer, diabetes, disabilities, and heart disease are more prevalent. It also provides a life expectancy map. Each of these data sets will be embedded in the web-based prioritization tool that the PWR LIO is developing in 2022 to support future project proponents target projects to address these disparities.

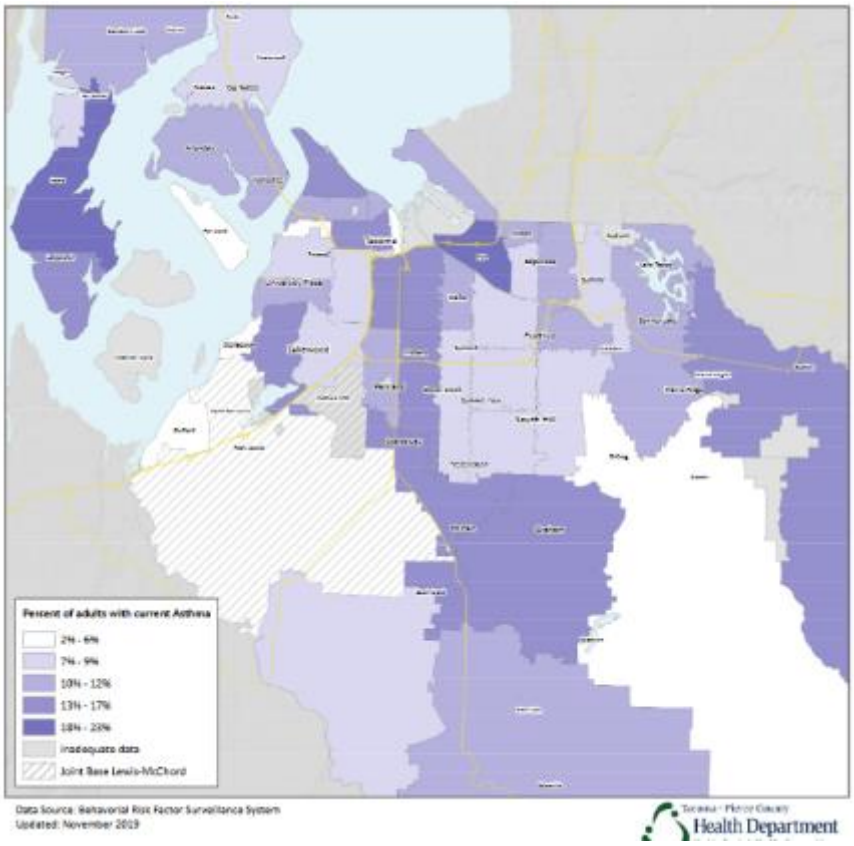


Figure 3. Tacoma-Pierce County Asthma Prevalence by ZIP code map, 2011 - 2017

To address the overlapping reality of social justice issues and environmental concerns, the PWR LIO will move forward with a commitment to not just maintaining equity as a leading principle for future work, but also to use recommendations from other sources to weave together equity, environmental justice, and community-based empowerment to define and drive future policy and actions. The PWR LIO will focus effort to define goals and partnerships to address issues of barriers to open space such as financial constraint, variable tree cover that addresses heat island impacts, water quality near superfund sites, and other issues of environmental recovery that are directly tied to equity and human wellbeing.

Key Plans, Goals, Strategies, and References for Equity and Human Wellbeing

The overall goal for the Equity and Human Wellbeing focus area is to build all peoples' sense of their oneness with the natural world and commitment to a healthy environment for human and ecological benefits.

The PWR LIO will work in support of the goals, targets, strategies and actions for Equity and Human Wellbeing described in existing collaboratively developed documents for the Watershed. Key documents are described below with hyperlinks for more information. This is not an exhaustive list.

SOUND HEALTH FOR SOUND TRIBES

Jeffrey Thomas' 2015 thesis at the School of Marine and Environmental Affairs titled Sound Health for Sound Tribes: Developing Tribal/ Salmonids Social-Ecological Systems Model (Thomas, 2015) provides an overview of parameters that can impact Puget Sound tribes when salmon recovery actions are undertaken that do not properly involve tribal inputs.

The results from this work demonstrate the need to empower the tribal community, nurture decision outcomes, pursue high-quality resource conditions, and prioritize high-quality salmon fitness results. All salmon stocks in Puget Sound originate in ancestral lands of Federally-recognized Tribes; therefore, it is critical to involve the Tribes in a proper co-management role with respect to environmental changes. As co-managers of fisheries and as stewards of the land, Tribes need a seat at the table and to be meaningfully heard; however, their voices are often not considered for decision making.

A key takeaway from this work is to consider the following concepts that effectively center policy design to properly consider Indigenous Well-Being:

1. The natural environment plays an integral role in achieving and maintaining health.
2. Indigenous cultures perceive the natural environment as linking traditional cultural practices, social connectedness, identity, and health.
3. Health includes physical, mental, cultural, spiritual, and social components.
4. These components are interrelated with each other and with the health of the natural environment - particularly as it relates to traditional gathered foods.
5. The need to involve indigenous constituents and policies, and to "consult with constituents" to create new and meaningful scales for important cultural values.

PUYALLUP-WHITE WATERSHED OPEN SPACE STRATEGY

The 2014 Puyallup-White Watershed Open Space Strategy (Green Futures Research & Design Lab, 2014) highlights an initiative that represents the first of multiple open space conservation strategies to be developed for the Central Puget Sound Regional Open Space Strategy.

This report presents the results of the Puyallup-White Watershed Open Space Strategy that highlights strategies that will identify projects and actions that contribute to the formation of the final integrated regional open space and green infrastructure strategy and therefore merit regional and interjurisdictional efforts and resources.

Ecological, economic, and climate stresses affect water quality and supply, fish, farm, and forest production; flood and other environmental hazard vulnerability; biodiversity; economic opportunities; and overall quality of life. The

Central Puget Sound Regional Open Space Strategy is an effort to address this need and to conserve and enhance open space systems that contribute to the ecological, economic, recreational, and aesthetic vitality of our region. The Strategy worked with community members, leaders in their fields, and policy makers to identify projects and actions that contribute to the formation of the final integrated regional open space and green infrastructure strategy and therefore merit regional and interjurisdictional efforts and resources.

A key result from the development the Strategy was identifying the following project areas for actions to develop the Central Puget Sound Regional Open Space:

- Ecosystems
- Biodiversity
- Health and Active Living
- Resource Lands
- Community Development

For each of the areas, the Strategy proposes actions in Section 3 that work toward the goals of the Strategy. Actions include establishment of programs to protect riparian areas from development, creating educational programs, creating large trail systems, and developing management strategies. For more details, refer to Section 3 of the report.

HEALTH EQUITY ASSESSMENT FOR THE TACOMA - PIERCE COUNTY HEALTH DEPARTMENT

The 2015 Health Equity Assessment for the Tacoma-Pierce County Health Department built off work conducted in the Community Health Improvement Plan (TPCHD, 2016) and the 2011 – 2015 Tacoma-Pierce County Health Department Strategic Plan (TPCHD, 2011).

The plan identified health inequities, or differences in health between communities, as one of the county's top health concerns. This assessment was the first step to directly address the need to reduce health inequities as identified by the 2011-2015 Strategic Plan. The goals of the assessment were the following:

- Help understand the causes of health inequity in Pierce County;
- Identify where inequities occur;
- Identify health outcomes that have the most severe inequities;
- Identify populations that suffer inequitable health outcomes;
- Examine our internal policies, practices, and perceptions;
- Examine partner perceptions of how well we address health inequities; and
- Determine if the Department is effectively positioned to help achieve health equity in Pierce County.

With those goals in mind, the plan organized the information into a few key areas: Economic and Social Condition, Chronic Diseases, Communicable (infectious) Diseases, Environmental Health, Maternal and Child Health, and Behavioral Health: Mental Health and Substance Misuse.

For consideration in including this work for the PWR LIO ERP, the focus fell on the goals laid out by the Department to address Environmental Health. They key take away was the development of the following narrative goals for specific categories under the umbrella of Environmental Health:

Air Quality. Through the Department's Outdoor Air Quality Program, raise awareness among residents of the short- and long-term effects of exposure to air pollution. Working with partners such as the Puget Sound Clean Air Agency for their Wood Smoke Reduction Program, assisting anyone living in the Smoke Reduction Zone with replacing or recycling their wood-burning device. This program serves residents who may be renting, low-income, or need to heat with wood for financial reasons.

Drinking Water Quality. Improve the quality of water with a specific focus on contaminants such as *E. coli* bacteria and nitrogen present as result of human activity. Educate the public on the impact of consuming contaminated water, especially with regard to the impact on children and the elderly. Work to improve all impacts of water quality, but with specific focus on rural and low-income communities.

Surface Water Quality. Provide education and support to allow for safe recreational opportunities considering safe levels of biotoxins in shellfish that are important facets of supporting health. The Department will continue to increase data gathering to determine whether there is income, educational, racial, ethnic, or geographic inequities in surface water quality.

Septic Systems. Promote environmental stewardship by helping communities protect and monitor their local water through implementation of routine septic maintenance. Strengthen the partnership with other organizations (Pierce County Surface Water Management and Pierce County Community Connections) to find funding to create more affordable loans to help septic system owners repair, upgrade, or replace failing systems for low-income communities.

Waste Management. Promote education to reduce solid waste accumulation, which can reduce property values and contribute to rodent infestations and other community risks. Increase efforts to address root causes to address efforts that promote health equity, including housing availability, housing value (home equity), community cohesion, and neighborhood conditions such as walkability and crime.

Land Contamination. Continue to support the Contaminated Sites Programs that address risk from the release of toxic chemicals into the natural and built environment. By supporting this, the Program educates on the impact of accidental or inappropriate handling of toxic chemicals that result in toxic spills contaminating our drinking water supply, degrading the natural environment, and exposing the community to those toxic chemicals. Continue to raise awareness and provide support of low-income communities and communities of color that often have higher levels of toxic spills and contaminations in their neighborhoods.

Food Safety. Support the efforts of food inspectors who regularly inspect, educate, and consult with food establishments to protect people from food-borne illnesses. Continue to review food preparation and service plans when food establishments are starting up or making changes. Collaborate with city, state, other county and federal governments, community leaders, and community members to continue these efforts effectively. Support further data collection to better understand the impact food safety has on low-income communities and communities of color.

Impacts of Climate Change. Highlight the impact climate change has on human health and wellbeing as a result of increased extreme weather events, wildfire, decreased air quality, threats to mental health, illnesses transmitted by food and water, and diseases spread by carriers such as mosquitoes and ticks. Better understand and strategize around the reality that the impacts of climate change add to the cumulative stresses vulnerable populations already face including children, the elderly, the poor, some communities of color, and people with chronic illnesses.

PARKS, RECREATION, & OPEN SPACE PLAN

The Parks, Recreation and Open Space Plan (Pierce County, 2020) directs the development and management of the park system effectively and strategically, using resources to strengthen families and connect community through unique and engaging parks and programs that inspire play, exploration, relaxation, and appreciation of nature. There is a connection between healthy and happy, and that connection comes most naturally when we step outside and play together in public parks and programs. This plan is specific to the Pierce County Park System, which primarily serves unincorporated Pierce County.

The Parks, Recreation and Open Space Plan establishes goals, objectives, and recommendations for developing, conserving, and maintaining the parks, trails, and open space that allow Pierce County Parks to attain its mission. The 2020 PROS Plan provides an update to previous plans to guide projects and programs that meet the needs of residents as the County grows.

Pierce County Parks' values define how Pierce County Parks makes decisions and prioritizes work to achieve the vision and mission:

- **Equity.** We provide a park system that is geographically dispersed, culturally responsive, and inclusive of all people and income levels;
- **Accessible.** We encourage everyone to use and enjoy our park system. Our park system can be reached by foot, bicycle, transit, boat, and car;
- **Stewardship.** We wisely manage a well-maintained park system for the enjoyment of future generations. We are transparent and accountable in our decision-making and practices;
- **Active Lifestyle.** We provide a park system that makes it easy for people to be active year-round. Our park system supports people in their efforts to maintain and improve their health and wellbeing; and
- **Engagement.** We actively collaborate with the community we serve. We provide ways for residents to volunteer, learn about sustainability, and influence decisions related to the care, growth, and use of our park system.

Goals for this plan are the following:

- Connect with Nature: Pierce County residents place a high priority on expanding opportunities to connect with nature in their community. Pierce County Parks aims to expand opportunities by opening more natural areas for hiking, walking, and wildlife viewing and by offering more nature-based programming and events.
- Healthy Lifestyles: Parks are a place where people go to recreate, play, and exercise. Pierce County Parks will expand opportunities for residents and visitors to enjoy a variety of activities that promote active, healthy lifestyles.
- Vibrant Community Spaces Parks are places where people go to relax, enjoy family and friends, and come together as a community. Pierce County provides stewardship of parks, trails, and open spaces to maximize a healthy natural environment and to provide access to nature in an increasingly urban landscape.
- Sustainable Practices and Administration of System: Pierce County Parks practices all aspects of sustainability: social, environmental, and economic, by ensuring the park system is managed effectively and equitably by being fiscally responsible and by offering opportunities for the public to learn about sustainable practices.

Planning for Equity Policy Guide

The 2019 Planning for Equity Policy Guide (American Planning Association, 2019) identifies policy recommendations for planners to advocate for policies that support equity in all aspects of planning at local, state, and federal levels. The Planning for Equity Policy Guide provides specific, actionable policy guidance through an equity lens on cross-cutting topics and areas of planning. The plan focuses on the following policy focus areas:

- Climate change and resilience
- Energy and Resource Consumption
- Health Equity
- Heritage Preservation
- Housing
- Mobility and Transportation
- Public Spaces and Places

Within Cross-Cutting Equity Issues

- Gentrification
- Community engagement and empowerment
- Environmental Justice
    - Environmental Justice Policy 1: Encourage Triple-Bottom-Line Outcome - No population is disproportionately impacted by development, disaster recovery, and redevelopment.
    - Environmental Justice Policy 2: Give Deference to Local Knowledge - Giving deference to local, indigenous knowledge that affected community residents bring to the planning process is important for building credibility and trust.
    - Environmental Justice Policy 3: Encourage Collaborative Problem Solving - Implement innovative place-based solutions through collaborative problem solving to address multi stakeholder interests and concern.
    - Environmental Justice Policy 4: Organize and Support Pro-Bono Planning Efforts to Assist Underserved and Underresourced Communities with Environmental Justice Concerns - Early intervention, before market pressures are intense, allows residents to offer their vision for better and healthy communities.

Full report available here.

Calling out Implications and Opportunities: Climate Change and Equity and Human Wellbeing

The 2016 Tacoma Climate Change Resilience Study (City of Tacoma, 2016) sought to "better understand and proactively manage climate risk in order to protect local residents, make sound investments, and ensure that the City can prosper, even in a changing climate." The study focused on three systems: built infrastructure, natural systems, and social systems. When considering Equity and Human Wellbeing; social systems include general health and social services and potentially at-risk populations and neighborhoods. The study found the following:

- Populations along the city's coastlines, such as West End and North End residents and businesses, will experience higher flood risk and higher landslide risk than inland communities.
- However, Tacoma's residential areas are mostly located inland. Therefore, the most prominent climate hazards for Tacoma's social systems and population centers are extreme heat and inland flooding.
- Future increases in the frequency and duration of extreme heat events will disproportionately affect populations located in urban heat islands and in areas with low tree canopy cover.
- Potential direct inundation of the tideflats area could also carry considerable consequences for Tacoma's economy.
- Populations with especially high sensitivity to climate impacts include the sick, disabled, young, elderly, and those who work outdoors or lack access to cooling or shelter. Relatively more of the very young and elderly reside in the West End and North End areas of the city.
- Persons without air conditioning at their homes or workplaces will be especially sensitive to extreme heat events.
- A person's income, level of education, first language, and level of insurance coverage will affect their ability to rebuild, retreat, or respond to extreme events and stresses.

To address these findings, the following near-term needs were identified by the study:

1. Prioritize South Tacoma, New Tacoma near downtown, the southwest area of West End, and Eastside in capital improvement, development, and planning activities as relevant to ensure that these communities receive the services they need to adequately build resilience to climate change and other stressors.
2. Develop a coordinated strategy for addressing extreme heat risks, which could include actions such as enhanced public education and outreach around heat risks and preparedness; increased use of passive and active cooling solutions; and coordinated preparedness and response efforts. Maintain and expand utility rebate programs for cooling equipment, especially for lower-income households.
3. Begin a conversation with the business community around climate impacts and resilience, starting with forums such as chambers of commerce and business district meetings.
4. Engage with and support community organizations that enhance community resilience in order to understand and respond directly to needs on the ground.

Equity and Human Wellbeing Success in the Watershed

PIERCE CONSERVATION DISTRICT'S CULTURAL AMBASSADORS PROGRAM

In 2015, Pierce Conservation District (PCD) received $50k from the National Association of Conservation Districts for translation of their urban agriculture program Harvest Pierce County's materials into the top 5 languages spoken in our county. PCD had been operating under the assumption that if only the District's materials were translated and classes interpreted, people with Limited English Proficiency (LEP) would show up. PCD quickly

realized that as an organization, it lacked relationships in the communities they were seeking to connect with and had not been actively designing programming with those community's particular interests and needs in mind. Outreach would continue to fall flat until PCD addressed this essential piece.

Figure 4: Participants in the Cultural Ambassadors Program

There is still an important place in language access for translation and interpretation. But the need to adapt PCD's programming and build reciprocal relationships with immigrant and refugee communities in Pierce County is what led to the formation of what is now called the Cultural Ambassadors Program, which hosts a network of bilingual and bicultural community connectors who have lived experience and cultural expertise. Cultural Ambassadors work with the Pierce Conservation District to identify needs in their communities and co-create solutions that are rooted in their own cultural context. In addition to helping PCD connect more diverse communities to programs and education already offered, Ambassadors have also connected PCD to BIPOC communities that are already deeply passionate and are taking leadership in conservation. Supporting and empowering this leadership moves the county closer to a more sustainable future.

As PCD moves forward, it is simplifying and codifying the co-creative process into an interactive set of steps that others in the organization can follow. PCD started calling this process Community-Centered Design (CCD), an adaptation of Human Centered Design concepts from community planning and tech fields. The program format is now spreading to other programs within PCD: the Farm Program has their own network of Cultural Ambassadors that centers on Latinx farmers (called Cultural Navigators), and the Water Quality Program is beginning to build their network. PCD have also begun consulting with organizations and agencies outside of PCD as they start their own Ambassador networks, including the City of Tacoma and the Tacoma Pierce County Health Department.

PROJECTS

- Brian Abbott Above and Beyond Award: Swan Creek Limpieza Team

PROGRAMS

- Craft3
- TappsWise Program
- Puget Sound Wood Stove Program

COMMUNITY

- Carbon River Corridor Cooperative Action Plan

Priority Actions

- Outreach to BIPOC leaders and communities to better understand their priorities and needs and how they would like to be connected to ecosystem restoration efforts; increase their participation in LIO activities.
- Increase the LIOs understanding and use of best practices for improving equity in environmental decision making and participate in implementation of the HEAL Act and implementation of the Environmental Justice Task Force Recommendations for Prioritizing EJ in Washington State Government (Rasmussen et. al., 2020).
- Increase education of Tribal Treaty Rights and the Tribal Land Settlement Agreement.
- Include the rights for foraging and cultivation of traditional foods and work with Tribal nations to increase their access to traditional foods throughout the watershed.
- Support use of the Tacoma/Pierce County Equity Index (in development).
- Support the Puyallup Tribe of Indians and their work to restore the ancestral name of Mt. Rainier to Mount Tacoma or Mount Tahoma. In the native Lushootseed, the mountain is called təqʷuʔməʔ.
- Ensure information is available for non or low-English proficiency speakers, especially around health issues associated with harvesting fish and shellfish.
- Support access to elk forage areas for Muckleshoot tribes.
- Increase funding for the Tacoma/Pierce County Health Department's Outdoor Air Quality Program
- Provide outreach and investment towards rural communities to support expansion of existing trail systems and safe disposal of solid waste.
- Increase the development of community green space such as urban rooftop gardens, urban tree planting, and pocket parks to mitigate the effects of urban heat islands.
- Support farmers markets and community gardens as a source for fresh fruits and vegetables.
- Support recommendations made by the Puyallup-White Watershed Open Space Strategy (Pierce County, 2020), specifically supporting the following:
    - **The Lower Puyallup Green Core,** which would combine trail and recreational development, shoreline restoration, and agricultural land conservation in the lower Puyallup river Valley to create a Green "Y" for urbanized Pierce County.
    - **The White River Corridor** which would protect and enhance forested lands along the White River and its tributaries.
    - **The Greater Rainier (Mother Mountain) Conservation and Recreation Initiative** which is a collaborative program of public and private conservation/recreational development efforts.
- Develop and implement an engagement process with local Tribes to reframe salmon recovery efforts to emphasize food sovereignty and cultural relevance.
- Model and scale a Cultural Ambassadors program that recruits and contracts local, bi-lingual community members to better engage low-English Proficiency community members into ecosystem recovery efforts.
- Expand non-motorized trail completion and taking from example project such as the following:
    - Pipeline Trail - City of Tacoma
    - Pipeline Trail Design | Pierce County, WA - Official Website (piercecountywa.gov)
    - Tahoma to Tacoma

Climate Change

Climate Change is the defining issue of our time. The 2021 United Nations Environmental Report Making Peace with Nature – A Scientific Blueprint to Tackle the Climate Biodiversity and Pollution Emergencies (UNEP, 2021) offers that "only a fundamental, system-wide transformation across technological, economic, and social factors, including paradigms, goals, and values can reverse the current trends that threaten the wellbeing of present and future generations and the survival of other species. … To prevent extinctions and maintain nature's life-supporting contributions, biodiversity conservation and restoration must be integral to the many uses of terrestrial, freshwater, and marine ecosystems, and coupled with an expanded and better-managed global network of interconnected protected areas designed to be resilient to climate change."

From rising sea levels that threaten coastal property and increase flood risk to increased temperatures that threaten food production and increase the risk of forest fires, the impacts of climate change are global in scope. However, mitigation, adaptation, and development of resilience to the impacts of climate change starts on a local level. Climate-driven changes in temperature, precipitation, and sea level are projected to have wide-ranging impacts on the Puget Sound region in the coming decades, exacerbating other stresses such as those caused by urbanization and shoreline alteration in the Watershed.

Climate change will impact the other focus areas in this ERP, and as such needs to be incorporated into the planning and implementation of nearly every priority action identified herein. Whether it is increased flooding that threatens homes and other infrastructure due to bigger storm events; expanding drought conditions that threaten endangered salmon and our local farming industry due to warmer summer temperatures and dwindling snowpack; increased occurrence of devastating wildfires that harm our forests, biodiversity, and threaten our communities; or simply ever decreasing public health because of extreme heat events, lower air quality, and the disasters listed above, the climate crisis will exacerbate each of the pressures on our ecosystems and community identified throughout this ERP. As such, many of the focus area chapters will integrate strategies and priority actions that will help mitigate and/or adapt to Climate Change, whereas this chapter will largely focus on the impacts we can expect for the Watershed. According to the University of Washington's Climate Impact Group, Figure 5 provides an overview of the climate impacts predicted for the Watershed by 2050.

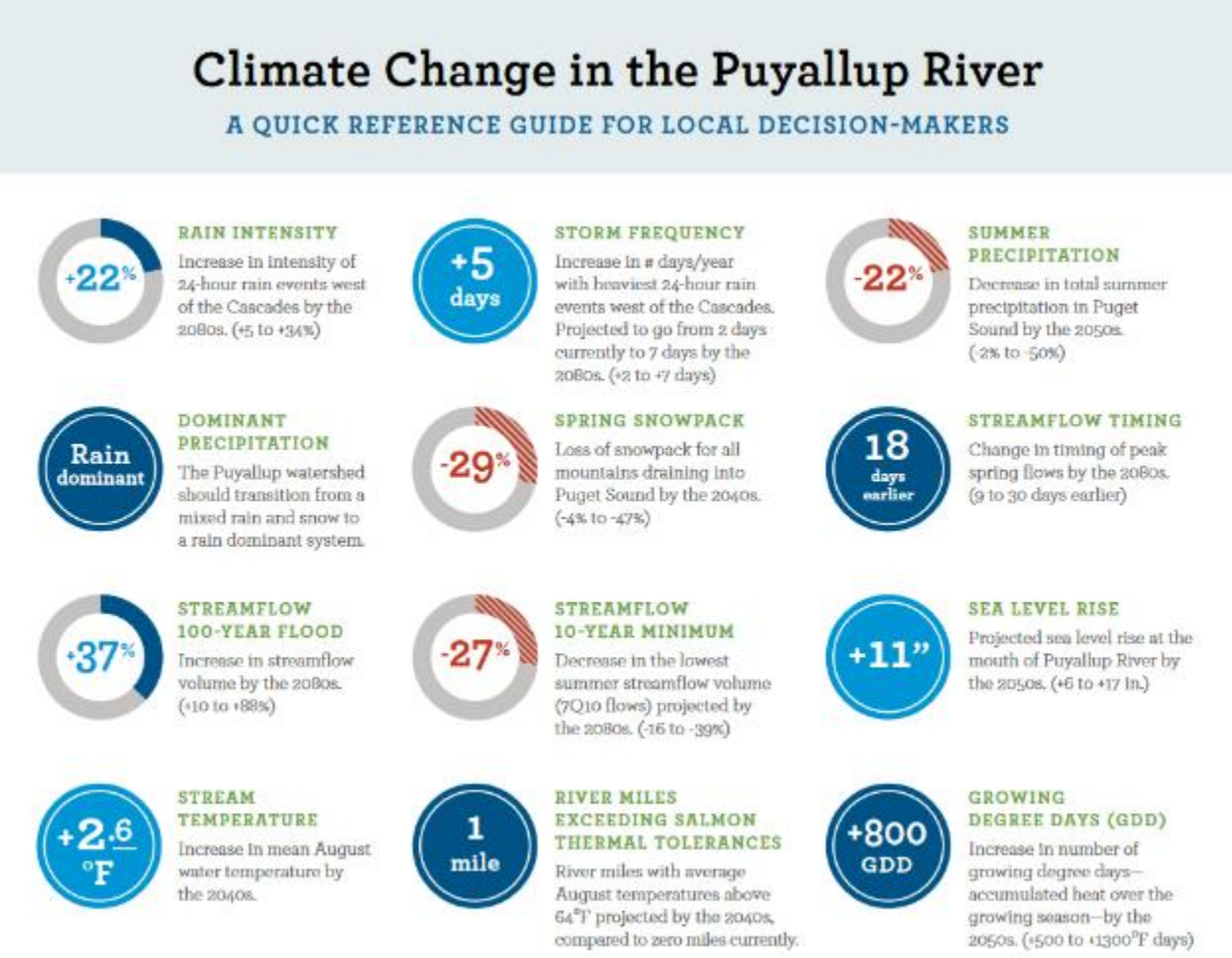


Figure 5: Overview of the effects of climate change expected for the Puyallup River watershed by 2050. For more information, refer to the full fact sheet.

