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Cherry Point Aquatic Reserve Management Plan

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WASHINGTON STATE DEPARTMENT OF
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Acknowledgements

Washington State Department of Natural Resources

Hilary Franz, Commissioner of Public Lands
Alex Smith, Deputy Supervisor for Aquatics

Aquatic Resources Division

Thomas Gorman Division Manager
Hannah Blackstock, Asst. Division Manager
Katrina Lassiter, Former Division Manager
Kristin Swenddal, Former Asst. Division Manager

Orca-Straits District

Dennis Clark, Former Assistant Division Manager
Ross Zimmerman, Aquatic Land Manager

Principal Authors

Roberta Davenport, Aquatic Reserves Program Manager
Allison Brownlee, Natural Resource Scientist
Betty Bookheim, Former Ecologist
Ron Coleman, Ecologist
Erica Bleke, Aquatic Reserves Research and Monitoring Scientist
Lowell Dickson, Environmental Planner
David Palazzi, Former Aquatic Land Planning and Stewardship Program Manager

GIS and Mapping

Allison Brownlee, Natural Resource Scientist

DNR Contributors

Erin Stehr, Puget SoundCorps Team Lead
Ben Papadopoulos, Puget SoundCorps Team

Cover Photo

Image taken near Point Whitehorn in May of 2022 by Allison Brownlee

List of Reviewers:

Lummi Nation

Devin Flawd
Lena Tso

Swinomish Indian Tribal Community

Heather Spore

Cherry Point Aquatic Reserve Implementation Committee

Brendan Brokes
Kim Clarkin
Lovel Pratt
Tom Ehrlichmann
Mike McKay
Sandi McMillan
(and others)

Industries:

Phillips 66
bp

Copies of this report may be obtained from the Washington State Department of Natural Resources Aquatic Reserves Program or copied from the web page. Copies may also be obtained by contacting:

Aquatic Reserves Program Manager

Phone: 360-902-1100

E-mail: aquaticreserve@dnr.wa.gov

Web: <https://www.dnr.wa.gov/aquatic-reserves>

Those needing this information in an alternative format, please call TTY-711

Cherry Point Aquatic Reserve Management Plan

Washington State Department of Natural Resources
Aquatic Resources Division
April 2024



Executive Summary

The Cherry Point Aquatic Reserve is a unique aquatic ecosystem located in the Strait of Georgia in northern Puget Sound—on the western shores of Whatcom County, Washington. The environment of the 3,050-acre reserve includes cobble intertidal areas, submerged aquatic vegetation, and a steep gradient into deep water that supports a high diversity of fish and wildlife. Species of the reserve include Cherry Point Pacific herring and other forage fish, ESA listed Chinook and coho salmon, groundfish, marine and shore birds, migratory waterfowl, Dungeness crab, bivalves and other marine invertebrates, and marine mammals. Its marine waters and aquatic lands are a portion of Treaty-protected Usual and Accustomed grounds and stations of local Native American Indians, and are used by the Indians for commercial, ceremonial, and subsistence purposes. The aquatic lands in the reserve are also used by non-Indians and provide significant economic benefits, recreational opportunities, and other social values. Cherry Point’s distinctive bathymetry provides deepwater access for large vessels without the need to dredge out shipping channels or berthing areas in the aquatic lease areas for the bp and Phillips 66 piers and a very limited need for dredging in the aquatic lease areas for the Petrogas pier. Major water-dependent industries have located on the shores adjacent to aquatic lease areas and upshore of the aquatic reserve, bringing jobs in manufacturing, petroleum oil refining, shipping and commerce. These major water-dependent industries include impacts such as vessel noise and presence impacts, and potential impacts such as accidents that lead to prop wash spills, ballast water and waste spills, fuel and cargo spills, hydraulic fluid spills, and material spills.

The Washington State Department of Natural Resources (DNR) is responsible for managing state-owned aquatic lands to provide a balance of public benefits. In 2000, DNR recognized the need to protect the significant environmental resource of aquatic lands at Cherry Point and designated those state-owned lands not already under a lease agreement as the Cherry Point Aquatic Reserve in order to ensure long-term environmental protection. All aquatic lands within the Cherry Point Aquatic Reserve are state-owned and managed by DNR. The aquatic reserve does not include aquatic lands within the boundary of Birch Bay State Park, privately owned lands, tribal lands, or aquatic lease areas. The intent of designating the aquatic lands at Cherry Point as an aquatic reserve was to withdraw the lands from further leasing.

This plan was created to identify the natural resources—habitats and species—existing within the reserve, as well as identify future threats to these resources, and to aid in the management of current and proposed uses in and adjacent to the reserve. The plan outlines potential management actions that DNR and partners can take to protect these resources. The plan addresses the management of aquatic lands; it does not address the harvest of finfish or shellfish within the aquatic reserve. Regulation and harvest of finfish and shellfish are managed by affected tribal governments and the Washington Department of Fish and Wildlife pursuant to treaties and court decisions. The plan was developed with the help of independent scientists, federal, tribal and state resource agencies, site users, lessees, and environmental and community groups who recognized the ecological importance of the site to both Puget Sound recovery and to commerce and industry.

