



STATE OF THE SOUND

R E P O R T 2 0 2 1



The Salish Sea is a bioregion encompassing the inland marine waterways of British Columbia and Washington and their watersheds. The State of the Sound addresses the southern portion of the Salish Sea within Washington.

The Puget Sound Partnership acknowledges the ancestral and contemporary lands called home by Indian tribes and nations since time immemorial. We recognize tribal sovereignty and learn from tribal stewardship of this place.

» CONTENTS

Map	2
Acknowledgements	4
Appendices	4
Letter from the Director	5
Letter from the Leadership Council	6
Comments from the Science Panel	8
How is Puget Sound doing?	9
Puget Sound Vital Signs help gauge ecosystem health	10
Overview of target status and progress of indicators.....	12
Our partners help us monitor the ecosystem.....	16
Healthy Water Quality	18
Abundant Water.....	22
Protected and Restored Habitat.....	24
Thriving Species and Food Web	28
Vibrant Human Quality of Life.....	32
Healthy Human Population	36
References.....	42
What are the challenges to progress?	43
Funding does not meet the need	44
Changing ocean and climate conditions already affect the ecosystem	46
Developmental pressure is driving the conversion of ecologically important lands.....	49
We haven't heard all the voices	50
What gives us hope?	51
Our delegation and federal partners advance Puget Sound recovery	52
The Washington State Legislature approved major policies and funding that support recovery	53
Partners are coming together to shape the 2022-2026 Action Agenda and ensure it responds to the scale of the challenge	54
People are committed to restoring and protecting Puget Sound.....	56
A call to action to save Puget Sound	57
For the State Legislature.....	58
For state agencies	58
For local governments.....	59
For Congress.....	59
For federal agencies.....	59
For non-governmental organizations	59
For the Puget Sound Partnership.....	60
For business	60
For the public.....	61
For tribes.....	61

2021 STATE OF THE SOUND

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» Acknowledgements

Leadership

Laura Blackmore, Director
Larry Epstein,
Deputy Director

Rebecca Hollender

Jenna Judge
Wessyl Kelly
Beihua Page
Jeff Parsons

Freshwater Work Group
Marine Birds Work Group
Marine Mammals Work Group

Phillip Dionne
Margaret Dutch
Brad Hanson
Sheryl Howe

Project managers

Jon Bridgman
Nathalie Hamel
Alex Mitchell

Katrina Radach
Mary Ramirez
Scott Redman
Jillian Reitz

Marine Waters Work Group
Modeling Work Group
Nearshore Work Group
Salmonids Work Group
Spatial Data Work Group
Stormwater Work Group
Toxics Work Group

Neala Kendall
Christopher Krembs
Jay Krienitz
Kate Macneale
Amber Moore
Scott Pearson

Lead writers

Kevin Hyde

Erin Ryan-Peñuela
Andres Sheikh

Vital Sign indicator leads:

Rabia Ahmed
Lynne Barre
Scott Berbells
Kelly Biedenweg
Robert Black
Jennifer Burke
Susan Burke
Jennifer Carlson
Bart Christiaen
Tish Conway Cranos
Rick Dinicola

Ken Pierce
Mary Ramirez
Scott Redman
Julianne Ruffner
Todd Sandell
Jill Schulte
Jim Shedd
Jeremy Simmons
Doris Small
Camille Speck
Don Velasquez
Markus Von Prause
Brian Walsh
James West

Graphic design

Chase Nuuhiwa

Dan Stonington
Stephanie Suter
Ron Thom

Maps

Jennifer Burke

David Trimbach
Elene Trujillo
Katherine Wyatt

Contributing staff

Tristan Contesse
Alexandra Doty
Don Gourlie
Kristin Hayman

Puget Sound Ecosystem Monitoring Program

Lisa Chang, Chair
Diseases Work Group
Forage Fish and Food Webs Work Group

» Appendices

[Appendix A: The full Science Panel letter](#)

[Appendix B: The 2021 State of the Sound statutory reporting \(RCW 90.71.370, 3a-f\)](#)

The statutory report includes:

- a. An assessment of progress by state and nonstate entities in implementing the action agenda, including accomplishments in the use of state funds for action agenda implementation;
- b. A description of actions by implementing entities that are inconsistent with the action agenda and steps taken to remedy the inconsistency;
- c. The comments by the panel on progress in implementing the plan, as well as findings arising from the assessment and monitoring program;
- d. A review of citizen concerns provided to the partnership and the disposition of those concerns;
- e. A review of the expenditures of funds to state agencies for the implementation of programs affecting the protection and recovery of Puget Sound, and an assessment of whether the use of the funds is consistent with the action agenda; and
- f. An identification of all funds provided to the partnership, and recommendations as to how future state expenditures for all entities, including the partnership, could better match the priorities of the action agenda.



Laura Blackmore, Executive Director

When we published the last State of the Sound report in 2019, we could not have foreseen what was to come: a global pandemic, a social justice reawakening, terrifying wildfires that poisoned the air in Puget Sound, a contested election, and a heat dome that sent June temperatures in the Puget Sound region soaring over 100F, killing humans and marine creatures alike. These challenges – most of them of our own making – have tested us over the past two years.

Perhaps it is not surprising that the 2021 State of the Sound report also mainly presents challenges. Very few of our indicators met their 2020 targets. The Southern Resident orca population hovers at 74 animals, and Chinook salmon populations show no signs of recovery. Marine water quality continues to decline.

However, these past two years also have shown us that we are resilient, even in the face of loss. We are finding ways to navigate the pandemic, and to reach out to those who need some help doing so. Many of us are grappling in our own ways with the long-overdue reckoning of the social justice movement. And hundreds if not thousands of people continue to pour their time, energy, hearts, and souls into Puget Sound recovery.

This agency's mission is to accelerate Puget Sound recovery. It will take all of us – all who live in and care about this special place – working together to restore Puget Sound to resilience. We know that national and global action is necessary to combat climate change. In the meantime,

Puget Sound needs us to redouble our efforts to protect and restore habitat, clean up the water, cool our rivers and streams, and ensure there is local food to harvest. If we don't, we risk losing our salmon and orca as the climate warms and our population inexorably grows. With their loss, we humans lose something of ourselves, too.

Regional decision-makers made the right decisions for Puget Sound often enough over the past 10 years that some of our habitat indicators show signs of progress. That trend must continue, but it's only going to get more difficult as we face the very real need to provide affordable housing, transportation, and other services for human beings here in this special place. We must support regional decision-makers and work together to find solutions to ensure people of all walks of life can continue to enjoy the bounty of the Puget Sound region.

We know what we need to do for Puget Sound. Let's do it.

» Leadership Council letter

We are proud to present the *2021 State of the Sound* report.

This past year has been extraordinary. Unusually extreme weather and climate events have struck nearly every state, from the coasts to the heartland. The COVID-19 pandemic continues to inflict a devastating toll on our public health and our communities. The adverse economic effects have been nearly as significant. As the pandemic raged, racial injustice once again sparked outrage across our land.

Even in these challenging times, the Puget Sound region remains an attractive place to live. Our economy and population continue to grow, with upwards of 7.7 million people now calling Washington State home and the Seattle metro area alone recently surpassing Atlanta as the tenth largest regional economy in the U.S. Most analysts forecast continued economic growth in the region, and with it a growing population. Unabated, these changes increase impacts to our land, water, air, and wildlife.

The connection between a healthy Puget Sound and human wellbeing is clear. Recent studies strongly demonstrate that Puget Sound residents of all races and ethnicities are finding happiness, tranquility, and recreational opportunities in Puget Sound's green and blue spaces. We

are fortunate to live in a place with abundant and unparalleled access to mountains, forests, rivers, parks, and beaches. It is incredibly important that we increase opportunities for everyone – from every background – to enjoy the restorative and sustaining green and blue open spaces of this remarkable place we call home.

How, though, are these special places faring? We look to our Puget Sound Vital Signs for a status check on the health of the ecosystem around us. Unfortunately, most of our Vital Sign indicators are static or slowly getting worse. Few meet – or even approach – the recovery targets we set for them. Notably, no Species and Food Web indicators have improved and some of our most iconic species – including Southern Resident Orcas and Chinook salmon

– are far from recovery targets with trajectories heading in the wrong direction. Many indicators related to marine and freshwater quantity and quality are also worsening, and the impacts of climate change will further hasten downward trends.

Indeed, this summer's heat wave in the Puget Sound region showcases the unprecedented threat of climate change. The Seattle area rarely experiences triple digit temperatures: prior to this summer, we'd only reached the 100-degree mark three times in the past 117 years. In late June, however, we witnessed three consecutive days of high temperatures exceeding 100 degrees Fahrenheit. This extraordinary heat literally cooked more than a billion of shellfish alive on exposed tide lands. The aggregate impact on wildlife is not currently known.

Despite these ominous signs, there remains cause for some cautious optimism: During the past two years, conversion of forests and ecologically important lands slowed down. Investments in restoration continue to improve degraded habitats in many Puget Sound watersheds. Salmon runs in Hood Canal are improving— a happy deviation from populations in other parts of the Sound. In the context of increasing climate impacts and continued regional growth and development, reversing negative trends is a notable accomplishment. Our task now is to build on – and rapidly accelerate – the positive trends.

Let us be crystal clear that we, the Puget Sound Partnership's Leadership Council, believe that lasting, durable recovery of Puget Sound is possible. We offer the following as bold, decisive actions we must take over the next two years to support a resilient Puget Sound ecosystem for people and for the creatures with whom we share this special place:

1. Work with the Governor's Office to make Puget Sound and salmon recovery the cornerstone of Governor Inslee's third term;
2. Establish a new funding source – such as a Puget Sound Recovery Fund – and significantly increase funding for habitat restoration, road retrofits to manage stormwater, and wastewater treatment systems to protect shellfish beds;
3. Bring the State Growth Management Act and Shoreline Management Act into the 21st century with a Net Ecological Gain standard, and other updates that will reverse historic habitat loss;
4. Broaden and deepen the coalition demanding a healthy Puget Sound, including annually convening Puget Sound Day on the Sound, to highlight Puget Sound recovery needs and generate political momentum for necessary decisions and investments; and
5. Implement systems of accountability, performance measurement, and adaptive management to ensure our investments in Puget Sound recovery deliver the transformational results we need.

Climate change and explosive population growth are upon us. Nevertheless, we've experienced signals that the system can indeed respond when we take decisive action and build toward a resilient ecosystem. With our dedicated network of partners, there has never been a better or more urgent time to act.

Jay Manning, Chair
Stephanie Solien, Vice Chair
Will Hall
Russell Hepfer
Deborah Jensen
Dennis McLerran
Toby Murray

» Comments from the Science Panel

We must act decisively to achieve our mutual interests in a Puget Sound that sustains a healthy economy, ecology, and environment for all.

Our world has changed since the *2019 State of the Sound* report. The continued impacts of climate change and a transition in national leadership have shifted how we must approach Puget Sound recovery. In particular, a heightened focus on social justice has brought about a new emphasis on the human dimensions to the recovery project. The pace of climate change and its associated impacts increases the need for a resilient ecosystem and increases the scale and scope of needed actions and protections. Current circumstances amount to a critical turning point; the recent pandemic has shown that such situations can bring about wholesale modifications in behaviors and policies.

Creative thinking and bold actions are urgently required to make the transformative gains we seek in the Puget Sound socioeconomic system; this is a key overall theme of the Science Panel's comments. While the road ahead remains challenging, we must redouble our commitment to forge a future Puget Sound that embodies the scientific principles, ecological relations, and human values that provide the foundation for resilience, sustainability, and equity.

Despite some impressive gains in several areas of the recovery project, we have yet to see truly transformative changes in the Puget Sound ecosystem. Some dimensions of the ecosystem are improving, but at the whole system level we have not seen the needle move as much. For that to happen, we need to make hard choices about the future we want. To help make the decisions that will lead to system-level change under current projections for climate change and population growth, we are investigating alternative future scenarios. Advances in modeling that better

address uncertainties allow us to project the impacts of our actions on ecosystems, how communities make choices, and policy decisions in a formal way. This effort will provide valuable insights on potential future conditions to complement our reflections on the observed impacts of past actions.

To be transformative we must recognize and embrace ecosystem recovery as a human as well as ecological process. A critical component of ecosystem recovery is ensuring human wellbeing in all its dimensions. Puget Sound recovery requires acting collectively on a large scale over an extended period of time towards ends that may not be realized soon afterwards. Part of any successful strategy for Puget Sound recovery will be achieving buy-in from a broad coalition of residents, stakeholders, and politicians — it gets to the very core of understanding what motivates individuals and groups to act in their short-term but also long-term interests, and at both local and broader scales.

We are not going back to a past Puget Sound. We are moving forward into a future that must establish resilience in the Puget Sound ecosystem. Resilience depends on three components: diversity, connectivity, and adaptation. Promoting these three components in our recovery actions will help create resilience. Resilience is also a management strategy as well as an attribute of a system, encouraging us to adopt adaptive rather than rigid tactics. The Partnership's Alternative Futures Project will assess the strategies that should prove successful given factors such as a warming climate and population growth. Resilient strategies should be part of our interventions in ecosystems, to allow us to enhance the chances of a healthy Puget Sound under a broad range of possible future human activities on ecosystems.