For more than 150 years, industrialization, deforestation, and large-scale agriculture has increased the quantities of greenhouse gasses in the atmosphere. As populations, economies, and standards of living grow, so does the cumulative level of greenhouse gas (GHG) emissions. Starting in 2005, the Puget Sound Clean Air Agency (PSCAA) has conducted comprehensive greenhouse gas inventories of its four-county area: King, Pierce, Snohomish, and Kitsap. The 2015 inventory provides updates of community emissions within the agency's jurisdiction.

The key findings across the PSCAA region are:

- Greenhouse gas emissions in 2015 totaled 34.4million megagrams (Mg)—or million metric tons (MT)—of carbon dioxide equivalent (CO_2e) in PSCAA's four-county area;
- In 2015, the average resident within the PSCAA's jurisdiction emitted 8.8 $MgCO_2e$;
- The largest source of other emissions was from residential land development (approximately 93,000 $MgCO_2e$); and
- Emissions from solid waste (2%), wastewater (1%), and agriculture (1%) were minimal in the Puget Sound region in 2015—typical of community GHG inventories.

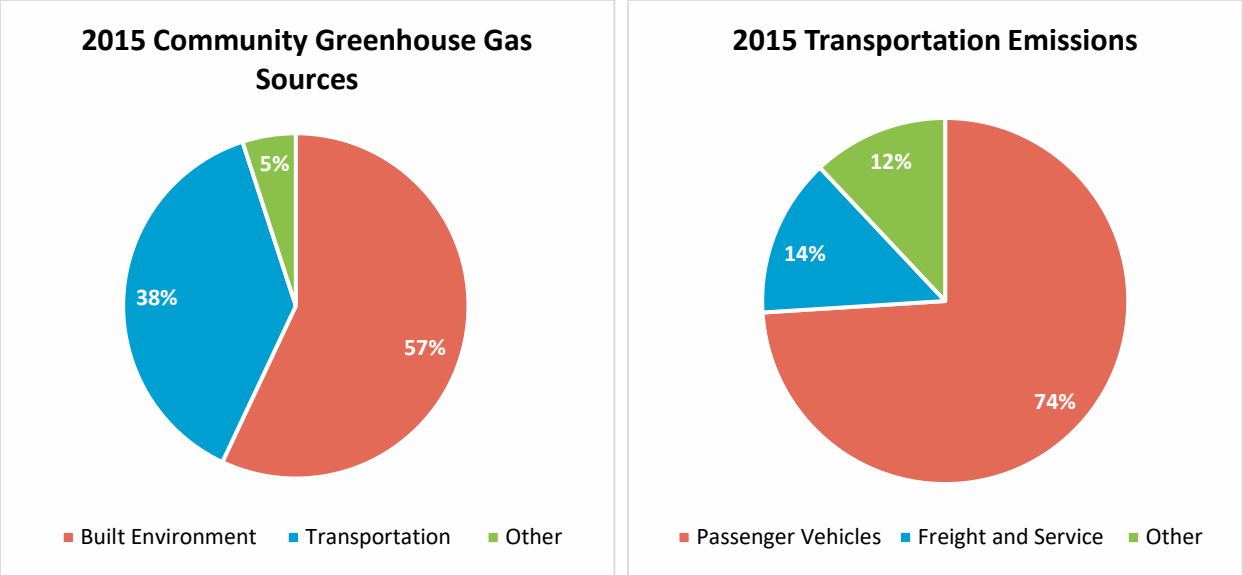


Figure 6: Pie charts depicting the 2015 percent community greenhouse gas sources and transportation emissions.

According to the 2015 inventory report, Pierce County itself accounts for 2.7 Mg of CO_2e from transportation, 1.3 Mg from Residential Built Environment, and 0.9 Mg from Commercial Built Environment. PSCAA is actively working to update the analysis for Pierce County exclusively.

Mitigating and reducing these GHG drivers and addressing the overall impacts of Climate Change is central to the PWR LIO's priorities moving forward through efforts such as energy conservation, electrification of the grid, and carbon sequestration of natural lands/forest/agricultural land. On December 10, 2019, the Tacoma City Council passed Resolution No. 40509. It acknowledges the climate emergency facing the area and prioritizes addressing climate change for the city by promoting a carbon-neutral economy and adaptation of resilience strategies to prepare for intensifying climate impacts. It also commits these actions to be done with an equity lens.

Key Plans, Goals, Strategies, and References for Climate Change

The overall goal for the Climate Change Focus Area is to understand and mitigate, adapt, and develop resilience to the impacts of climate change for the entire county as well as considering the communities disproportionally impacted.

The PWR LIO will work in support of the goals, targets, strategies, and actions for Climate Change in existing collaboratively developed documents for the Watershed. Key documents are described below with hyperlinks for more information. This is not an exhaustive list.

CLIMATE CHANGE AND OUR NATURAL RESOURCES – A REPORT FROM THE TREATY TRIBES IN WESTERN WASHINGTON

The 2016 Climate Change and Our Natural Resources (Treaty Tribes in Western Washington, 2016) report is from the twenty member tribes of the Northwest Indian Fisheries Commission. Members include the: Puyallup Tribe of Indians, Muckleshoot Indian Tribe, Squaxin Island Tribe, the Nisqually Tribe, Hoh Tribe, Jamestown S'Klallam Tribe, Lower Elwha Klallam Tribe, Lummi Nation, Makah Tribe, Nooksack Indian Tribe, Port Gamble S'Klallam Tribe, Quileute Tribe, Quinault Indian Nation, Sauk-Suiattle Indian Tribe, Skokomish Indian Tribe, Stillaguamish Tribe of Indians, Suquamish Tribe, Swinomish Indian Tribal Community, Tulalip Tribes, and the Upper Skagit Indian Tribe.

The report identifies threats and impacts of climate change to tribal homelands, waters, and ways of life. It contains detailed analyses of the anticipated response of species and other resources that are important to each Tribe to climate threats.

The threats and impacts are:

- Declining runs of salmon and steelhead from changes in streamflow, stream temperature, levels of dissolved oxygen, the amount of sediment in streams, susceptibility to disease, ocean temperatures, ocean chemistry, timing of prey availability, prey type, and competition from warm-water species;
- Migration of marine fish away from historical fishing grounds as they seek out cooler ocean temperatures;
- Replacement of traditional fish runs with invasive species and new species that have migrated from warmer waters;
- Declining populations of shellfish (including mollusks and crustaceans) due to changing ocean chemistry;
- Closing of shellfish harvest areas due to harmful algal blooms;
- Loss of traditional shellfish harvesting areas, forage fish spawning grounds, and important cultural sites to sea level rise or increased coastal erosion;
- Loss of water supplies for drinking and other needs due to saltwater intrusion from sea level rise, changes in precipitation patterns, streamflow alterations, and/ or groundwater availability;
- Declining populations of wildlife and birds due to habitat changes, loss of food sources, disease, and competition with invasive species;
- Migration of wild game and birds from traditional hunting grounds as they move north or to higher elevations;
- Decreased plant productivity and shifts in species ranges due to heat stress, drought, invasive species, or increasing numbers of pests;
- Loss of traditional hunting grounds, plant gathering areas, and sacred sites due to wildfire, landslides, or invasive species;
- Loss of access routes to important cultural sites due to flooding, bridge damage, permanent road closures, or landslides;
- Changes in the timing of key life stages in a variety of species such as the migration of salmon, fruiting of berries, or the optimal time to harvest cedar bark; and
- Negative health outcomes from poor air quality, heat stress, spread of diseases, loss of nutrition from lack of traditional foods, and loss of opportunities to engage in traditional cultural activities.

The report highlights the following narrative goals to address these impacts:

- Development of tribal capacity to assess on- and off-reservation climate change impacts and to promote resilience to these impacts at multiple scales;
- Management of natural resources using practices that incorporate climate change impacts into long-term plans;
- Coordination between tribes and among departments within each tribe, such as natural resources, planning, public health, emergency management, and community outreach;
- Partnerships between tribal and non-tribal scientists on research, modeling, and tracking environmental trends;
- Partnerships with federal, state, and local governments to work together on local concerns and solutions; and
- Access to funding sources that assist in the implementation of adaptation projects that protect tribal people, homelands, and resources.

SUSTAINABILITY 2030: PIERCE COUNTY'S GREENHOUSE GAS REDUCTION PLAN

The Sustainability 2030: Pierce County's Greenhouse Gas Reduction Plan (Pierce County, 2021) provides a roadmap of measurable and science-based actions to achieve the County's key goal of reducing government operations and countywide GHG emissions by 45% by 2030 based on 2020 levels.

The report developed a set of measurable and science-based actions for the County to achieve this GHG emissions reduction goal for five areas of focus:

- Energy and the Built Environment;
- Transportation;
- Consumption and Waste Reduction;
- Carbon Sequestration; and
- Education and Outreach.

Embedded in this plan is the county's recognition of the importance of ensuring underrepresented communities are included in the prioritization, implementation, and future updates of Pierce County's Sustainability 2030 Plan. To reduce GHG emissions in Pierce County, the county is committed to ensuring that these changes result in a more equitable Pierce County. To perform the necessary work around environmental equity, the plan outlines an environmental equity assessment to be conducted within the first two years of this plan. This assessment will provide insight on which communities are most threatened by degraded environmental conditions. By 2023, Pierce County plans to have a list of community-generated GHG reduction actions to share with the Pierce County Council.

For each area of focus, key actions are organized to highlight the GHG reduction potential, associated co-benefits, implementation timeline, internal (Pierce County operations), or external (countywide) emissions impact and collaboration and partnership between internal departments, community partners, residents, and businesses to reach the GHG reduction goal.

TACOMA CLIMATE CHANGE RESILIENCE STUDY

The Tacoma Climate Change Resilience Study (City of Tacoma, 2016) documents and describes key climate impacts and vulnerabilities in the region. Study goals were to better understand and proactively manage climate risks to protect residents, make sound investments, and ensure that the city can prosper, even in a changing climate with specific focus on the following systems: built infrastructure, natural systems, and social systems.

The plan also lays out priority adaptation actions that have been vetted by City departments and community partners. While this assessment is specific to Tacoma, actions can be used by other local governments, with the exception of the Tacoma subarea planning. The assessment team looked at vulnerabilities in these three systems in parallel to facilitate the identification of potential adaptation methods that would provide multiple benefits. The study describes near-term needs and windows of opportunity for each study system:

Built infrastructure, focusing on surface water, wastewater, solid waste, and transportation assets:

1. Review ongoing and near-term capital improvement projects for climate change considerations.
2. Encourage the leads of existing Puyallup River flood planning and reduction work to integrate relevant climate change considerations (e.g., increased sediment, increased flow, increased sea level) into current and near-term work.
3. Evaluate the development code related to landslide and flooding hazards.
4. Develop a city standard of practice that accounts for climate change (e.g., higher flow, higher sea level, higher temperature) in the design of capital projects.

Natural systems, including streams, lakes, wetlands, open spaces, and restoration sites:

1. Preserve remaining natural areas.
2. Establish stronger, more resilient landscapes in open spaces by increasing plant diversity, extending establishment periods, using smaller planted stock, and adding more habitat types.
3. Incorporate greater resilience in habitat restoration projects.
4. Provide more explicit design guidance or performance specifications for considering climate science in habitat restoration plans.

Social systems, including general health and social services and potentially at-risk populations and neighborhoods:

1. Incorporate outcomes from the "Fairness Across Places? Your Health in Pierce County" report into targeted resilience activities and initiatives.
2. Consider climate change risks in the Tacoma Mall Neighborhood Subarea Plan.
3. Incorporate climate resilience actions into equity initiatives and programs. Current programs that could incorporate resilience activities, education, and actions include the Healthy Homes, Healthy Neighborhoods program, Puyallup Watershed Initiative, Tacoma Office of Equity, Family Support Centers, and the Tacoma-Pierce County Health Department's Health Equity Initiative.
4. Contribute to and leverage HUD grant activities, should the grant be awarded.
5. Integrate future climate risk in emergency planning and hazard mitigation planning updates.

This study also provides useful strategies for the city of Tacoma and the surrounding watershed:

Built Infrastructure

1. Adaptation options for the wastewater water system include reducing exposure by raising the infrastructure above projected high tide elevations and reducing sensitivity by installing measures to address inflow and infiltration.
2. Adaptation options for the surface water system include reducing exposure through implementation of flow control best management practices, increasing canopy cover, and reducing the amount of impervious surface.
3. Many potential adaptation measures to reduce exposure to extreme high tides and Puyallup River flooding will be costly and difficult.

Natural Systems

1. Develop an urban landscape strategy or framework that values and expands upon the natural features of the landscape, including urban forests, critical areas, and open spaces.
2. Reduce non-climate stressors affecting fish, wildlife, plants, and ecosystems.
3. Establish transitional zones around the nearshore where armoring or other infrastructure currently restricts the ability of marine ecosystems to adjust to sea level rise.
4. Continue to engage in and support regional efforts within the Puyallup River basin to consider river management related to floods, sediment, agriculture, and infrastructure protection.

Social Systems

1. Develop a coordinated strategy for addressing extreme heat risks.
2. Adjust and/or amend the Critical Areas Ordinance and drainage code under development regulations to build resilience to increased landslides and flooding.
3. Maintain and expand utility rebate programs for cooling equipment, especially for lower-income households.
4. Prioritize South Tacoma, New Tacoma near downtown, the southwest area of West End, and Eastside in capital improvement, development, and planning activities as relevant to ensure that these communities receive the services they need to adequately build resilience to climate change and other stressors.

The following strategies have been identified to potentially provide benefits across all three systems of study:

1. Evaluate development surrounding steep slopes to ensure that development practices do not either (1) put people or property at risk of harm, or (2) disconnect a vital sediment source from the nearshore.
2. Preserve and expand urban forest canopies.
3. Encourage low impact development (LID) practices for stormwater management where feasible.
4. Reduce non-climate stressors (e.g., vegetation clearing, stormwater runoff, and impaired water quality) affecting fish, wildlife, plants, and ecosystems.
5. Where possible, reestablish flood pathways in altered former natural floodplains.

An updated plan is expected to be released in late 2021.

KING COUNTY STRATEGIC CLIMATE ACTION PLAN

The PWR LIO includes a small portion of King County in Federal Way, Auburn, and other areas north of White and Greenwater Rivers. The 2020 Strategic Climate Action Plan (SCAP) (King County, 2021) is a five-year blueprint for county climate action that integrates climate change into all areas of county operations and work with King County cities, partners, communities, and residents.

The SCAP outlines King County's priorities and commitments for climate action for decision-makers, employees, partners, and the public. The 2020 SCAP continues King County's focus on reducing GHG emissions and preparing for climate change impacts while strengthening the county's commitment to lead with equity, engage communities, and reduce health disparities.

New content developed for the 2020 SCAP:

- Guiding principles developed by the Climate Action team;
- "Sustainable and Resilience Frontline Communities" section added;
- Updated target and supporting actions in the GHG focus areas; and
- Strategic framework for climate preparedness.

The updated 2020 SCAP consists of three core sections: Reducing Greenhouse Gas Emissions, Sustainable & Resilient Frontline Communities, and Preparing for Climate Change. The Reducing Greenhouse Gas Emissions core section notes numeric goals, while the other two core sections highlight visions and strategies. High level details are below; refer to the report for more details.

1. Reducing Greenhouse Gas Emissions: Reduce county-wide sources of GHG emissions as compared to a 2007 baseline by 25 percent by 2020, 50 percent by 2030, and 80 percent by 2050. Pursue additional goals and actions to sequester carbon and reduce emissions from consumption of goods and services.
2. Sustainable & Resilient Frontline Communities: Achieve climate equity through the following strategies (1) building equitable practices, (2) language access, (3) community leadership, (4) finding solutions to root causes, (5) advancing an equitable climate future, and (6) aligning initiatives.
3. Preparing for Climate Change: Create, support, and implement policies and actions that reduce climate change vulnerabilities equitably and increase the resilience of King County communities, natural systems, and the built environment.

PUYALLUP TRIBE CLIMATE CHANGE IMPACT ASSESSMENT AND ADAPTATION OPTIONS

From 2015 to 2016, the Puyallup Tribe worked with Cascadia Consulting Group to develop the Puyallup Tribe Climate Change Impact Assessment and Adaptation Options (Puyallup Tribes of Indians, 2016) report.

The report identified key options to help Tribal staff and members better understand and prepare to proactively manage climate risks to ensure that Tribal customs and the Tribal community can thrive for many generations to come, despite a changing climate.

Changes that have occurred already:

- Average annual temperatures for the Pacific Northwest have risen 1.3°F since 1895. One of the implications has been a longer frost-free season.
- The cumulative area of Mt. Rainier's glaciers decreased by 27% between 1913 and 1994.
- Sea level has risen by 7.8 inches in our region over the last century.
- Ocean pH has already declined by about 30% as the oceans absorb increasing amounts of carbon dioxide.

The assessment focused on eight key resources or sectors: Fisheries and Hatcheries, Shellfish, Wildlife, Restoration Sites, Water Quality, Cultural and Archaeological sites, Transportation, and Public Health and Safety. The assessment identified actions needed to protect resources, infrastructure, and people as the climate continues to

change for all sectors. The adaptation options are presented by sector/ resource and categorized under these five main strategies within each sector/resource:

- Implement protection, restoration, and management practices;
- Provide education and guidance;
- Reevaluate policies, plans, and protocols;
- Gather additional information; and
- Leverage partnerships.

Strategies are summarized in Table 3. More details about each strategy can be found in the report.

Table 3. Puyallup Tribe Climate Change Impact Assessment and Adaptation Options Strategies

Sector/Resource	Strategies
Fisheries, Hatcheries, and Shellfish	• Reduce sources of nutrients that contribute to harmful algal blooms; in the future, as conditions worsen, this effort could include exploring the use of mussels to filter out excess nutrients. • Lobby for state changes in hatchery management (e.g., increases in shading, augmenting flows with cooler groundwater when necessary). • Expand efforts to stabilize headwaters above spawning habitat (e.g., using large wood, vegetative mattresses). Help seek funding for local jurisdictions to implement such efforts beyond the Puyallup Reservation. • Continue to work with the Army Corps of Engineers to increase shading downstream from Tribal hatcheries.
Public Safety, Air Quality/Health, Transportation, and Infrastructure	• Increase urban water absorption capacity by minimizing paved surfaces, using absorptive or permeable construction materials, and increasing public awareness and participation in reducing runoff. • Work with other agencies and jurisdictions to consider building new set-back levees to channel flood waters away from critical roads and abutments of important bridges. • Incorporate climate resilience into current public outreach and education programs, such as those for air quality.
Natural Resources (Habitat and Wildlife Restoration and Conservation), Water Quality	• Implement on-the-ground habitat and water quality restoration projects that serve one or more of the following functions: enhance floodplain connectivity, provides refuges for fish, reduces discharge of warm water and stormwater into rivers and streams, reduce forest susceptibility, restore high-quality freshwater habitat, maintain and increase biological diversity and connectivity, diversify vegetation and enhance water-retaining areas, provide corridors between conservation areas, protect undeveloped areas that are up-gradient from tidal wetlands, restore badly eroded streams at coastal outfalls. • Use public access points, nature centers, and hunting and fishing regulation guides to inform people of climate change impacts on wildlife, and what they can do to help. • Introduce new policies that encourage or require native and/or drought-tolerant vegetation in all landscaping and restoration projects.

Sector/Resource	Strategies
	• Work with conservation groups and nonprofits to encourage private landowners to protect critical habitat areas through conservation easements.

PIERCE COUNTY RURAL CLIMATE DIALOGUES

The Pierce County Rural Climate Dialogues brought together a microcosm of the county for a five-day deliberative event modeled on the Citizens' Jury method of deliberative democracy. Participants were tasked with creating a shared, community-based response to climate change and extreme weather events in response to their charge: "How might our community, in the face of extreme weather and climate change, secure a healthy, resilient, and economically vibrant future?"

The outcomes and findings of the Climate Dialogues will inform the Pierce Conservation District's Climate Resiliency 2021-2025 Strategic Goals and Targets and be used to shape the commissioning partners' ongoing conservation work. The outcomes will also be shared with decision-makers to inform future planning and decision-making related to climate change and extreme weather among Pierce County government agencies and elected bodies. The outcomes may also be used to initiate a series of community pilot projects funded through a grant received by the Pierce Conservation District.

The Pierce County Dialogues was commissioned by the Pierce Conservation District and the Puyallup Watershed Initiative. The commissioning bodies partnered with the Center for New Democratic Processes to design and implement the deliberative event. The goals and strategies identified below were elected by the juror participants and represent only a subset tagged by Pierce Conservation District and Puyallup Watershed Initiative as having high relevancy to the scope of the PWR-LIO Ecosystem Recovery Plan.

Goals Identified by Attendees

There are going to be repercussions for what has already been done to contribute towards climate change, but rural communities can keep it from becoming worse and can prepare for the consequences to help mitigate the damages. Regardless of the perceived cause of changing climate trends in Pierce County, there are actions these communities can take to mitigate, slow, or possibly even reverse these trends. Special focus needs to be applied to addressing public health and disaster and emergency preparedness impacts from climate change and extreme weather.

Air Quality

A well-informed, educated community of practice that understands how climate change impacts local air quality as it relates to public health, which is compounded by high temperature heat events and wildfire smoke. Agencies and organizations will prioritize at-risk groups using a combination of recommendations and resources for individual precautions and tackling the "underlying" problems with a collaborative, intersectional task force.

Agriculture and Food Systems

By adopting regenerative and adaptive practices, agricultural lands are more resilient to changing growing seasons, increased drought conditions, and other climatic stressors on crops. Farms (both urban and rural) utilize techniques such as agroforestry and permaculture to both increase soil health and sequester carbon to curb emissions. Farms are supported to make these transitions with the appropriate resources, resulting in a healthier and more vibrant local food economy.

Disaster and Emergency Preparedness

Governmental agencies, organizations, and frontline community groups utilize a holistic, comprehensive approach to responding to local disasters and emergencies by incorporating environmental stewardship, technology deployment, and up-to-date response plans tailored to the unique characteristics of rural areas of Pierce County

while also incorporating climate change studies and best available science. Coordination and response efforts are properly resourced to address the scale of the problems presented by climate change.

Wildfire

Rural and wildland urban interface communities are resilient to changing fire regimes and increased wildfire risk due to climate change. Governmental agencies and local partners adopt an integrative management approach that is proactive, financially sustainable, and addresses the scale of the problem presented by climate change. This means healthier forests, increased fire awareness and preparedness, and developing policies that bring onboard forest landowners at any scale, but especially so for larger forest landowners.

Utilities and Energy Grid Reliability

Local utilities adopt best available science and technologies to mitigate issues presented by further electrification of the grid, a growing population in the region, and impacts from climate change and extreme weather resulting in increased number and length of outages. Systems are in place to help people modernize and electrify their homes. This requires legislative change to allow energy companies to incentivize people to switch to electric sources, but this legislation needs to be drafted in a way that not only provides direct financial benefit to the energy company but to the customer as well.

Strategies Identified by Attendees

Air Quality

- Create a general awareness and education campaign on the impacts of air quality to public health, which is compounded by high temperature heat events and smoke resulting from wildfires;
- Develop and employ a prioritization mechanism to dedicate resources and program services targeting sensitive groups that are most at-risk to the effects of wildfire smoke in rural Pierce County;
- Equip homes and community centers with air filtration and air-cooling equipment through organized donation or group purchase campaigns;
- Create a more robust air quality monitoring network that is integrated with alert systems notifying local communities about air quality conditions and protective measures required; and
- Launch an interagency local taskforce to address underlying causes resulting in poorer air quality.

Agriculture and Food Systems

- Scale up existing education campaigns and workshops offered by agricultural agencies and partners, extending these into more rural areas of Pierce County;
- Increase financial incentives available to farmers to transition them to more sustainable agricultural practices, such as agroforestry and permaculture; and
- Streamline education, acquisition, installation, and utilization of rainwater collection systems on farms in rural Pierce County, especially so for those more susceptible to drought conditions.

Disaster and Emergency Preparedness

- Form Community Emergency Response Teams comprised of emergency management divisions, fire districts, and local community groups utilizing PC Alert and PC NET models and resources;
- Identify community safe spaces where food, water, shelter, and medical support would be provided in the event of a disaster. This includes identifying funding resources and coordinating bodies; and
- Incorporate disaster preparedness knowledge into school curriculum to help increase overall awareness and emphasize importance of community preparedness.

Wildfire

- Allocate the right level of resources to at-risk communities located in the County's rural and urban-rural interface. For example, this might include scaling up firefighters and frontline workers in these areas;

- Deliver rural community's information pertinent to wildfire. For example, many rural residents might not be aware that lahar signals are equipped with a separate alert to signal fire emergencies; and
- Improve wildfire resiliency on private and public owned properties, such as greenways, using practices such as FireWise.