Potential threats to habitats and species of the reserve were identified in the 2010 plan, and the 2024 plan update provides new details and information in Chapter 2, Ecosystem Description, Human Impacts and Stressors and Appendix A. A number of species and habitats addressed in this plan have experienced declines over the past 40 years, including the Cherry Point herring stock, which has

sharply declined from approximately 13,606 tonnes¹ in 1973 to ranging between 1,200 and 250 tonnes over the ten year period 2010 to 2019. In 2023, no Cherry Point herring stock spawn was detected. Other key species in decline include Puget Sound Chinook salmon, steelhead, and certain species of rockfish, surf scoter, and southern resident killer whales (Shared Strategy for Puget Sound 2007; WDFW 2011; National Marine Fisheries Service 2008).

The 2024 update provides a new Chapter 4, Progress Made Toward Achieving Plan Goals. The new chapter documents a wide range of projects in support of the reserve completed by many partners and collaborators in addition to work done by DNR's Aquatics Division staff.

This plan identifies the management emphasis for the Cherry Point Aquatic Reserve as environmental protection above all other management actions. The goals, objectives, and management actions for the reserve are detailed in Chapter 5, Management Guidance.

The plan includes actions related to: protection, enhancement and restoration, outreach and education, monitoring, data collection and research, and allowed and prohibited uses within the reserve. DNR management emphasizes long-term protection of the aquatic resources within and directly adjacent to the reserve. Consistent with its statutory authority, DNR will limit new uses in the reserve to those that are consistent with this management plan. New activities authorized on state-owned aquatic lands within or adjacent to the reserve must avoid and minimize adverse impacts to habitats and species as specified in Chapter 5. The existing industrial uses at Cherry Point do not conflict with aquatic reserve status. If the facilities are managed in alignment with this plan and the lessees actively work to further goals for the reserve, the uses can serve the objectives of the reserve. Because DNR, tribes, local, and state and federal regulatory agencies all are responsible for the state's aquatic resources, and DNR's authority is limited to proprietary management of state-owned aquatic lands, collaborative management efforts by DNR and partner organizations are needed for the success of this plan.

'Collaborative Adaptive Management' is a key component of the Cherry Point Aquatic Reserve Management Plan. Adaptive management is a systematic process for improving management actions by learning from the outcomes of actions previously taken. It requires managing and sharing data, tracking progress in carrying out the plan, making technical assessments about effectiveness of plan actions, evaluating and communicating progress, and determining course corrections needed to make the plan more effective over time. Because DNR does not have the resources to implement all the plan's actions, the following steps are a high priority for the next five years (2021-2026) of implementation:

- 1) Monitor the effectiveness of the protection actions in this plan that address existing and proposed uses, and
- 2) With collaborators, research causes of the decline, genetics and life history of Cherry Point herring, and develop methods to help recover the species.

This management plan will be reviewed and updated at least every ten years. Changes in ecosystem condition and existing uses of state-owned aquatic lands are included in the updates. Research and

¹ Tonne: A metric unit of mass equal to 1000 kilograms or 2204.6 pounds. Also known as a metric ton. The imperial ton (still widely used in the US) equals 2000 pounds; 1 tonne equals 1.10231 tons.

monitoring are used to guide DNR, collaborators and partners in determining whether management actions are supporting the objectives of the reserve.

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List of Acronyms

ACZA	Ammoniacal Copper Zinz Arsenate
AIS	Automatic Identification System
ANeMoNe	Acidification Nearshore Monitoring Network
AOP	Air Operating Permit
ARCO	Atlantic Richfield Company
BBWARM	Birch Bay Watershed and Aquatic Resources Management
bp	bp Cherry Point Refinery
CAO	Critical Areas Ordinance
CoSMoS	Coastal Storm Modeling System
CP	Cherry Point
CPAR	Cherry Point Aquatic Reserve
Ecology	Washington State Department of Ecology
EGC	European Green Crab
EPA	United States Environmental Protection Agency
ERM	Environmental Resources Management
ESA	Endangered Species Act
ESHB	Engrossed Substitute House Bill
CSC	Citizen Stewardship Committee
DNR	Washington State Department of Natural Resources
DOH	Washington State Department of Health
ESU	Evolutionary Significant Unit
GIS	Geographic Information System
GMA	Growth Management Act
GRP	Geographic Response Plan
HPA	Hydraulic Project Approval
IC	Implementation Committee
JARPA	Joint Aquatic Resource Permit Application
LPG	Liquefied petroleum gas
MLLW	Mean Lower Low Water
MOU	Memorandum of Understanding
MRC	Marine Resources Committee
NMFS	National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPS	North Puget Sound
NWACP	Northwest Area Contingency Plan
NWIFC	Northwest Indian Fisheries Commission