Read the entire [Science Panel letter](#)

» How is Puget Sound doing?

► Puget Sound Vital Signs help gauge ecosystem health

The [Puget Sound Vital Signs](#) are measures of ecosystem health that guide the assessment of progress toward six statutory Puget Sound recovery goals (figure 1). The Legislature established those goals in statute in 2007. We express each of the six recovery goals with one or more Vital Signs that represent important components of the ecosystem, including human wellbeing (e.g. marine water quality, economic vitality; figure 2). We use one or more indicators to measure specific aspects of each ecosystem component.

In 2011, the Partnership adopted [ecosystem recovery targets](#) (targets), which are science-informed statements of desired future conditions for the indicators. Using the most recent data available, we report here on whether targets set for the year 2020 were achieved. With year 2020 behind us, the Partnership is reviewing the 2020 targets and working with our boards and partners to select new targets over the next few years.



Figure 1. Statutory ecosystem recovery goals for Puget Sound

Puget Sound Vital Signs include aspects of human wellbeing

Vital Signs include [measures of human wellbeing](#) that illustrate the human or social aspects of ecosystem health in the Puget Sound region. An example of such measures is the number of jobs in natural resource sectors. Thanks to these measures, we include human-related factors in our recovery efforts and recognize the key role of social sciences in providing concepts, methods, theories, and toolkits necessary to understand, address, and integrate human wellbeing into ecosystem recovery.

Knowing about aspects of human quality of life and health help the Puget Sound recovery community make good decisions about how best to sustain healthy ecosystems while also:

- Promoting strong communities
- Promoting a thriving economy and
- Supporting diverse cultures and ways of life.



Figure 2. Puget Sound Vital Signs adopted by the Puget Sound Partnership in years 2010 and 2015

Overview of target status and progress of indicators

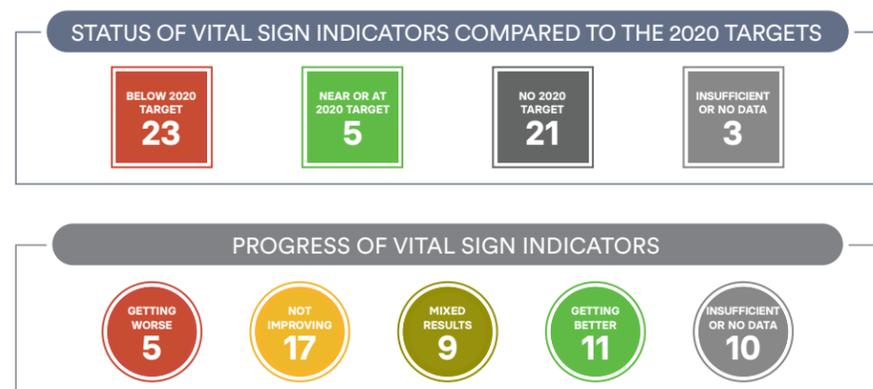


Figure 3. Number of indicators in each category of status relative to their 2020 ecosystem recovery targets and progress of indicators. The status of indicators tells us whether indicators are meeting their 2020 recovery targets. The progress of indicators tells us how indicators have changed over time.

Puget Sound is not doing well, but we see signs of progress

After more than 10 years of reporting indicators and comparing them to ecosystem recovery targets for 2020, patterns emerge:

- Few indicators reached their 2020 ecosystem recovery targets, signaling that ecosystem conditions are not good enough to say the system is resilient or recovered.
- We see the most progress for the habitat goal. Success arises in areas where decision-makers and land managers have direct influence on habitat outcomes, for example, restoring estuaries and floodplains or preventing conversion of ecologically sensitive lands. Many indicators in the habitat goal measure restoration and land conversion. Where our recovery community is involved, we see progress.
- We see the least progress in indicators affected by multiple factors (such as salmon and orca population abundance) and large-scale forces, such as climate change (which affects marine water quality), and where we rely on decisions made nationally or even globally to create positive change.
- Taken all together, indicators send mixed signals about the health of Puget Sound.
 - » About half of indicators are either not improving or getting worse.
 - » Many indicators are not trending in any direction.
 - » Some indicators show mixed results as conditions may be better or worse, depending on location.
 - » Most Puget Sound Vital Signs are changing slowly at best.

The recovery community is making a difference. When tribal, federal, state, and local decision-makers work together to protect and restore Puget Sound, the ecosystem improves. However, we must redouble our efforts to ensure the scale of our response matches the scale and urgency of the problem. We need to focus our monitoring efforts to better understand the causes of change, including changes in the health and quality of life of Puget Sound residents.



Water Quality overview

From mountain peaks to the mouth of Puget Sound rivers to the Pacific Ocean, water connects different parts of the ecosystem. However, the condition of this key resource is at risk for all who depend on it.

Water quality is at risk, but we see notable improvements in places.

- Sediment health at the bottom of Puget Sound shows hopeful signs. An index of exposure to chemicals came within reach of its 2020 target. Also, the number of chemicals found in sediments decreased over the past 20 years in Elliott Bay and Commencement Bay—some of the most urbanized bays in Puget Sound.
- While the health of streams and freshwater quality vary locally, areas less affected by development and that have less impervious surfaces have better water quality.
- Puget Sound water temperatures were generally warmer than normal in recent years but not as warm as during the “2014-2016 blob” of warm water from the Northeast Pacific Ocean. Combined signals from temperature, salinity, oxygen, and nutrients show declining conditions in the marine environment compared to 20 years ago.
- Many contaminants in fish species are a cause for concern, both for the health of species and for the wider food web, including humans, although declines in PBDEs are notable.

We must do more to improve water quality, especially since climate change and an increase in the human footprint will add to the challenges that already exist in the ecosystem. We must restore the health of both marine and freshwaters for the recovery of the whole Puget Sound region.



Abundant Water overview

Puget Sound depends on freshwater that comes from the Olympic and Cascade mountains. Rain, snow, and glacier meltwater recharge our rivers and groundwater. Streamflows vary with the seasons and affect the people, fish, and wildlife that need enough water to survive.

Climate change continues to threaten our water supply.

- The lowest flows, measured in the summertime, have been declining in most rivers since the 1970s. Loss of streamflows in summer months translates into a loss of habitat for fish and is also correlated with lower adult salmon returns.
- The future effects of climate change will worsen the declines in summer low flow, threatening salmon growth and survival.

We must restore natural hydrology and sustain water resources for people, fish, and wildlife by reducing peak flood flows and maintaining or increasing low flows caused by land conversion and development.



Protected and Restored Habitat overview

Habitats are our shared natural heritage and create the quality of life that makes Puget Sound an attractive place to live, work, and play. Human activity and development have deeply changed the Puget Sound region.

Conversion of ecologically important lands has slowed, but habitat loss continues throughout Puget Sound ecosystems.

- Humans made habitat gains and improvements through restoration efforts and slowed down the conversion of forests and other ecologically important habitat.
- Preserving habitat is also key for human wellbeing, as it ensures that tribal treaty rights are respected and people have access to land and waters vital for their wellbeing.
- Climate change poses a high risk to most Vital Signs related to the Protected and Restored Habitat goal, with floodplains, estuaries, and shorelines at the greatest risk.

We must counteract the growing human footprint and protect and restore habitat in ways equitable to all, while also making net gains in ecosystem function.



Species and Food Web overview

A diverse and resilient food web allows for healthy and sustaining populations of native species in the Puget Sound. Healthy habitats, water quality, and the dynamic relationships between species must be restored and preserved to ensure a thriving food web.

None of the indicators for species and food webs have improved. Some species continue to decline while others are maintaining their levels.

- Orca populations, a species in danger of extinction, is only a fraction of what we hoped for by 2020. At last count, there were 74 whales, a mere three-quarters of the 2020 target of 95 whales.
- Puget Sound Chinook salmon, also a threatened species, remain at historic lows and have not experienced significant population changes since they were listed in 1999.
- Marbled murrelets, a threatened species, are declining. Other marine birds, rhinoceros auklets and pigeon guillemots, are maintaining their population abundances.
- Climate change poses a high risk to most Vital Signs related to Thriving Species and Food Web, particularly with orcas, Chinook salmon, and Pacific herring.

We must do more throughout the Puget Sound region to improve native species populations to sustaining levels.



Vibrant Quality of Life overview

A healthy ecosystem provides aesthetic values, opportunities for recreation, and access for the enjoyment of Puget Sound. Tribal cultures depend on the ability to exercise treaty rights to fish, gather plants, and hunt for subsistence, cultural, spiritual, ceremonial, and medicinal needs. Human wellbeing is also tied to economic prosperity.

Humans have complex, reciprocal relationships and interactions with the environment—ones that can contribute to the decline or health of the Puget Sound ecosystem.

- Understanding nature's influence on people and how we contribute positively to nature allows us to make plans that meet recovery goals for both the ecosystem and people.
- When we consider residents and their wellbeing at all phases of design, planning, and implementation, we improve recovery effort outcomes.
- We now have baseline information about human quality of life in Puget Sound.
- Survey results show that Puget Sound residents have a strong sense of place.
- Survey results show that Puget Sound residents vary in their level of trust in how the environment is managed.
- The region is making progress with overall growth among natural resource industries, largely driven by growth in the recreation and tourism sector.
- Our social sciences work tells us that Puget Sound ecosystem recovery improves the quality of life and connection to the environment for people living in Puget Sound.

We must ensure human wellbeing, in a just, equitable, diverse, and inclusive manner, when protecting and recovering the Puget Sound ecosystem.



Healthy Human Population overview

Humans are part of the Puget Sound ecosystem. From the air we breathe and the water we drink, to the local foods we eat and the parks we enjoy, a healthy Puget Sound supports a healthy human population. However, pollution and unequal access to natural resources degrades the health of Puget Sound residents.

Puget Sound offers foods that grow locally, clean water to drink, and places for recreation, yet many communities face disproportional health risks.

- The Puget Sound region provides an abundance of locally harvestable foods and outdoor opportunities that benefit people’s physical and mental health. Interacting with nature through outdoor activities helps to form and strengthen residents’ sense of place and stewardship of the environment.
- Air pollution impacts both urban and rural communities and the severity of local and regional wildfires in recent years has exposed all Puget Sound residents to poor air quality. Vulnerable communities are often disproportionately exposed to degraded air quality.
- Some areas, northwestern Whatcom County in particular, have experienced widespread and decades-long nitrate contamination, primarily from fertilizers and manure applied to crops. However, most groundwater in Puget Sound is not contaminated by nitrates.
- The Department of Health must limit shellfish harvest and swimming in some areas to protect public health. Overall, we see positive to no trends in closures and advisories due to water quality.
- Toxics in fish and pollution in our water limits the amount of seafood we can safely eat. This raises concerns regarding inequitable health impacts on certain communities who rely on local Puget Sound seafood.
- Climate change is negatively impacting – and will continue to negatively impact – all of these factors that are so critical for healthy human populations.

We must continue to support tribal, federal, state, and local efforts to protect and restore farmlands while reducing harmful runoff. We must keep working regionally to prevent wildfires, and support state, national, and global efforts to mitigate climate change.

Our partners help us monitor the ecosystem

It takes many partners, working side by side, to monitor the ecosystem. The ecosystem is complex. No single source of information exists about how the ecosystem is doing. To answer questions about the ecosystem, we use different sources of information from across the Puget Sound recovery community.

Monitoring delivers key information to evaluate Puget Sound recovery

The Puget Sound Ecosystem Monitoring Program, or PSEMP, is a network of experts who organize and communicate scientific information from different parts of the Puget Sound ecosystem.

Scientists and partners serve as the region’s eyes and ears to assess:

- ecosystem status and trends;
- progress toward Puget Sound recovery; and
- the success of recovery actions.

The science and monitoring data produced by the PSEMP network help inform policies, investments, and actions to advance recovery.

PSEMP builds connections among this network of partners from diverse organizations. The program includes topical work groups for a coordinated approach to monitoring, data sharing, and assessment. Collaboration in monitoring helps us find opportunities for action. Together, partners work to protect and enhance Puget Sound now and for future generations.

The Partnership supports PSEMP and its work groups by supplying staff capacity, funding monitoring projects, and promoting connections to ecosystem recovery efforts. The Partnership has awarded state and federal funds for PSEMP projects that improve monitoring efforts in support of Puget Sound recovery. All projects are expected to support the objectives of the PSEMP’s Strategic Plan to increase collaboration, support adaptive management, and improve communication. Under the latest solicitation *Monitoring to Accelerate Recovery in 2021*, projects should also address cross-cutting principles of integrating biophysical and social sciences, justice, equity, diversity, and inclusion, and climate change.

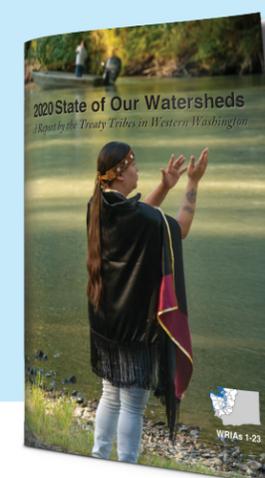
In 2019-2021, the Partnership funded six projects with the following outcomes: a nearshore restoration summit and proceedings, a dashboard of climate and oceanographic measures, an annual marine water overview, estuary bird habitat models, prioritizing contaminants of emerging concerns, and juvenile salmon monitoring. For more information about these PSEMP projects, please see [Puget Sound Partnership - PSEMP products](#).