Utilities and Energy Grid Reliability

- Advance legislative policies that remove barriers for utilities to electrify residential buildings, with a special focus on financial benefits to the utility customer;
- Upgrade utilities with better distribution and management systems utilizing advanced technologies.
- Deploy a plan for affordable solar installation, energy efficiency projects, and EV charging stations in Pierce County's rural jurisdictions and unincorporated Pierce County; and
- Educate communities on incentives and other programs available to rural communities for electric vehicles, energy efficiency, and renewable energy projects.

Calling out Implications and Opportunities: Equity and Human Well-Being and Climate Change

The effects of climate change disproportionately affect underrepresented communities. One way in which these effects are felt is in changing weather patterns that homes are unprepared for. Unfortunately, upgrading homes is expensive and often cost-prohibitive. Tacoma Public Utilities has a program that offers rebates, loans, and deferred loans to homes and residential properties through its Residential Incentives program. Free estimates can be scheduled through the site as well. Tax credits are also available for these improvements.

Improvements to homes can include better heating and cooling systems, insulation, windows, water heaters, lighting, and irrigation. Each of these modifications comes with significant cost savings in energy efficiency in addition to the savings of the installation of the modification itself.

This program aims to incentivize improvements to homes that can drastically reduce energy costs and makes the improvements more available to lower-income residents.

Climate Change Success in the Watershed

TACOMA-PIERCE COUNTY WOOD STOVE RULE

The City of Tacoma had a target in their 2016 Environmental Action Plan to meet healthy fine particle pollution levels 365 days a year. Despite having met the US Environmental Protection Agency (EPA) standard for fine particulate matter pollution (PM2.5), wood smoke continued to play a large part of this pollution problem in the region.

The fine particle pollution in the Smoke Reduction Zone (Figure 7) comes mainly from smoke due to burning in wood stoves and fireplaces. Pollution is worse during the winter months when more households are burning wood for heat. In addition, stagnant weather conditions trap the smoke from these fires close to the ground and cause air pollution to build up rapidly.

Figure 7. Tacoma Pierce County Smoke Reduction Zone

As of October 1, 2015, it is illegal to purchase or operate an uncertified wood stove in the Tacoma-Pierce County Smoke Reduction Zone. The new rule requires any wood stove that is not EPA certified to be removed and recycled or rendered inoperable.

While this project is helpful for removing a substantial contributor to air pollution, it is even more important with the increased smoke days from increased wildfire in recent years. Any reduction the Watershed can control within its borders will help ease the impacts of influences from other areas.

PROJECTS

- Tacoma Public Utilities Community Solar
- Owen Beach renovation to deal with Sea Level Rise

PROGRAMS

- Heat Pump Rebates
- Pierce Conservation District City Forest Credit Program

COMMUNITY

- Northwest Ports Clean Air Strategy

Priority Actions

- Encourage and support local governments to use recommendations outlined by the 2016 Climate Change Resilience Study (City of Tacoma, 2016) and the updated recommendations set to be released in late 2021.
- Develop a pilot project for on farm carbon sequestration practices and quantify the impacts to align with and support the Sustainable Farms and Fields bill (SB 5947).
- Implement disaster preparedness initiatives such as FireWise, developing natural protective infrastructure, and planting drought and heat resistant plant species for erosion control.
- Develop ‘resilience hubs’ across communities to cope with issues such as summer cooling, air quality during fire season, etc.

- Develop a civic engagement series similar to the Rural Climate Dialogues conducted in June 2021 to include Tribal-, urban-, and equity-focused versions to continue community engagement and development of community action plans.
- Connect trail systems to allow for more non-motorized transit for communities and support plans for electrification of transportation and associated infrastructure. Prioritize connecting non-motorized paths to public transportation stops and/ or hubs.
- Support a Puget Sound Clean Air Agency GHG emissions analysis for Pierce County.
- Continue local climate research to fill knowledge gaps such as those identified by the FFTF study done by Climate Impacts Group.
- Support the implementation of Top Actions identified by the Pierce County Rural Climate Dialogues Community Action Plan (Pierce Conservation District, 2021) in rural regions of the county.

Salmon

Salmon are an iconic species in the Pacific Northwest and a crucial part of the identity and vitality of the Watershed.

A healthy and vibrant salmon population within the Watershed is central to the Puyallup and Muckleshoot Tribes' religion, culture, and physical sustenance. Salmon are culturally and economically important to many Tribal and non-Tribal families and communities. In 2017, recreational and commercial salmon fishing employed approximately 16,000 jobs and contributed $540M in income for Washingtonians. A 2011 assessment by Earth Economics found that within the Watershed, ecosystem services that include salmon have an estimated value of a minimum of $13 billion. Salmon play a key role in the overall health of Puget Sound because they are essential prey for predators such as the endangered Southern Resident killer whale (Habitat Protection and Restoration Strategy for Puyallup and Chambers Watersheds, 2018). The White River sustains a key spring Chinook run, which is their preferred prey.

Ongoing human attitudes, activities, and infrastructure that create pressure on salmon in the Watershed include:

- Population growth and related conversion of land from natural cover to commercial and industrial areas
- Marine levees, floodgates, tide gates, armoring and other shoreline alterations
- Freshwater levees, floodgates, tide gates, armoring and other shoreline alterations
- Marine shoreline infrastructure
- Agricultural & Forestry Effluents
- Dams

Puget Sound is currently home to eight species of salmon, trout, and charr (Table 4). The Watershed, including the nearshore areas and Commencement Bay, has four species of salmon and is home to the last spring Chinook salmon run in the South Puget Sound region. Three of these species are listed as threatened under the Endangered Species Act. Table 4 lists the salmonid species in the Watershed and their regulatory status.

Table 4. Federal Status of Puget Sound Salmonid Species in the Puyallup-White Watershed

Common Name	Scientific Name	Regulatory Agency Status
Chinook Salmon	*Oncorhynchus tshawytscha*	NMFS/Threatened/1999
Chum Salmon	*Oncorhynchus keta*	No listing
Coho Salmon	*Oncorhynchus kisutch*	NMFS/Species of Concern/1997
Pink Salmon	*Oncorhynchus gorbuscha*	No listing
Bull trout/ Dolly varden	*Salvelinus confluentus*	USFWS/Threatened/1999
Coastal cutthroat trout	*Oncorhynchus clarkii ssp.*	No listing
Steelhead/ rainbow trout	*Oncorhynchus mykiss*	NMFS/Threatened/2007

Key Plans, Goals, Strategies, and References for Salmon

The overall goal of salmon recovery is to achieve self-sustaining, harvestable salmon populations in the Watershed and in Puget Sound. Watershed-based efforts in support of this goal focus on identification, protection and/ or restoration of critical habitat for salmon.

The PWR LIO will work in support of the goals, targets, strategies and actions for salmon described in existing collaboratively-developed documents for the Watershed. Key documents are described below with hyperlinks for more information. This is not a comprehensive list.

THE SALMON HABITAT PROTECTION AND RESTORATION STRATEGY

The Salmon Habitat Protection and Restoration Strategy (Lead Entity, 2018) for the Puyallup and Chambers Watersheds describes the foundation for salmon recovery in the Watershed. It provides technical guidance to identify and prioritize salmon habitat projects with a focus on increasing the abundance, productivity, spatial structure, and diversity of salmon populations. Salmon recovery projects can be expensive, challenging to carry out, and can take years to complete. The Strategy has a clear science-based approach to identify and prioritize areas for protection, and to develop restoration strategies for salmon habitat to make these investments successful. The Strategy establishes salmon-recovery based goals for estuaries, floodplains, and riparian habitats.

The Lead Entity

The Salmon Habitat Protection and Restoration Strategy was developed by the Lead Entity. The Lead Entity coordinates local salmon recovery efforts and develops local priorities for salmon recovery projects. LIOs and Lead Entities work closely together on ecosystem restoration. This Ecosystem Recovery Plan incorporates and is consistent with the goals, strategies, and priorities established by the Lead Entity.

To address limiting factors and support salmon recovery in the Watershed, the Lead Entity has developed 50-year habitat goals and 10-year implementation goals:

50-Year Habitat Goals:

- 32,000 acres of floodplain habitat (including in estuary and nearshore areas) are protected from development within the Core Salmon Habitat and Flood Zone Protection Corridor by 2067;
- 3,300 acres of functioning riparian buffer, with a width equal to or greater than one site-potential tree height (to be determined), will define a protected Riparian Buffer Zone by 2067; and
- 62 stream miles open to fish movement and passage by 2067.

10-Year Implementation Goals:

- 203,000 linear feet of levees removed and 2,300 acres of floodplain reconnected by 2027;
- Ten percent increase in functioning riparian buffer habitat by 2027;
- Three major physical barriers to fish movement and migration removed or modified by 2027; and
- 153 acres of nearshore habitat is restored by 2027.

The 50-year habitat goals and the 10-year implementation goals from the Strategy can be made for two corridors that are ideal for protection and restoration: (1) The Core Salmon Habitat and Flood Zone Protection Corridor and (2) The Riparian Buffer Zone Corridor. These two corridors are identified as lands that have the highest value for the recovery of salmon and that the river, estuary, and nearshore habitats offer the biggest chance for salmon recovery:

Priority strategies to achieve these goals include the following:

- Protect Highly Productive Tributary and Mainstem Areas: This includes implementing existing priority plans and developing new studies related to identifying, acquiring, prioritizing, and protecting land throughout the watershed. A few plans exist that identify priority lands for protection in some areas of the watersheds such as areas identified in the Core Salmon Habitat and Flood Zone Protection Corridor with a 200-foot Riparian Buffer Zone. Most land-trust acquisitions need long-term funding for maintenance, which usually results in the ownership of priority lands passing to Pierce County SWM and the Tribes.
- Reconnect Mainstem River Channels to Their Floodplains: This strategy includes levee setbacks, revetment (structures in streams) removal, road decommissioning, culvert replacements/improvements

in floodplain areas, Engineered Log Jams (ELJs) designed to promote over bank flow (increase bed elevations), and removal of pinch points such as bridge pilings that alter or prevent normal flow of water.

- Remove Physical Barriers to Fish Movement and Migration: Includes culvert replacement or removal, bridge replacement or removal, dam upgrades for fish passage, addressing instream structures that decrease or prevent water's normal flow, flow restoration, modified flow regulation at dams, restoring normal temperature variations, and changing how temperature is related to flow at dams to be healthier for fish.
- Restore Habitat in Highly Productive Tributaries and Mainstem Areas: This includes the following (other restoration methods may be identified): riparian restoration; in-channel ELJs and debris fencing; side channel and off-channel habitat restoration that focuses on spawning and rearing; redirecting stream channels to their historic locations; and large wood and nutrient enhancement.

Figure 8. Core salmon habitat and flood zone protection corridor with riparian buffer zone. (Photo Source)

- Restore and Maintain Hydrologic Regime: This includes considering all activities that influence the hydrologic regime (the normal way water flows in an area), including land management, impervious surfaces that allow for runoff, stormwater management, dam regulation, preventing the loss of forest lands, and creating a Community Forest Program.
- Restore Estuarine Habitats: This includes identifying and prioritizing areas for restoration throughout the estuarine area in the Lower Watershed from where Clarks Creek joins the Puyallup-White Rivers to the mouth of the Puyallup-White River. Projects of particular interest in the Puyallup-White Watershed include the Union Pacific and Pierce County Clear Creek properties.
- Restore Nearshore Areas: This includes identifying and prioritizing areas for restoration along the nearshore zone of the watersheds. Nearshore habitats go from the land that is affected by the tides, including cliffs along the shore, and goes out to where the water is deep enough that light cannot reach the bottom. Specific areas in the Watershed include nearshore areas along Commencement Bay including the Outer Hylebos, Puget Creek nearshore, and Mason Creek estuary. This includes conducting outreach to other stakeholders such as the Port, City, and Metro Parks to identify new project supporters.
- Coordinate Regulatory and Incentive Programs: This includes working with regulatory agencies in the watershed to ensure that existing rules, regulations, permits, enforcement, and frameworks are coordinated with salmon recovery needs and that new frameworks can be identified as they are needed to address regulatory gaps needed to support salmon recovery.

- Develop and Implement Salmon-Safe Farming Practices: This includes coordinating with the agricultural community, Stewardship Partners, and other groups to develop and implement salmon-safe farming practices and identify buffer areas available for restoration and protection. Programs in the Skagit and Snohomish Watersheds can serve as a reference model.
- Conduct Outreach and Education: This includes developing, starting, and supporting outreach and education to stakeholders, including the public, throughout the watersheds. The work involves coordinating with the Environmental Education Community of Interest in the Puyallup-White Watershed, City of Tacoma and Pierce County Environmental Educators, K-12 schools, Puyallup River Watershed Council, and Puyallup Tribe of Indians.
- Improve Water Quality: This includes working with stakeholders, including the public, NPDES Municipal Stormwater Phase I and Phase II Permittees, and regulatory agencies in the watersheds to improve water quality and address impacts to salmon related to stormwater runoff and other nonpoint pollution sources.

FLOODPLAINS FOR THE FUTURE SHARED MONITORING PLAN

Floodplains for the Future (FFTF) is a partnership of 22 organizations with a shared vision to improve salmon habitat, protect communities and infrastructure from flooding, and preserve agricultural lands. The range of actions managed by FFTF Partners include efforts to: acquire properties that flood frequently to remove communities from the path of floods and work on floodplain restoration; design and carry out large scale levee set-backs on mainstem rivers; restore instream, side channel, and off-channel habitat in tributary basins; reconnect tidal freshwater wetlands and off-channel habitat in the Puyallup delta; make sure agricultural needs are met; and get agricultural easements to preserve farmland.

The FFTF Shared Monitoring Plan (FFTF, 2018) outlines FFTF Partners' agreement on vision, strategies, and actions. The plan describes two specific goals related to salmon:

- Increase salmon numbers; and
- Protect existing functional salmon habitat and restore areas that salmon traditionally used for habitat.

Collective progress of FFTF Partners toward these goals will be monitored in two ways: by tracking change in the status and trends in abundance of ESA-listed and non-listed salmon species and by tracking the number of projects identified in WRIA 10/12 Salmon Habitat Protection and Restoration Strategy with financial support from FFTF partners. Partners meet to review shared goals and progress at an annual Monitoring Results Summit.

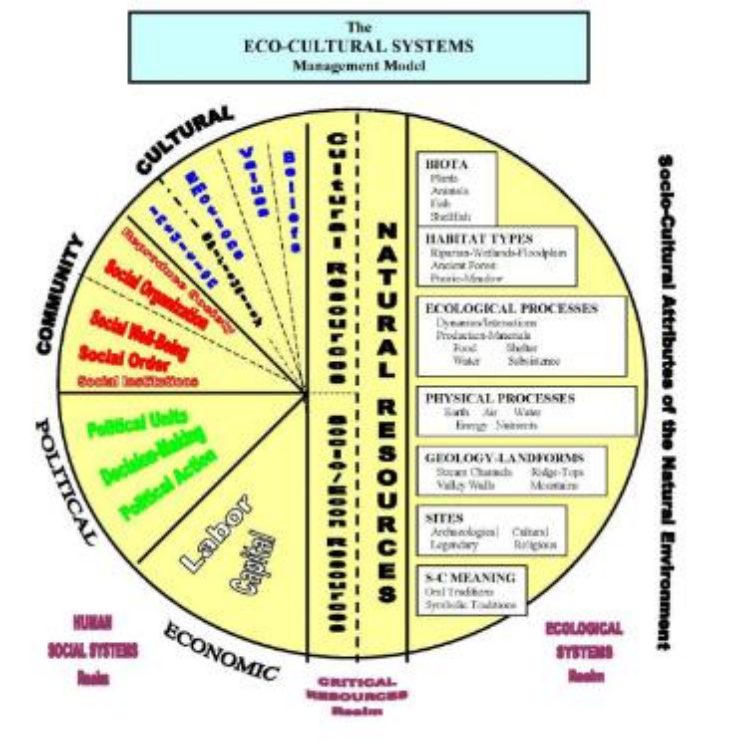
Calling out Implication and Opportunities: Equity and Salmon

Salmon and equity come together in a variety of ways, particularly around human wellbeing. Salmon are an iconic part of the Puget Sound ecosystem. They are a critical part of the diet of Southern Resident killer whales, seals, and sea lions. When salmon return to their natal rivers to spawn, their death returns critical nutrients to forest lands. Salmon are also a critical part of the human systems for the region. Since time immemorial, local Tribes have utilized salmon in their diets and traditions. Other communities rely on salmon returns for recreational and commercial fishing. Industries are built around the different salmon species.

Salmon in Puget Sound are important to the people living here. Many of the Puget Sound Partnership's Human Wellbeing Vital Signs Indicators are tied to salmon, including:

- Participation in cultural practices
- Employment in natural resource industries
- Natural resource industry output
- Percent of employment in natural resource industries
- Sense of Place Index
- Locally harvestable foods
- Nature-based recreation
- Nature-based work

These indicators all have one thing in common: they depend on the availability of salmon in the region. Increasing abundance and distribution will enhance the relationships and increase the ties that many people feel to this land. Increasing access to fishing and traditional practices will increase a sense of place for Tribal communities. The figure below is from the thesis for the degree of Master of Marine Affairs from the University of Washington by Jeffrey P Thomas, Director of the Timber, Fish & Wildlife Program with the Puyallup Tribe of Indians. It depicts the ties between the socio-ecological systems in Puget Sound, of which salmon play a critical role.



Calling out Implication and Opportunities: Climate Change and Salmon

Studies show that human behavior has contributed to the average annual air temperature in the Puget Sound region increasing by 1.3°F between 1895 and 2014. Additionally, the region has seen a lengthening of the frost-free season (+30 days, on average, for 1920-2014), an increase in average daily minimum temperatures (+1.8°F, 1895-2014) (ibid.), and a decreased snowpack. Increased air temperatures will mute diurnal and seasonal cooling in streams, resulting in warmer water. Observed changes in annual and seasonal precipitation in the Puget Sound region are mixed, with the direction (increasing/decreasing) and magnitude of trends varying depending on the time evaluated. However, while individual model results will vary, the majority of climate models project small increases in total annual precipitation for the Puget Sound region with an enhancement of existing seasonal patterns (i.e., wetter winter, spring, and fall precipitation and drier summers).

The report, Addressing Climate Change Impacts on Salmon in Puyallup and White River Basin (found in Appendix D of the Salmon Habitat Protection and Restoration Strategy for Puyallup and Chambers Watersheds), identifies six areas of work to address climate change as follows:

1) Address changes in seasonal flows, which include lower flows in summer and higher more flashy flows in winter by improving floodplain connectivity and protection and restoration of channel migration zones, implementing low impact development and green stormwater infrastructure practices in urban areas and supporting programs to reduce water use, and maintaining and restoring physical processes that regulate and infiltrate water flow such as riparian areas and beaver complexes.
2) Address increasing summer water temperatures by protecting and restoring riparian areas, removing fish passage barriers, improving the physical complexity of stream systems, and addressing water withdrawals.
3) Address sediment supply and transport by implementing large-scale restoration efforts to help move sediment through the watershed and protecting and restoring floodplains and riparian habitat.
4) Address stormwater runoff by improving stormwater management from transportation infrastructure and in parking lots, encouraging stormwater retrofits on private property, and implementing green stormwater infrastructure.
5) Address sea level rise including protecting marine and freshwater shorelines from armoring and encouraging appropriate armor removal.
6) Address ocean acidification by supporting local and regional efforts to protect and restore areas of carbon uptake such as tidal marshes.

Salmon Success in the Watershed

MUD MOUNTAIN DAM FISH PASSAGE FACILITY

The U.S. Army Corps of Engineers began construction on the new $112 million Mud Mountain Dam Fish Passage Facility in June 2018; it was completed in December 2020. It is the nation's largest trap-and-haul facility, transporting Endangered Species Act-listed and other fish around the dam near Buckley, Washington. Mud Mountain Dam is a flood control dam protecting the lower White and Puyallup River valleys from flooding by holding back water from heavy rains and melting snow in its reservoir. Visitors to the facility, located on the White River near Mt. Rainier in Washington State, can view the dam, picnic, hike, bike, or ride their horses in a scenic woodland setting.

The U.S. Army Corps of Engineers built the dam on the White River in the 1940s. The Corps also made channel improvements and built levees on the lower Puyallup River. Together, these structures have saved an estimated

$308 million in flood damages. Currently, the project helps protect the homes and businesses of about 400,000 people. The dam regulates flooding by holding back water from heavy rains and melting snow in the reservoir, and slowly releasing it back into the river. The reservoir is usually empty except for the normal flow of the White River. Completely filled, the reservoir stretches 5.5 miles and cover 1,200 acres.

Figure 9. Mud Mountain Dam (photo credit)

Other Success Stories

- Salmon return to Clear Creek
- South Prairie Creek restoration

Call out: Electron Dam

The Electron Dam Project, or Puyallup Project, is a 12-foot-tall dam on the Puyallup River near Kapowsin. It was started in 1904 and generates 22 megawatts of electricity, which historically was sold to Puget Sound Energy. The PRWC and the PWR LIO support removal of this dam because it is a major fish passage barrier and causes other problems for endangered Chinook salmon, steelhead, and bull trout. Its removal will open up access to 37 miles of salmon habitat.

Calls for removal of the dam have recently accelerated. In 2020, dam operators began a construction project to install artificial turf at the dam. This project was not permitted by Pierce County and the artificial turf discharged crumbs of rubber into the river. On August 7, 2020, Pierce County and the US Army Corps of Engineers issued a stop work order to the dam operators. On September 14, 2020, the County cited "inexcusable environmental harm" and "irresponsible management" in a formal letter from County Executive Bruce Dammeier to the dam operators. Puget Sound Energy has formally halted its agreement with the Electron Dam, citing the same environmental damages as the county. Lawsuits have been filed by the Puyallup Tribe and other nonprofit organizations under the Federal Clean Water Act.

Moving forward, the Pierce County Executive intends to work to have the dam removed from the river, and is formally supported by the Northwest Treaty Tribes and by U.S. Representative Kim Schrier. Local nonprofits Citizens for a Healthy Bay and Puget Soundkeeper Alliance filed a lawsuit on March 9, 2021 under the federal Clean Water Act.

Priority Actions for Salmon

The PWR LIO will prioritize support for projects identified for funding by the WRIA 10 Lead Entity. Currently the Lead Entity is recommending a number of property acquisition and levee setback projects, fish barrier removals, and other habitat enhancements including:

- Update of the Ecosystem Diagnosis and Treatment Model (EDT): EDT is a fish life-cycle habitat model designed to help managers identify priorities for habitat restoration investments and to understand how habitat conditions control fish numbers and where fish are. Updating the model will help us understand if we are working on the highest priority actions in the watershed. This project will be completed in 2021.
- Riparian Decision Support System: This project will include the development of a GIS Model to identify high priority areas for protection and/or restoration.
- Monitoring Plan: Based on existing recovery plans, the Monitoring and Adaptive Management of the Puget Sound Chinook will focus on monitoring to serve as the foundation to develop a Monitoring and Adaptive Management Plan to monitor progress in protecting and restoring salmonid habitat (freshwater, estuarine, and nearshore) and to inform adaptive management activities.
- Thermal Infrared Study: Quantum Spatial Incorporated (QSI) was contracted by the Puyallup Tribe of Indians and South Puget Sound Salmon Enhancement Group to collect airborne thermal infrared (TIR) data during the summer of 2019 for the Puyallup River and White River, their main tributaries and canals, and the Lacamas Creek basin and Wapato-Hylebos basin located near Tacoma, Washington. The purpose

of this survey is to aid the Puyallup Tribe of Indians and South Puget Sound Salmon Enhancement Group with an analysis of the spatial variability in stream and surface temperatures as well as thermal influence of point sources, tributaries, and springs.

- Puyallup Watershed Thermal Restoration Design: This design effort will produce preliminary plans and specifications. The project will enhance fish access to thermal refuge (away from areas in the water column that are too warm) and cold-water areas previously identified. Project designs will include a permit-ready, site-specific plan and section drawings for proposed actions to reconnect off-channel areas, install wood structures, and remove infrastructure limiting floodplain connectivity.
- Implementation of the Swan Creek Watershed Characterization and Action Plan: The primary goal of the Action Plan is to build on the information presented in the Basin Plan and to make recommendations to support Pierce County's efforts to improve water quality in Swan Creek. Characterizing existing conditions included reviewing prior reports, summarizing historical data collected in the watershed, collecting additional data on sediment erosion and non-point source pollutants, and assessing the relationships between historical data, new data and past and on-going land use activities, land ownership and stormwater conveyance and capacity. Recommended actions to improve water quality included new projects, programmatic measures and additional studies. Capital improvement projects, programmatic measures, and additional studies from the Basin Plan were also recommended again as actions. Projects and programmatic measures were assessed, scored, and ranked into high, medium and low priorities for implementation.

The full set of Lead Entity priority actions for salmon is available here.

Estuaries

Estuaries are the area where freshwater meets saltwater. They provide important ecosystem services and critical habitat to many species. The main estuary of the PWR LIO is the Puyallup River Estuary at Commencement Bay. An 1884 inventory of tidal wetlands estimated that there were over 2600 acres of tidal marsh, tide channels, and salt ponds in the estuary. Historically, these areas were important habitat for salmon and were a source of food, materials, and transportation for the Puyallup Tribe.

The estuary has been significantly filled and altered since European settlement, resulting in significant loss of intact nearshore habitat, tidal wetlands and channels, and salt marsh. Beginning in the early 1900s, industrialization in Commencement Bay resulted in the filling of a vast area of tideflats and the channelization of the meandering streams and rivers that flowed into the bay. For most of the 20th century, the resulting eight channelized waterways received releases of hazardous substances from various industries, including shipbuilding, oil refining, and chemical manufacturing plants. The Port of Tacoma occupies over 2,400 acres in Commencement Bay. Figure 10 shows the 1877 shoreline of the Puyallup estuary and lower river as compared to the current shoreline.