OFM	Washington State Office of Financial Management
OWSC	Office of the Washington State Climatologist
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PSC	Puget SoundCorps
PSE	Puget Sound Energy
QA/QC	Quality Assurance/Quality Control
RCW	Revised Code of Washington
SEPA	State Environmental Policy Act
SMA	Shoreline Management Act
SMP	(Whatcom County) Shoreline Management Program
SOG	Strait of Georgia
SOK	Spawn-on-kelp
SQU	Sediment Quality Unit
SRKW	Southern Resident Killer Whale
SVMP	DNR Submerged Vegetation Monitoring Program
TAC	Technical Advisory Committee
TMDL	Total Maximum Daily Load
UGA	Urban Growth Area
USCG	United States Coast Guard
VEAT	Vessel Entries and Transits
VTRA	Vessel Traffic Risk Assessment
WAC	Washington Administrative Code
WCC	Whatcom County Code
WDFW	Washington State Department of Fish and Wildlife
WRIA	Water Resource Inventory Area

1. Introduction

Washington's Department of Natural Resources

The Washington State Department of Natural Resources (DNR) Aquatic Resources Division manages about 2.6 million acres of state-owned aquatic lands. This includes 64,000 acres of tidelands, 32,000 acres of shorelands, and 2.46 million acres of marine and freshwater bedlands. In addition, there are approximately 13,000 acres of other aquatic lands, such as Harbor Areas, waterways and abandoned lands, that fall under DNR management.

DNR is directed by the Revised Code of Washington (RCW) to manage state-owned aquatic lands to provide a balance of public benefits that include encouraging public access, fostering water-dependent use and access, ensuring environmental protection, and utilizing renewable resources. In addition, DNR is directed to generate revenue from state-owned aquatic lands when it is consistent with the other public benefits. DNR manages the state's sensitive aquatic lands and when necessary, removes them from conflicting uses. As part of this authority, under Washington Administrative Code (WAC) 332-30-151, DNR can establish aquatic reserves on state-owned aquatic lands. The Cherry Point Aquatic Reserve was initially established by Public Lands Commissioner Jennifer Belcher as an environmental aquatic reserve in 2000 prior to the establishment of the Aquatic Reserves Program. Cherry Point was confirmed as a reserve candidate in 2003 after the establishment of the Aquatic Reserves Program and according to the Program Implementation Guidance. The first management plan was adopted in 2010 and amended in 2017. The management plan update began in January 2020 and was finalized in 2024.

Aquatic Reserves Program

DNR established the Aquatic Reserves Program to promote preservation, restoration, and enhancement of important native ecosystems on state-owned aquatic lands. There are eight existing reserves as of the 2024 plan update (Figure 1).

Successful long-term management of aquatic reserves depends upon a fair and transparent process for proposing, designating, and planning for management actions in reserves to conserve the most important aquatic resources statewide.

Three types of aquatic reserves may be established through the Aquatic Reserves Program: environmental, scientific, or educational. A combination of the categories is also possible. The objectives for each reserve category can be found in the *Aquatic Reserve Program Implementation and Designation Guidance*, on DNR's webpage <https://www.dnr.wa.gov/>.

DNR and its partners manage each reserve in a manner consistent with the goals for the type of reserve established and site-specific management plans.



Figure 1. Washington State Aquatic Reserves.

Legal Authorities for Establishing State Aquatic Reserves

RCW 79.105.030 identifies environmental protection as one of DNR’s primary directives for the management of state-owned aquatic lands and provides the statutory requirement for the Aquatic Reserves Program. WAC 332-30-151 directs DNR to consider lands with educational, scientific, and environmental values for aquatic reserve status, and identifies management guidelines for aquatic reserves. WAC 332-30-106(16) defines environmental reserves as sites of environmental importance, which are established for the continuance of environmental baseline monitoring and/or areas of historical, geological, or biological interest requiring special protective management. RCW 79.10.210 further authorizes DNR to identify and withdraw from all conflicting uses public lands that can be utilized for their natural ecological systems. DNR does not acquire properties to establish reserves; they are designated on existing state-owned aquatic lands or donated aquatic lands.

Reserve Description in Brief

The Cherry Point Environmental Aquatic Reserve was initially established in 2000. The 3050-acre reserve is located in the Strait of Georgia, on the western shores of Whatcom County. It is bounded on the north by the southern boundary of Birch Bay State Park, and on the south by the northern boundary of the Lummi Indian Nation Reservation. Cherry Point has a unique marine and freshwater ecosystem that supports a variety of natural resources, fish and wildlife. Aquatic diversity along this reach is very high with mixed coarse, cobble intertidal habitat, including boulders, sandy beaches, eelgrass, and mixed seaweed beds including bull kelp. Additionally, the deep water area close to shore and the steep gradient along this reach is important to marine diversity. At one time Cherry Point provided spawning habitat for the largest Pacific herring population in Washington State. The area is a nearshore migratory corridor for juvenile salmon, and provides significant habitat and foraging areas for marine seabirds and migratory waterfowl populations. Five species of salmon — sockeye, Chinook, coho, chum, and pink — and four species of forage fish: Pacific herring, surf smelt, Pacific sand lance, and northern anchovy rely upon these habitats. Various species of ground fish have been surveyed offshore.

Cherry Point supports a large recreational, commercial (both tribal and non-tribal), and tribal ceremonial and subsistence Dungeness crab fishery, and a smaller spot shrimp fishery located offshore to the west (Whatcom County MRC 2001).