Together with partners throughout the PSEMP network, we track more than 50 indicators.

In this chapter, we draw from findings reported in the [Vital Sign web module of Puget Sound Info](#), a collaborative platform for publicly sharing information about Puget Sound recovery accomplishments and progress toward recovery goals. We also incorporate monitoring results published by the topical work groups supported by PSEMP. Finally, we draw from the scientific work and invaluable knowledge of our tribal partners at the Northwest Indian Fisheries Commission and their seminal *State of Our Watersheds Report*.

Findings in Puget Sound Info represent data and narrative contributed by dozens of people from state and federal agencies, local jurisdictions, tribes, not-for-profit environmental organizations, academia, and consultants. Leads for reporting on indicators contribute data and narrative, while topical work groups in PSEMP review the indicators and synthesize information to produce high-level messaging for each Vital Sign.

Partners leading the work to report on indicators for the Puget Sound Vital Signs:



The Northwest Indian Fisheries Commission’s *State of Our Watersheds Report* delivers important signals

Every four years, the Northwest Indian Fisheries Commission publishes the *State of Our Watersheds Report*. The report shows trends in environmental conditions and key issues for the treaty tribes in western Washington.

Each tribe provides indicators and special topics that tie to the region’s environmental health. The report focuses on many water, habitat, and species concerns shared by the Puget Sound recovery community.

We include signals about ecosystem conditions from the report for each of the Puget Sound recovery goals below.



▶ HEALTHY WATER QUALITY

STATUTORY GOAL

Fresh and marine waters and sediments of a sufficient quality to support water that is safe for drinking, swimming, and other human uses and enjoyment, and that are not harmful to the native marine mammals, fish, birds, and shellfish in the region.



VITAL SIGN	STATUS	PROGRESS
FRESHWATER QUALITY		
Freshwater impairments	■	●
Benthic Index of Biotic Integrity	■	●
Water Quality Index	■	●
MARINE SEDIMENT QUALITY		
Chemicals exceeding Sediment Quality Standards	■	●
Sediment Quality Triad Index	■	●
Sediment Chemistry Index	■	●
MARINE WATER QUALITY		
Marine Water Condition Index	■	●
Dissolved oxygen in marine waters	■	●
TOXICS IN FISH		
Contaminants in adult Chinook salmon	■	●
Contaminants in English sole	■	●
Contaminants in juvenile Chinook salmon	■	●
Contaminants in Pacific herring	■	●

Figure 4. Indicators for Healthy Water Quality, by Vital Sign, and whether they are making progress and meeting their 2020 targets.

KEY

■ BELOW 2020 TARGET	■ NEAR OR AT 2020 TARGET	■ NO 2020 TARGET	■ INSUFFICIENT OR NO DATA	● GETTING WORSE	● NOT IMPROVING	● MIXED RESULTS	● GETTING BETTER	● INSUFFICIENT OR NO DATA
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One indicator of the Healthy Water Quality goal met the target

While only one of the 11 indicators with targets in the Healthy Water Quality goal met its 2020 target, more improved. The Sediment Chemistry Index indicator is the only indicator that was within reach of its 2020 target. Exposure to chemicals in sediment has generally been minimal throughout the past 20 years and has remained in good condition. However, improvements in Elliott and Commencement Bays are particularly noteworthy, especially given that they are situated in more urbanized and industrial landscapes.

Other signals for marine and freshwater water quality did improve in some places or at least stayed the same, namely the Water Quality Index of freshwater, the Benthic Index of Biotic Integrity, and indicators of contaminants in different fish species in different habitats. The Marine Water Condition Index is the only indicator that has steadily declined over the past few decades.

- Aspects of freshwater quality such as oxygen and temperature generally have stayed about the same over the past 20 years for a given river – if conditions were good, they stayed good, and if they were bad, they stayed bad. Water quality issues are localized, and the condition of some streams, when measured in terms of insect life using the Benthic Index of Biotic Integrity, have degraded over time. Some streams where the condition was categorized as excellent dropped to a more degraded “good” category. BIBI scores are correlated with land use conversion and urbanization, with poorer conditions in watersheds with greater urban development. Stormwater runoff from urban and urbanizing areas causes the majority of habitat and water quality degradation in small streams.
- In 2019, Puget Sound waters were warmer and saltier than average – although not as warm as during the “blob” of warm water from the Northeast Pacific Ocean (2014-2015). Abnormally warm and salty waters impact the Puget Sound food web; however, predicting effects on species is difficult. Warmer waters can be inhospitable to some animals (like salmon) but welcoming to other animals (like anchovy). And impacts can be complicated: warmer waters may support more abundant zooplankton populations or different types of zooplankton, which can alter food availability for fishes like Chinook salmon and Pacific herring.
- Marine water quality generally continues to decline as shown by [Marine Water Condition Index \(MWCI\) scores](#) and other measures such as oxygen, temperature, pH, and nutrient balances documented in the [Marine Waters 2019 Overview](#). Declines were noteworthy in Bellingham Bay, Whidbey Basin, and further north in the Georgia Basin, Canada. Dissolved oxygen levels in many parts of Puget Sound were lower on average in 2019 compared to the baseline (1999–2008) conditions, continuing a six-year declining oxygen trend. Ocean acidification is a continuing problem, particularly in Hood Canal and on the outer coast of Washington, where carbon dioxide concentrations are higher than global averages.
- While exposure to chemicals in sediments may generally have been minimal throughout Puget Sound, the small animals that live in the sediment have nonetheless been affected, though perhaps by other factors. The health of benthic communities is especially degraded in areas with poor circulation and slow water exchange and that are high in organic matter and low in oxygen.
- Aquatic animals in Puget Sound are exposed to complex mixtures of thousands of chemicals that may have cumulative impacts on their health and survival and limit the amount of seafood we can safely eat. The contaminants in Pacific herring and adult salmon indicators failed to meet their recovery targets because PCBs exceed their health effects thresholds. However, PBDEs, a type of flame retardant, declined.
- Thousands of chemicals, known as contaminants of emerging concern, might harm Puget Sound aquatic species but are less well known. Governments do not regulate their levels.
- Other indicators dependent on water quality but that also affect human health point to areas where the resource is unfit for human use or pose a health risk to humans. Such indicators include nitrates in ground water (a source for drinking), water quality at swimming beaches, and shellfish growing areas.

For more details about ecosystem conditions relating to this goal, please see our [Story Map on Puget Sound Info](#).

Climate change poses a risk to healthy water quality

Climate change poses a high risk to most Vital Signs related to Healthy Water Quality. This includes Freshwater Quality, Marine Water Quality, and Marine Sediment Quality. Toxics in Fish is at moderate risk (Siemann and Binder 2017).

Freshwater Quality is at risk from:

- heavier rain events;
- higher peak flows;
- lower summer flows; and
- warming streams.

Marine Water Quality is at risk from:

- ocean warming;
- ocean acidification; and
- heavier rain events.

Marine Sediment Quality is at high risk from:

- heavier rain events;
- coastal erosion and flooding; and
- ocean warming.

Toxics in Fish is at risk from:

- heavier rain events;
- higher peak flows; and
- increasing water temperatures (Mauger and Vogel 2020).



» Signals from the 2020 State of Our Watersheds Report

Water Quality: In 2014 only 7% of the Puget Sound Region’s stream miles were assessed for water quality, a total of ~3,867 miles. Of the assessed streams, 87% were determined to be impaired for one or more parameters and are listed in WA Ecology’s 305b report to EPA. Of the 305b listed impaired streams, 56% are identified as salmonid bearing.

PSEMP Puget Sound Marine Waters Overview

Every year, the PSEMP Marine Waters Work Group produces the [Marine Waters Overview Report](#). The project includes an annual workshop to share observations about changing climatic conditions, water quality, and condition of the lower trophic levels of the food web over the course of the previous year. Over the last 10 years, the Marine Waters Overview has had contributions from over 70 experts at over 30 organizations, representing a wide range of monitoring programs across the region. The information gathered in the report is relevant to many of the Puget Sound Vital Signs.

Notable observations for [2019](#) included:

- Overall, Puget Sound waters have been warmer and saltier over the past few years – although not as warm as during the “blob” marine heatwave of 2014-2016.
- Long-lasting hypoxia (i.e. critically low oxygen concentrations) continues to be observed in Southern Hood Canal, though no fish kills were observed.
- Toxic algal blooms and other water-borne and bacterial pathogens continued to be present in Puget Sound waters but were not any more problematic than they were in previous years.
- Ocean acidification continues to be a concern for Puget Sound waters, especially as it relates to shellfish and other calcifying organisms. The highest values were recorded in deep waters of Whidbey Basin and Hood Canal, and at levels known to be stressful to shell-building organisms.
- Marine plastics continue to be present in samples, waters, and sediments across Puget Sound and have been ubiquitous in sampling collections over the past five years.

Red flags raised by the PSEMP Toxics Work Group

- PCBs remain a problem because they are harming the health of aquatic life and people throughout Puget Sound, despite past and ongoing work to reduce PCB pollution throughout the region.
- Coho salmon die when exposed to 6PPD-quinone, a tire-related contaminant in runoff from roads, particularly in streams in and around cities. This condition is known as urban runoff mortality syndrome.

More details on the [Toxics in Fish Vital Sign webpage](#).



VITAL SIGN	STATUS	PROGRESS
SUMMER STREAMFLOWS		
Summer low flows	■	●

Figure 5. Indicators for Abundant Water, by Vital Sign, and whether they are making progress and meeting their 2020 targets.



The only indicator of the Abundant Water goal fell short of meeting its recovery target

The summer low flow indicator, the only indicator for the Abundant Water goal, did not meet its 2020 target because several rivers (all those without dams or enclosures) had lower than expected flow trends.

- The summer low flow indicator measures the long-term trend of annual summer low flows for each of 12 rivers. Generally, the target calls for stable or increasing summer low flows.
- Summer low flows in most rivers without dams have declined since the 1970s. Regulated rivers, those with dams, have had stable or even increasing flows. This is an expected result, since licensed dams must release agreed-upon instream flows. Therefore, progress of the summer low flows indicator is mixed.
- The Dungeness and Puyallup, two of the unregulated rivers, are meeting the recovery target for stable flows. Water from melting glaciers feeds those rivers.
- Summer low flows in the Puget Sound basin are affected by a variety of human activities, including land-use conversion, forest practices, and human water use, as well as by natural factors such as rainfall. The summer low flow indicator signals the combined effects of human and natural factors, with the potential for climate to mask the effects of human activities.

For more details about ecosystem conditions relating to this goal, please see our [Story Map on Puget Sound Info](#).

Climate change threatens sufficient water quantity

Climate change poses a high risk to the Abundant Water goal (Siemann and Binder 2017).

Summer Streamflows are at high risk from:

- decreased snowpack; and
- increased evaporation and vegetative demand for water.

Accelerated glacial melt may temporarily offset diminishing low flows in some rivers (Mauger and Vogel 2020).

▶ ABUNDANT WATER STATUTORY GOAL

An ecosystem that is supported by groundwater levels as well as river and streamflow levels sufficient to sustain people, fish, and wildlife, and the natural functions of the environment

» Signals from the 2020 State of Our Watersheds Report

Groundwater Withdrawals Impact Surface Flows:

Since 1980, over 67,000 wells have been developed in the Puget Sound Region. Of these, 5,815 were built between 2015-2019, a 40% increase over the number of wells built during the previous five years (2010-2014). This increasing rate of new well installations threatens groundwater availability, which has effects on instream flows and overall ecosystem health across the region.



▶ PROTECTED AND RESTORED HABITAT STATUTORY GOAL

A healthy Puget Sound where freshwater, estuary, nearshore, marine, and upland habitats are protected, restored, and sustained.



VITAL SIGN	STATUS	PROGRESS
EELGRASS		
Sound-wide eelgrass area	■	●
ESTUARIES		
Area of estuarine wetlands restored to tidal flooding	■	●
Estuary restoration meeting salmon recovery goals	■	●
FLOODPLAINS		
Restoration of floodplains	■	●
Floodplain function	■	●
LAND COVER AND DEVELOPMENT		
Rate of forest cover loss to development	■	●
Riparian restoration	■	●
Conversion of ecologically important lands	■	●
Growth in Urban Growth Areas	■	●
SHORELINE ARMORING		
Armor on feeder bluffs	■	●
Net change in permitted shoreline armor	■	●
Use of soft shore techniques	■	●

Figure 6. Indicators for Protected and Restored Habitat, by Vital Sign, and whether they are making progress and meeting their 2020 targets.





While more of the indicators of the Habitat goal are near or at their recovery targets compared to other goals, habitat protection and restoration remains a priority

Four of the 10 habitat indicators with enough data came close to reaching or reached their 2020 targets. Where we have enough data, most of the indicators improved, and none declined. Most indicators for this goal measure the restoration activities by humans in different habitats. So, by improvement, we mean more habitat was gained or improved thanks to restoration. However, while protection and restoration efforts continue, loss of habitat throughout Puget Sound ecosystems also continues.