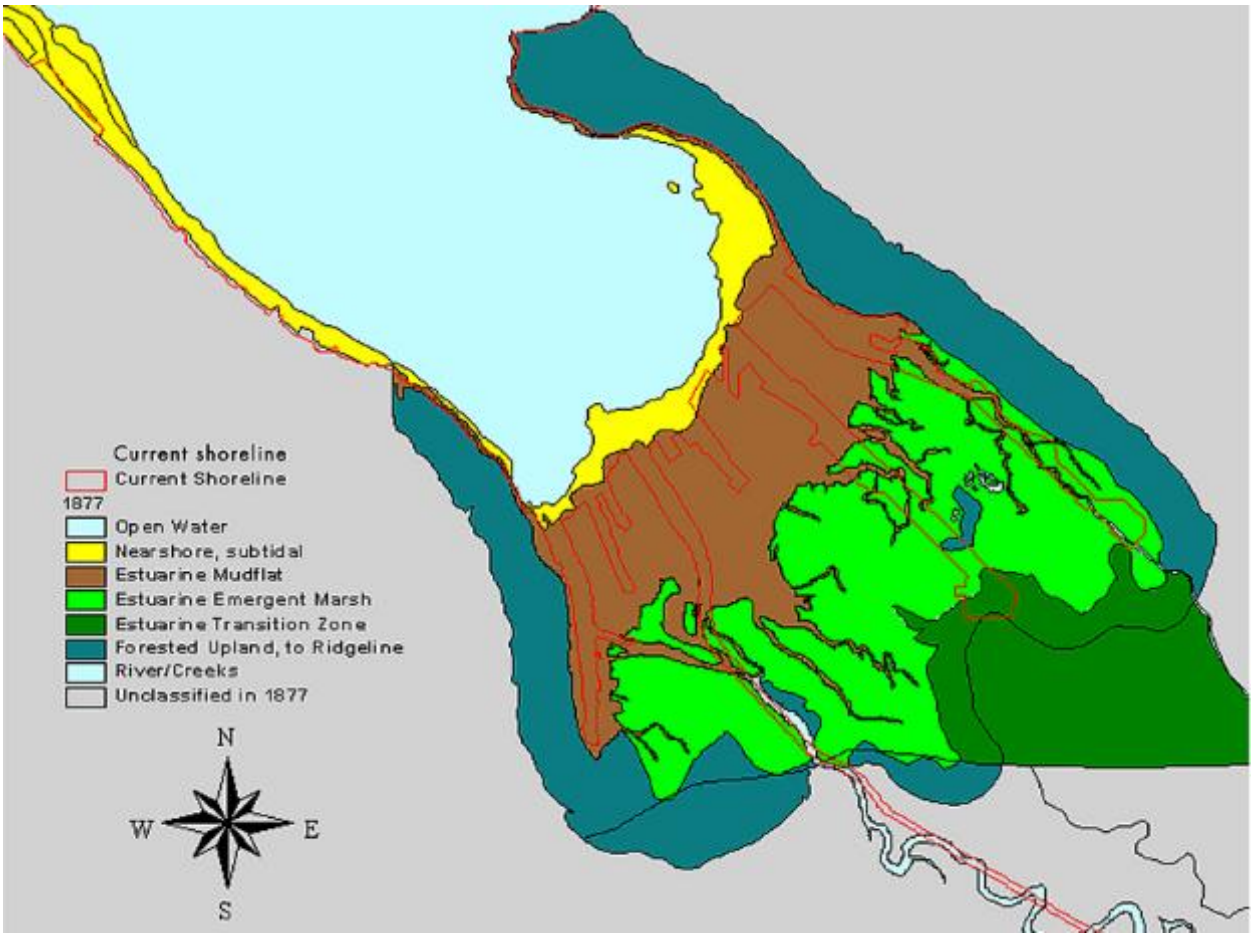


Figure 10. Historic extent of the Puyallup estuary and lower river overlayed with the current shoreline.

The Puyallup-White River estuary contains the Commencement Bay Superfund Site. The main contaminants included PCBs, dioxins, and heavy metals. Beginning in the late 1980s, the EPA, with technical support from NOAA,

began to direct the clean-up of a significant portion of the Superfund site. The EPA has divided the site into several "operable units." Each unit is managed as a distinct cleanup site within the larger Superfund site:

- Asarco Smelter
- Hylebos Waterway
- Middle Waterway
- Sitcum Waterway
- St. Paul Waterway
- Thea Foss Waterway
- Tacoma Tar Pits

The PWR LIO work on estuaries will contribute to progress for multiple Puget Sound Partnership Vital Signs including: Streams and Floodplains, Estuaries, Freshwater Quality, Forage Fish, and Salmon.

Key Plans, Goals, Strategies, and References for Estuaries

The overall goal for estuaries in the Watershed is to support the restoration of estuarine and shoreline habitat to enhance functional and sustainable ecosystems, where feasible.

The PWR LIO will work in support of the goals, targets, strategies and actions for estuaries described in existing collaboratively developed documents for the Watershed. Key documents are described below with hyperlinks for more information. This is not an exhaustive list.

ESTUARY GOALS IN THE SALMON HABITAT PROTECTION AND RESTORATION STRATEGY

The Salmon Habitat Protection and Restoration Strategy (Lead Entity, 2018) describes the following 50-Year Habitat Goal and 10-Year Implementation Goal related to estuary recovery:

50-Year Habitat Goal:

- 32,000 acres of floodplain habitat (including in estuary and nearshore areas) is protected from development within the Core Salmon Habitat and Flood Zone Protection Corridor by 2067. (NOTE: These 32,000 acres of floodplain habitat would include estuary recovery, however the specific acres of tidal marsh, tide channels, and salt ponds to be restored is still to be determined.)

Ongoing human attitudes, activities, and infrastructure that create pressure on the Puyallup-White River Watershed Estuaries include:

- Population growth and related conversion of land from natural cover to commercial and industrial areas
- Roads & railroads (including culverts)
- Marine levees, floodgates, tide gates, armoring and other shoreline alterations, such as the fill and development at the Port of Tacoma
- Marine shoreline infrastructure

10-Year Implementation Goal:

- 153 acres of nearshore habitat is restored by 2027.

Priority strategies include:

- Restore Estuarine Habitats: This includes identifying and prioritizing areas for restoration throughout the estuarine area in the Lower Watershed from where Clarks Creek joins the Puyallup-White River to the mouth of the Puyallup-White River. Projects of particular interest in the Puyallup-White Watershed include the Union Pacific and Pierce County Clear Creek properties.

- Restore Nearshore Areas: This includes identifying and prioritizing areas for restoration along the nearshore zone of the watersheds. Nearshore habitats go from the land that is affected by the tides, including cliffs along the shore, and goes out to where the water is deep enough that light cannot reach the bottom. Specific areas in the Puyallup-White Watershed include nearshore areas along Commencement Bay including the Outer Hylebos, Puget Creek nearshore, and Mason Creek estuary. This includes conducting outreach to other stakeholders such as the Port, City, and Metro Parks to identify new project supporters.

GW∂DZADAD TEACHING OF OUR ANCESTORS: TRIBAL HABITAT STRATEGY

The 2019 Tribal Habitat Strategy was created by the Member Tribes of the Northwest Indian Fisheries Commission. It provides goals, indicators, and initiating tasks for five habitat areas: Pacific Ocean, Nearshore, Floodplains, Riparian, and Water. The ultimate goal is salmon recovery because, as Billy Frank Jr. said, "As the salmon disappear, so do our cultures and treaty rights. We are at a crossroads and we are running out of time." This document provides a roadmap for recovery and emphasizes immediate action.

The main goal for the nearshore of the Salish Sea is to restore and/ or maintain ecological connectivity and geomorphic function of the nearshore, from 200 feet on the landward side to 100 feet below mean water low water.

Indicators to track this work are:

- Shoreline armor and overwater structures;
- Tidal hydrology barriers; and
- Impervious surfaces, fill, or agriculture in nearshore.

Tasks to initiate this work are:

- Create permit tracking tool to monitor and assess impacts of permits;
- Coordinate with NOAA on Shoreline Programmatic ESA Consultation to streamline and incentivize softer shoreline protection approaches for landowners;
- Address food web concerns, increase protection of forage fish spawning areas for orca recovery; and
- Identify and address regulatory inadequacies in nearshore protection.

CITY OF TACOMA SHORELINE RESTORATION PLAN

The City of Tacoma's Shoreline Restoration Plan (City of Tacoma, 2011) was designed to meet the requirements for restoration planning under the state Shoreline Management Act. The plan describes how the city will protect and restore shoreline habitat to achieve a no net loss standard. It is guided by four main principles:

1. Improve shoreline water quality.
2. Re-establish and restore natural shoreline processes, restore degraded and lost habitat, and wildlife corridors.
3. Improve connectivity of the shoreline environments to one another and to adjacent habitat corridors that support priority species and species of local significance.
4. Promote shoreline stewardship.

The specific goals related to estuaries are included with other goals related to habitat:

- Restoration of estuarine wetlands (hydrology); and
- Restoration and protection of salt marsh habitat.

The plan describes ecosystem process and function, level of alteration, restoration potential, objectives, restoration actions, and metrics and monitoring strategies for 12 areas of shoreline habitat in the Watershed's estuary ecosystems. In the historic Puyallup River estuary, strategies and actions include decreasing pollution loading, cleaning up pollution sources, and restoring the freshwater to saltwater transition zones and wetlands. In

the Puyallup River, strategies and actions include floodplain and side channel reconnection, wetland restoration and connectivity, improving summer low flows, reducing sources of pollution and pollution loading, and improving riparian cover and large woody debris. Restoration potential in the former Puyallup estuary and in the river are listed as low or moderate for all strategies.

ESTUARY GOALS IN THE FLOODPLAINS FOR THE FUTURE SHARED MONITORING PLAN

The FFTF Shared Monitoring Plan (FFTF, 2018) outlines the common agreement on visions and strategies that will improve salmon habitat, protect communities and infrastructure from flooding, and preserve agricultural lands. It establishes many shared goals and metrics related to habitat protection and restoration, salmon restoration, and flood damage reduction. The specific goal related to estuaries is: Restored Habitat – amount (acres) of restored habitat (estuary, riparian). Progress is assessed and reported annually.

COMMENCEMENT BAY NATURAL RESOURCE RESTORATION PLAN

The Commencement Bay Natural Resource Damage Assessment Restoration Monitoring Plan (Commencement Bay Natural Resource Trustees, 2001) provides a framework for a program to put the bay's Environmental Impact Statement into use. It focuses on Commencement Bay and the immediate area surrounding it, which is where the discharges of oil and other hazardous substances have occurred. The relevant goals are:

- Provide a functioning and sustainable ecosystem where selected habitats and species of injured fish and wildlife will be enhanced to provide a net gain of habitat function beyond existing conditions;
- Integrate restoration strategies to increase the likelihood of success;
- Coordinate restoration efforts with other planning and regulatory activities to maximize habitat restoration; and
- Involve the public in restoration planning and implementation.

Calling out Implications and Opportunities: Equity and Estuaries

According to Pierce County's Sustainability 2030: Greenhouse Gas Reduction Plan (Pierce County, 2020), the county calls for action to increase partnering with local Tribes and others to identify innovative ways to sequester carbon in estuaries and the nearshore environment. To aid in this, the county plans to provide greenhouse gas reduction educational workshops, activities, and engagement opportunities for all residents, including Tribes, through a process that has a focus on equity and prioritizes underrepresented communities. These actions will serve to not only work to ease the impacts of climate change to the nearshore environment, but they will also involve people traditionally not a part of the process. This will help to unite communities, increase trust, and ultimately increase success.

Calling out Implications and Opportunities: Climate Change and Estuaries

The EPA states that the largest impacts on estuaries from climate change are rising sea levels, altered rain patterns, drought, and ocean acidification. As a result of rising sea level, estuarine shorelines will move and inundate lowlands, displace wetlands, and alter the tidal range in rivers and bays. Increased instances of storm surges will similarly result in more areas subject to periodic inundation, greater stormwater runoff, erosion, and sedimentation. This alteration of the nutrient load, pollution, and sediment load may threaten the functionality of estuarine ecosystems.

Alteration in rainfall will also impact the natural balance between freshwater and saltwater, which is a balance that is central to estuaries. Changing levels of carbon dioxide in the ocean can lead to ocean waters that are lower than usual in pH entering the ecosystem, impacting species (such as shellfish) that rely on a stable pH. Impacts to the built environment will also result. For example, the Port of Tacoma was built on fill and is very slowly sinking in elevation while sea level is slowly rising.

LIO Partners are working to address climate change in the Puyallup River estuary at the Port of Tacoma. As a participant in the Regional Ports Collaborate for an Emissions-free Future, the Port of Tacoma is working toward a carbon and air emissions-free future for the region's ports and other maritime industry. As part of Pierce County's Sustainability 2030: Greenhouse Gas Reduction Plan (Pierce County, 2020), the County call for action to increase partnering with local Tribes and others to identify innovative ways to sequester carbon in estuaries and the nearshore environment.

Estuary Success in the Watershed

HYLEBOS CREEK ESTUARINE RESTORATION SITE

The Hylebos Creek Estuarine Restoration Project is a 6.7-acre site located adjacent to Hylebos Creek near Commencement Bay. Historically, the site supported tidal wetlands; however, by 1996 the site had been isolated from Hylebos Creek by a man-made berm, was dominated by non-native species, and contained several structures and a significant amount of debris.

In 2007, Wildlands implemented the first phase of restoration, which was to demolish all the structures (including three houses, a machine shop, storage sheds, and a concrete driveway) on site and remove 942 tons of debris. In 2009, Wildlands implemented the second phase of construction, which included excavation and grading to create a complex of marsh, channel, mud flat, and upland buffer habitats on the site.

The Restoration Project is now a functioning estuarine marsh featuring intertidal channels and forested upland. The re-established estuarine habitats have replaced a limited resource within the Hylebos Creek Watershed and have restored natural habitat-forming processes for the benefit of Chinook salmon, steelhead, bull trout, and other native fish and wildlife species. Wildlands has implemented an ongoing adaptive monitoring and management program to ensure the future success of the Restoration Project.

Project highlights within Water Resource Inventory Area (WRIA) 10:

- Provide habitat for Chinook salmon, bull trout, and other wildlife; and
- Restored habitats include marsh, channel, mud flat, and upland buffer.

Figure 11. Various views of the Hylebos Creek estuarine restoration site (photo credit)

Other Success Stories

PROJECTS

- Clear Creek Habitat Restoration
- Thea Foss Waterway Cleanup

PROGRAMS

- Tacoma Shoreline Master Program

COMMUNITY

- Puget Creek Restoration Society

Priority Actions for Estuaries

The PWR LIO will prioritize support for projects identified for funding by the WRIA 10 Lead Entity in the 4-Year Workplan, the Port of Tacoma in the Port of Tacoma Habitat Restoration Projects Plan, and the City of Tacoma's Shoreline Restoration Plan (City of Tacoma, 2011).

Currently, projects are focused on land acquisition, nearshore restoration, wetland mitigation banks, and long-term stewardship of Natural Resource Damage Assessment (NRDA) restoration sites in the Commencement Bay area.

Floodplains

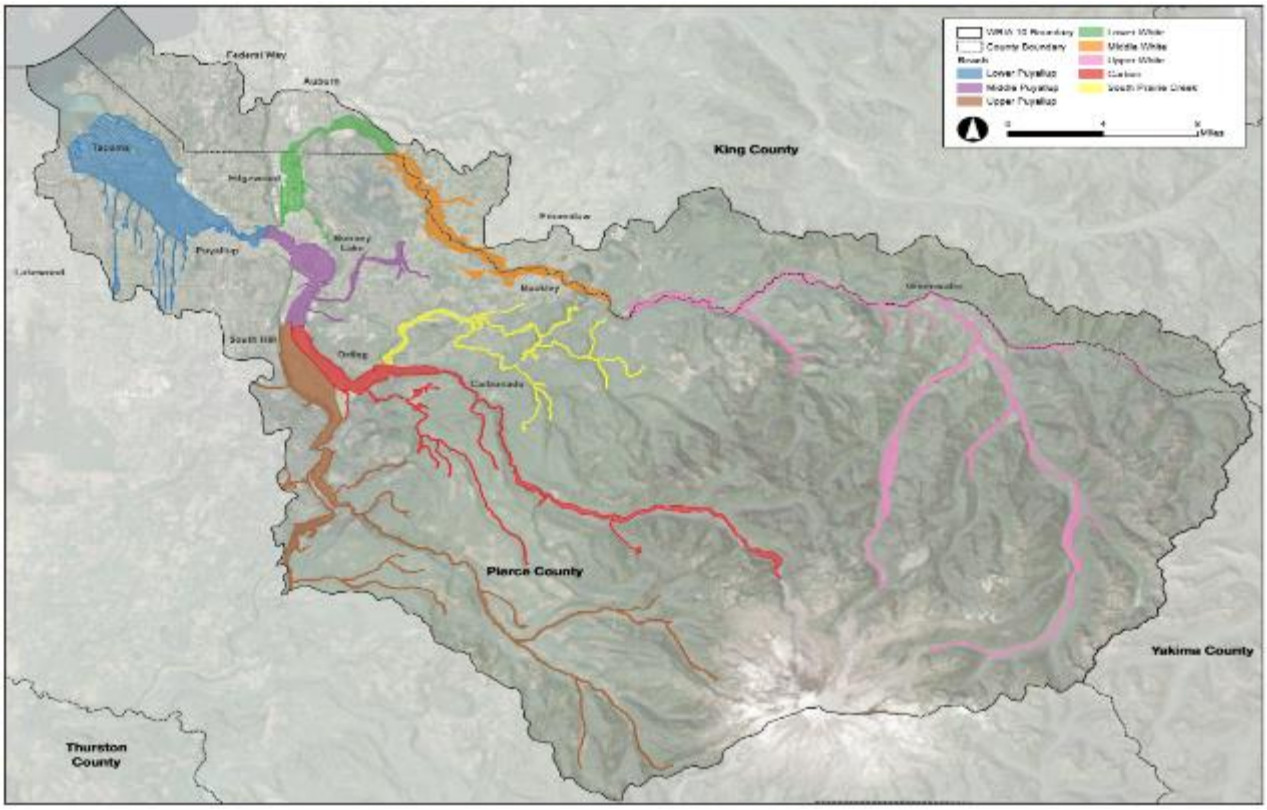


Figure 12: Puyallup-White River Watershed (*Source: FFtF 2018 Annual Report*)

Floodplain health is defined by Floodplains for the Future (FFTF) as, "the condition of multiple elements that when considered together contribute to a functioning floodplain, including the natural physical process and biological factors that support salmon populations; the long-term viability of agricultural lands; and the reduction of the risk of flooding" (FFTF, 2018). Today the Puyallup-White Watershed contains 9,000 homes with 21,000 individuals at risk of repetitive flooding, approximately 170 key facilities, and $2.7 billion of assessed value at risk. Given the complexity of floodplain restoration and conservation, the PRWC relies on the work of the FFTF and Pierce County to inform floodplain recovery.

Integrated floodplain management is a planning strategy where partners work together to pursue diverse funding opportunities and develop a suite of integrated projects that move stakeholders in the watershed closer to achieving their goals. Local governments, Tribes, community groups, and individuals who live and farm in the floodplain have developed integrated approaches.

An integrated floodplain management approach must also consider flood impact risk and mitigation. Given the geography of the area, Pierce County has dealt with major flooding events that resulted in the loss of residential and commercial infrastructure. According to a study by Earth Economics, the economic loss of a 100-year flood occurring in the Puyallup-White River Watershed is estimated to exceed $725 million (Earth Economics, 2013). As a result, over the last two decades, Pierce County has done several studies to better inform flood impact management in the region (GeoEngineers, 2008; Natural Systems Design, 2014). Historically, flood impact risk has been lessened through practices such as levee setbacks and dredging, which are short term and expensive practices. Pierce County seeks to use understanding of the Watershed to develop long-term, sustainable solutions to lessen flooding across the region.

Key Plans, Goals, Strategies, and References for Floodplains

As per FFTF, the overall goal for floodplains is to have restored connections between rivers and land that improve habitat for salmon, protect communities and critical infrastructure from flooding, and provide new opportunities for recreational and cultural uses while preserving agricultural lands in the Puyallup River Watershed.

The PWR LIO will work in support of the goals, targets, strategies, and actions for Floodplains described in existing collaboratively developed documents for the Watershed. Key documents are described below with hyperlinks for more information. This is not an exhaustive list.

The following are the primary habitat factors that negatively impact floodplains in the Puyallup-White watershed:

- Population growth and conversion of land from natural cover to commercial and industrial areas
- Roads & railroads (including culverts)
- Marine levees, floodgates, tide gates, armoring and other shoreline alterations
- Marine shoreline infrastructure

FLOODPLAINS FOR THE FUTURE SHARED MONITORING PLAN

The FFTF Shared Monitoring Plan (FFTF, 2018) outlines the common agreement on visions and strategies that will improve salmon habitat, protect communities and infrastructure from flooding, and preserve agricultural lands**.** This plan identifies a set of watershed-wide goals relevant to improving and maintaining floodplain health. Goals relevant to floodplain recovery are:

- Reconnect floodplains;
- Reduce flood risk;
- Increase integration across partners and interests; and
- Increase the resilience of flood management infrastructure, the ecosystem, and agriculture as climate changes.

Strategies are focused primarily on reconnecting floodplains including:

- Reconnect floodplains through levee setbacks and side channel reconnection;
- Remove structures at risk of flooding through parcel acquisition and demolition; and
- Develop a strong, commonly understood collaborative structure and partnership based on appreciating and living in our complex, interdependent living systems.

Metrics help guide efforts and measure progress in three areas:

- **Land**
  - Connected floodplain with natural land cover: amount (acres) of floodplain connected to the river or tributary;
  - Changes in Built environment in the floodplain: changes in land use (acres) in the floodplain; and
  - Accessible stream miles: number of miles of accessible streams uninterrupted by barriers such as culverts, roads, and dams.

- **Investments**
  - Combined contributions by FFTF partners: amount (dollars) of FFTF investments in integrated floodplain management;
  - Floodplain restoration projects: number, status, and acres reconnected of floodplain restoration projects;
  - At-risk structures removed from flood risk: number of at-risk structures removed from flood risk; and

    - Restored habitat: amount (acres) of restored habitat.

- **Outcomes**
    - Overall floodplain status: overall status of floodplain health and condition; and
    - Flood claims: cost of flood claims (dollars).

GW∂DZADAD TEACHING OF OUR ANCESTORS: TRIBAL HABITAT STRATEGY

The 2019 Tribal Habitat Strategy was created by the Member Tribes of the Northwest Indian Fisheries Commission. It provides goals, indicators, and initiating tasks for five habitat areas: Pacific Ocean, Nearshore, Floodplains, Riparian, and Water. The ultimate goal is salmon recovery because, as Billy Frank Jr. said, "As the salmon disappear, so do our cultures and treaty rights. We are at a crossroads and we are running out of time." This document provides a roadmap for recovery and emphasizes immediate action.

The goal for floodplains is to protect, restore, and enhance hydrological and geomorphic connectivity between rivers and their floodplains and deltas.

Indicators to track this work are:

- Frequency of flooding;
- Channel migration zones;
- Floodplain surface roughness;
- Habitat diversity; and
- Presence of plant and animal species traditionally important to tribes.

Tasks to initiate this work are:

- Prevent development in floodplains, e.g., levees, bank armor, fill, infrastructure, and impervious surfaces;
- Restore and permanently protect floodplains through land acquisition; and
- Research best practices for using floodplain function to reduce the impacts of climate change, integrating traditional knowledge.

The goal for riparian areas is to protect and restore riparian corridors (extending 300 feet on both sides of the stream) to conditions that sustain and support salmon and shellfish populations and productivity.

Indicators to track this work are the percent of riparian corridors:

- Dominated by perennial woody vegetation (short-term goal);
- Dominated by large, mature trees (long-term goal); and
- With impervious surface present.

Tasks to initiate this work are:

- Compare current riparian conditions against the land-use laws, regulations, etc. that guide land management;
- Document the effectiveness of riparian programs in protection and restoration on a landscape scale;
- Improve and/or develop laws, regulations and BMPs that protect and restore habitat; and
- Uniformly protect riparian areas with buffers based on 1 site potential tree height (SPTH).

THE SALMON HABITAT PROTECTION AND RESTORATION STRATEGY

The overall goal of the Salmon Habitat Protection and Restoration Strategy (Lead Entity, 2018) is to achieve salmon recovery (Lead Entity, 2018). The following 50-Year Habitat Goal and 10-Year Implementation Goal directly impact floodplain recovery:

50-Year Habitat Goal:

- 32,000 acres of floodplain habitat (including in estuary and nearshore areas) are protected from development within the Core Salmon Habitat and Flood Zone Protection Corridor by 2067.

10-Year Habitat Goal:

- 203,000 linear feet of levees removed and 2,300 acres of floodplain reconnected by 2027.

The 50-year habitat goal and 10-year implementation goal will also reduce flood risks to the built environment, provide ecosystem and resiliency functions such as water filtration, support continued agriculture, and provide open space corridors and recreational opportunities throughout the watersheds.

A relevant strategy is:

- **Reconnect Mainstem River Channels to Their Floodplains:** This strategy includes levee setbacks, revetment (structures in streams) removal, road decommissioning, culvert replacements/improvements in floodplain areas, Engineered Log Jams (ELJs) designed to promote over bank flow (increase bed elevations), and removal of pinch points such as bridge pilings that alter or prevent normal flow of water.