In addition to the unique habitat features of Cherry Point, the distinctive bathymetry and water depths of more than 70 feet relatively close to shore provide deepwater access for large vessels (Appendix C, Map C-1). Three major water-dependent industries are located adjacent to the aquatic reserve within existing lease areas, and on the shores of Cherry Point, bringing jobs in manufacturing, shipping and commerce. In recognition of the importance of this economic base to the region, Whatcom County established the Cherry Point Management Area to provide a framework for balancing special port, industrial and natural resource needs.

Cherry Point Aquatic Reserve Boundary

The Cherry Point Aquatic Reserve (Figure 2) is within the state-defined Water Resources Inventory Area 1, known as the “Nooksack WRIA” (Appendix C, Map C-2). The existing boundary for the aquatic reserve includes all state-owned tidelands and bedlands within approximately 5,000 feet of the marine shoreline and any adjacent state-owned bedlands within the 70-foot bathymetric contour as shown in Figure 2. The legal description for the reserve is located in Appendix G.

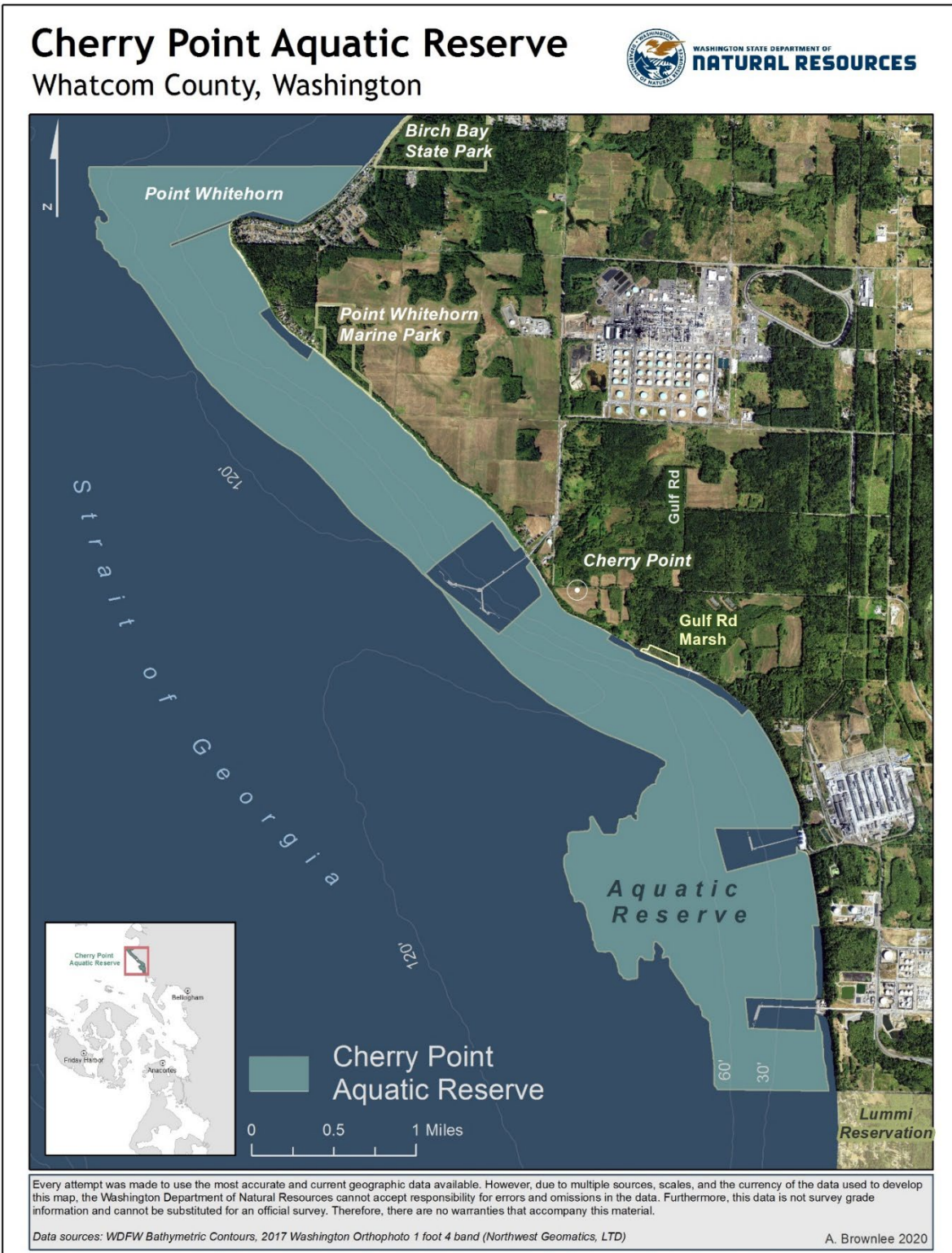


Figure 2. Cherry Point Aquatic Reserve boundary.