- Humans have disconnected much of the habitat in river deltas, or estuary habitat at the mouths of rivers, from full tidal flooding. River deltas gained 3,500 acres from restoration projects, but efforts still fell short of the 2020 target. The recovery community made notable gains in tidally inundated wetlands in the Nisqually and Skokomish deltas. Practitioners have restored many acres in rivers in the north like the Snohomish, Stillaguamish, and Skagit, but gains are small compared to historical levels of habitat.
- Only about one-third of Puget Sound’s major river floodplains are in good condition, meaning that they are natural lands and connected to the river. Practitioners have completed floodplain improvement projects to improve or restore 9,550 acres, but the total still ended below the 2020 target. There have been habitat gains in North Sound floodplains, but those gains are still short of historical levels.
- Efforts to restore riparian corridors continued every year through streambank revegetation, invasive species removal, and other activities to re-establish riparian functions.
- Forest loss and the conversion of ecologically important lands under high development pressure continue. However, these indicators of changes in land cover and development have improved in recent years and came in near or at their 2020 recovery target.
- Most urban growth has occurred within already urbanized areas, yet there is increasing development pressure in rural areas that threatens natural habitats.
- Shoreline armor, like bulkheads and seawalls, affects beach habitat by disrupting erosion processes. The indicator for permitted shoreline armor measures the net change in permitted shoreline armor (new minus removed). By 2020, more armor had been permitted for removal than construction, resulting in a net removal length of 739 feet. A net permitted removal of armor meets the 2020 target for this indicator. Experts think that increased awareness of the impacts of armor on shoreline functions was one factor in reaching the target. In addition, efforts to seek potential removal opportunities and to encourage the use of soft techniques across Puget Sound have helped limit new armor permits.
- Eelgrass is the only Vital Sign with an indicator—Sound-wide eelgrass area—that has a stable trend. Eelgrass health depends largely on the quality and clarity of the water, and while there are eelgrass declines in the San Juan Islands and South Puget Sound, it is reassuring that total eelgrass has been relatively stable when compared to other developed areas.

For more details about ecosystem conditions relating to this goal, please see our [Story Map on Puget Sound Info](#).

Climate change impacts upland and nearshore habitats

Climate change poses a high risk to most Vital Signs related to the Protected and Restored Habitat goal. This includes Floodplains, Estuaries, and Shoreline Armoring. Eelgrass and Land Cover and Development are at low risk (Siemann and Binder 2017).

Floodplains are at high risk from:

- lower summer streamflows;
- higher winter peak streamflows;
- altered sediment dynamics; and
- warming streams.

Estuaries are at high risk from:

- sea level rise;
- changes in freshwater flows;
- altered sediment dynamics; and
- increased water temperatures.

Shoreline Armoring is at high risk from:

- altered sediment dynamics; and
- sea-level rise.

Climate change impacts are expected to lead coastal landowners to add new armoring, strengthen existing armoring, and resist efforts to remove armoring (Mauger and Vogel 2020).

» Signals from the 2020 State of Our Watersheds Report

Shoreline Armoring Continues to Threaten Salmon and Forage Fish Spawning Habitat:

Of the total 2,460 miles of shoreline within the Puget Sound Region, 715 miles (or 29%) is armored. Hydraulic project permits issued between 2015 and 2018 showed a net reduction of about 1 mile of armoring and an additional 6.7 miles of shoreline armoring replacement in the Puget Sound Region. While this reduction is a positive sign, the shoreline ecological functions have been severely impacted by past shoreline armoring and more restoration work needs to be done. For example, the Puyallup watershed’s marine shoreline is 92% impacted by armoring, resulting in lost foraging opportunities and reduced residence times for juvenile salmonids which in turn result in a decreased survival rate of these runs.

Impervious Surface Continues to Increase: Excluding federal lands, impervious surface area increased to about 7% in 2016, an increase of 1.2% since 2011. By 2040, the forecast population for Puget Sound will increase an additional 1,100,000 people beyond 2016; with an associated increase to almost 8.5% impervious surface area. The Puget Sound Salmon Recovery Plan lists minimizing impervious surfaces as a key strategy for protecting habitat.

Forest Cover Loss Continues in Puget Sound Lowlands:

From 2011 to 2016, an additional 243 square miles (2% net reduction) of forest cover was lost in the Puget Sound lowlands. The projected trend is to see continuing high rates of forest cover loss if protective actions are not taken. Minimizing forest cover removal will reduce the long-term impacts of forest cover loss and is a key strategy for protecting and restoring habitat within Puget Sound.

Diminished Riparian Forest Cover:

Diminishing riparian forests in the lowlands of western Washington continue to impair habitats critical to the recovery of the region’s anadromous salmon. The number of 6th-level Hydrological Unit Codes rated for properly functioning riparian forest cover shrank by 37.9% between 2011 and 2016. In 2011, National Marine Fisheries Service identified for most of Puget Sound that degraded riparian areas are a limiting factor to the recovery of Chinook salmon.

PSEMP Nearshore Restoration Summit and Synthesis

The PSEMP Nearshore Work Group and the Washington Department of Fish and Wildlife’s (WDFW) Estuary and Salmon Restoration Program (ESRP), Oregon State University, and University of Washington organized the first [Nearshore Restoration Summit](#) in March 2021. The goal was to connect restoration scientists and practitioners to synthesize nearshore science and restoration actions in Puget Sound and create a roadmap that updates restoration conceptual models and identifies key uncertainties for future research and management to address. The summit brought together about 80 speakers and over 500 registrants. The summit was particularly notable for bringing together people from a wide range of disciplines in the social and natural sciences. Proceedings will provide a synthesis of biophysical and social science research, a compilation of nearshore restoration work, updated conceptual models, and a set of social sciences principles for inclusion in the conceptual models. Proceedings will be available in fall 2021.

Kelp forests in need of conservation and monitoring

Thanks to the leadership of the Northwest Straits Commission and the Puget Sound Restoration Fund, the State Legislature provided funding to implement the Puget Sound [Kelp Conservation and Recovery plan](#) for the 2021-2023 biennium. These funds will help address top level priorities in the plan, including understanding and reducing stressors of kelp, describing kelp distribution and trends, and restoration of kelp forests. Projects will integrate Indigenous knowledge and support volunteer-based community science and [new Vital Sign indicators of kelp](#). Projects will ultimately inform and improve management actions to reduce stressors and conserve kelp habitat.



▶ THRIVING SPECIES AND FOOD WEB

STATUTORY GOAL

Healthy and sustaining populations of native species in Puget Sound, including a robust food web.

PHOTO BY: JOHN MCMILLAN

VITAL SIGN	STATUS	PROGRESS
BIRDS		
Terrestrial bird population abundance	■	●
Marine bird population abundance	■	●
CHINOOK SALMON		
Chinook salmon population abundance	■	●
ORCAS		
Number of Southern Resident killer whales	■	●
PACIFIC HERRING		
Biomass of spawning Pacific herring	■	●

Figure 7. Indicators for Thriving Species and Food Web, by Vital Sign, and whether they are making progress and meeting their 2020 targets.



None of the indicators of the Thriving Species and Food Web goal met their 2020 recovery targets and none improved

Species indicators are not making progress toward the targets. None of the indicators have improving trends, with many marine bird species, Southern Resident Killer Whales, and Pacific herring populations declining. There have been recent improvements with certain herring stocks, and Chinook salmon populations are stable but at historic lows.

- Southern Resident killer whales, Pacific herring, marbled murrelets, and scoters are indicator species that continue to decline.
- At best, Chinook salmon populations, the main prey of Southern Resident orcas, have remained stable on the spawning grounds since they were listed under the Endangered Species Act in 1999. Many populations have had slight increases since then, but the margin of error suggests this is not a significant trend toward recovery.
- With only 74 Southern Resident orcas at last count according to the Orca Network, the population is far from reaching the target of 95 whales. However, three whales were born since 2020, the first seen since 2015.
- There have been short-term improvements with certain herring stocks, but the size of all three Pacific herring stocks remains below their baseline levels and target values. However, the year 2020 was exceptional with many more fish on the spawning grounds.
- Marine bird populations have mixed population size trends, with marbled murrelets—an endangered species—and scoters declining, while pigeon guillemot and rhinoceros auklets remain stable.
- The breeding population size of birds living in interior forests has steadily declined since 1968, while human-associated species have remained relatively stable. The declining trend in forest interior species is driven by declines in the golden-crowned kinglet, the most abundant of the three indicator species.

For more details about ecosystem conditions relating to this goal, please see our [Story Map on Puget Sound Info](#).

Climate change exacerbates current stressors on species and food webs

Climate change poses a high risk to most Vital Signs related to Thriving Species and Food Web. Orcas, Chinook salmon, and Pacific herring are at high risk. Birds are at moderate risk (Siemann and Binder 2017).

Orca are at high risk from:

- reduced quality and availability of Chinook salmon, a primary prey species; and
- ocean warming.

Chinook salmon are at high risk from:

- lower summer flows;
- warming streams;
- earlier peak streamflow;
- higher peak flows; and
- ocean warming and acidification.

Pacific herring are at high risk from:

- sea level rise and increased shoreline armoring; and
- ocean acidification and reduced availability and quality of forage fish prey.

Birds are at moderate risk from:

- changes in availability, quality, and timing of marine bird prey; and
- changes in and loss of forests and other terrestrial habitats.



Habitat Suitability for Puget Sound Birds

The Stillaguamish Tribe of Indians and Audubon Washington, with support from the PSEMP Marine Birds Work Group, led the development of the [Avian Habitat Suitability Models for Puget Sound Estuary Birds](#). This study provides a scientific basis for integrating birds into estuarine restoration and conservation. Extensive habitat loss and degradation in Puget Sound estuaries has impacted the abundance and distribution of birds that rely on estuarine and coastal habitat. The study identifies valuable information about the environmental conditions that best explain where five “narrative” species are likely to occur and where they are most abundant. For example, wetlands – particularly estuarine emergent wetlands – and mudflats are essential to support native species populations. It also points to specific actions that land managers can take to ensure Puget Sound continues to serve as a vital link for Pacific Flyway birds. The study makes clear recommendations for restoration and monitoring and highlights the need for a regional monitoring framework.



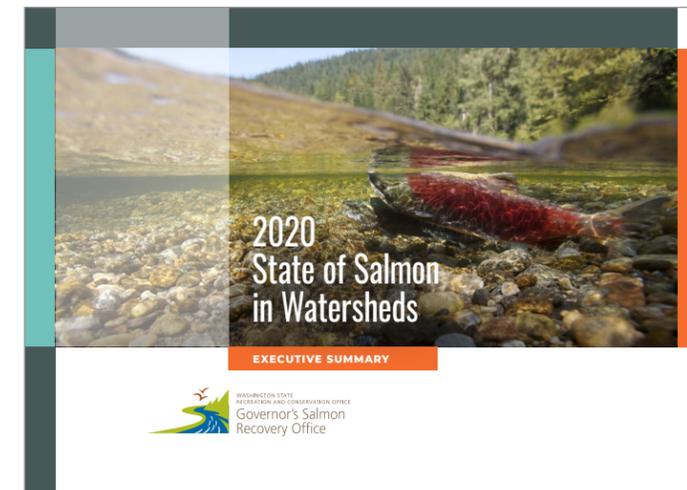
» Signals from the 2020 State of Our Watersheds Report

Blocking Culverts Impact Salmonid Survival:

During the first six years of implementing the U.S. v. Washington culvert case injunction, the state of Washington has corrected 150 fish-blocking culverts. At the current rate, if additional support is not gained, the corrections of the remaining 799 culverts would be completed in 32 years (2052).

European Green Crab Threaten Native Species:

Between 2016 and 2019, over 360 European green crabs were captured in the Puget Sound Region by Washington Sea Grant, Washington State Department of Fish and Wildlife, tribes, U.S. Fish and Wildlife Service, and partners. Although European green crab occurrences in the Puget Sound region have so far been relatively rare, the impacts of their populations in other parts of the world indicate the potential for widespread changes to Puget Sound’s ecosystem if action is not taken to limit their spread. Green crab are outcompeting juvenile native Dungeness crab for space, increasing the threat to Dungeness crab from predators and decreasing food availability.



State of Salmon in Watersheds overview

Every two years the Washington State Recreation and Conservation Office reports on the [State of Salmon in Watersheds](#). This web report provides stories and data about salmon, habitat, and salmon recovery. It documents the collaborative work of state and federal agencies, Indian tribes, regional organizations, and nonprofits to recover salmon and steelhead stream by stream.

The 2020 report describes a wide range of progress toward recovery for 14 species of salmon and steelhead listed as at-risk of extinction under the Endangered Species Act. In Puget Sound, Chinook salmon are in crisis. Summer chum abundance, however, is approaching federal recovery goals in both the Hood Canal and Strait of Juan de Fuca populations.



▶ VIBRANT HUMAN QUALITY OF LIFE STATUTORY GOAL

A quality of human life that is sustained by a functioning Puget Sound ecosystem.