RIVER FLOOD HAZARD MANAGEMENT PLAN

In 2013, Pierce County adopted the Rivers Flood Hazard Management, which guides how flooding and the associated hazards are managed. The Rivers Flood Hazard Management Plan (Pierce County, 2018) is a technical update and progress report that reflects new information on hazards, vulnerabilities, and accomplishments since the adoption of the 2013 Flood Plan. The purpose of this plan is to: recommend regional policies, programs, and projects that reduce risks to public health and safety; reduce public and property damage; reduce maintenance costs; and improve habitat conditions while protecting and maintaining the regional economy. This plan identifies specific revised goals from the 2013 plan relevant to flood hazard management:

- Reduce risks to life and property from river flooding and channel migration;
- Identify and host flood hazard management activities in a cost-effective and environmentally sensitive manner;
- Support resilient communities, economic activities, and improve habitat conditions in flood-prone and channel migration areas; and
- Continue to do cost effective river flood hazard management activities supported by a long-term flexible funding strategy.

The 2018 plan is undergoing a major expansion and update and will be completed in 2023. It will include new sections including groundwater flooding, climate change and sea level rise, and environmental justice/equity.

Floodplain work is expected to contribute to the Puget Sound Partnership Vital Signs for Streams and Floodplains, Freshwater Quality, and Salmon.

Calling out Implications and Opportunities: Climate Change and Floodplains

Floodplains for the Future (FFTF) assesses climate vulnerability for the attributes that impact floodplain habitat. Climate vulnerability refers to the potential for negative effects due to variations or changes in climate. This is further defined by the sensitivity, exposure, and adaptive capacity for a resource. Using this framework, FFTF identified the following areas of concern and priority for climate impact withing the Pierce County's floodplains as particularly sensitive given current observation and future modeling:

- Growing season
- Snowmelt
- Low Flow
- Water temperature
- Precipitation
- Peak flow
- Sediment
- Sea level
- Groundwater

These areas will be the focus of climate mitigation for floodplain management across the Watershed.

Calling out Implications and Opportunities: Equity and Floodplains

Updated in 2019, the Pierce County Hazard Identification and Risk Assessment (HIRA) (Pierce County, 2019) is the latest rendition of a process and document that has gone on for over twenty-five years. The HIRA is an assessment of natural, technological, and human-caused hazards that threaten those who live, visit, work, or play in Pierce County. This is the foundation for other Emergency Management planning documents in fulfillment of both their mission statement and the statutory requirements of the Washington Administrative Code (WAC). The mission of the Department of Emergency Management is to create resilient communities and enhance public safety by empowering the whole community in Pierce County to prevent, mitigate, prepare for, respond to, and recover from all types of hazards, emergencies and disasters.

With reference to floodplain and flood risk specifically, the assessment notes that the Puyallup River and Nisqually River watersheds include forests, national parks, and wilderness areas in the upper watersheds; rural and agricultural uses in the mid to lower basin areas; and urban areas dispersed throughout the lower Puyallup watershed near the river mouth. The plan highlights 11 specific planning areas of interest:

- Puyallup River
    - Lower Puyallup River
    - Middle Puyallup River
    - Upper Puyallup River
- White River
    - Lower White River
    - Upper White River
    - Greenwater River
- Carbon River
    - South Prairie Creek
- Middle Nisqually River
- Upper Nisqually River
- Mashel River

One strategy to address this risk is direct land and home acquisitions and purchases. The plan notes specific land and home acquisitions that have occurred since 1991 across these planning areas, using a combination of federal and state grant funds and local match. Details on acreage of land and home acquisitions are found in the 'PC Flood for Review' chapter. Through this acquisition and purchase strategy, the county hopes to continue to support the creation of resilient communities.

Projects of special interest to the LIO include the next phase of South Prairie Creek restoration efforts, which will identify and design protection and restoration actions for the lower 15.5 miles of South Prairie Creek and the lower 6 miles of Wilkeson Creek.

Floodplain Success in the Watershed

SOUTH PRAIRIE FLOODPLAIN RESTORATION

A tributary to the Carbon River, South Prairie Creek, is a principal salmon bearing stream in the Watershed. Historic agricultural use contributed to incision, floodplain disengagement, limited instream habitat, and water quality degradation. South Puget Sound Salmon Enhancement Group (SPSSEG) and project partners (Puyallup Tribe, Pierce Conservation District, and Pierce County Surface Water Management Division) engaged NSD to restore floodplain

function and off-channel habitat. This project aims to restore over a half-mile of main channel habitat, create a half-mile of new side channel habitat, increase groundwater recharge and flood storage, and:

- Replace a condemned crossing over South Prairie Creek with a bridge over Silver Springs Creek;
- Install 4 channel spanning wood and rock structures along a 0.5-mile reach of South Prairie Creek;
- Place 6 mid-channel wood structures;
- Create over 0.5 miles of new side channel habitat;
- Restore connectivity to 80 acres of floodplain;
- Demolish 9 remnant barn and dairy structures; and
- Restore 63 acres of valley bottom forest.

In the summer of 2020, NSD's team of scientists and engineers embarked on a subbasin-scale analysis of the geologic, geomorphic, and hydrologic conditions that influence the target reach. Combined with reach-scale 2D hydraulic modeling, groundwater analysis, and soil stratigraphy, multiple designs were developed to improve habitat for refuge and spawning, and to re-engage the larger floodplain for native vegetation. All designs were assessed for predicted impacts to FEMA base flood conditions and for potential effect on water supply to adjacent community water tanks managed by Tacoma Water. Design options and analyses, along with each option's associated balance of benefit, risk, and cost, were presented to the project partners. The project partners selected a preferred design of spanning structures that raised the mainstem by three feet, restoring a branching system bifurcating flow into a newly excavated, wood-stabilized historical side channel. The implementation also required rapid design revision prior to construction to accommodate recent deformation in the mainstem.

Within days of completion, returning Chinook were observed upstream of the project passing all spanning structures in base flow conditions. The project has received enthusiastic praise from WDFW biologists and from environmental science professors at the University of Puget Sound, who have used the construction progression to demonstrate large-scale aquatic restoration to their students.

Figure 13. South Prairie Creek restoration (Photo source)

Other Success Stories

PROJECTS

- Setback Levees
    - 128th Street
    - Butte Pit
    - Carbon River
    - Lower White River
- Puyallup River South Fork Restoration
- Ball Creek Habitat Restoration
- Orville Road Revetment project

COMMUNITY

- Levee Setback Feasibility Analysis Puyallup River Watershed
- 2023 Comprehensive Flood Hazard Management Plan

Priority Actions for Floodplains

The PWR LIO will prioritize support for projects identified for funding by members of the FFTF as well as local experts on Floodplain management. Currently projects are focused on levee setbacks, floodplain restoration, floodplain reconnection, and road impact mitigation in the following geographic areas:

- Puyallup River
- White River
- Greenwater River
- Carbon River

Forests

From the dense woods of the Mount Baker Snoqualmie National Forest to the acres of timber across Pierce County, the forests of the Watershed represent and provide significant environmental, social, cultural, and economic value to the community. Forests contain environmental benefits such as carbon storage, nutrient cycling, water resource, water quality, and air purification. Social benefits include incalculable spiritual and cultural connection, recreational use, and forests are a fundamental learning and educational resource. The economic benefits of forests are that they are a source of timber and food. They are also a driver of the recreation economy, particularly public lands. In fact, The Public Benefits of Private Forests (Van Deren et. al., 2018), estimated that the forest ecosystems that exist on privately owned land in Pierce County provide between $259 million and $942 million in ecosystem service value every year. The Gem of the Emerald Corridor report (Mojica et. al., 2018) estimated the annual value of forest and stream stewardship in the Upper White River at $137,400, which translates to an asset value of $4.7 million.

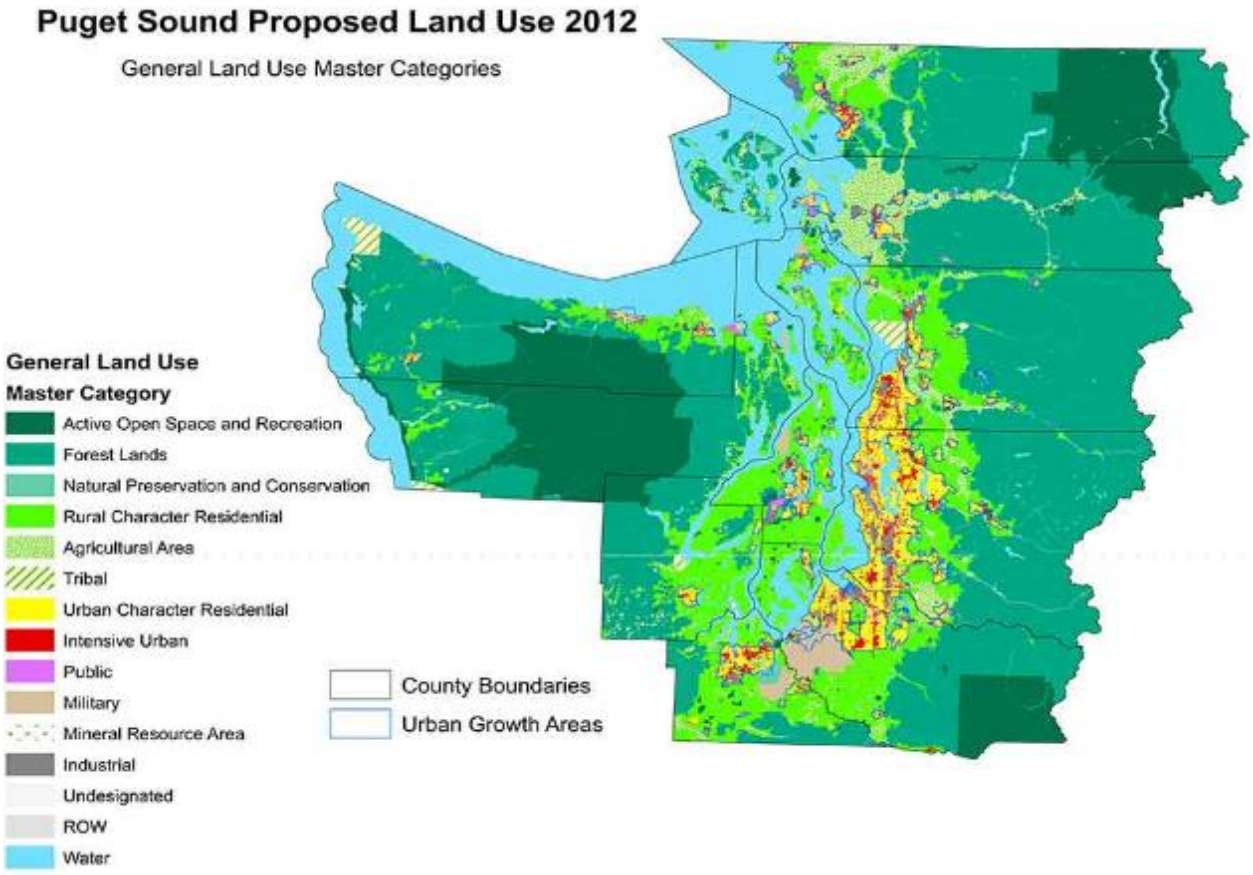


Figure 14. 2012 Land Use Map (Photo Source)

As of 2014, the U.S. Forest Service manages 142,162 acres of forestland within the watershed and 32,324 acres within wilderness areas (Norse and Clearwater) in the watershed (PRWC, 2014). The National Park Service manages 130,000 acres of the Mount Rainier National Park within the watershed. Private industrial timber companies own large tracts of land for the production of timber products, with 96,600 acres owned by Hancock Timber Resources. About 18% of the private forestland in the watershed is owned by small forest landowners (PRWC, 2014). Small forest landowners are defined by the state as landowners who harvest less than an average of two million board feet per year. Other swaths of forest land are managed by DNR or the Muckleshoot Tribe.

Overall, Pierce County has 800,881 acres of forestland. Of that, 414,955 acres are considered "working forest" and provide nearly 10,000 jobs (PRWC 2014). According to the World Resource Institute, "working forests" are defined as forests that are actively managed to generate revenue from multiple sources, including sustainably produced timber and other ecosystem services, and thus are not converted to other land uses such as residential development.

Given the complexity of working forests, forest restoration, and conservation, the PRWC worked closely with the Forests Community of Interest (FCOI) at the Puyallup Watershed Initiative to identify appropriate goals and objectives to sustainably manage working, natural, and urban forest habitats. The FCOI helped identify two specific forest management areas: the upper/middle watershed and the lower watershed. The entire watershed is at significant risk of conversion of forestland to non-forest uses due to increased development pressure across the county. In the upper/middle watershed, the areas most at risk are the lands on the fringe of commercial forest lands (e.g., near Carbonado, South Prairie, Orting, and Buckley). The lower watershed has had most of the urban stream riparian tree canopy coverage greatly reduced, which has led to water quality, biodiversity, and aquatic species concerns.

Focusing on urban forestry, the City of Tacoma, along with other cities in the watershed, is working to increase the tree canopy coverage within their city limits. The City of Tacoma supports the Grit City Trees program and the Tree Coupon Program to encourage residential landowners to plant trees in their yards. Targeting streamside landowners should be a priority. Another focus area is to work with public organizations that manage public land such as parks, schools, and open space to identify opportunities to increase tree canopy coverage.

Ongoing human attitudes, activities, and infrastructure that create pressure on Forests in the Watershed include:

- Population growth and related conversion of land from more natural cover to housing and urban areas
- Conversion of land from more natural cover to commercial and industrial areas
- Roads and railroads (including culverts)
- Tourism and recreation
- Spread of invasive species and noxious weeds
- Habitat fragmentation

Key Plans, Goals, Strategies, and References for Forest

The overall goal for the Forest Focus Area is to keep forested lands in forest for ecosystem and human benefits, improving the health of forested lands, and increasing urban and rural forest cover.

The Puyallup-White LIO will work in support of the goals, targets, strategies, and actions for forests described in existing collaboratively developed documents for the Watershed. Key documents are described below with hyperlinks for more information. This is not an exhaustive list.

PUYALLUP WATERSHED INITIATIVE - PUYALLUP WATERSHED FOREST RESOURCES ROUNDTABLE COMMUNITY OF INTEREST PROPOSAL

The Puyallup Watershed Roundtable Community of Interest (FCOI) focuses its work on forestlands and urban forest habitats within the Watershed. Their scope ranges from urban street trees to small forestlands in rural Pierce County to large working forests in the foothills of the Cascades. The group spawned from their 2013 Proposal and Strategic Plan, which describes challenges related to trees and forestry in the Puyallup River Watershed, and initial strategies for addressing those problems. One of the main stressors identified during the creation of the Proposal was the realization of how much forest turnover in ownership there will be in the next three to ten years. The desired impact of the Proposal is to enhance, preserve, and protect existing forestlands and increase forest cover. The Forest COI is a membership-driven group and has evolved its focuses and strategies over time based on feedback and interests of members, all while serving the same mission for the Watershed: to keep forestlands forested, and to ensure that every neighborhood has access to trees. The Proposal describes the FCOI's interest in forest resources at the urban, rural, and working forests levels as:

1. Conservation of forest habitats benefitting wildlife habitat, cultural resources, ecosystem services and recreation.
2. Working forests that provide economic benefits to the community while also providing ecosystem services benefits to the region.
3. Protection and enhancement of urban forest habitats and their benefits to the community.

The FCOI's founding strategies are:

1. Integrate work on forest issues across the watershed.
2. Develop a community forest trust.
3. Engage small forest landowners.
4. Improve knowledge and stewardship for a healthy urban forest.

PUYALLUP RIVER WATERSHED ASSESSMENT

The Puyallup River Watershed Assessment (PRWC, 2014) is an overarching document that provides the historical context of the watershed, its current status as of 2014 when it was written, and details the hydrology and water use, different habitats, water quality, and calls out key watershed features. It is a compilation document with minimal or no new data collection. The Assessment does not establish numeric goals for forest protection or restoration. Instead, in Section 10.1.2, it makes eight recommendations to advance healthy and productive forests by assessing threats and opportunities:

1. Decrease the loss of forestland from conversion to development.
2. Maintain working forests.
3. Develop a comprehensive assessment and analysis of forestland.
4. Address invasive non-native plant species.
5. Do a comprehensive assessment and analysis of forestland.
6. Promote landowner incentive programs that encourage forestland ownership
7. Increase education and outreach.
8. Establish a Pierce County Forestry Program.

URBAN FOREST MANAGEMENT PLAN ACTION PLAN - ONE CANOPY

Beginning in 2017, the City of Tacoma, began a strategic plan for Tacoma's Urban Forest Management. The Urban Forest Management Plan (City of Tacoma, 2019) evaluated categories on urban forest sustainability, management, and equity. Having a healthy urban forest will contribute to vibrant, vital, and sustainable communities, while promoting public health and safety. This document informs the community, decision makers, and City staff on the strengths and vulnerabilities of Tacoma's urban forest. The Urban Forest Action Plan organized actions into six themes with the subsequent goals**:**

1. **Management Policy**: Tacoma's urban forest policies are the foundation for preserving the environmental benefits, management, and the character of Tacoma's urban forest.
2. **Capacity and Training**: The City has the capacity and expertise to provide ideal levels of service for equitable urban forest management.
3. **Funding and Authority**: City resources and authority enable equitable urban forest management for the preservation and enhancement of tree benefits.
4. **Inventories and Plans**: A comprehensive understanding of the urban forest ensures data-driven decisions, sustainable and equitable planning, and amplifies the benefits received from trees.
5. **Risk and Disaster Planning**: The City proactively manages risks to the urban forest and is equipped with the resources to address unforeseen risk and disasters.
6. **Community Engagement**: Sustainable urban forest management and equity are achieved through a partnership with the city and its residents, resulting in improved wellbeing, human health, and local economies.

Within these themes, the plan highlights specific outcomes and associated targets to measure the progress towards the goals. Targets include the numbers of trees listed on the Heritage Tree Registry, how many trees are planted, discusses funding needs, and discusses staff needs. The plan also describes Short- Mid- and Long-Term Strategies to achieve the goals within each theme. Strategies such as the roles of staffing, what maintenance of trees is needed, and monitoring of pests and disease are included. Refer to the report for more details.

GREENWATER AND VICINITY COMMUNITY WILDFIRE PROTECTION PLAN

WA DNR has classified the Greenwater area as a "High Hazard Area" Wildland-Urban Interface community. The Greenwater and Vicinity Community Wildfire Protection Plan (Greenwater Community Firewise Board, 2005) was put together by residents of the Greenwater community in partnership with county, state, and federal stakeholders to proactively plan and implement actions to protect lives, protect their community, and reduce the risk of wildfire and other related disasters. Partners approached this plan with a recognition of the threat wildfires pose to life, property, and critical infrastructure in the wildland-urban interface in the 4,500 acres surrounding the town of Greenwater. A community risk assessment was completed using data collected by WA DNR for the following risk factors: values at risk, fire history, fuels, structure vulnerability, and local protection capabilities. The Greenwater community serves as a Firewise model for the other communities of South King and Pierce County. It is the hope of the Greenwater community that more residents will start efforts to make their properties "Firewise" and implement defensible space.

The goals of the CWPP are:

- Reduce the potential of losses (life, natural resources, property) because of wildfires in the wildland-urban interface;
- Protect people, structures, infrastructures, and unique ecosystems that contribute to the community's way of life and the sustainability of the local and regional economy;
- Educate community residents about the unique challenges of wildfire in the wildland-urban interface or properties where homes are surrounded by forested lands;
- Establish mitigation priorities and continue strategies to reduce losses to wildfires in the Greenwater area;
- Strategically locate and plan fuel reduction projects;
- Provide recommendations for alternative treatment methods, such as modifying forest stand density, fuel reduction techniques, and abatement of treated slash; and
- Meet or exceed the requirements of the National Fire Plan and FEMA for a community wildfire protection plan.

OTHER SOURCES OF INFORMATION FOR FORESTS

There are a variety of other plans that have been developed for the Cascades region that touch on parts of the Puyallup-White watershed and are helpful references to use. A few are listed below with hyperlinks for more information.

- The Cascade Agenda (Cascade Dialogues Steering Committee, 2005) worked to identify 1.26 million acres of working forests, farms, streams, rivers, and estuaries in the King, Kittitas, Pierce, and Snohomish counties to conserve. For forest land, the agenda developed goals, objectives, and strategies to accommodate a wide spectrum of forest activities ranging from recreational opportunities close to urban centers, primitive hiking, close-in campsites, preserved wilderness, and effective management of timber operations.
- The USDA Greenwater Access and Travel Management Project (USDA, 2016) summarizes the findings of a travel analysis in the Mt. Baker-Snoqualmie National Forest (MBS) meant to inform a Sustainable Roads Strategy (SRS) describing opportunities and priorities that can be used by the responsible official for identification of the forest's sustainable road system following appropriate NEPA analysis. Section 1.7 summarizes goals, standards, and guidelines for forest management.
- The USDA Snoquera Landscape Analysis Environmental Assessment (USDA, 2020) provides background and assessments for the Snoqualmie Ranger District of the Mt. Baker-Snoqualmie National Forest. It

resulted in the following proposed actions: approximately 12,245 acres of proposed variable density timber thinning, 3,030 acres of non-commercial acres, and habitat improvement vegetation treatments, improvements to the transportation system and aquatic organism passage (AOP), 23.83 miles of road decommissioning, a shooting area closure, and a number of other restoration and recreation projects such as stream improvements, dispersed camping site improvements, and trailhead enhancements. It provides primary goals and secondary goals for management of the Mt Baker-Snoqualmie National Forest.

- The Carbon River Corridor Cooperative Action Plan (Pierce County, 2020) is on deck to be completed during the summer of 2021. This Plan will encompass the area between the town of Wilkeson and the Carbon River entrance to Mount Rainier National Park. This plan is developed with property owners, community groups, and recreational groups. The purpose of this Plan is to guide the development of visitor services in the area that meet demands but protect environmental and cultural resources. It will do these things while balancing the character desired by residents.

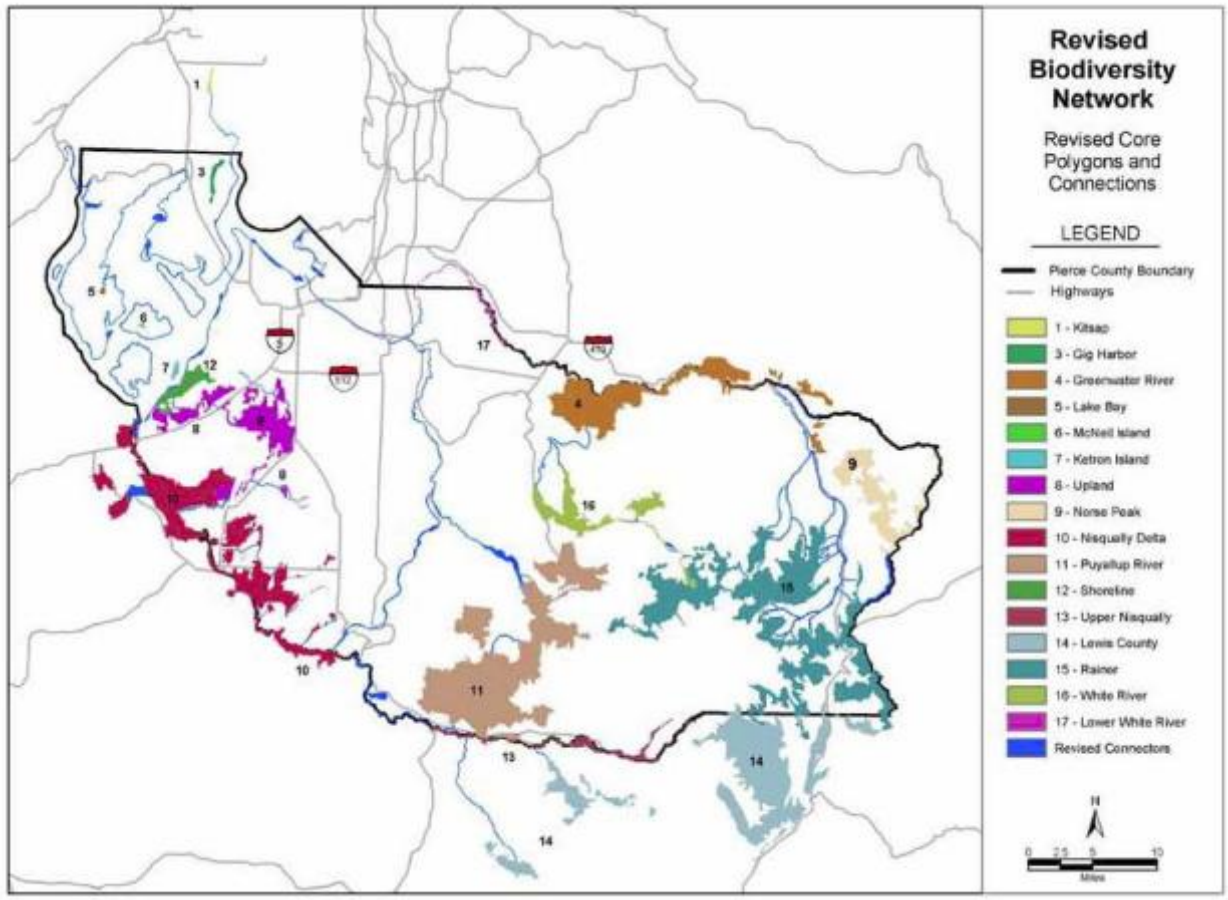


Figure 15. Biodiversity Management Areas in Pierce County (Photo Source)

PIERCE COUNTY BIODIVERSITY NETWORK

The Pierce County Biodiversity Network identifies 16 biologically-rich areas and connecting corridors that cover 267,784 acres of land. The habitat types represented in the Biodiversity Network include lowland riparian areas and wetlands, oak savannas and prairies, old-growth forests, and alpine meadows. Many of these habitats contain imperiled species including Chinook Salmon, Western Gray Squirrel, Spotted Owl, Grizzly Bear, and Western Pond Turtle. Deciduous old-growth forests constitute important habitat for these imperiled species, motivating the Network to identify Biodiversity Management Areas (BMAs) in forest areas in the upper watershed.