2017 Boundary Change Amendment

On January 5, 2015 the Lummi Nation submitted a request to the US Army Corps of Engineers (Corps) to deny the Gateway Pacific Terminal (GPT) Section 404/10 permit application because of a greater than *de minimis* impact on their usual and accustomed (U&A) treaty fishing rights at Cherry Point. (this request was also supported by other tribes with U&A rights) On May 9, 2016, the Corps issued a *Memorandum for Record* with the subject: "Gateway Pacific Terminal Project and Lummi Nation's Usual and Accustomed Treaty Fishing Rights at Cherry Point." The memo finds that the proposed overwater structure would have a greater than *de minimis* impact on the Lummi tribe's access to its usual and accustomed fishing grounds for harvesting fish and shellfish (U.S. Army Corps of Engineers 2016).

In 2016, DNR evaluated a request from the Lummi Nation to change the reserve boundary to add aquatic lands previously excluded under the August 1, 2000 and November 18, 2010 Commissioner's Orders. A technical advisory committee met in November 2016 to evaluate the proposal to include the 45-acre "cutout" (left for then-proposed Gateway Pacific Terminal) into the reserve. The technical advisory committee unanimously recommended incorporating the "cutout", citing important Pacific herring and eelgrass habitat vital to local salmon runs. The technical advisory committee recommendation noted that "The CPAR and the Gateway cutout "is of profound cultural and spiritual significance' to the Lummi Nation and other tribal nations," and "an important area for state and Tribal crab and salmon fisheries." DNR also conducted a public State Environmental Policy Act (SEPA) review to evaluate the boundary change. Over 5,000 interested parties provided comments or signed petitions regarding this Determination of Nonsignificance, the majority of which were in support of the boundary change. On January 3, 2017, the Commissioner's Order (see Appendix G) amending the reserve boundary was signed and the management plan maps and reserve legal description were revised to reflect this change.

In 2023 bp purchased 1600 acres of the property from SSA marine adjacent to the former GPT proposed pier. As of early 2024 the company has not stated a plan for the property other than for mitigation and buffering their current facility.

Purpose of the Cherry Point Aquatic Reserve Management Plan

This plan describes the habitats and species identified for conservation in the aquatic reserve and the management actions that will be taken by DNR to protect these resources. The management emphasis will place protection of these aquatic resources as the highest priority. Community and regional interests and values are important for the long-term existence and support for the reserve and are recognized as essential elements of the plan as well. This plan is developed in accordance with the State Environmental Policy Act (SEPA), and will serve as DNR's primary management guidance for the 90-year term of the reserve. At least every ten years after the adoption of this plan (in 2010), it will be reviewed, and as necessary, updated with current scientific, management, and site-specific information.

The primary focus of this plan is to protect, enhance and restore habitats used by Cherry Point herring, salmon, migratory and resident birds, and Dungeness crab, groundfish rearing areas and marine mammals, as well as the protection of submerged aquatic vegetation and water quality. This management plan does not address the harvest of finfish or shellfish within the aquatic reserve.

The people who assisted with the development and update of this plan realize that the aquatic environment of Cherry Point:

- provides essential habitat and irreplaceable biological and ecological functions;
- provides significant economic benefits, recreational opportunities and other social values;
- and is located within the area of treaty-protected usual and accustomed (U&A) grounds and stations of local Native American Indians.

The plan is intended to provide the basis for greater understanding of factors affecting the aquatic ecosystem of the Cherry Point Aquatic Reserve, provide guidance for management actions, and allow for adaptive management in order to protect these resources, while recognizing the importance of the continued industrial and other water-dependent uses located in and adjacent to the reserve. The plan contains the following chapters:

1. **Introduction:** Describes the role of the Washington State Department of Natural Resources, the background on the aquatic reserve, important conservation elements, how the plan was developed, the aquatic reserve boundary, and relationship to federal, state, local and tribal management.
2. **Ecosystem Description, Human Impacts and Stressors:** Provides an overview of the ecological characteristics and current conditions of the site, and provides a summary of the current and potential future impacts. Greater detail on these topics are found in Appendix A.
3. **Ownership and Uses:** Describes adjacent ownership, land use, leases, and activities within and near the reserve.
4. **Progress Made Toward Achieving Plan Goals:** Describes activities and projects completed by DNR and partners that help achieve goals of the plan.
5. **Management Guidance:** Describes the goals, objectives and strategies for reserve management.
6. **Implementation Guidance:** Describes how the plan will be implemented, including monitoring and adaptive management to evaluate the success of the recommended actions.
7. **References:** Contains references for all chapters.

Plan Updates and Adaptive Management

This is the first update of the plan following adoption of the original management plan in 2010. Every ten years, the plan is reviewed and updated with current scientific, management, and site-specific information. During the development of each update, DNR works with the Cherry Point Aquatic Reserve Implementation Committee to establish cooperative management for activities within and adjacent to the reserve. These activities aim to conserve, enhance and restore habitats and species within the reserve, and support public access and education. As with the development of this plan, DNR will update the plan through work with other jurisdictions, tribes, interest groups, landowners and lessees, and local community members to establish cooperative management actions.