VITAL SIGN	STATUS	PROGRESS
CULTURAL WELLBEING		
Participation in cultural practices	■	●
ECONOMIC VITALITY		
Percent of employment in natural resource industries	■	●
Employment in natural resource industries	■	●
Natural resource industry output	■	●
GOOD GOVERNANCE		
Good Governance Index	■	●
SENSE OF PLACE		
Overall life satisfaction	■	●
Psychological Wellbeing Index	■	●
Sense of Place Index	■	●
SOUND STEWARDSHIP		
Engagement in stewardship activities	■	●
Sound Behavior Index	■	●

Figure 8. Indicators for Vibrant Human Quality of Life, by Vital Sign, and whether they are making progress and meeting their 2020 targets.

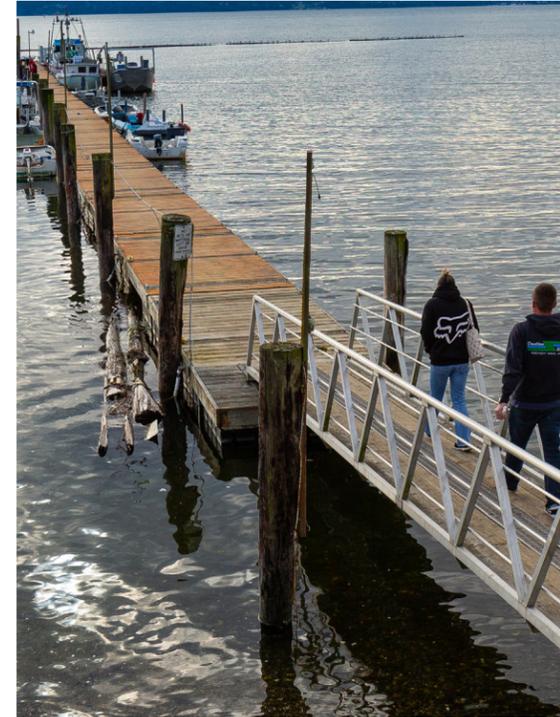




We now have baseline information for all indicators of the Vibrant Human Quality of Life goal

Thanks to surveys of Puget Sound residents, we now better understand how people perceive the importance of Puget Sound for their quality of life. Survey data were first collected in 2018 and again in 2020 from thousands of people in the general population. Little change was detected between the two years. These surveys establish a baseline of subjective measures of human wellbeing. The economic indicators are derived from other, longer-term data sources for jobs and employment in natural resource industries. Though the Partnership has not set targets for indicators in this goal, they ideally should progress or increase over time, although there might be some complexity and trade-offs to achieve sustainability or resilience.

- Survey results show that Puget Sound residents have a strong sense of place. Most residents identify with and feel positively attached to the region’s natural environment.
 - Residents with a strong sense of place are more likely to engage in stewardship behaviors. Over one-third of the Puget Sound population engages in stewardship behaviors that benefit the environment at least once a week.
 - Residents’ opinions were split on how our government and other organizations manage the natural environment. Responses to questions about access to information, opportunities to influence decisions, and trust in policy makers ranged from strongly disagree to strongly agree.
 - The region has seen overall growth among natural resource industries, mostly through growth in recreation and tourism. Gross domestic product in tourism and recreation has increased consistently each year since 2010. Combined product value, or prices paid to producers for timber, fish, shellfish, crops, and livestock, measured in the low billions annually from 2005–2018, with ups and downs from year to year.
 - Aquaculture, agriculture, and recreation and tourism sectors all report growth in general employment and total wages from 2005–2018. Employment in timber and fishing, however, has flattened or declined.
 - Natural resource industries support a higher percentage of wage and employment in small, rural counties that have relied on these industries in the past.
 - Climate change is expected to impact human wellbeing across the region in numerous profound ways. Low-income, rural, Indigenous, and other communities are already experiencing climate-related changes to their wellbeing, with most of these populations relying on natural resource infrastructure (e.g., fisheries, forestry, agriculture) for economic security.
- For more details about ecosystem conditions relating to this goal, please see our [Story Map on Puget Sound Info](#).



Climate change poses a risk to human quality of life and equity

Climate change poses a high risk to most Vital Signs related to Vibrant Human Quality of Life. This includes Cultural Wellbeing, Economic Vitality, and Sense of Place. Good Governance is at moderate risk (Siemann and Binder 2017).

Cultural Wellbeing is at high risk from:

- negative impacts to fishing, foraging, first foods, traditional medicines, and cultural gatherings.

Economic Vitality is at high risk from:

- negative impacts to natural resource-based industries, including fisheries, aquaculture, timber, and snow-based recreation tourism.

Sense of Place is at high risk from:

- reduced access to valued places or activities; and
- diminished emotional connection to natural resources due to worsening ecosystem conditions.

Good Governance is at moderate risk from:

- increased frequency and severity of natural disasters that cause large social and economic disruption and undermine trust in government; and
- increased regulations that weaken people’s sense of freedom to make decisions about how the environment is managed.



» Signals from the 2020 State of Our Watersheds Report

Climate Change Impacts Puget Sound and Tribal Traditional Practices:

Today, Puget Sound watersheds are experiencing the effects of a changing climate and it is predicted that these effects are going to continue or accelerate into the future. Tribal communities are on the front line of the climate crisis as their traditional practices are now threatened by broad-scale and far-reaching environmental changes. The harms caused by climate change are compounded by ongoing damage to the ecological integrity and resilience of our watersheds. In the Pacific Northwest (PNW), the observed and projected trends include warmer air temperatures; shrinking glaciers and snowpack; lower summer streamflows; higher winter flood flows; shifts in streamflow patterns and timing; higher stream temperatures; larger and more frequent wildfires; warmer ocean temperatures; rising sea levels; and changing ocean chemistry, including ocean acidification and low levels of dissolved oxygen.

▶ HEALTHY HUMAN POPULATION

STATUTORY GOAL

A healthy human population supported by a healthy Puget Sound that is not threatened by changes in the ecosystem.



VITAL SIGN	STATUS	PROGRESS
AIR QUALITY		
Exposure to impaired air quality	■	●
DRINKING WATER		
Nitrate concentration in source water	■	●
Index of Vulnerability for Elevated Nitrates in Groundwater	■	●
LOCAL FOODS		
Locally harvestable foods	■	●
Bivalve harvester-days	■	●
Recreational Dungeness crab catch	■	●
ONSITE SEWAGE SYSTEMS		
Inventory, inspection, and repair of onsite sewage systems	■	●
Percent of unsewered shoreline that has inspection program	■	●
OUTDOOR ACTIVITY		
Nature-based recreation	■	●
Nature-based work	■	●
Condition of swimming beaches	■	●
SHELLFISH BEDS		
Area of harvestable shellfish beds	■	●

Figure 9. Indicators for Healthy Human Population, by Vital Sign, and whether they are making progress and meeting their 2020 targets.





A few indicators of the Healthy Human Population goal have recovery targets, none were met

While the indicators did not meet their targets for 2020, some trended in a positive direction, while others stayed the same or grew worse. More shellfish beds are available to harvest commercially. Local health jurisdictions continue to make advances in inventorying and inspecting septic systems, which ultimately helps to reduce harmful bacteria that pose a risk for human health. Some indicators, like the condition of swimming beaches and drinking water, are not improving, but are in good shape overall. Poor air quality in some years and low crab harvest are concerning. Harvesting local foods provides valuable health and cultural benefits; however, toxics and other pollutants limit the amount of seafood people can safely eat.

- Between 2007 and 2020, more acres of shellfish beds were upgraded than downgraded across all classifications. The result was a net increase of 6,659 acres of harvestable shellfish beds, a sizable fraction of the 2020 target of 10,800 acres.
- There is a long-standing tradition of harvesting clams and oysters along the beaches of Puget Sound. Most people harvest shellfish at beaches in the Hood Canal or North Sound regions. Pollution limits people's access to shellfish harvest at many beaches in Central and South Sound.
- Over 200,000 people purchase a license to harvest Dungeness crab in Puget Sound each year. However, an increasing number of harvest closures due to low crab populations have been in effect in South and Central Puget Sound since 2015. Total harvest and endorsements issued have also declined.
- A survey of Puget Sound residents suggests wildlife viewing and birding, gardening, and walking or hiking on paths and trails are the most frequently practiced outdoor activities.
- In addition to gathering high quality food, harvesting and hunting are opportunities for people to make meaningful connections with Puget Sound's natural resources. Plants, berries, and mushrooms are more likely to be harvested than fish, shellfish, or game species.
- Most groundwater supplying large public water systems in Puget Sound is not contaminated by nitrates. However, Whatcom, Island, and Clallam counties had higher nitrate levels compared to other Puget Sound counties.
- The severity of local and regional wildfires has been the main cause of Puget Sound residents' exposure to unhealthy air quality in recent years.

For more details about ecosystem conditions relating to this goal, please see our [Story Map on Puget Sound Info](#).

Climate change directly impacts human health

Climate change poses a high risk to all of the Vital Signs related to Healthy Human Population (Siemann and Binder 2017).

Air Quality is at high risk from:

- increased wildfire frequency and extent; and
- increased allergen intensity and season length.

Drinking Water is at high risk from:

- lower summer water availability;
- warmer water temperatures and increased sediment loading that reduce surface water quality;
- heavier rain events that may flood and damage supply systems; and
- sea level rise and saltwater intrusion in some coastal areas.

Local Foods are at high risk from:

- negative impacts to shellfish and finfish; and
- shifts in availability of terrestrially harvested foods.

Onsite Sewage Systems are at high risk from:

- heavier rain events;
- sea level rise; and
- increased groundwater saturation in winter.

Outdoor Activity is at high risk from:

- degraded water quality at beaches due to warmer water temperatures and increased recreational use;
- heavier rain events that erode and washout roads and trails;
- increased wildfires that impede access to recreation areas or make them less desirable to visit following a burn;
- reduced snowpack and shortened winter seasons that limit snow-based recreation; and
- extreme heat events that affect the health and safety of outdoor workers.

Shellfish Beds are at high risk from:

- ocean warming;
- ocean acidification; and
- heavier rain events.



» Signals from the 2020 State of Our Watersheds Report

Commercial Shellfish Growing Conditions Remain a Concern in the Puget Sound Region: Since 2014, there has been an increase of nearly 6,000 acres of approved or conditionally approved commercial shellfish growing areas in the Puget Sound Region due to improved water quality conditions. However, there remains a considerable amount of prohibited and restricted growing areas across the region. Of the over 280,000 total acres of growing areas in 2020, 34% (98,052 acres) had either prohibited or restricted status. This prompts concerns about water quality issues across the region.

Why is human wellbeing important for Puget Sound recovery?

Puget Sound plays a big part in residents' wellbeing. While human behaviors can often damage the environment, ecosystem recovery lessens those effects and improves residents' wellbeing. Integrating human dimensions in planning—like human wellbeing through social sciences—opens possibilities for leveraging new partners, ideas, strategies, tools, concepts, and even funding sources to help address shared problems.

People and Puget Sound are intertwined and mutually reinforcing

A healthy and vibrant Puget Sound depends on healthy and vibrant communities. The Partnership sees Puget Sound's health as a social-ecological system: humans are a part of and not apart from ecosystems.

People interact with the environment in complex ways:

- ▶ as beneficiaries of nature's contributions to health and quality of life;
- ▶ as pressures on natural systems; and
- ▶ as implementers of recovery efforts.

These interactions can damage or improve the health of the Puget Sound ecosystem.

The Partnership's considerations of human wellbeing also help to bring attention to issues of diversity, equity, inclusion, and environmental justice.

Human wellbeing surveys help us understand people's connections to Puget Sound

In 2018, the Partnership, working with Oregon State University, embarked on a project gauging residents' wellbeing using regional surveys. The first two surveys were conducted in 2018 and 2020. We will repeat surveys in the future to track changes.

With these surveys we want to know about residents' perceptions of sense of place, stewardship, recreation, access to local foods, cultural wellbeing, and governance (Fleming and Biedenweg 2018).

The surveys cover a range of aspects of human wellbeing that relate to Puget Sound recovery. The surveys reveal the vital relationships residents have with Puget Sound and its natural resources. Such surveys measure attitudes, feelings, actions, and connections to Puget Sound. For example, the survey gauges how often residents take part in activities to care for the environment. These surveys establish the first baseline of subjective measures of human wellbeing. The baseline is useful as the region faces continued population growth that will alter not only demographics and physical landscapes, but also likely the health of Puget Sound's ecosystem.

Results show strong sense of place

Survey results show that Puget Sound residents have a strong sense of place associated with Puget Sound's natural environment (Fleming et al. 2020). For example, 75 percent of respondents strongly agree or agree they feel responsible for taking care of Puget Sound's natural environment. A strong sense of place links to the residents' psychological wellbeing, which suggests that residents' use of the outdoors contributes to their mental health. This sense of place also builds upon residents' outdoor activities, like wildlife viewing, birding, and use of local foods, like shellfish.