As of 2011, Pierce County Biodiversity Alliance (PCBA) has developed Stewardship Plans in two areas within the Pierce County Biodiversity Network: the Gig Harbor BMA and Lower White River BMA (Dvornich and Burgess, 2016) The purpose of these plans is to develop long-term biodiversity management strategies that supplement the Pierce County Biodiversity Network Assessment recommendations.

BMAs included in the watershed are:

- BMA 4 Greenwater River: this area is an extensive, intact riparian area that has not had a lot of development pressure. It is a critical area to maintain the integrity of because of its biodiversity and ecological significance. Keeping this area as a managed forestland should be done through Forest Practice Regulations.
- BMA 9 Norse Peak: this area contains high alpine habitat, which is critical for species such as spotted owls, martens, and grizzly bears. Much of this area is in a designated wilderness area (the Norse Peak Wilderness Area), and as such should remain secure. Management for biodiversity and recreational aspects should be maintained. In addition to this work, in 2020 there was a large forest fire and there is thus a resulting need for replanting trees in this area.
- BMA 11 Puyallup River: this portion of the Puyallup is in the south central portion of the county, and has had little development pressure on it. It has a variety of forestlands in different stages of re-growth and contains a large number of at-risk, listed, and priority species. This area should be retained as managed forestland through Forest Practice Regulations.
- BMA 15 Rainier: the goal of this area is to have long-term protection of fish and wildlife species, particularly for rare species such as Grizzly Bears and Gray Wolves. This area should be managed for fish, wildlife, native habitat, and recreation, and park extensions should occur when funding and public support align.
- BMA 16 White River: this area has high quality forestland and an intact riparian corridor. It also contains a significant amount of old growth forest. This should be managed to protect biodiversity and recreational areas should be expanded only after careful consideration.
- BMA 17 Lower White River: despite development pressures, this area has maintained its riparian vegetation and biodiversity. Areas that have lost vegetation should be targeted for restoration. Passive recreation should be targeted over riverfront development.

It is recommended that each of these BMAs have stewardship plans developed, similar to the plan described below for BMA 17 Lower White River. Along with BMA plans, corridors need to be protected and have stewardship plans developed as well.

The Lower White River BMA (Dvornich and Burgess, 2016) is a Puget Sound lowland environment that includes the local jurisdictions Buckley, Auburn, Pacific, and Sumner. The White River joins the Puyallup River in Sumner and flows into Puget Sound at Commencement Bay in Tacoma. The Lower White River BMA Stewardship Plan planning process includes developing implementation measures to conserve biodiversity within each jurisdiction included in the BMA. In the Lower White River BMA, several conservation targets were selected to represent the key ecological functions occurring throughout the area. These conservation targets include coniferous/ deciduous mixed forest areas.

The Lower White River BMA contains a patchwork of lowland coniferous/ deciduous forest interspersed with wetlands, riparian areas, pastures, and parcels developed for single family residential and commercial uses. Along the adjacent lands, the forest cover transitions to a continuous coniferous/ deciduous forest habitat. The Muckleshoot Tribe and Puget Sound Energy have left much of the forest surrounding the river intact. Forested areas provide connectivity between the different habitat patches and serve to maintain hydrologic cycles within a watershed. Best available science indicates that 65% forest cover within an urban watershed provides high quality hydrological function for wetland water level fluctuation and stream hydrology. As of 2015, the Lower White River BMA has at least 65% forest cover, and more if the riparian areas along the floodplain are included. These forest areas are a necessary component in the lifecycles of many terrestrial native species. Each species has its own unique needs for habitat patch size. This size increases for mammals and birds, which have a sensitivity to patch size, and is very important for pond-breeding amphibians and native fish species that utilize the stream, wetland,

and lake systems in the watershed and BMA. It will be crucial to work with each jurisdiction to maintain or increase forest cover for the persistence of native biodiversity.

Specific conservation strategies are:

- Reduce Habitat Conversion and Fragmentation (due to development and human activity);
- Enhance Water Quality and Quantity;
- Eliminate Invasive and Introduced Species;
- Remove Fish and Wildlife Movement Blockages;
- Manage Flooding;
- Control Erosion and Siltation;
- Reduce Predation by domestic cats and dogs and Poaching of Native Species; and
- Reduce or Eliminate Pollution Within the LWR BMA

These conservation strategies can be applied to the five other BMAs in the Watershed.

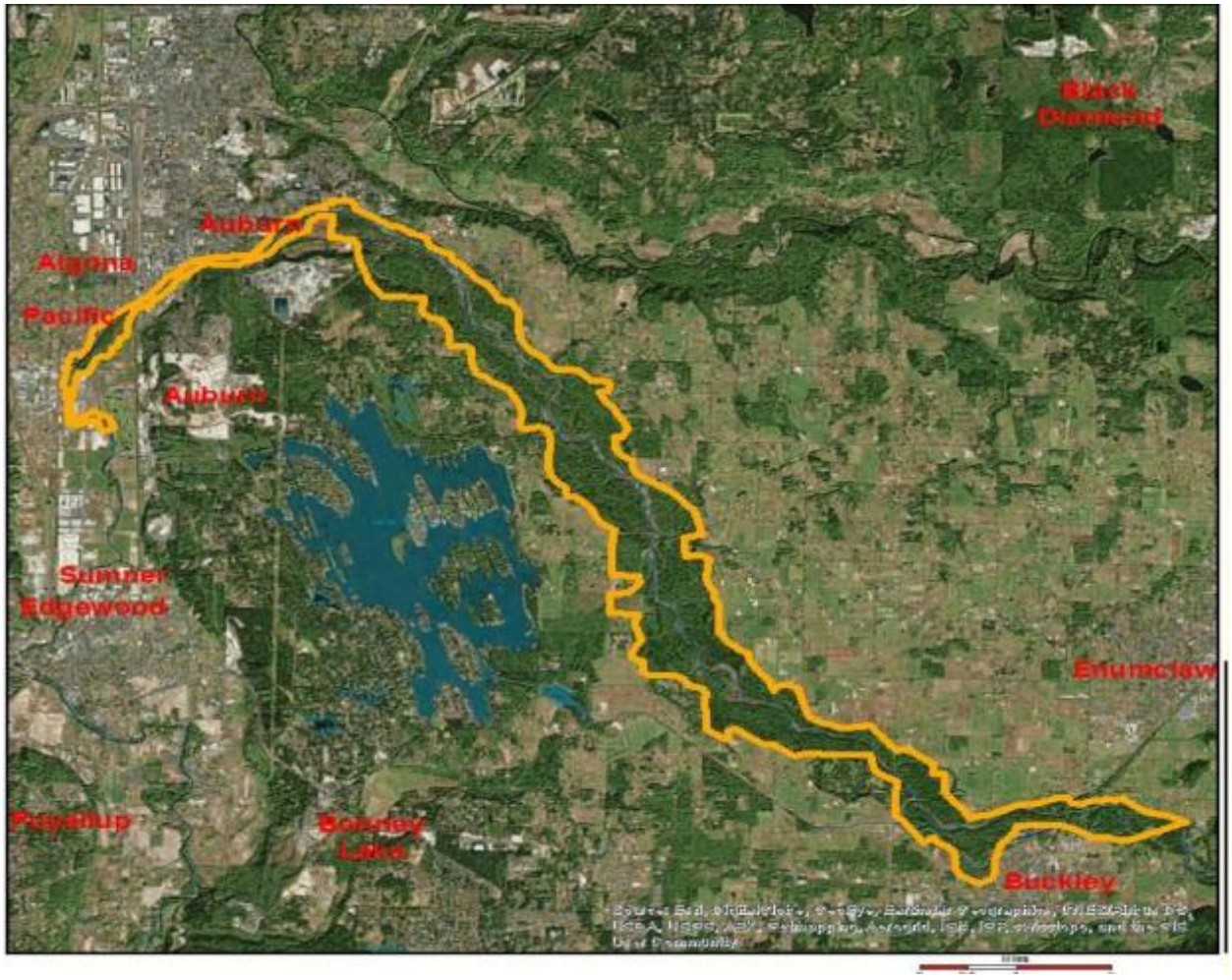


Figure 16. Lower White River Biodiversity Management Area (Photo Source)

Calling out Implications and Opportunities: Forests and Climate Change

According to the Tacoma Climate Change Resilience Study (City of Tacoma, 2016), average annual temperatures for the Pacific Northwest have risen 1.3°F since 1895. Pierce County has experienced an increase in forest fires during the droughts of 2015 and 2017. Depending on worldwide emissions, temperatures could increase by 3.1 to 7.2°F by 2080–99 when compared to the average temperature between 1950–1999. There is strong agreement among climate models that extreme heat events will become more frequent while extreme cold events will become less frequent. Wildfires are expected to become more common as temperatures rise and less rain falls during summer months.

Emerging pests and diseases in forests is a major issue, especially given that Tacoma is a major port city and likely has a higher potential for being an entry point for invasive pests and diseases. Tacoma will be using the Urban Forest Pest Readiness Playbook to develop its plan for how to handle these incidents. Pests and invasive species will likely increase with climate change as conditions change and ranges of acceptable habitat for a pest can change. Pests and diseases can create higher amounts of dry or dead wood in forests, making the climate issue of increased forest fires an even larger problem.

Calling out Implications and Opportunities: Forests and Equity

Forests are critical relationships and resources not only to the wildlife that rely on them, but to the people who rely on them as well. Since time immemorial, Puget Sound tribes have used the forests to hunt and gather plants. The access of forest areas for Tribes needs to be preserved, especially given that tribes such as the Puyallup are lacking in significant forest land on their reservations. Preserving access to Tribes is often an afterthought in Forest Practices applications. Access needs to be provided to Tribes for activities such as elk foraging and berry harvesting in the upper watershed. A plan for maintaining access to elk foraging areas (WDFW, 2002) for the Muckleshoot Tribe has been created based on studies of elk foraging areas.

Forest Success in the Watershed

CITY OF TACOMA TREE COUPON PROGRAM

While it is common to think of keeping vast areas of forests in forest, the other part of the watershed that needs tree cover is urban areas. Trees in urban areas help with heat island effects, stormwater management, increase property value, filter air pollutants, and create beauty. The City of Tacoma has a goal to increase tree canopy cover from 20% to 30% by 2030. One way it is doing this is by providing coupons to home owners in any area of Pierce County to purchase trees to plant either on private property or in the right-of-way abutting property. Each year, homeowners can purchase up to three trees using the coupon program. This program was started in 2013 and is funded by Tacoma Public Utilities and the Puyallup Watershed Initiative.

Figure 17. City of Tacoma's Tree Coupon Program (Photo credit)

Other Success Stories:

PROJECTS:

- South Prairie Creek Restoration
- Grandview Forest Park Diseased Tree Removal

PROGRAMS:

- City of Tacoma Grit City Trees Program
- Pierce Conservation District City Forest Credits
- Pierce County Conservation Futures Program

COMMUNITY:

White River Forest Protection Associated Group

Call Out: Forest Fires and the Watershed

Forest fires have long been a part of the Pacific Northwest's natural ecosystem. Traditionally, forests were successfully managed by Tribes. As humans have altered the systems and Tribes have not been able to manage forests in a traditional manner, they have subsequently altered the fire regimes. Forest management is not always done properly, leading to increased fire risk. Increased human presence in the landscape changes the risk of fires. Humans can inadvertently start fires through a campfire that gets out of control, tossing a lit cigarette into dry timber, or more recently, a gender reveal party gone awry. These are usually unintentional; however, they can still trigger massive damages to surrounding areas. Nature can also start fires through lightning strikes.

Climate conditions have also changed, increasing the likelihood of starting fires more easily and for the fire season to be longer. Changing conditions, such as decreased precipitation, decreased snowpack, and changing wind patterns all contribute to a more intense fire season.

Another contributing factor is pests and disease in forests. Changing climate conditions may allow introduced species to settle that are detrimental to forests. Increased pests that bore into wood or consume it will increase the likelihood of downed branches and trees, which act as kindling for fires. Diseases in trees can cause similar effects.

Intersecting with the issue of climate change, forests, and fires is human health and equity. Fires produce a great amount of ash that can carry over long distances and remain in the air for an extended period. The amount of ash can reach unsafe levels, causing people to need to stay in their homes. People with respiratory diseases such as asthma are at greater risk for complications. People who are homeless have a harder time escaping the unsafe air. Many marginalized communities already deal with increased air pollution that fires only add to.

A challenge to the issue of forest fires and air pollution is that while forest fires and the resulting air pollution can be addressed locally, recently the source of the majority of the smoke is from areas outside of the watershed. Sources include eastern Washington and British Columbia. This highlights a reason for the watershed to control its fires: reducing the impact from local fires will decrease the amount of air pollution from other fires. The conversation then shifts from being reactive to controlling forest fires to controlling how the watershed adapts to the broader effects of climate change.

Firewise is a program geared to helping residents prepare their homes for wildfire risks. It provides people with tips such as how to properly clean debris around a home to decrease ignition around the home, where to store fuel, how to maintain landscaping, and how to space trees. People can do this individually, or a community can become a Firewise community and take action at a broader scale.

Priority Actions for Forests

The PWR LIO will prioritize support for projects identified by local experts on forest management. Projects are currently focused on planting, urban forest management, and community forestry.

Projects of particular interest include the following.

- Projects that protect or restore natural forest cover and improve the connectivity of forest habitat in the watershed, including projects that provide resources for private landowners to assist them in developing forest stewardship plans to improve forest health and to maintain and improve canopy cover in riparian areas and projects in the identified Biodiversity Management Areas.
- Building on existing forest management capacity (Pierce Co Forestry Management) and working with tribal governments and non-governmental organizations working on forest issues develop a Forest Protection and Management Plan for unincorporated Pierce County including a prioritized list of parcels for protection with an emphasis on the Biodiversity Management Areas in the upper watershed and connecting corridors.
- Projects that provide multiple benefits by connecting forest protection and management to carbon sequestration and mitigation such as those described in the Pierce County Climate Change Resilience Plan.
- Projects that increase tree cover and access to green space in urban areas, such as the priority strategies listed in Tacoma's Urban Forest Management Plan (City of Tacoma, 2019) and the Tree Coupon Program, and stewardship projects for trees planted in urban areas that can increase the likelihood of successful establishment of trees and open career opportunities to youth in the watershed.
- Expanding the Urban Pest Playbook (State of WA, 2019) to the county level.
- Projects that link to regional efforts such as the 2020 Washington Forest Action Plan (Washington Department of Natural Resources, 2020), the Snoquera/Greenwater Project (United States Department of Agriculture, 2020), and the Forest Service Open Space Conservation Strategy (United States Department of Agriculture, 2007)
- Projects that bring innovative funding to the watershed such as those contemplated by the Blue Forest alternative funding instruments.

Farms and Agricultural Land

Rural agricultural land and urban agriculture practices present important opportunities for increasing food security in the watershed, economic development, protection of open spaces, education, and restoration of floodplains and riparian areas. Agriculture faces many challenges in the Watershed, including the same development pressures that are impacting other focus areas in this ERP. Once farmland is lost, so is the opportunity to work with farmers to implement multi-benefit practices that can create both better food production and a healthier environment. Getting communities to work together is needed to support successful agriculture and continued ecosystem benefits from agricultural lands.

Agriculture in the Watershed dates to the late 1800s and it has shaped the culture and land. Initially, starting in 1865, the land was cultivated to produce hops. This industry was started by Ezra Meeker, and flourished until 1891, at which time an outbreak of aphids destroyed the crops. The lower Puyallup Valley above the tide flats shifted from producing hops to vegetables, flower bulbs, and berries. In the mid-1900s, it became home to poultry and dairy farms. The area from the Puyallup Valley to Sumner became known as the "Rhubarb Pie Capital of the World," and as of 2007, raises about 27 percent of the nation's supply of rhubarb. As lands were developed for farming and agricultural, major changes to the Puyallup and White Rivers were made to reduce flood risk and damage to property. The river was also straightened in some places to reduce flood risks and complexities for farms working in the floodplain. At the peak of agricultural activities in the 1940s, more than 160,000 acres were used for agriculture (PRWC, 2014).

Pierce County's population started to increase in the 1950s. This resulted in the loss of agricultural lands to residential and commercial development. As of 2014, less than 50,000 acres of agriculture land remain in Pierce County, with about 29,000 acres still in use. According to the 2014 Puyallup River Watershed Assessment, approximately 30 percent of all of Pierce County's agriculture land lies in the Puyallup River watershed.

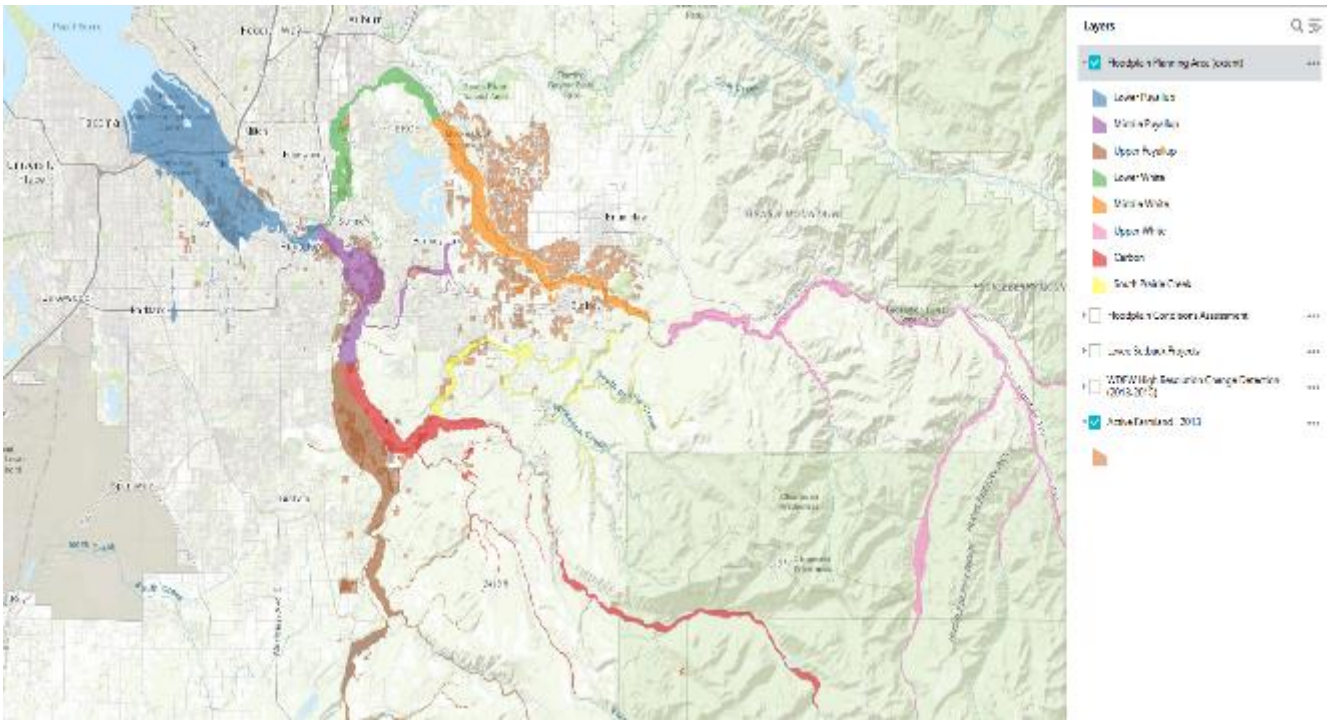


Figure 18. Floodplains and overlapping farmland in the Watershed. (Photo Source)

Viable agriculture in the watershed continues to be under pressure. Pressures on agriculture include climate change, population growth and land conversion, structural issues with regulations, and changing regional and global markets. The Agriculture Infrastructure Study (Muir, 2015) found that financial burdens, daunting regulatory conditions, lack of marketing support, drainage issues, and other pressures create challenges to getting the level of investment needed to address all of the issues. Another issue that impacts the agriculture community is transportation. Transportation changes can increase the amount of traffic on farm operations, including agri-tourism businesses that rely on the public.

In the past, agricultural practices have been viewed as sources of pressure on the ecosystem. However, more recent work recognizes that matching up the concerns and goals of environmental recovery with those of farming and agriculture presents many opportunities for benefits to ecosystem protection and restoration. Organizations such as the Washington Farmland Trust, Floodplains for the Future, Pierce Conservation District, and the PRWC seeks to find common ground and create partnerships between the agriculture industry and groups trying to fund effective environmental restoration and protection.

Ongoing human attitudes, activities, and infrastructure that create pressure on Farms and Agricultural Land in the Watershed include:

- Population growth and related conversion of land to residential, commercial, and industrial areas
- Spread of invasive species and weeds
- Climate change
- Transportation

As development has reduced the amount of traditional farmland in the watershed, agriculture can also be looked to as an opportunity for re-greening our urban spaces. Harvest Pierce County, the urban agriculture program at Pierce Conservation District, was developed over the last ten years to reconnect communities to each other and to their environment by cultivating community-based food systems. Along with numerous partners, this effort supports community gardens, gleaning, and works to center historically underserved populations and prioritize projects that work to increase food sovereignty. Each of the 80 community gardens in the greater Tacoma metro area serve as green stormwater infrastructure, reducing pollution from stormwater runoff and adding much needed greenspace to our built environment. Work to create greater food access, whether through preserving traditional farmland or converting vacant city lots into urban farms, is an essential connection point for our community to further our goals of ecosystem recovery.

Key Plans, Goals, Strategies, and References for Farms and Agricultural Land

The overall goal for the Farms and Agricultural Focus Area is to maintain and expand vibrant, viable agricultural areas and protect soil health to ensure healthy food for people and for open space benefits.

The PWR LIO will work in support of the goals, targets, strategies, and actions for Agriculture described in existing collaboratively developed documents for the Watershed. Key documents are described below with hyperlinks for more information. This is not an exhaustive list.

SHARED CONSERVATION STRATEGY DOCUMENT: PIERCE COUNTY STRATEGIC CONSERVATION PARTNERSHIP

The Shared Conservation Strategy (Pierce County Strategic Conservation Partnership, 2016) was written by the Pierce County Agricultural Program, Washington Farmland Trust, Forterra, and the Pierce Conservation District to establish a shared strategic conservation vision across these groups. The main goal of the Strategic Conservation Partnership (SCP) is to increase the rate of farmland protection through collaboration and to improve the pace, quality, and durability of resource land conservation activities in Pierce County. The principle of this work is that to dramatically accelerate the rate of farmland production, strategic partnerships are needed. This collaboration will allow for the greatest use of existing funding sources and it will help to meet the needs of farmers interested in

conservation. In support of this vision, the SCP established an ambitious goal for voluntary conservation of agricultural land: The ten-year voluntary conservation goal is 6,000 acres.

Voluntary conservation includes purchase of agricultural conservation easements or acquisition of the land from willing sellers. This goal describes the highest priority lands identified as "most suitable for current funding sources" and high priority in a GIS analysis conducted by FLO Analytics for the former Farmland Conservation Committee in 2013. The SCP also describes "Strategies to Achieve Short- and Long-Term Goals, Funding Options, and Stewardship" policies as described in the Strategy Section later in this chapter. The SCP plan helped inform the Regional Conservation Partnership Program, which matched $8,000,000 in federal funding from partners at the USDA's Natural Resource Conservation Service to conserve farmland and install best management practices, with $7,000,000 in local and state funding. The SCP strategy has also informed the agricultural component of the Floodplains for the Future efforts to conserve farmland and create multi-benefit projects that also reduce flood risk and restore salmon habitat.

PUYALLUP RIVER WATERSHED ASSESSMENT

The Puyallup River Watershed Assessment (PRWC, 2014) is an overarching document that provides the historical context of the watershed, its current status as of 2014 when it was written, and details the hydrology and water use, different habitats, water quality, and calls out key watershed features. It is a compilation document with minimal or no new data collection. Chapter 10, section 2, provides an overview on agricultural lands in the watershed. It emphasizes that sustainable agriculture and a thriving agriculture industry are vital to the health of the watershed. To do this, agriculture land must remain in active production, including infrastructure, local markets, and a community of farmers. The assessment provides an overview of needs by assessing the threats and opportunities:

1. Develop opportunities for use of geographical advantages: Prime agricultural soils and close proximity to markets are a big opportunity for Pierce County's farm industry.
2. Promote innovation: New farmers are joining long-term producers to grow diverse, value-added, and innovative products.
3. Develop market incentives: The development of new market channels and increased consumer demand for local products provides new sales outlets.
4. Increase collaboration: Numerous organizations throughout the watershed, county, and western Washington are working to provide support and tools for farmers to increase profitability. They are also working to transfer farmland to the next generation of farmers in an affordable manner.

FLOODPLAINS FOR THE FUTURE REPORTS

Restoration of floodplains is a critical activity for the watershed. Floodplains are especially important to restore for agricultural land use. These areas are highly productive and have fertile soil when they are in peak condition; however, in a degraded form, there is frequent flooding and important nutrients in the soils are stripped away. Floodplains by Design is a public-private partnership to integrate and accelerate efforts to reduce flood risks and restore habitat across Puget Sound's major river corridors, including the Puyallup, White, and Carbon Rivers. The Shared Monitoring Plan (FFTF, 2018) outlines the common agreement on visions and strategies that will improve salmon habitat, protect communities and infrastructure from flooding, and preserve agricultural lands. This plan identifies a set of watershed-wide goals relevant to improving and maintaining floodplain health. Goals relevant to agricultural land recovery are:

- Integrate agricultural interests into proposed large levee setback projects;
- Protect and conserve agricultural lands;
- Prevent conversion of agricultural lands to non-ag uses;
- Maintain a viable farming economy/ critical mass of farmland and farm businesses; and
- Improve drainage on existing farms.

The plan describes metrics to track progress toward shared goals. The goals focused on agricultural lands are:

Investments

- Conserved Farmland: Number of acres of conserved farmland;
- Amount of FFTF investments in integrated floodplain management; and
- Number of properties that are conserved or converted to non-agricultural land uses.

Land

- Actively farmed land: amount (acres) of actively farmed land;
- Type and extent of parcels with changes in agriculture land use;
- Number of parcels located within zip codes that are Organic Trade Association organic hotspots; and
- Number of development permits in the floodplain and other specific developments.