DNR intends to manage the reserve through the Collaborative Adaptive Management² process. This is a structured process of decision making in the face of uncertainty, with an aim to reduce uncertainty over time via system monitoring. Collaborative Adaptive Management helps DNR integrate changes in scientific knowledge concerning the site, conditions of habitats and species, and uses of state-owned aquatic lands. Knowledge gained from research and monitoring activities provides objective data about how well management actions are meeting goals and objectives for the reserve. This process improves site management through learning about the system, using results from data generated by DNR and local partners to evaluate management actions and develop new strategies. For instance, data on forage fish spawning sites could be used to evaluate whether restoration work is increasing egg survival, or spawning areas are expanding or contracting. In the past ten years, significant studies were completed that provide science-based information to support management actions in the upcoming ten-year period. Ongoing monitoring provides the ability to compare current conditions to a baseline and detect changes over time.

By establishing a stronger process to engage stakeholders and partners during the 2020–2024 management plan update, DNR will support the collaborative aspect of adaptive management. DNR will include new scientific results in plan updates, and new inclusions and adaptations will not be restricted to every ten years. Plan updates will be posted on the aquatic reserves webpage and emailed to the stakeholder group.

Important Conservation Elements

The Cherry Point Aquatic Reserve is established to protect and conserve key elements of the natural environment and preserve valued ecosystem goods and services listed in Table 1.

Protecting, enhancing and restoring these elements will be the focus of conservation efforts and management actions in the reserve. Managing the complexity of this ecosystem and its many values to the community require a broad array of expertise that is reflected in the plan’s emphasis on collaboration. We continually refer to the important conservation elements as we prioritize areas of focus for research, monitoring, and resulting actions.

Table 1. Important Conservation Elements for the Cherry Point Aquatic Reserve.

Category	Conservation Element	Description
Physical Processes	Hydrologic processes	Freshwater inputs to the nearshore, and other functions that are unimpeded by structures and modifications.
	Sediment movement	Critical functions of healthy nearshore habitat areas are supported by sediment drift cells on beaches with minimal armoring. Restoration is essential to maintain, enhance or restore natural functions and habitat.

² Williams, B. K., and E. D. Brown. 2012. Adaptive Management: The U.S. Department of the Interior Applications Guide. Adaptive Management Working Group, U.S. Department of the Interior, Washington, DC.

Category	Conservation Element	Description
Habitats and Communities	Submerged aquatic vegetation	Native eelgrass beds (<i>Zostera marina</i>) provide complex structural habitat for many species, including spawning, nursery, refuge, and foraging areas for juvenile and adult invertebrates, fishes, and birds.
		Floating and understory kelp and other macroalgae support primary productivity, and provide structural habitat for spawning, nursery, and foraging juvenile and adult fishes, invertebrates, and birds.
	Tide flats, intertidal nearshore	Intertidal areas support diverse habitats for resting and foraging birds, juvenile fishes, crabs, numerous small crustaceans, and invertebrate species. Tidal flats function as a storm buffer, minimize flooding, and facilitate water absorption; water temperatures warm earlier and retain heat; detritus, carbon, nutrients are retained; and contaminants are taken up.
	Beaches that support spawning habitat	Shorelines with upper intertidal areas of mixed sand and fine gravels, particularly depositional features such as spits, provide critical habitat for forage fish spawning and foraging birds.
Species	Surf smelt and Pacific sand lance	Forage fish provide a food source for many seabirds, salmon, and marine mammals. Surf smelt are the most common species of forage fish on reserve beaches and spawn primarily in summer months.
	Pacific herring: Cherry Point herring	Although spawning has declined precipitously over the past decade for the Cherry Point herring stock, broad year-to-year fluctuations are typical of Pacific herring. Preserving and optimizing available spawning habitat areas continues to be a priority in the reserve.
	Southern Resident Killer Whale; marine mammals	Southern resident killer whale (orca) pods are known to travel through and feed in the reserve waters. Marine mammals (such as Harbor seals) haul out on the beach and on large rocks in the intertidal zone.
	Dungeness crab	Key ecosystem components support the life cycle of Dungeness crab, which are an important cultural and commercial species in the reserve.
	Juvenile salmonids	The reserve provides refuge and forage areas for juvenile salmon. Coho, Chinook, pink, and chum salmon utilize the shoreline as migratory corridors and rearing area.

Category	Conservation Element	Description
	Seabirds, migratory waterfowl Waterbirds ³	The reserve is an important wintering and migratory bird area, providing shallow protected waters and foraging areas. Seasonal and migratory birds include geese, grebes, loons, scoters, diving and dabbling ducks, terns and gulls. Resident birds include great blue heron, bald eagle, osprey, and several species of cormorant.
Valued Cultural Features	Crabbing, fishing, shellfishing	Recreational and commercial uses.
	Treaty protected tribal uses; and traditional uses	There are five tribes with treaty rights in the Cherry Point area. The Lummi Nation is committed to maintaining the cultural, historical and ecological benefits and opportunities provided by the Cherry Point aquatic landscape.
	Traditional uses – shellfish harvest	Shellfish resources are a valued traditional food source for local native tribal communities.
	Aesthetics – scenic beauty	Public access to water views, wildlife, and shorelines. Recognize and emphasize the importance of scenic beauty and ecosystem existence value.