Survey response patterns did vary by certain factors, including by place of residence. Shellfish in particular is a local food that is culturally, commercially, and recreationally important among Puget Sound residents, with differences in public access due to bed closures from hazards or other concerns (Poe et al. 2016). Many of the region's Indigenous communities see shellfish and the act of harvesting as key to their health and wellbeing (Donatuto et al. 2011; Poe et al. 2016).

More sense of place, more stewardship

Residents with a strong sense of place are more likely to engage in actions that help improve the ecosystem (Trimbach et al. 2020). Residents also vary in their opinions of environmental governance in the region. This shows that in some places, decision-makers might need do more to build trust and include residents in planning efforts. Decision-makers could also help foster people's connections to Puget Sound to improve beliefs about environmental governance and recovery overall (Kibler et al. 2018).

Puget Sound as a place of healing during the Covid-19 pandemic

The human wellbeing Vital Signs and their survey findings show that Puget Sound's natural environment and health are crucial to the region's residents. The Covid-19 pandemic has made residents' connections to Puget Sound even clearer. Residents rely more than ever on the region's natural environment, notably public parks and green spaces (Shirley 2020; Stinchcombe 2020). As public and private spaces closed due to the pandemic, many Puget Sound residents opted for outdoor recreation (Banse 2020). Residents' use of the outdoors shows that outdoor recreation is a key economic sector for the state and region (Mojica 2020). A 2020 report from Earth Economics states that outdoor recreation accounts for 264,000 or six percent of total jobs in the state (Mojica 2020).

The Covid-19 pandemic may have influenced residents' answers to the human wellbeing survey, signaling changes to their wellbeing and interactions with Puget Sound. For example, residents' weekly stewardship actions decreased in 2020 (35 percent) from 2018 (~50 percent), possibly caused by the short-term closures of nonprofit or stewardship groups and delays in activities. While Covid-19 may have affected stewardship actions, residents still went out to enjoy Puget Sound's natural bounty (Stinchcombe 2020). Such increases in outdoor activities show that Puget Sound is not just a place for recreation and play, but a place that gives residents a sense of awe, escape, sanctuary, calm, and healing during an uncertain time. Residents' reliance on Puget Sound during Covid-19 highlights the power of this place and the need to ensure its health and recovery for future generations.

Puget Sound Vital Sign indicators and targets will change in 2022

In 2019, the Partnership undertook a collaborative effort to revise the Puget Sound Vital Signs and indicators to address longstanding concerns and critiques. The Partnership initiated revisions to the water quality and quantity, habitat and species and food webs goals by incorporating scientific and institutional information gained since the indicators were selected 10 years ago.

The revisions effort relied mainly on expert judgment from science and policy experts from throughout the Puget Sound recovery community, along with recommendations from previous studies, analyses, and conceptual models. Throughout the process we emphasized working iteratively with the Puget Sound recovery community and selecting Vital Signs and indicators that were supported by relevant scientific and policy experts.

On June 10th, 2020, the Vital Signs revisions project team presented recommendations for revised Vital Signs and indicators to the Leadership Council, who unanimously adopted 13 Vital Signs and 34 indicators. Nineteen more indicators were flagged for future development. Reporting will start after January 2022.

Find the complete list of new and revised indicators [here](#).



Figure 10. The new and revised Vital Signs. Reporting will begin after January 2022.

▶ References

Banse, T. 2020. Locals only, please. Reopening of some Washington State Parks greeted by concern. Oregon Public Broadcasting. 30 April. Available at: <https://www.opb.org/news/article/washington-state-parks-may-reopening-concern-coronavirus-covid-19/>

Donatuto, J. L., Satterfield, T. A., and Gregory, R. 2011. Poisoning the body to nourish the soul: prioritising health risks and impacts in a Native American community. *Health, Risk & Society*, 13(2): 103-127

Fleming, W. and Biedenweg, K. 2018. Visualizing Human Wellbeing in the Puget Sound. Human Dimensions Lab, Department of Fisheries, Wildlife, and Conservation Sciences, Oregon State University.

Fleming, W., Kehoe-Thommen, Katz, B., Hart, J., and Biedenweg, K. 2020. Vital Signs Survey Summary 2020. Human Dimensions Lab, Department of Fisheries, Wildlife, and Conservation Sciences, Oregon State University.

Kibler, K. M., G. Cook, L. G. Chambers, M. Donnelly, T. Hawthorne, F. Rivera, and L. Walters. 2018. Integrating sense of place into ecosystem restoration: a novel approach to achieve synergistic social-ecological impact. *Ecology and Society* 23(4): 25-36.

Mauger, G.S. and J.M. Vogel. 2020. PSP Climate Literature Review: A tailored review of climate change science to inform recovery. Report prepared for the Puget Sound Partnership. Climate Impacts Group, University of Washington.

Mojica, J., Cousins, K., Fletcher Munoz, A., 2021. Economic Analysis of Washington State Parks. Earth Economics. Tacoma, WA.

Poe, M. R., Donatuto, J, and Satterfield, T. 2016. "Sense of Place": human wellbeing considerations for ecological restoration in Puget Sound. 44(5): 409-426.

Shirley, J. 2020. State parks say you might have to go elsewhere as people flock to the great outdoors. *The Olympian*. 31 July. Available at: <https://www.theolympian.com/news/local/article244607997.html>

Siemann, D. and L. Whitely Binder. 2017. Preliminary Climate Change Assessment for Puget Sound Partnership. A Collaboration of Puget Sound Partnership and the University of Washington Climate Impacts Group. Seattle, WA.

Stinchcombe, C. 2020. Washington park employees and volunteers grapple with people flocking outdoors amid covid-19. *The Seattle Times*. 14 August. Available at: <https://www.seattletimes.com/life/outdoors/washington-park-workers-are-doing-overtime-as-people-flock-outdoors-amid-covid-10/>

Trimbach, D. J., Fleming, W., and Biedenweg, K. 2020. Whose Puget Sound?: examining place attachment, residency, and stewardship in the Puget Sound region. *Geographical Review*. <https://doi.org/10.1080/00167428.2020.1798763>

» What are the challenges to progress?

The Puget Sound Partnership Leadership Council presents these challenges to progress.

► Funding does not meet the need

Priority Puget Sound recovery capital programs are consistently underfunded

During each state budget round, the Partnership provides the Governor’s Office with its ranked list of the highest priority funding requests needed to advance Puget Sound recovery.

In the last ten years, six of the most consistently high-ranked capital funding programs have repeatedly received awards that fall well short of what was requested (Table 1). In the latest 2021-23 funding round, all six of these programs ranked among the top seven capital budget requests.

From the 2013-15 biennium to the 2021-23 biennium the Legislature has funded some of the highest ranked Puget Sound restoration and protection programs at an average of 53 percent of what was asked, a \$763 million gap, leaving many high priority projects languishing unfunded (see table 1). These programs provide tangible results and are a good investment of state dollars.

For example, the Puget Sound Acquisition and Restoration program (PSAR) has implemented 620 projects, restoring 6,449 acres of shoreline and producing 3,413 jobs. PSAR projects and many others are making a difference for salmon and the health of the ecosystem and people, but more needs to be done to build on these successes. Over the last 10 years the legislature has only funded 55% of the PSAR request.

Table 1: Highly ranked state agency capital program requests, with significant long-term funding shortfalls (2013-15 to 2021-23 biennia).

Funding proposal request	Agency	Description	Difference between original statewide request and enacted amount (\$ millions)	% of requested amount funded
Salmon Recovery Funding Board (SRFB)	RCO	Awards grants to protect and restore salmon habitat.	\$198	35%
Brian Abbott Fish Passage Barrier Removal Board (FBRB)	WDFW/RCO	Identifies and removes impediments to salmon and steelhead migration.	\$94	44%
Centennial Clean Water Fund (CCWF)	ECY	Provides grants for water quality infrastructure and nonpoint source pollution projects.	\$145	55%
Puget Sound Acquisition and Restoration (PSAR)	PSP/RCO	Supports projects that protect and recover salmon and salmon habitat in Puget Sound.	\$200	55%
Estuary and Salmon Restoration Program (ESRP)	WDFW/RCO	Provides grants and technical assistance for projects that restore and conserve nearshore areas in Puget Sound.	\$38	57%
Floodplains by Design (FbD)	ECY	Grant program for large-scale multi-benefit floodplain restoration projects that improve habitat, prevent flood hazards, and protect farmland.	\$88	71%
TOTAL			\$763	53%

Public funding for Near Term Actions in both the 2016-2018 Action Agenda and 2018-2022 Action Agenda does not meet the needs

Since 2008, the Puget Sound Action Agenda has identified the priority projects – Near Term Actions – the region must implement to advance Puget Sound recovery goals. Despite many stories of success, a significant shortfall in funding for Near Term Actions has persisted and that trend continued with the 2016-2018 and 2018-2022 Action Agendas. Funding for Near Term Actions comes from a variety of sources – over 100 different sources for the 2018-2022 Action Agenda – with just under half coming from the state and the other half from local and federal sources in roughly equal shares.

Among the Near Term Actions in the 2016-2018 Action Agenda only 37 percent were fully funded, with 38 percent partially funded and 25 percent not reporting any funding received. The total cost of all 2016-2018 Action Agenda Near Term Actions was about \$182.5 million, with a funding gap of 48 percent (\$88 million shortfall; figure 12) as of fall 2020, leaving only 21 percent of Near Term Actions fully implemented as planned.

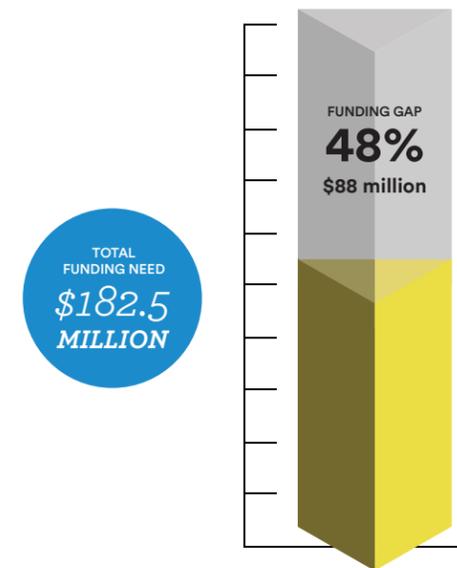


Figure 11. Final reported Near Term Action funding gap, 2016-2018 Action Agenda (Fall 2020)

Our most current reporting tells us that of 631 Near Term Actions in the 2018-2022 Action Agenda most are still in the planning or design stage, with only 20 percent of actions underway and just three percent completed. Around 90 percent of Near Term Action owners reporting a barrier to implementing their action cited a lack of funding and resources. The total cost of all 2018-2022 Action Agenda Near Term Actions is about \$1.4 billion, with a current funding gap of 76 percent (figure 13). See the [Action Agenda Tracker](#) for the latest Near Term Action information.

It is critical the funding needs across Puget Sound are met. Around half of the 631 Near Term Actions in the 2018-2022 Action Agenda are ecosystem protection and restoration projects, which are typically funded—at least in part—by state capital investment programs. The costs of protecting Puget Sound will become increasingly expensive over time. We need to accelerate funding for our large capital programs and fully fund the Action Agenda for Puget Sound if we are to recover Puget Sound.

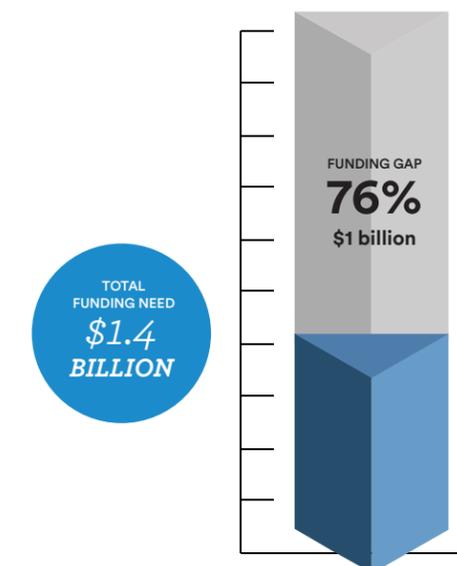


Figure 12. Reported Near Term Action funding gap, 2018-2022 Action Agenda (as of May 2021)

► Changing ocean and climate conditions already affect the ecosystem

Every day, changing ocean and climate conditions are significantly affecting the health of our ecosystems as well as the economy, health, and wellbeing of communities across the region.

Because climate change is impacting ecosystems, wildlife, and people across Puget Sound, it is one of the largest obstacles we face as we work to create a more resilient Puget Sound. In the coming decades, increasingly severe climate impacts to the region will become an even greater obstacle to achieving our statutorily mandated biophysical and sociological recovery goals. In fact, each of the Partnership's six statutory recovery goals is threatened by climate change and almost 90 percent of Puget Sound Vital Signs are at moderate to high risk of being impacted by climate change by 2050. See the goal reports in the "How is Puget Sound doing?" chapter for more details on how climate change impacts the ecosystem.

Projected climate impacts are alarming

Climate research predicts that a suite of alarming climate effects will appear across the region in the coming decades.