Outcomes

- Farm Revenue: Total market value of agricultural products sold;
- Farm Businesses: Number of farm businesses; and
- Results of Farming Information Survey.

The 2020 Puyallup Watershed Gap Analysis for Farming in the Floodplain Project (ESA, 2020) was developed for the Farming in the Floodplain Project, which is part of the Floodplains for the Future program. The purpose of this analysis is to identify gaps on information, specifically on physical conditions and natural processes. It also includes some of the built environment conditions that affect agriculture. It is meant to inform future work to improve agricultural resilience in this region. Gaps were identified through literature review and stakeholder review and discussion in a variety of topic areas, including agriculture. Gaps and potential next steps are identified in the analysis. The gap analysis identified several agriculturally-specific gaps in the following topic areas:

- Historical river management actions
- Hydraulics and hydrology
- Flooding and flood risk
- Water rights and instream flows
- Groundwater and wells
- Erosion and sedimentation
- Agricultural drainage and water-related infrastructure
- Water quality and stormwater runoff
- Saltwater intrusion
- Soils
- Soil compaction
- Land subsidence
- Lahars
- Wildlife intrusion
- Climate change
- Development pressure
- Infrastructure projects
- Current agricultural practices
- Agricultural production infrastructure

Calling out Implications and Opportunities: Agricultural Lands and Equity

According to the 2016 Mind the Meal Gap 2018 report by Feeding America, 14% of people in Pierce County experience food insecurity; according to the Feeding America website, one in ten people and one in seven children are food insecure at some time throughout the year in Washington. Food insecurity can have detrimental and lasting effects for all of those that it impacts, making it necessary for us to pay close attention to these numbers and work to eliminate food insecurity. Within urban areas such as East Tacoma, places limited access to a variety of healthy and affordable food, or food deserts, can have long term effects of the health and wellbeing of residents. Many of these residents are low-income, communities of color, and other marginalized groups. As such, the PWR LIO prioritizes direct action to assist in reducing the impact of food scarcity to these areas.

Under the umbrella of the Puyallup Watershed Initiative, The Just & Healthy Food System Community of Interest (JHFS COI) is a broad, inclusive partnership of organizations and individuals focused on addressing issues of food justice, food sovereignty, and equity at the community level. Their current working group includes over 40 different organizations and individuals representing a diversity of interests and perspective. The goal of the JHFS is to create a just and healthy food system that works to undo institutional racism, increase equity, and promote strong communities and healthy people.

Calling out Implications and Opportunities: Agricultural Lands and Climate Change

The Farming for the Floodplain Project Literature Review (ESA, 2020) was developed for the Farming in the Floodplain Project (FFP), which is part of the Floodplains for the Future Puyallup, White, and Carbon Rivers (FFTF) program. The objective of this literature review was to compile existing information regarding agricultural resilience, the expected future climate conditions in Washington State's South Puget Sound region of Washington State, and the interaction between agriculture, development, and a changing climate. The review was based on research questions centered on five themes: future climate conditions, the relationship between climate change and agriculture, the relationship between development and agriculture, agricultural resilience, and barriers to resilient agriculture. Recommended adaptive actions were organized in the follow 12 sections.

1. Water Use
2. Research
3. Hydrology
4. Economics
5. Soil
6. Organizational
7. Energy
8. Education and Outreach
9. Crops
10. Pests, diseases, and invasive species
11. Livestock
12. Forecasting and Planning

Farming and Agriculture Success in the Watershed

PROFESSIONAL PHOTOS FOR PIERCE COUNTY FARMERS

In a recent study, local farmers indicated that marketing support was strongly desired. Pierce County Fresh is working to fill this need for farmers. The Professional Farm Photography Project is just one way that Pierce County Fresh aims to boost Pierce County agriculture. Storytelling is an integral part of successful farm marketing and with high-quality images of their operations, these businesses will be better equipped to showcase their products and farms across multiple media platforms.

Pierce County Fresh, a buy-local program dedicated to promoting local agriculture in Pierce County, WA, has been working to increase the marketing of local farmers to boost sales at farmers markets. One way they have done this is to team up with photographer Rylea Foehl to provide free professional photos for Pierce County farmers. Funded by the Puyallup Watershed Initiative, Pierce County Fresh was launched in 2016 as a way for local shoppers to discover the bounty and fun available to them from local farms, farmers markets, and "agri-tourism" destinations. During the first two years alone, sales at local farmers markets increased by 29%.

Figure 19. Photo by Rylea Fohl promoting Local Color Farm and Fiber. (Photo image sourced from Pierce County Fresh's Facebook page, May 11, 2021.)

Other Success Stories:

PROJECTS:

- Bright Ide Acres gutter installations

PROGRAMS:

- Pierce County Fresh Program
- BackPack Kids
- American Heart Association Fund
- Abe's Golden Acres
- Pierce Conservation District Farm Foundations
- WSU Farm to School
- Taste Washington Day
- School Garden & Farm Successes in WA
- Salmon-Safe Farming

COMMUNITY:

- PIERCE COUNTY CONNECTED Spotlight: Working Together To Feed Our Neighbors

Priority Actions for Agriculture and Farming

The PWR LIO will prioritize support for projects identified for funding by members of the Agriculture Community of Interest (AgCOI) and local experts on Farm and Agricultural land management. Projects of particular interest include the following:

- Increasing use of Transfer of Development Rights/Purchase of Development Rights (TDR/PDR) to help keep agricultural lands in agriculture. The Pierce County Transfer of Development Rights Program is a voluntary market-based program that shifts development rights from ecologically sensitive and resource-rich lands to lands more suitable for development. This shift preserves ecologically sensitive and resource-rich lands while redirecting growth to urban areas.
- Apply the findings and insights from the 2015 Incentives to Encourage the Protection of Farm Land, Farmers, and the Agricultural Industry in Pierce County report prepared by the AgCOI inventories to existing and new agricultural incentive programs currently being used and that could be used in Pierce County. Key ideas include: considering actual motivators in structuring incentives, sizing incentive payments correctly, continuing incentive payments over time, and maintaining a positive approach.
- Improving the way that agricultural lands are designated based on the Agricultural Resource Land Recommendations to better protect farmland.
- Support farmers in improving the energy efficiency of farm operations through participation in the USDA On-Farm Energy Initiative or Rural Energy for America Program.
- Mitigation of road/highway impacts, improvements to market access, and other support for farming as described in the Agriculture Infrastructure Study (Muir, 2015)
- Removal of priority culverts inhibiting agricultural drainage and blocking passage of endangered fish species in the Clear Creek reach and other priority subbasins.
- Irrigation efficiency projects that support sustainable agriculture and the water offset and net ecological benefit goals of the Watershed Restoration and Enhancement Plan (Washington Department of Ecology, 2021)
- Stormwater catchment projects in priority subbasins that reduce on-farm irrigation costs, reduce runoff into streams, and benefit groundwater recharge.
- Projects described in the Clear Creek Agricultural Resilience Action Plan (Currently in draft form).
- The Pierce County Agriculture Program is designed to help local producers and processors navigate permits, improve relationships between agricultural operations and County government, and establishes partnerships with other agricultural service providers in the County and region. An action to take is to leverage this existing platform to meet with farmers and other industry professionals one on one to understand the challenges they face and develop other priority actions. A model platform is through ESA Associates and Floodplains for the Future.
- Actions that address and promote communication with on-the-ground farmers in addition to farm service providers and policy makers.
- Continue progress to implement proposed projects from Floodplains for the Future.
- Incorporate actions from the "Recommendations from Agricultural Drainage Task Force, 2021, Pierce County Council:"
    - Drainage has been identified as an important factor in maintaining viable agricultural lands and sustaining farm businesses in Pierce County. Agricultural drainage is a catch-all term that includes subsurface drainage infrastructure, soil infiltration rates, surface conveyance and surface storage. The concerns about agricultural drainage led to the creation of the Agricultural Drainage Task Force by the Pierce County Council (Resolution 2019-59s). This Task Force submitted a set of deliverables to the County Council in July 2021. Recommendations from the Task Force included:
        - Creation of a Drainage Team with additional staffing requirements to help landowners create long-term drainage management plans that incorporate Best Management

Practices (BMPs) into their maintenance activities. Plans would also help landowners acquire the necessary approvals and/or permits from state and federal regulatory agencies.
    - Considerations should be made on how to incentivize the adoption of more BMPs on farmlands in Pierce County to reduce sedimentation of ditches and streams.
    - Efforts to control noxious weeds in agricultural areas should be increased through programmatic support to the Noxious Weed Control Board. This would be focused primarily on problematic weeds that impact surface drainage systems and/or spread into agricultural fields.
- In addition to the Agricultural Drainage Task Force, Pierce County's Floodplains for the Future (FFTF) project (funded by WA Department of Ecology's Floodplains by Design program) is considering shifting its agricultural focus to drainage infrastructure improvements. Pierce Conservation District is working to expand its culvert replacement program with these funds, and the Pierce County Agriculture Program has begun a watershed-focused assessment of drain tile systems.
- There are also opportunities to increase cooperation between the agriculture industry and wildlife specialists (including state government officials, local Tribes, and NGOs) when dealing with beavers. Beaver populations continue to grow in many natural and man-made channels throughout Pierce County, but there are not enough resources currently available to effectively track their ecological significance or economic impacts.

Stormwater and Water Quality

The flow of clean, cool, healthy water that connects the Cascade Mountains to Puget Sound is essential to the quality of life and prosperity of Pierce County residents, businesses, and fish and wildlife. The quality of water throughout the Watershed determines whether it can be safely used by humans, fish, and wildlife.

Fresh water flows to the Puyallup and White Rivers and associated tributaries from the source at Mt. Rainier and surrounding foothills. As the waterways near Puget Sound, the water tends to become increasingly polluted as it flows through urban centers. The pollution resulting from urban centers has resulted in poor water quality conditions in many parts of the watershed. These poor water quality conditions are not meeting the needs of the humans, fish, and wildlife that live there. As Pierce County's population has grown, the impact of human activity on water quality conditions has increased both in freshwater and marine water portions of the PWR LIO geography. This increase is a result of pollution that is carried in from rainwater, wastewater/ industrial wastewater discharges, stormwater, road runoff, air deposition, and land use change. While there are myriad sources of pollution to our waterways, this chapter will have a specific focus on stormwater because it affects all waterways, from small creeks to the marine shoreline. In the upper watershed, agricultural and forestry sources of stormwater are more prevalent, whereas in the lower watershed, urban sources dominate.

Stormwater is water that originates from rainwater or snowmelt that moves across the landscape. As it travels, it can pick up soil, sediment, and pollutants, and carry them to waterways. Agricultural fields are a source of nutrients, pesticides, and sediment to waterways. De-forested land is subject to erosion. Roadways are a source of oils, fluids, and tire shavings from vehicles, which can cause immediate mortality in certain salmon species. The roadway itself contains oils, and in some locations, it contains PCBs. Cropland contains nutrients and pesticides. City streets contain all sorts of discarded waste, including animal feces that are not picked up. As it flows unabated and untreated into local waterways, it contributes to stormwater pollution in our waterways. Jurisdictions such as the City of Tacoma have invested millions in stormwater prevention activities and outreach efforts to help residents lessen their impact. Regulations also help reduce the impact of stormwater and other pollution sources.

Regulation relies on management of both point (i.e., a pipe draining to a waterway) and nonpoint (i.e., runoff from forests or agriculture fields) sources of pollution. Within the Watershed, different areas of some waterways have been listed for failing to meet water quality standards for one or more of the following parameters: ammonia, biological oxygen demand (BOD), fecal coliform, pH, sediment, and temperature. The three most common listings for water are BOD, fecal coliform bacteria, and temperature. In addition, there are habitat listings (invasive exotic species, instream flow, fine sediment) and fish tissue listings of specific chemicals that are higher than is healthy for the fish or people consuming the fish (e.g., dieldrin, PCBs, chlorinated pesticides, DDTs, and arsenic). A listing means that one or more aspects of the waterway is degraded and is being monitored.

The Water Quality Standards for Surface Waters of the State of Washington define use designations for aquatic life, recreation, water supply, and local jurisdictions through their National Pollutant Discharge Elimination System (NPDES) municipal stormwater permit and other permits. Permit requirements address water quality and the preservation of natural drainage systems. Permittees consist of a variety of businesses (agriculture, steel manufacturers, auto shops, etc.) that have discharges of pollutants that can harm the ecosystem, such as chemicals or nutrients. Jurisdictions monitor for pollution under both federal and state laws, and conduct inspections and provide technical advice to owners of privately and publicly owned stormwater facilities to meet legal requirements and reduce the impacts of polluted runoff on people and fish.

The upper and mid regions of the watershed are often more impacted by nonpoint sources of pollution. Nonpoint sources are difficult to manage because nonpoint sources are not permitted, and thus require sound planning and investment by private parties, state government, and local government. This means that private landowners need to self-regulate their discharges rather than abide by a permit. Local groups and municipalities provide both technical and financial assistance to help people understand and reduce their impacts on stormwater pollution. These resources can help residential or commercial landowners install things like raingardens that capture and

infiltrate stormwater before it carries pollution to local waterbodies, or farmers better store and manage livestock manure to keep fecal contaminants out of streams.

In the lower watershed, where there are more urban areas, permits are used to manage stormwater. Each jurisdiction has its own National Pollutant Discharge Elimination System (NPDES) municipal stormwater permit and associated plans and programs to reflect the needs of the region. In the PWR LIO, the municipalities of Tacoma, Bonney Lake, Buckley, Fife, Puyallup, Federal Way, Edgewood, Orting, Milton, Auburn, and Sumner have their own programs and plans.

Stormwater and Water Quality management relies on the use of stormwater Best Management Practices (BMPs) that help to reduce the discharge of pollutants as much as possible. Permittees provide guidance to applicants (who can fall under residential, commercial, and industrial categories) based on regulatory requirements. This guidance helps with controlling the quantity and quality of stormwater produced by new development and redevelopment to comply with water quality standards and to help protect the waterways the discharge is going into.

Across the watershed, total maximum daily load (TMDL) plans are used to inform restoration. TMDLs identify the maximum amount of a pollutant that bodies of water can receive while still meeting water quality. These levels are ultimately based on the U.S. Clean Water Act. Individual states develop their own water quality standards, which must meet minimum federal requirements. States can, however, be more restrictive than the federal standards. The EPA approves these levels. Essentially, some level of pollutants is allowed to be discharged to a waterway; TMDLs help make sure the different contributions from different sources do not let a pollutant to be in an unsafe concentration.

Sustainable stormwater and water quality management depends on partnerships and actions across different levels of government, local organizations, and the residents of the watershed. These partnerships can improve water quality and habitat, educate, and raise public awareness about watershed health. The Pierce Conservation District (PCD) is a non-regulatory organization that partners with the county and cities. PCD works directly with residents and cities to provide BMPs and assistance from all available sources—public and private, local, state, and federal— to develop locally-driven solutions to natural resource concerns. Other groups such as the Washington Stormwater Center at WSU Puyallup, the Center for Urban Waters, and UW Tacoma are other key partners and resources for research, projects, and overall water quality management. For the general public, behavior change programs such as Puget Sound Starts Here and STORM exist to educate and show people how they can make a difference in their watershed.

Key Plans, Goals, Strategies, and References for Stormwater and Water Quality

The overall goal for the Stormwater and Water Quality Focus Area is to manage stormwater and prevent pollution in support of clean water for people and fish.

The PWR LIO will work in support of the goals, targets, strategies and actions for stormwater and water quality described in existing collaboratively developed documents for the Watershed. Key documents are described below with hyperlinks for more information. This is not an exhaustive list.

GWƏDZADAD TEACHING OF OUR ANCESTORS: TRIBAL HABITAT STRATEGY

The 2019 Tribal Habitat Strategy was created by the Member Tribes of the Northwest Indian Fisheries Commission. It provides goals, indicators, and initiating tasks for five habitat areas: Pacific Ocean, Nearshore, Floodplains, Riparian, and Water. The ultimate goal is salmon recovery because, as Billy Frank Jr. said, “As the salmon disappear, so do our cultures and treaty rights. We are at a crossroads and we are running out of time.” This document provides a roadmap for recovery and emphasizes immediate action.

The goal for water is to ensure that our waters provide a fit home for salmon, shellfish, and all of the tribes’ treaty-reserved resources by meeting all applicable standards and ecologically based instream flows.

Indicators to track this work are:

- Toxic contaminants and other attributes;
- Condition parameters, e.g., temperature, dissolved oxygen (DO), at levels harmful to treaty resources or tribal consumption and use; and
- Streams, rivers and waters supporting ecological flows.

Tasks to initiate this work are:

- Maintain and implement more protective water quality standards (WQS);
- Defend against efforts to deregulate protection requirements;
- Advance science documenting stormwater impact on treaty resources; and
- Map and evaluate impacts to ecological flows.

NPDES PHASE I AND PHASE II PERMIT STORMWATER MANAGEMENT PROGRAM PLANS

The Pierce County Stormwater Management Program Plan (Pierce County, 2020) describes programs that support compliance with Municipal Stormwater NPDES and State Discharge General Permit in the largest area of the watershed that is not in federal or state lands. These efforts protect water quality and satisfy the requirements of the US Clean Water Act and State Water Pollution Control Act. This permit targets the control of discharges into and out of the municipal separate storm sewer systems that Pierce County owns and operates. It also requires the use of stormwater best management practices to reduce discharges of pollutants to the maximum extent practicable. Tacoma, the Phase II cities within Pierce County (Bonney Lake, Buckley, Edgewood, Enumclaw, Federal Way, Fife, Orting, and Puyallup), and the Port of Tacoma also have Stormwater Management Program Plans with parallel stormwater management requirements. In addition, there are several Municipal Separate Storm Sewer System (MS4) permits in the watershed:

- City of Tacoma MS4 Discharges to Puyallup Tribal Waters;
- Pierce County MS4 Discharges to Puyallup Tribal Waters; and
- Washington State Department of Transportation MS4 Discharges to Puyallup Tribal Waters.

HYLEBOS WATERSHED PLAN

In 2016, Earth Corps prepared the Hylebos Watershed Plan (Schwartz et. al., 2016) with the purpose of working on restoration throughout the Hylebos watershed. Adopting a holistic management approach, the Hylebos Watershed Plan sought to identify, prioritize, and act on behalf of ecological and human health in the Hylebos Watershed. This vision was done by highlighting problems and recommending solutions to achieve the goal of mitigating those problems. For water quality, the Plan identified priorities to improve the ecological and human health in the Watershed:

- Centralize a database for updated water quality data;
- Implement GSI management;
- Restore vegetative riparian buffers; and
- Enforce compliance with point source pollution regulations.

The specific goals of this Plan are to:

- Unify the stakeholder vision;
- Characterize the watershed; and
- Find solutions.

TOTAL MAXIMUM DAILY LOAD WATERSHED RESTORATION PLANS

Under the US Clean Water Act, a Total Maximum Daily Load (TMDL) is the calculation of the maximum amount of a pollutant allowed to enter a waterbody so that the waterbody will meet water quality standards. In other words, it

is the highest amount of a specific pollutant that can be present in a specific water body and not cause harm to the organisms there or to human health. Since many times a TMDL is used in areas where a pollutant is already at unsafe levels, it is used to determine a pollutant reduction target and allocates load reductions necessary to the source(s) of the pollutant. TMDLs determine pollution sources and how to decrease them.

Pollutant sources are characterized as either point sources that receive a waste load allocation (WLA), or nonpoint sources that receive a load allocation (LA). For purposes of assigning WLAs, point sources include all sources subject to regulation under the National Pollutant Discharge Elimination System (NPDES) program, such as wastewater treatment facilities, stormwater discharges, and vessel discharge. For purposes of assigning LAs, nonpoint sources include examples such as fecal bacteria from livestock manure, tree removal, nutrient application in agricultural areas, oil and grease from urban runoff and energy production, and sediment from construction sites or eroding streambanks. TMDLs must also account for seasonal variations in water quality and include a margin of safety (MOS) to account for uncertainty in predicting how well pollutant reductions will result in meeting water quality standards.

The Department of Ecology is the state agency responsible for the enforcement of the Clean Water Act in Washington state. It has established TMDLs in the Puyallup Watershed that are summarized in Table 5.

An important report for TMDLs in the watershed is the Puyallup River Watershed Fecal Coliform Total Maximum Daily Load (Mathieu and James, 2011). The Implementation Plan chapter describes in detail the actions that are needed for each tributary of the Puyallup and White Rivers. This plan is of particular importance because it takes a watershed-wide approach to the cross-cutting issue of fecal coliform, which has implications for salmon recovery.

Other important TMDLs for the Watershed:

- South Prairie Creek TMDL for Fecal Coliform and Temperature (Seabrook et. al., 2006)
- Clarks Creek TMDL for Fecal Coliform (Hoffman et. al., 2008)
- Clarks Creek TMDL for Dissolved Oxygen and Sediment (James et. al., 2014)

Table 5. Current TMDLs in the Puyallup-White River Watershed

Location	TMDL(s)
Upper White River	Sediment and Temperature
Lower White River (in development and has not been sent to the EPA for approval at the time of this publication)	pH
Puyallup River	Fecal Coliform Bacteria
Clarks Creek	Fecal Coliform Bacteria
South Prairie Creek	Fecal Coliform Bacteria and Temperature
Clarks Creek	Dissolved Oxygen and Sediment

CLARKS CREEK RESTORATION PLAN

As a result of the 2014 Clarks Creek Dissolved Oxygen and Sediment TMDL Report, an agreement between WA Dept of Ecology, EPA, and the County was made to establish the Clarks Creek Restoration Plan (Pierce County, 2017) that describes the methods and models used to evaluate the projects and actions the County is seeking to apply to meet the numerically expressed goals of the TMDL. The 20-year waste load allocation and load allocation goals set by the County for Clark Creek are:

- 50% reduction in untreated stormflow volume Dissolved Oxygen Deficit (DOD), and/or a combination of flow and DOD reduction;

- 66% reduction in sediment baseload assigned to Pierce County;
- 85% increase in riparian shade;
- 75% instream reduction of *Elodea*; and
- Reduce Nonpoint Sediment Load from General Load Allocation (LA) Parcels located within the County's Jurisdiction.

Calling out Implications and Opportunities: Water Quality and Climate Change

Climate change will cause myriad effects in the water quality of Puget Sound. While atmospheric changes such as altered precipitation patterns and storm intensities will contribute to altered water quality conditions, other effects will likely occur, according to the University of Washington's Climate Impacts Group and the Climate Change Impact Assessment and Adaptation Options (Puyallup Tribe of Indians, 2016). Other effects include reduced oxygen in the water column, declining pH levels, increased nutrients, and higher temperatures. All of these are effects that are tracked by the US Clean Water Act and are recognized to be detrimental to ecosystem health.

With these predictions in mind, salmon hatcheries are at risk; while the Puyallup Tribe's hatcheries typically draw from cooler groundwater, fish have to navigate through hotter streams. Acidifying waters also decrease salmonid survival. Higher temperatures are also increasing harmful algal blooms in the area. Algal blooms can be harmful to pets and the respiratory track of humans.

The Puyallup Tribe's Assessment provides a section on adaptations that local residents can take to decrease impacts of climate change on various natural resources and to public health.

Calling out Implications and Opportunities: Water Quality and Equity

The Puget Sound region has been experiencing a homelessness crisis during the last few years. Tacoma is no exception to this trend. Homeless encampments can have a detrimental environmental impact. The City of Tacoma Environmental Services Department launched a pilot project called Purple Bags to assist with not only the environmental impacts but to help the people living in these spaces. This pilot project ran for 16 weeks and focused on one encampment in East Tacoma.

The 16-week trial period from December 2020 to March 2021 resulted in the removal of 21,520 pounds of trash from the site. Several individuals from the site were connected to staff at Neighborhood Community Services. Providing trash bags and free trash pickup helped to keep the site cleaner, safer, and healthier for those living there, and was $4,000 cheaper than a previous clean up at that site that was done after people had vacated the site and left trash behind.

The site is now undergoing habitat restoration activities.

Water Quality Success in the Watershed

MEEKER CREEK STREAM RESTORATION

In 2015, work was completed to restore Meeker Creek. This project was funded partly by the City of Puyallup and partly by the WA Dept of Ecology through a grant obtained in 2013. Work was done by contractors as well as several community volunteer events. The work transformed the creek from a degraded, highly altered state to

natural meander channels and restored the floodplain surrounding it. Its current state shows better water quality, filters sediment loads from the stream, hosts wildlife (including a bald eagle, blue heron, and salmon), and supports the city's implementation of permit-required TMDL plans. This work is a good model of local residents working with the city to restore a vital waterway connection and leveraging state and city dollars and volunteers to achieve a desired outcome.

Figure 20. These photos show the creek before restoration (left) and after restoration (right). The left shows that the creek had become essentially a ditch. The restored portion on the right shows a wider channel with an associated freshwater wetland floodplain that creates salmon habitat, reduces flooding, and improves water quality. (Photo Source)

Other Success Stories:

PROJECTS:

- Commencement Bay Superfund Site Cleanup Projects
- Thea Foss Waterway Cleanup
- Greenwater River Hazard Mitigation Analysis Project

PROGRAMS:

- Orcas Love Raingardens
- TappsWise Septic Care Incentive Program
- Blue Water Task Force

COMMUNITY:

- Prairie Line Trail Regional Stormwater Treatment Facility
- Point Defiance Regional Stormwater Treatment Facility
- Boise Creek Surface Water Cleanup

Priority Actions

The PWR LIO will prioritize support for projects identified for funding by members of the local jurisdiction by Pierce County, the cities of Tacoma, Sumner, Puyallup, and other jurisdictions within the bounds of the watershed, and local experts on stormwater and water quality management.