Cherry Point Aquatic Reserve Background

DNR has been involved in aquatic land management in the Cherry Point area since the 1950s when the first refinery pier was constructed on state-owned aquatic lands. As additional facilities were proposed at Cherry Point, DNR and other stakeholders recognized the need for striking a balance between economic development and environmental protection. In 2000, then Commissioner of Public Lands, Jennifer Belcher designated an environmental aquatic reserve for state-owned aquatic lands at Cherry Point not already under a lease agreement, ensuring environmental protection as a long-term management objective. While state-owned aquatic lands at Cherry Point were reserved and withdrawn from conflicting uses, there was no site-specific plan to guide management decisions for the reserve. This set in motion DNR’s actions to develop a plan that protects the reserve’s unique ecosystem while managing the area consistent with Whatcom County’s “Cherry Point Special Management Area” shoreline designation. In 2001, interim management guidance was finalized and applied to the Cherry Point Aquatic Reserve until a management plan was adopted in 2010.

DNR began discussing the future management plan for the Cherry Point Aquatic Reserve in 2003. The Technical Advisory Committee (TAC), an independent group of scientists tasked with evaluating the Cherry Point site against DNR aquatic reserve criteria, unanimously recommended managing the site as an environmental aquatic reserve. The committee’s recommendation recognized

³ Waterbirds. For this plan, the term *waterbird* is used to describe birds listed in Appendix B that occupy and use shallow inland marine bays, and salt marsh habitats. These include marine diving ducks and alcids, shorebirds of all kinds, dabbling ducks, gulls, and brants geese.

Cherry Point as an extraordinary stretch of shoreline with excellent potential to maintain the relatively undeveloped character of the area. The herring spawning in the area was recognized as a unique biological feature of Puget Sound and its importance to the ecosystem was emphasized. They also noted that aquatic diversity along this reach is very high with cobble intertidal habitat, large rocks and boulders, and kelp just offshore.

The Technical Advisory Committee specifically noted:

“...while initially disturbing, industrial development associated with the piers appears to be compatible with aquatic reserve status and noted the opportunity to facilitate multiple-uses as an example where commercial activities and environmental resources can co-exist.”

DNR staff and scientists prepared preliminary documents providing background information regarding the uses in the area and a list of potential issues of concern relating to the aquatic ecosystem in the Cherry Point area. Outreach included the various resource agencies and interest groups in the area. Information was gathered to broaden the issues to be considered in the planning process. Public meetings were held to further refine the scope of the planning process. This led to the development of an outline for future discussion of planning needs.

During this planning process, Whatcom County updated their critical area inventory and shoreline analysis leading to an updated Critical Area Ordinance (CAO) that covered Cherry Point, which was adopted in September 2005.

In 2006, DNR staff worked with Whatcom County Shoreline planners and their consultants to examine the opportunity to merge planning efforts. The Whatcom County Shoreline Management Program (SMP) update was underway and needed to examine and plan for environmental and public access considerations in the Cherry Point Management Area. Believing there were common interests to be addressed, the County and DNR considered the option of incorporating certain aspects of an aquatic reserve management plan into the SMP and at the same time provide a potential alternative to the Cherry Point Aquatic Reserve. DNR agreed to this process based on the understanding that any alternative approach to managing this area must meet or exceed the protection for resources provided under the Aquatic Reserves Program, and its management plan. The Cherry Point Workgroup was formed to evaluate this and other resource planning alternatives.

Plan Development and the Cherry Point Workgroup

In 2007, DNR brought together a group of stakeholders with a wide range of interests in the community and Puget Sound to assist DNR in evaluating management options for the Cherry Point Aquatic Reserve. The Cherry Point Workgroup first met in July 2007 for a preliminary discussion of the goals and possible outcomes of the process.

Between July 2007 and April 2008 the Workgroup and several subcommittees examined the management of activities in the vicinity of Cherry Point during the previous ten years. The group sought out information and answers from a wide range of professionals regarding all aspects of resource and industrial management in the area. The Workgroup contributed technical information and developed recommendations for actions to be included in the management plan. As a result of the Workgroup's efforts, DNR determined that state-owned aquatic lands within the Cherry Point Aquatic Reserve would continue to be managed as an aquatic reserve. The Workgroup took an ecosystem-based approach towards identifying the habitats, species and threats associated with the Cherry Point Aquatic Reserve. Note the Workgroup is now called the Cherry Point Aquatic Reserve

Implementation Committee (CPAR IC). More detail on the work of the committee is included in Chapter 6, Implementation Guidance.

Areas outside the reserve are discussed in this plan to provide an ecosystem-based approach to habitat and species protection, minimize the gaps in understanding of Cherry Point resources, and facilitate coordination of plan implementation amongst the agencies, stakeholders, and others. DNR will work collaboratively with resource managers that have authority under federal, state, and local laws to help address off-site impacts to the aquatic reserve and achieve the goals and objectives of this plan.

In 2020 the CPAR IC and DNR reserves staff began the process of updating the management plan, with an in-person planning meeting held shortly before the Covid 19 epidemic began. This process stretched over several years because of the impacts of Covid on participants, tribes, and other unforeseen delays such as substantially late but necessary comments, and additional outreach to U&A treaty tribes.