- Air temperature has already warmed, and climate projections show that, as warming accelerates, air temperature could reach 4.7°C above historical levels by the end of the century.
- Summer rainfall could decrease by as much as 27 percent by the end of the century and heavy rain events will become more intense in the last half of the century, increasing the risk and severity of flooding, erosion, and landslides.
- Peak snowpack is projected to decrease by 42 percent to 55 percent or more by the end of the century.
- River and stream temperatures—affected by warming air temperature, changes in precipitation, and decreased snowpack—could exceed 4°C-4.5°C above historical levels by the end of the century.
- Projections show that streamflow will increase by 18 percent to 42 percent during periods of peak flow and decrease by 16 percent to 55 percent during periods of low flow as a consequence of warming air, melting snow, drier summers, and more intense heavy rain events.
- Sea level rise, ocean warming, and ocean acidification have already begun and will accelerate throughout the century, resulting in an ocean that is 1.6 feet to 2 feet higher, as much as 2.8°C warmer, and 38 percent to 109 percent more acidic than historical levels by the end of the century.

Consequences to our Puget Sound community

Climate change will continue to profoundly affect the physical, mental, spiritual, cultural, and economic wellbeing of Puget Sound communities. Our overburdened communities will be impacted first, most often, and to the greatest extent. As climate change becomes more severe, humans will be increasingly affected by:

- Heat-related illnesses and deaths;
- Contamination of food by environmental contaminants;
- Contaminated freshwater and marine waters;
- Flooding and damage to low-lying infrastructure, homes, and businesses;
- Severe and frequent wildfires;
- Limited access to recreation and traditional cultural activities;
- Limited availability of traditional medicines; and
- Decreasing availability of local food.

These many climate impacts will continue to have profound and, in some cases, devastating consequences to the overall health and vitality of Puget Sound ecosystems and people. Predicted climate impacts can devastate communities across the region, particularly tribes, people of color, and other communities with the increased risks of flooding, property damage, health hazards, and pollution. Unabated climate impacts could quickly strip the region of its iconic natural resources, including salmon and orca, as well as the region's many iconic landscapes and ecosystems as habitat is reduced and degraded. Local and customary foods may become scarce or too toxic to consume.



Puget Sound recovery work inherently increases climate resilience

Projects that restore floodplains and riparian areas can increase climate resilience by decreasing flood risk during extreme rain events and providing shade to offset warming streams. Many Puget Sound recovery projects, like those that establish soft shorelines and restore estuaries, can decrease the magnitude of climate change by sequestering carbon and offsetting emissions, as well as increasing climate resilience. Maintaining natural pathways can increase resilience to climate impacts: rewetting wetlands reduces risk of fires; macroalgae conservation decreases shore erosion and beach loss; and restoring natural river flows can reduce flooding events.

Along with strong action at the international and national level, locally we need to accelerate efforts to update policies, plans, practices, and procedures to account for climate impacts and increase climate preparedness. If provided with the necessary planning, funding, and political will:

- urban areas can better plan for increased storm events, soaring temperatures, drought, and increased fire and smoke, as well as accelerate development of emergency response to failing infrastructure;
- agricultural areas can understand how flooding, heatwaves, and drought may impact crop production; and
- scientists and natural resource managers across the region can collaborate to better understand what ecosystems in the region can efficiently decrease the magnitude of climate change by sequestering and storing carbon in soils and vegetation.



2021 Northwest record-setting heatwave

The record-setting temperatures the Northwest experienced in the summer of 2021 would not have been possible in the absence of human-caused climate change. This extreme weather event shows some of the devastating effects climate change is already having on the people, wildlife, and environment across Puget Sound.

Although the many impacts of the heat wave—including the number of human lives lost—is not yet fully known, we know that the combination of extreme heat and low tides produced lethal conditions for local shellfish and aquatic wildlife.

In addition, urban heat islands common in the most urbanized areas in King County created inequitable health risks to local communities. High temperatures in the Northwest also caused extreme mountain snowmelt that washed out a bridge and inhibited recreation.



▶ Developmental pressure is driving the conversion of ecologically important lands

The Puget Sound region has experienced extraordinary growth over the last decade. This growth has serious impacts on Puget Sound’s ecosystem and resources.

Puget Sound is developing faster than we can restore it

Recent data indicates that some of the benefits produced from restoring or protecting lands significant to water flow, habitat quality, or biodiversity in Puget Sound are already being offset by the continued degradation of habitat due to development. And between now and 2050, the population of the Puget Sound region is expected to increase by another 1.8 million people.

Population growth will increase development pressure

With population growth comes the increased demand for added infrastructure and maintenance, urban expansion and paved surfaces, shoreline development and armoring, and increased land use and transportation. Nearly 1.1 million acres, or 13 percent of the entire Puget Sound land area, are identified as both ecologically important and under high pressure for conversion to development. Due to land conversion from development pressures associated with population growth, many Puget Sound habitats have been reduced in size, diminished in quality, or have been fragmented. Ecosystem processes, like water quality, quantity, and flow, that form and sustain these habitats have been degraded and disrupted. While much of the population growth within the last 10 years has remained within urban growth areas, an increasing amount has occurred outside of these areas, with growing pressure to develop within rural areas close to urban growth boundaries.

With an ever-growing human population, rethinking development choices can not only help maintain the health of Puget Sound watersheds, but also develop resiliency to climate change, strengthen the capacity of its natural defense systems to keep contaminants out of our lands and waterways, buffer against flooding risk, and protect and maintain water quality. We must redirect development pressure and reduce conversion of ecologically important lands, while supporting working lands and protecting and restoring natural and vegetated areas.



▶ **We haven't heard all the voices**

Puget Sound is a culturally rich and diverse region spanning 13 counties and hundreds of miles. It's home to over 4.5 million people. Connections with the sea and local natural resources are abundant, with many communities economically and culturally tied to natural resource systems such as fisheries, agriculture, and timber. Effective ecosystem recovery requires a diverse representation of viewpoints, perspectives, and values from all affected communities and sectors, as well as scientific evidence to ensure an informed, sustainable, and supported effort.

Together, we will generate the political will and momentum necessary to achieve a healthy and resilient Puget Sound

We need to engage farmers, timber workers, fishermen, business owners, and especially communities whose viewpoints have been historically left out of the ecosystem recovery effort. We need to seek out and listen to different concerns, engage with each other honestly, and work together to preserve the rich abundance of this place that we love. We're facing big challenges that will require collective action from all of us.

We're working to include the perspectives and values of the overburdened communities in the Puget Sound recovery effort. We see human wellbeing, environmental justice, and diversity, equity, and inclusion work as key to ecosystem recovery. Human health and quality of life are dependent on a healthy Puget Sound. As a recovery community, we must acknowledge and actively address inequities and injustices that exist within our recovery system.

To address systemic inequities, remove barriers to inclusive representation, and incorporate multiple forms of knowledge for environmental decision-making, the Puget Sound recovery community must:

- remove barriers and address disparities within decision-making processes;
- build trust and relationships with new partners and help amplify their voices within the recovery community;
- develop recovery strategies and commitments that address and integrate environmental justice;
- ensure that decision-making bodies within the recovery system represent a broad range of voices that guide our collective effort.



» **What gives us hope?**

Puget Sound recovery faces challenges that are serious and complex. Despite the magnitude of those challenges, we find many reasons to be hopeful about recovery.

- ▶ Our congressional delegation and federal partners help lead and support Puget Sound recovery.
- ▶ The Washington State Legislature passed budgets and bills that advance recovery, confront climate change, and extend the benefits of recovery to more people throughout the region.
- ▶ Partners are coming together to shape the 2022-2026 Action Agenda, our shared vision and roadmap for Puget Sound recovery, to respond to the scale of the challenges we face.
- ▶ All across Puget Sound people are getting involved and taking action to restore and protect Puget Sound.

People care about Puget Sound, about its current condition and its future. We know what we need to do to create a healthy and resilient Puget Sound, for us and future generations. We have the chance now to work together and build momentum for ecosystem protection and restoration. We can solve difficult problems with collective action. We can make sure that we all benefit from Puget Sound recovery.

▶ Our delegation and federal partners advance Puget Sound recovery

The leadership of the Washington congressional delegation makes us hopeful, as does the dedication of our federal partners, and we are grateful to both our delegation and our federal partners for their commitment to Puget Sound recovery.

Our delegation supports the Promoting United Government Efforts to Save Our Sound (PUGET SOS) Act, which would raise the Puget Sound recovery effort to the same stature of national importance as that in the Chesapeake Bay. It sets up a Puget Sound Recovery National Program Office at the U.S. Environmental Protection Agency, defines the Puget Sound Federal Leadership Task Force, and authorizes \$50 million annually for five years for recovery and restoration.

By supporting funding for federal programs like the National Estuary Program, the Puget Sound Geographic Program, and the Pacific Coastal Salmon Recovery Fund, our delegation has helped make progress in critical areas that include:

- salmon and orca recovery;
- fish passage infrastructure;
- habitat conservation;
- water quality improvement; and
- the protection of key species in Puget Sound.

Funding for the Puget Sound Geographic Program and National Estuary Program totaled \$28.5 million in 2019, increasing to \$33.75 million in 2020. Over the last eight years, the Pacific Coastal Salmon Recovery Fund has invested \$124 million statewide, including over \$14 million in the last two years for projects and administration in Puget Sound.

Our delegation also takes time to participate in Puget Sound Day on the Hill, hosted by the Partnership and the Northwest Indian Fisheries Commission. This event brings the delegation together with representatives from tribes, state agencies, local governments, nonprofits, and businesses, along with concerned residents, in support of action to save Puget Sound and uphold tribal treaty rights. During Puget Sound Day on the Hill, members of our delegation join the recovery community to discuss salmon recovery efforts, Puget Sound restoration and protection, and environmental policy. Puget Sound Day on the Hill helps build support for recovery priorities.

Federal partners

Our partners in the federal government play a crucial role in carrying out the Action Agenda and funding state and local partners. Federal agencies created their own Puget Sound recovery [Task Force and Action Plan](#) in 2016 to support the Action Agenda, including over 75 key actions to protect and restore Puget Sound.

With the tremendous partnership and collaboration of our federal partners, we have been able to make more progress on Puget Sound recovery and better coordinate our actions.

The U.S. Environmental Protection Agency and the National Oceanic and Atmospheric Administration, in particular, work with the recovery community and provide substantial support for the Action Agenda and salmon recovery efforts.

▶ The U.S. Environmental Protection Agency (EPA)

EPA plays a vital role in Puget Sound recovery. The agency oversees the Puget Sound Geographic Program and National Estuary Program. EPA also passes funding to the state under the Clean Water Act to improve water quality.

▶ National Oceanic and Atmospheric Administration (NOAA)

NOAA manages the Pacific Coastal Salmon Recovery Fund, a source of funding for critical salmon recovery projects. The fund helps salmon recovery organizations pursue habitat, hatchery, harvest, and hydropower actions for salmon recovery. It has helped prevent the extinction of 28 listed Pacific salmon and steelhead species on the West Coast.

▶ The Washington State Legislature approved major policies and funding that support recovery

This year, the Washington State Legislature had a banner session, which makes us hopeful for the future. The Legislature advanced policies that address a number of challenges related to Puget Sound recovery and approved budgets that provide significant funding for recovery projects and initiatives.

2021 Legislative session

The Legislature passed two major climate change policy bills—one bill will reduce the carbon intensity of transportation fuels and another bill creates a cap and invest program to support climate change adaptation and the reduction of greenhouse gas emissions.

The Legislature passed the HEAL Act, a landmark environmental justice act. This bill carries out recommendations of the Environmental Justice Task Force to require agencies to follow specified environmental justice guidance. The Partnership's Leadership Council supported the HEAL Act and we're beginning to implement the environmental justice guidance within our work.

The Legislature passed other priorities of the Partnership's Leadership Council in the 2021 session, including a bill that streamlines the permitting of salmon habitat restoration projects; a bill that requires the use of the least impactful alternative when replacing shoreline armoring for residences along Puget Sound shores; and a bill that reauthorizes the Washington Invasive Species Council for 10 years.

We look forward to the Legislature taking up important reforms in future sessions like Growth Management Act reform, addressing climate change, and addressing barriers to salmon recovery.

2021-23 state budget

Although funding continues to be a barrier, funding for Puget Sound recovery improved during the last session. In May 2021, the Legislature approved an estimated \$1.3 billion for Puget Sound recovery. The Puget Sound budget for 2021-2023 is almost double the amount for 2019-2021, with a significant increase in funding for fish barrier removal and an 18 percent increase in the capital budget over 2019-21.

► **Partners are coming together to shape the 2022-2026 Action Agenda and ensure it responds to the scale of the challenge**

The 2022-2026 Action Agenda gives us hope. The 2022-2026 Action Agenda update will be a shared ecosystem recovery plan that improves the health of Puget Sound and the people who live in the region. It includes the work of many partners from around Puget Sound to describe regional plans and specific actions to help federal, state, local, tribal, and private partners better invest resources and coordinate work.