Projects of special interest include the following:

- Continued expansion of green stormwater infrastructure programs such as Orcas Love Raingardens to increase implementation of GSI at schools, commercial properties, and private residences throughout the watershed.
- Continued work and projects described in TMDL water cleanup plans and Stormwater Management Program Plans and priorities and support for efforts to coordinate across jurisdictional boundaries.
- GIS-based mapping and analysis models to better prioritize water quality efforts such as the City of Tacoma Stormwater Management Watershed Prioritization Tool and Ecology Puget Sound Watershed Characterization Project Map.
- Projects and priorities described in the WRIA 10 Watershed Restoration and Enhancement Plan.
- Continued expansion and acceleration of progress of cleanup in the Tacoma Tideflats Superfund Site and related and adjacent state cleanup sites, including increased monitoring of water quality at the Tideflats. Projects that create multiple benefits and respond to community input such as that being gathered through the Tideflats Subarea Plan are especially preferred.
- Create a regional funding model similar to the Los Angeles Safe Clean Water program to fund stormwater and other water quality projects with a parcel scale fee.
- From the Puyallup Tribe's Climate Change Impact Assessment and Adaptation Options (Puyallup Tribe of Indians, 2016): Increase urban water absorption capacity by minimizing paved surfaces, using absorptive or permeable construction materials, and increasing public awareness and participation in reducing runoff.
- Implement the Swan Creek Watershed Characterization and Action Plan (Pierce County, 2015): The primary goal of the Action Plan is to build on the information presented in the Basin Plan and to make recommendations to support Pierce County's efforts to improve water quality in Swan Creek. Characterizing existing conditions included reviewing prior reports, summarizing historical data collected in the watershed, collecting additional data on sediment erosion and non-point source pollutants, and assessing the relationships between historical data, new data and past and ongoing land use activities, land ownership and stormwater conveyance and capacity. Recommended actions to improve water quality included new projects, programmatic measures and additional studies. Capital improvement projects, programmatic measures, and additional studies from the Basin Plan were also recommended again as actions. Projects and programmatic measures were assessed, scored, and ranked into high, medium and low priorities for implementation.
- Actions consistent with the Tacoma Water Utilities Watershed Management Plan (City of Tacoma, 2018) which seeks to protect and improve water quality throughout the watershed.
- Support regional studies of emerging treatment technologies, enhanced maintenance strategies, stormwater contaminants of concern, water quality monitoring, or other water quality related topics coordinated through the Puget Sound Partnership, Department of Ecology, Washington Stormwater Center, WSU Extension, and others.

Adaptive Management

Adaptive management is a process of paying attention to results and experiences of implementation over time, considering new and emerging information, and making changes to adjust and evolve strategies and actions to continuously improve performance and results. The PWR LIO will evaluate the Ecosystem Recovery Plan at least annually and will adaptively manage it over time.

Adaptive management will follow the Conservation Measures Partnership (CMP) Cycle (Figure 21). Conceptualization (step 1) and action and plan monitoring (step 2) are underway with creation of the PWR LIO Ecosystem Recovery Plan. Action implementation and monitoring (step 3) will take place through ongoing projects as implemented and monitored by PWR LIO members and captured to a limited extent in the initial suite of priority actions identified in the ERP. As data and results become available from these projects (step 4), PWR LIO members will share lessons learned at LIO meetings.

The PWR LIO will pursue adaptive management of the ERP by regularly reviewing efforts and results including consideration of:

- What strategies have been executed and to what extent?
- Where performance and results are not moving as quickly as desired, is there work that can be done with program implementers and project sponsors to identify barriers to implementation and/or program refinements?
- Review of PWR LIO goals and targets to track progress and to adjust over time as needed.
- Adjust conceptual models and strategies to new scientific and technical information when needed when plans and strategies are updated.

The PWR LIO will accomplish adaptive management primarily through ongoing discussions with the PWR Technical Team and the PWR Leadership Team. The PWR LIO anticipates at least one ERP review per year; the review may be implemented as a session at the longstanding and well attended Puyallup Watershed Symposium.

The PWR LIO notes that adaptive management and evolutionary decision making involve a combination of responding to scientific and technical information and interactions with policy makers, project sponsors, and the broader community so the overall ERP can continue to reflect what is needed and what can be done.

The PWR LIO also recognizes three interrelated capacities for adaptive management, which are important for cross sector relationships to be developed:

1. Develop systems intelligence
2. Cultivate mutual learning
3. Discern adoptive challenges.

Figure 21: Adaptive Management Cycle (Image Source)

Appendix A

Appendix Table 1: Goals for each Focus Area

Focus Area	Goals
Salmon	Overall Goal: achieve self-sustaining, harvestable salmon populations in the Puyallup-White Watershed and in Puget Sound. In the Puyallup-White, watershed-based efforts in support of this goal have focused on identification and protection or restoration of critical habitat for salmon
	[1] 50-Year Habitat Goal: 32,000 acres of floodplain habitat (including in estuary and nearshore areas) are protected from development within the Core Salmon Habitat and Flood Zone Protection Corridor by 2067
	[1] 50-Year Habitat Goal: 3,300 acres of functioning riparian buffer, with a width equal to or greater than one site-potential tree height (to be determined), will define a protected Riparian Buffer Zone by 2067.
	[1] 50-Year Habitat Goal: 62 stream miles open to fish movement and passage by 2067
	[1] 10-Year Habitat Goal: 153 acres of nearshore habitat is restored by 2027
	[1] 10-Year Habitat Goal: Ten percent increase in functioning riparian buffer habitat by 2027.
	[1] 10-Year Habitat Goal: Three major physical barriers to fish movement and migration removed or modified by 2027
	[1] 10-Year Habitat Goal: 153 acres of nearshore habitat is restored by 2027.
Estuaries	Overall Goal: to support the restoration of estuarine and shoreline habitat to enhance functional and sustainable ecosystems
	[1] 50-Year Habitat Goal: 32,000 acres of floodplain habitat (including in estuary and nearshore areas) is protected from development within the Core Salmon Habitat and Flood Zone Protection Corridor by 2067. (NOTE: These 32,000 acres of floodplain habitat would include estuary recovery, however the specific acres of tidal marsh, tide channels, and salt ponds to be restored is still to be determined.)
	[1] 10-Year Habitat Goal: 153 acres of nearshore habitat is restored by 2027.
	[2]Restoration of estuarine wetlands (hydrology)
	[2]Restoration and protection of salt marsh habitat.
Floodplains	Overall Goal: to have restored connections between rivers and land that improve habitat for salmon, protect communities and critical infrastructure from flooding, and provide new opportunities for recreational and cultural uses while preserving agricultural lands in the Puyallup River Watershed.
	[1] 50-Year Habitat Goal: 32,000 acres of floodplain habitat (including in estuary and nearshore areas) are protected from development within the Core Salmon Habitat and Flood Zone Protection Corridor by 2067.
	[1] 10-Year Habitat Goal: 203,000 linear feet of levees removed and 2,300 acres of floodplain reconnected by 2027
	**Reconnect floodplains
	**Reduce flood risk

Focus Area	Goals
	**Increase integration across partners and interests
	**Increase the resilience of flood management infrastructure, the ecosystem, and agriculture as climate changes.
Forests	Overall Goal: Keep forested lands in forest for ecosystem and human benefits, improving the health of forested lands, and increasing urban and rural forest cover
	[3]Reduce the potential of losses (life, natural resources, property) because of wildfires in the wildland-urban interface.
	[3]Protect people, structures, infrastructures, and unique ecosystems that contribute to the community's way of life and the sustainability of the local and regional economy.
	[3]Educate community residents about the unique challenges of wildfire in the wildland-urban interface or properties where homes are surrounded by forested lands.
	[3]Establish mitigation priorities and continue strategies to reduce losses to wildfires in the Greenwater area (see Greenwater Community Firewise Mitigation Action Plan).
	[3]Strategically locate and plan fuel reduction projects.
	[3]Provide recommendations for alternative treatment methods, such as modifying forest stand density, fuel reduction techniques, and abatement of treated slash.
	[3]Meet or exceed the requirements of the National Fire Plan and FEMA for a community wildfire protection plan.
	[4]Robust, resilient (to climate change), natural forest systems providing multiple social, economic, and ecological benefits
	[4]Informed citizens engaged in the stewardship of urban spaces and urban forests (native open spaces down to private property scales)
	[4]An increase in forest resiliency to climate change and impacts from pests and disease through species diversification
	[4]Enhanced function of existing natural systems
	[4]Increase in improved habitat for endangered and/ or threatened species
	[4]Improved quality of life for surrounding communities, including universal access to the benefits of trees and forests
	[4]Consistent use, implementation, compliance, and enforcement of regulations and standards
	[4]Lower incidence of poor air quality related health problems
	[4]Communities learning, communicating, and working together to engage in planning, design, and growth of their forestlands
	[4]Reduce incidence of flooding and increase stormwater flow control and infiltration.
	[5]Management Policy: Tacoma's urban forest policies are the foundation for preserving the environmental benefits, management, and the character of Tacoma's urban forest.
	[5]Capacity and Training: The City has the capacity and expertise to provide ideal levels of service for equitable urban forest management.
	[5]Funding and Authority: City resources and authority enable equitable urban forest management for the preservation and enhancement of tree benefits.

Focus Area	Goals
	[5]Inventories and Plans: A comprehensive understanding of the urban forest ensures data-driven decisions, sustainable and equitable planning, and amplifies the benefits received from trees.
	[5]Risk and Disaster Planning: The City proactively manages risks to the urban forest and is equipped with the resources to address unforeseen risk and disasters.
	[5]Community Engagement: Sustainable urban forest management and equity are achieved through a partnership with the City and its residents resulting in improved wellbeing, human health, and local economies.
Farms and Agricultural Land	Overall Goal: to maintain and expand vibrant, viable agricultural areas and protect soil health to ensure healthy food for people and for open space benefits
	[6]Acreage Goal: The ten-year voluntary conservation goal is 6,000 acres. Voluntary conservation includes purchase of agricultural conservation easements or acquisition of the land from willing sellers. This goal describes the highest priority lands identified as "most suitable for current funding sources" and high priority in a GIS analysis conducted by FLO Analytics for the former Farmland Conservation Committee in 2013.
	[9]Protect and conserve agricultural lands
	[9]Maintain a viable farming economy/ critical mass of farmland and farm businesses
	[9] Improve drainage on existing farms
	[9] Increase integration across partners and interests
	[9] Increase the resilience of flood management infrastructure, the ecosystem, and agriculture as climate changes.
Stormwater and Water Quality	Overall Goal: to manage stormwater and prevent pollution in support of clean water for people and fish
	[7]Centralize a database for updated water quality data
	[7]Implement GSI management
	[7]Restore vegetative riparian buffers
	Enforce compliance with point source pollution regulations
	[8] 50% reduction in untreated stormflow volume Dissolved Oxygen Deficit (DOD), and/or a combination of flow and DOD reduction
	[8] 66% reduction in sediment baseload assigned to Pierce County
	[8] 85% increase in riparian shade
	[8] 75% instream reduction of *Elodea*.
	[8] Reduce Nonpoint Sediment Load from General Load Allocation (LA) Parcels located within the County's
Equity and Human Wellbeing	Overall Goal: to build all peoples' sense of their oneness with the natural world and commitment to a healthy environment for human and ecological benefits.
	[10] Help understand the causes of health inequity in Pierce County.
	[10] Identify where inequities occur.
	[10]Identify health outcomes that have the most severe inequities.

Focus Area	Goals
	[10] Identify populations that suffer inequitable health outcomes.
	[10] Examine our internal policies, practices, and perceptions.
	[10] Examine partner perceptions of how well we address health inequities.
	[10] Determine if the Department is effectively positioned to help achieve health equity in Pierce County.
	[10] Air Quality. Through the Department's Outdoor Air Quality Program, raise awareness among residents of the short- and long-term effects of exposure to air pollution. Working with partners such as the Puget Sound Clean Air Agency for their Wood Smoke Reduction Program, assisting anyone living in the Smoke Reduction Zone with replacing or recycling their wood-burning device. This program serves residents who may be renting, low-income, or need to heat with wood for financial reasons.
	[10] Drinking Water Quality. Improve the quality of water with a specific focus on contaminants such as *E. coli* bacteria and nitrogen present as result of human activity. Educate the public on the impact of consuming contaminated water, especially with regard to the impact on children and the elderly. Work to improve all impacts of water quality, but with specific focus on rural and low-income communities.
	[10] Surface Water Quality. Provide education and support to allow for safe reactional opportunities considering safe levels of biotoxins in shellfish that are important facets of supporting health. The Department will continue to increase data gathering to determine whether there is income, educational, racial, ethnic, or geographic inequities in surface water quality.
	[10] Septic Systems. Promote environmental stewardship by helping communities protect and monitor their local water through implementation of routine septic maintenance. Strengthen the partnership with other organizations (Pierce County Surface Water Management and Pierce County Community Connections) to find funding to create more affordable loans to help septic system owners repair, upgrade, or replace failing systems for low-income communities.
	[10] Waste Management. Promote education to reduce solid waste accumulation, which can reduce property values and contribute to rodent infestations and other community risks. Increase efforts to address root causes to address efforts that promote health equity, including housing availability, housing value (home equity), community cohesion, and neighborhood conditions such as walkability and crime.
	[10]Land Contamination. Continue to support the Contaminated Sites Programs that address risk from the release of toxic chemicals into the natural and built environment. By supporting this, the Program educates on the impact of accidental or inappropriate handling of toxic chemicals that result in toxic spills contaminating our drinking water supply, degrading the natural environment, and exposing the community to those toxic chemicals. Continue to raise awareness and provide support of low-income communities and communities of color that often have higher levels of toxic spills and contaminations in their neighborhoods.
	[10] Food Safety. Support the efforts of food inspectors who regularly inspect, educate, and consult with food establishments to protect people from food-borne illnesses. Continue to review food preparation and service plans when food establishments are starting up or making changes. Collaborate with city, state, other county and federal governments, community leaders, and community members to continue these efforts effectively. Support

Focus Area	Goals
	further data collection to better understand the impact food safety has on low-income communities and communities of color.
	[10] Impacts of Climate Change. Highlight the impact climate change has on human health and wellbeing as a result of increased extreme weather events, wildfire, decreased air quality, threats to mental health, illnesses transmitted by food and water, and diseases spread by carriers such as mosquitoes and ticks. Better understand and strategize around the reality that the impacts of climate change add to the cumulative stresses vulnerable populations already face including children, the elderly, the poor, some communities of color, and people with chronic illnesses.
	[11] Connect with Nature: Pierce County residents place a high priority on expanding opportunities to connect with nature in their community. Pierce County Parks aims to expand opportunities by opening more natural areas for hiking, walking, and wildlife viewing and by offering more nature-based programming and events.
	[11] Healthy Lifestyles: Parks are a place where people go to recreate, play, and exercise. Pierce County Parks will expand opportunities for residents and visitors to enjoy a variety of activities that promote active, healthy lifestyles.
	[11] Vibrant Community Spaces Parks are places where people go to relax, enjoy family and friends, and come together as a community. Pierce County provides stewardship of parks, trails, and open spaces to maximize a healthy natural environment and to provide access to nature in an increasingly urban landscape
	[11] Sustainable Practices and Administration of System: Pierce County Parks practices all aspects of sustainability: social, environmental, and economic, by ensuring the park system is managed effectively and equitably by being fiscally responsible and by offering opportunities for the public to learn about sustainable practices.
Climate Change	Overall Goal: to understanding and respond to the impacts of climate change
	[12] Development of tribal capacity to assess on- and off-reservation climate change impacts and to promote resilience to these impacts at multiple scales.
	[12] Management of natural resources using practices that incorporate climate change impacts into long-term plans.
	[12] Coordination between tribes and among departments within each tribe, such as natural resources, planning, public health, emergency management, and community outreach.
	[12] Partnerships between tribal and non-tribal scientists on research, modeling, and tracking environmental trends
	[12] Partnerships with federal, state, and local governments to work together on local concerns and solutions.
	[12] Access to funding sources that assist in the implementation of adaptation projects that protect tribal people, homelands, and resources

REFERENCES:

1: Salmon Habitat Protection and Restoration Strategy (Lead Entity 2018)
2: City of Tacoma Shoreline Restoration Plan (2011)
3: Community Wildfire Protection Plan
4: Puyallup Watershed Forest Resources Roundtable Community of Interest
5: Urban Forest Management Plan (2017)
6: Shared Conservation Strategy (Pierce County Strategic Partnership 2016)

7: Hylebos Watershed Plan (EarthCorps 2016)
8: Clarks Creek Restoration Plan
9: Floodplains for the future shared monitoring plan
10: 2015 Health Equity Assessment for the Tacoma-Pierce County Health Department
11: Parks, Recreation and Open Space Plan (Pierce County 2020)
12: Climate Change and Our Natural Resources (Treaty Tribes of Western Washington 2016)

Appendix B: Summary of Educational Priorities, Recommendations, and Actions

Habitat Protection and Restoration

- Provide education and outreach about how forest, floodplains, and freshwater processes support ecosystem functions and services (such as abundant salmon) that are important to people to raise support for forest and freshwater protection and restoration efforts.

Pollution Prevention and Treatment

- Provide education, outreach, and support to landowners, particularly agricultural and livestock landowners, to help them limit pollutant loads to surface water through best management practices (e.g., through technical and financial assistance from conservation districts)
- Provide education and outreach about pollution reduction and how water quality supports ecosystem functions and services (such as clean, abundant water) that are important to people to raise support for water quality protection and restoration efforts

Salmon

- From the **2018 Salmon Habitat Protection and Restoration Strategy**
    - **Conduct Outreach and Education:** This includes developing, starting, and supporting outreach and education to stakeholders, including the public, throughout the watersheds. The work involves coordinating with the Environmental Education Community of Interest in the Puyallup-White Watershed.

Forests

    - From the **Puyallup River Watershed Assessment**
        - Increase education and outreach to advance healthy and productive forests by assessing threats and opportunities

Equity and Human Wellbeing

- From the **Puyallup-White Watershed Open Space Strategy**
    - Create educational programs
- From the **Health Equity Assessment for the Tacoma-Pierce County Health Department**
    - **Surface Water Quality.** Provide education and support to allow for safe reactional opportunities considering safe levels of biotoxins in shellfish that are important facets of supporting health. The Department will continue to increase data gathering to determine whether there is income, educational, racial, ethnic, or geographic inequities in surface water quality.
    - **Waste Management.** Promote education to reduce solid waste accumulation, which can reduce property values and contribute to rodent infestations and other community risks. Increase efforts to address root causes to address efforts that promote health equity, including housing availability, housing value (home equity), community cohesion, and neighborhood conditions such as walkability and crime.
- Priority Action
    - Increase education of Tribal Treaty Rights and the Tribal Land Settlement Agreement

Climate Change

- From the **Tacoma Climate Change Resilience Study**
    - Incorporate climate resilience actions into equity initiatives and programs. Current programs that could incorporate resilience activities, education, and actions include the Healthy Homes, Healthy Neighborhoods program, Puyallup Watershed Initiative, Tacoma Office of Equity, Family Support Centers, and the Tacoma-Pierce County Health Department's Health Equity Initiative.
- From the **Puyallup Tribe Climate Change Impact Assessment and Adaptation Options**
    - Provide education and guidance for the following sectors/ resources:
        - Fisheries, hatcheries, and shellfish
        - Public safety, air quality/ health, transportation, and infrastructure
        - Natural resources (habitat and wildlife restoration and conservation), water quality

Appendix C: Glossary and Acronyms

Glossary

Adaptive management: reliance on scientific methods to test the results of actions taken so that the management and related policy can be changed promptly and appropriately. (WAC RCW 77.85.010)

Attribute: characteristics that can serve as indicators of the structure and function (i.e., health) of ecosystem focus areas (Conservation Measures Partnership)

Climate change: Climate change describes a change in the average conditions over a long period of time. Scientists agree that the Earth has been getting warmer over the last century due to human activities that require burning fossil fuels (oil, gas, and coal). (WA ECY website)

Effluent: the water that leaves industries, businesses, farms, and homes. This includes water from sources like sinks, showers, toilets, pulp mills, and manufacturing companies. Different contaminants and pollutants enter wastewater depending on how and where water is used. Wastewater must be treated to remove these pollutants before it can be released back into the water environment. (WA ECY)

Equity: when race can no longer be used to predict life outcome and outcomes for all groups are improved (Government Alliance on Race and Equity website)

Estuary: partially enclosed coastal water body where freshwater from rivers and streams mixes with salt water from the ocean (US EPA website)

Floodgates: adjustable gates used to control water flow in flood barriers, reservoirs, rivers, streams, or levee systems

Floodplain: the land adjacent to the channel and other lands up to an elevation based on the elevation reached by a flood peak of a given frequency. Boundaries are defined based on the flood frequency (100, 500 years, etc). (US EPA website)

Hydrologic regime: how water moves in an area

Lead Entity: local, citizen-based, organizations that coordinate salmon recovery efforts in their local watersheds (PSP website)

Levee: A man-made structure, usually an earthen embankment or concrete floodwall, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide reasonable assurance of excluding temporary flooding from the leveed area (US ACE)

Limiting factor: Pressures and stressors are roughly equivalent to limiting factors, which is a term used in salmon recovery planning

Local Integrating Organization: local forums that meet regularly throughout the year to collaboratively work to develop, coordinate, and implement strategies and actions that that contribute to the protection and recovery of the local ecosystem (PSP website)

Nearshore: The nearshore is a narrow ribbon of land and shallow water that rings Puget Sound. It includes the cliffs or bluffs that neighbor beaches, portions of streams and rivers that are influenced by the tides, and shallow water areas to a depth where sunlight no longer supports marine vegetation (known as the photic zone). (WDFW)

Non-point source pollution: pollution, unlike pollution from industrial and sewage treatment plants, that comes from many diffuse sources. It is caused by rainfall or snowmelt moving over and through the ground. As the runoff

moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and ground waters. (US EPA)

Point source pollution: any single identifiable source of pollution from which pollutants are discharged, such as a pipe, ditch, ship, or factory smokestack (US EPA)

Pollutant: dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water (US EPA)

Pressure: human attitudes, social systems, and activities that give rise to stress in the ecosystem, such as development, transportation corridors (highways and railroads), and pollution (Puget Sound Pressures Assessment)

Puget Sound Partnership: state agency leading the region's collective effort to restore and protect Puget Sound. The Puget Sound Partnership brings together hundreds of partners to mobilize partner action around a common agenda, advance Sound investments, and advance priority actions by supporting partners. (PSP website)

Puyallup River Watershed Council: the mission is to restore, protect and enhance the environmental, economic and cultural health of our watershed, from Mount Rainier to Commencement Bay. We are citizens and representatives of businesses, governments and other groups collaborating to achieve clean water, healthy habitats and thriving communities. (PRWC website)

Revetment: structures placed along the riverbank to stabilize or protect the bank from erosion (USACE)

Riparian buffer: plant communities that form the transition between land and water comprise a riparian zone (Washington Forest Protection Association)

Riparian: interface between terrestrial and aquatic ecosystems. It may also include adjacent vegetation that can influence both the aquatic system and the terrestrial-aquatic interface (USFS)

Shoreline armoring: practice of constructing bulkheads (also known as seawalls) and rock revetments, disrupts the natural process of erosion, which supplies much of the sand and gravel that forms and maintains our beaches. Erosion also creates habitat for herring, surf smelt, salmon, and many other species in Puget Sound. Over time, shoreline armoring may cause once sandy beaches to become rocky and sediment starved, making them inhospitable to many of our native species. (Encyclopedia of Puget Sound)

Stormwater: rain and snow melt that runs off rooftops, paved streets, highways, and parking lots. As it runs off, it picks up pollution like oil, fertilizers, pesticides, soil, trash, and animal manure. Most stormwater is not treated, even when it goes into a street drain. It flows downstream directly into streams, lakes, and marine waters. (WA ECY website)

Strait: narrow passage of water connecting two larger areas of water

Strategy: A set of actions with a common focus that work together to achieve specific goals and objectives by targeting key intervention points, integrating opportunities, and limiting constraints. A good strategy meets the criteria of being: linked, focused, feasible, and appropriate. (Conservation Measures Partnership)

Stressor: proximate causes of change in the environment that the pressure affects (Puget Sound Pressures Assessment)

Tidegates: allow water to flow downstream, but prevents water flowing upstream

Tributary: river or stream flowing into a larger river or lake

Watershed: an area of land that drains all the streams and rainfall to a common outlet (USGS). In this case, everything drains to the Puyallup River, which drains to Commencement Bay.

Acronyms

- BIPOC: Black, Indigenous, People of Color
- BMA: Biodiversity Management Area
- BOD: Biological Oxygen Demand
- CAC: Citizens' Advisory Committee
- CCD: Community-Centered Design
- CDC: Center for Disease Control
- COI: Community of Interest
- CWPP: Community Wildfire Protection Plan
- ECY: WA Department of Ecology
- ELJ: Engineered Log Jam
- EPA: US Environmental Protection Agency
- ERP: Ecosystem Recovery Plan
- FFTF: Floodplains for the Future
- GHG: Greenhouse Gas
- LA: Load Allocation
- LEP: Limited English Proficiency
- LID: Low Impact Development
- LIO: Local Integrating Organization
- M&AM: Monitoring and Adaptive Management
- Mg: Megagrams
- MOS: Margin of Safety
- MS4: Municipal Separate Storm Sewer System
- NPDES: National Pollutant Discharge Elimination System
- OSS: On-site Sewage System
- PCB: Polychlorinated Biphenyl
- PCD: Pierce Conservation District
- PM: Particulate Matter
- PRWC: Puyallup River Watershed Council
- PSP: Puget Sound Partnership
- RM: river mile
- SCAP: Strategic Climate Action Plan
- SCP: Strategic Conservation Partnership
- SPSSEG: South Puget Sound Salmon Enhancement Group
- TAG: Technical Advisory Group
- TMDL: Total Maximum Daily Load
- TPCHD: Tacoma Pierce County Health Department
- WAC: Washington Administrative Code
- WLA: Waste Load Allocation
- WRIA: Water Resources Inventory Area

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