Like past Action Agendas, this update will identify key strategies and actions for recovery and how those actions connect to our long-term goals and the Puget Sound Vital Signs. This update will also differ from previous Action Agendas. First, it will organize strategies and actions around a set of science-informed desired outcomes that describe the pressures affecting the ecosystem and the changes needed to reduce those pressures. Second, instead of a solicitation for individual project ideas (called Near Term Actions in past Action Agendas), desired outcomes will be accompanied by a higher-level set of strategies, actions, policy recommendations, and commitments for advancing recovery over the next four years. These strategies and actions, for the first time, will explicitly address human wellbeing and responses to climate change.

The 2022-2026 Action Agenda update is scheduled for publication in June 2022. Between now and then, partners around the Sound are working to ensure that the vision and roadmap set forth in this Action Agenda will achieve the following:

- Respond to the scale of the challenge we face from human-caused pressures made worse by climate change and population growth.
- Use monitoring and effectiveness information to make sure investments produce maximum benefit.
- Give clear guidance for state budgeting and legislative proposals for Puget Sound.
- Align the work of partners.

Alongside our development of the new Action Agenda, we've also improved the adaptive management framework, a learning and decision-making process that helps us reduce uncertainty over time and manage Action Agenda implementation. We've expanded the series of measures and indicators to track progress toward recovery goals. We've created a target-setting strategy that produces related targets for both intermediate outcomes (Intermediate Progress Measures) and ultimate outcomes (Vital Signs). We'll roll out the new progress measures and a set of targets with the 2022-2026 Action Agenda.



The Action Agenda is the plan for Puget Sound recovery. It includes the work of many partners from around Puget Sound to describe regional plans and specific actions to recover the Sound. These plans and actions help federal, state, local, tribal, and private partners better invest resources and coordinate work.

- It brings efficiency and coordination to a complex system.
- It uses a “collective impact” approach to large-scale change in which groups of people use a common agenda to solve a problem.
- It is an inclusive effort, including partners who represent government, tribes, businesses, nonprofits, the public, and other interests.
- It is informed by science.
- It guides effective investment in Puget Sound recovery.

The Action Agenda meets the requirements of the Washington State Legislature and the Environmental Protection Agency’s National Estuary Program. This locks in federal and state resources that help our region plan and carry out recovery actions.

► People are committed to restoring and protecting Puget Sound

All across Puget Sound, residents volunteer, advocate, and commit their time and energy to protect and restore our waters, land, and wildlife. A recent study shows that Puget Sound residents engage in environmental stewardship and environmentally friendly behaviors at higher levels than the national average (Berkson and Dubois 2019). The willingness of people to take action is critical to the effort to create a healthy and resilient Puget Sound.

Orca Recovery Day is one inspiring example of the power of volunteers in action. Each October, groups volunteer and plan activities like tree planting, rain garden installations, and community clean ups, all in support of orca recovery. The fact that Orca Recovery Day has grown every year to include more people and more events makes us very hopeful.

In three years, Orca Recovery Day has included more than 160 groups, more than 1,300 students, and more than 6,000 participants. It has drawn volunteers to plant over 27,700 trees and shrubs and remove over 59,000 pounds of litter from reaching or re-entering the Salish Sea.

The COVID-19 pandemic did not stop Orca Recovery Day 2020. Around 1,160 people took part as volunteers or attendees in a month-long online EcoChallenge.

Berkson, B. and Dubois, L. 2019. Sound Behavior Index – 2019 Survey Report. Report prepared for the Puget Sound Partnership. Center for Economic and Business Research, Western Washington University.



During Orca Recovery Day 2020, people volunteered 1,138 hours of their time and carried out the following:

- 4,580 trees or shrubs planted
- 12.83 acres restored
- 4 rain gardens installed
- 7,327 lbs. of trash picked up
- 18 rain barrels installed
- 792 student contact hours
- 4,674 pounds of CO2 saved
- 137 elected officials contacted

Orca Recovery Day exemplifies the strong sense of pride Puget Sound residents have for their environment. Events like Orca Recovery Day help people create and sustain a connection to Puget Sound and understand what's at stake, why recovery matters. These connections to Puget Sound—strengthened by time spent in nature, or outdoor recreation, or environmental stewardship activities—can motivate people to preserve the place that they love.

» A call to action to save Puget Sound

This call to action is from the Puget Sound Partnership Leadership Council to the recovery community. Each of us can, and must, do more to accelerate recovery, and we are committed to our partnership with you. We must redouble our efforts to combat climate change and the effects of a growing population that threaten ecosystems and disproportionately affect vulnerable communities. Together, as we look to the future, let us be bold in our intent and actions to build a healthy, resilient, and economically prosperous Puget Sound for all.

▶ For the State Legislature

- Enact changes to our regulatory system as recommended by the Puget Sound Partnership Leadership Council ([psp.wa.gov/recommendations](https://www.psp.wa.gov/recommendations)) to protect and enhance salmon habitat, ensure human health and safety, provide irreplaceable ecosystem services, sustain tribal cultures, increase resiliency to climate change, and produce food for orcas.
- Authorize new funding that will provide reliable, dedicated funding in the amounts needed for Puget Sound recovery, as recommended by the Leadership Council.
- Fund a Puget Sound Budget that fully supports recovery, as recommended by the Leadership Council, which will include the following:
 - » State agency budget requests that fund implementation of the 2018-2022 and 2022-2026 Action Agendas for Puget Sound.
 - » Habitat protection and restoration programs, including the Puget Sound Acquisition and Restoration fund, the Salmon Recovery Funding Board, the Estuary and Salmon Restoration Program, the Floodplains by Design program, and state match for the federal Puget Sound Nearshore Ecosystem Restoration Project.
 - » Stormwater pollution prevention programs, such as the Stormwater Financial Assistance Program.
 - » Programs to protect and enhance shellfish beds, such as Pollution Identification and Control programs, and working lands and natural resource industries.
 - » Scientific research to deepen our understanding of effective recovery mechanisms, and monitoring to report progress and identify emerging issues.
- Enact and fund implementation of the recommendations of the Governor's Southern Resident Orca Task Force. In particular, we seek implementation of the Task Force's Recommendation #48: Adopt and implement policies, incentives, and regulations for future growth and development to prevent any further degradation of critical habitat and sensitive ecosystems; enable and channel population growth in ways that result in net ecological gain; evaluate and report outcomes for all jurisdictions at the state, county, tribal, and municipal levels.

▶ For state agencies

- Work with the Partnership and the Leadership Council to develop the Puget Sound Budget. Submit budget requests to implement the 2018-2022 and 2022-2026 Action Agendas for Puget Sound.
- Work with the Leadership Council to identify and implement changes to state policies and programs that will accelerate recovery and increase climate resiliency while sustaining vibrant human communities and working lands.
- Enhance collaboration with local governments and landowners to find effective ways to protect and restore habitat and water quality.
- Collaborate with the Partnership to finalize the 2022-2026 Action Agenda. Commit within the Action Agenda to implementing actions that will achieve biophysical and human wellbeing outcomes.
- Continue and enhance collaboration with British Columbia to ensure our recovery efforts don't stop at the border. Accelerate salmon recovery work with Oregon, Idaho, California, and Alaska.
- Implement the Riparian Working Group recommendations.
- Collaborate with the Partnership on evaluations of ongoing programs.
- Work with our state family to collectively advance environmental justice efforts and implement the HEAL Act.

▶ For local governments

- Collaborate with the Leadership Council and other regional partners to identify ways that state agencies and other partners can support local government efforts to accelerate recovery while enhancing human wellbeing.
- Adopt, implement, and enforce land use policies that protect habitat, prevent stormwater pollution, and lead to the reopening and protection of shellfish beds. Look for ways to achieve environmental net gains while accommodating growth.
- Help constituents understand the connections between these land use policies, climate resiliency, and Puget Sound recovery.
- Participate in watershed-scale recovery planning and implementation efforts, via Local Integrating Organizations and salmon recovery Lead Entities.
- Collaborate with the Partnership to finalize the 2022-2026 Action Agenda. Commit within the Action Agenda to implementing actions that will achieve biophysical and human wellbeing outcomes.

▶ For Congress

- Fund the Puget Sound Geographic Program at a level commensurate with the Great Lakes and Chesapeake Bay.
- Pass the Promoting United Government Efforts to Save Our Sound (PUGET SOS) Act to establish a Puget Sound Program Office at the EPA and require federal agencies to align their efforts.
- Fund science and monitoring to increase our understanding of, and ability to report on, Puget Sound recovery.
- Double the annual funding for the Pacific Coastal Salmon Recovery Fund to ensure that salmon recovery actions occur throughout the U.S. range of the Southern Resident orcas.
- Fund needed infrastructure in a manner consistent with recovery needs.

▶ For federal agencies

- Implement the priorities of the Puget Sound Federal Task Force and report progress regularly.
- Work with the Leadership Council to identify and implement changes to federal policies and programs that will accelerate recovery while benefitting all communities equitably.
- Collaborate with the Partnership to finalize the 2022-2026 Action Agenda. Commit within the Action Agenda to implementing actions that will achieve biophysical and human wellbeing outcomes.
- Develop a science enterprise to coordinate federal science and monitoring work and implement the priorities in the Puget Sound Science Work Plan.
- Continue and enhance collaboration with Canada and its Indigenous communities to ensure our recovery efforts don't stop at the border.

▶ For non-governmental organizations

- Continue and intensify advocacy for policies and funding that support Puget Sound recovery and healthy and resilient human populations.
- Collaborate with the Partnership to finalize the 2022-2026 Action Agenda. Commit within the Action Agenda to implementing actions that will achieve biophysical and human wellbeing outcomes.
- Help raise funds for implementation of the 2018-2022 and 2022-2026 Action Agendas.
- Increase public awareness of the condition of Puget Sound, why it matters, the effects of human activities and climate change on Puget Sound, and how individuals can support Puget Sound recovery.



► For the Puget Sound Partnership

- Work with the Leadership Council and all partners to identify and implement changes to state, federal, and local policies that will accelerate recovery and increase climate resiliency while sustaining vibrant human communities and working lands.
- Lead development of the Puget Sound Budget with the Leadership Council and state agencies.
- Engage more partners in the recovery system and diversify and enhance funding sources to leverage state investments in Puget Sound, including philanthropy, impact investment, private sector commitments, and federal funding.
- Lead collaboration with all partners to implement the 2018-2022 Action Agenda and to develop the 2022-2026 Action Agenda update, which will identify a short, unified set of strategies and actions that will accelerate recovery and enhance human wellbeing.
- Commit to specific actions to advance strategies in the 2022-2026 Action Agenda.
- Continue to develop and enhance our accountability and ecosystem monitoring programs to ensure investments in Puget Sound recovery are effective and targeted.
- Continue to facilitate partner alignment with a single recovery system, thus focusing and coordinating resources and efforts, and amplifying the impact of investments across multiple agencies and partners.
- Deploy cutting-edge science to diagnose pressures on Puget Sound, identify and test potential solutions, and stay abreast of emerging issues.
- Tell the story of Puget Sound recovery.
- Work with our state family to collectively advance environmental justice efforts and implement the HEAL Act. Increase diversity, equity, and inclusion to represent everyone in the recovery effort.

► For business

- Participate in programs that support recovery such as EnviroStars, LEED, and Salmon Safe.
- Invest in solutions with the non-governmental organization community.
- Participate in Puget Sound Day on the Hill to help make the case to our federal delegation that Puget Sound recovery helps the economy.
- Support innovation by participating in forums such as Water 100.
- Support recovery efforts in the watershed you do business in.
- Commit within the Action Agenda to implementing actions that will achieve biophysical and human wellbeing outcomes.

► For the public

- Get involved. Participate in the recovery community within your area. Volunteer on a habitat restoration project or in a community-based science program. See pugetsoundstartshere.org for links to organizations to join. Or plant a tree at home.
- Quiet the waters of Puget Sound to help orcas find food. If you're a boater, give orcas space. Follow the BeWhaleWise (bewhalewise.org) guidelines for whale watching. And please use pump-out stations to keep sewage out of Puget Sound.
- Drive less. Support efforts to improve alternative transportation options in the Puget Sound region.
- Keep plastics and toxic chemicals out of our waterways. Reduce single-use waste, reuse what you can, and recycle smartly. Use environmentally friendly products in your home and on your landscape, fix vehicle leaks, use a commercial car wash, and have your vehicle oil changed by a professional.
- Speak up for Puget Sound. Vote. Tell a friend. Make sure your local, state, and federal representatives know how important Puget Sound is to you.
- Learn about the tribes, tribal sovereignty, and treaty rights.

► For tribes

The Partnership and the Leadership Council recognize that our tribal partners are sovereign nations. We respectfully ask tribes to continue to work with us in the following ways.

- Continue working together to protect and uphold tribal treaty rights.
- Identify changes to federal, state, and local laws, policies, and programs that will accelerate recovery and implement the tribal habitat strategy while enhancing human wellbeing.
- Participate in regional and watershed-scale recovery planning, implementation, and science and monitoring efforts.
- Work with the Department of Fish and Wildlife and the Leadership Council to help us integrate habitat, harvest, and hatchery efforts in Puget Sound.
- Collaborate with the Partnership to finalize the 2022-2026 Action Agenda.



PUGET SOUND
PARTNERSHIP

www.psp.wa.gov

PO Box 40900, Olympia WA 98504

☎ (360) 725-5444 ✉ info@psp.wa.gov