Relationship to Federal, State, Local and Tribal Management

This plan is promulgated under DNR's proprietary authority to manage state-owned aquatic lands. Other federal, state, local and tribal authorities also regulate activities within the Cherry Point Aquatic Reserve and the watershed that drains into it. The successful management of activities and resources requires coordination and collaboration with public and private entities as well as local, state, federal, affected Tribal governments, and non-government organizations. The entities which share management authority for natural resources at Cherry Point are referred to as the 'resource managers.' The following provides information regarding ongoing management roles at the reserve.

Tribal Treaty Rights and Interests

Tribes manage cultural and natural resources located on adjacent reservation lands, and those resources related to the right to fish off-reservation at usual and accustomed places. DNR is obligated to conduct government-to-government consultations with all federally recognized tribes, under the 1989 Centennial Accord (<https://goia.wa.gov/relations/centennial-accord>), DNR Tribal Relations Commissioner's Order # 201029. In addition, pursuant to numerous court rulings and Presidential Executive Orders, all federal agencies are required to consult with affected Indian tribes in a government-to-government manner and ensure that impacts to tribal treaty rights are avoided and/or minimized and any unavoidable impacts are mitigated to the satisfaction of the affected tribal governments.

DNR will continue to engage in a government-to-government dialog with the affected tribes to help ensure this plan's conformance with treaty rights, and that tribal historical and cultural ties to the Cherry Point Aquatic Reserve are maintained. DNR will work cooperatively with the tribes to protect fisheries, archaeological sites, and access to cultural sites; and allow for treaty-protected hunting and gathering of resources in a manner that fosters the sustainability of those resources. Tribes and the state of Washington have developed a cooperative framework which provides for fisheries management and habitat protection.

This plan recognizes the policy statement developed by the Northwest Indian Fisheries Commission on behalf of member Northwest Tribes discussing the importance of considering the impacts conservation measures can have on tribal economics, subsistence and culture. Under this, Northwest Tribes highly recommend that the creation of any Marine Protected Area (local, state, federal or

otherwise) not occur in the absence of any demonstrated need. In the face of such demonstrated need, Northwest Tribes do recognize that Marine Protected Areas may be useful tools for protecting or sustaining resources (NWIFC 2003). In line with this policy, one of the primary goals of this management plan is to help demonstrate where there is a need for protecting and sustaining resources.

Cherry Point is located within the usual and accustomed areas of several federally recognized tribes, including the Lummi, Nooksack, Swinomish, Suquamish, and Tulalip Tribes. The cultural resources department of each tribe has specific interests in the long-term cultural resource protection and management of this area. Cherry Point is within the homeland of the aboriginal Lummi Tribe whose sole successor is the present-day Lummi Nation. Cherry Point contains homelands of the Lummi Tribe that were ceded to the United States in the Point Elliot Treaty for considerations, including the right to fish in common with the citizens of the territory at the tribe's usual and accustomed fishing grounds and stations. Tribes exercise their interest based on the specific location and particular impacts associated with local planning processes and project proposals. The federal government is obligated to protect the long-term interests of tribes by limiting or conditioning permits that impact cultural objectives of tribes. All projects and plans for this area shall require government-to-government consultation with appropriate tribal governments under the State Centennial Accord. Local entities are strongly advised to consult with Tribal governments regarding permitted activities and local plans. It is essential that conservation goals and management standards be established in cooperation with these tribes.

Regular discussions should be planned with affected tribes to ensure that this plan remains consistent with cultural resource goals and treaty rights of the tribes.

U.S. Coast Guard

The U.S. Coast Guard (USCG) manages vessel activity and responds to pollution reports within Puget Sound through the Marine Safety Office. The Coast Guard also helps ensure the safety of vessels during transit and while in port. The USCG manages commercial vessel traffic throughout Washington's waters, including at Cherry Point, and is responsible for reviewing designated anchorage sites. The Coast Guard is the lead response agency for spills in coastal waters and deepwater ports, implements federal ballast water laws, and discharge of onboard sewage in federal waters.

U.S. Army Corps of Engineers

Under Section 10 of the Rivers and Harbors Act, the U.S. Army Corps of Engineers (Corps) oversees any in-water development in navigable waters. Additionally, the Corps has been delegated authority under the Clean Water Act (CWA) for the issuance of Section 404 permits. The Corps supports navigation by maintaining and improving channels; develops projects to reduce flood damage, and regulates dredging and filling activities in wetlands and waterways including the construction of any structures such as bulkheads or piers. Like all federal agencies, the Corps must ensure that tribal trust resources are protected prior to taking any action that could potentially affect treaty-protected resources, including fishing and cultural or traditional properties.

U.S. Environmental Protection Agency

The Environmental Protection Agency (EPA) is the lead federal response agency for oil spills occurring in inland waters and jointly administers Section 404 of the CWA with the Corps. The EPA has delegated the administration of other sections of the Clean Water Act (e.g., Section 401, Section

402) to the Washington State Department of Ecology and the Lummi Nation but still retains the responsibility to ensure that those sections of the CWA are effectively administered and that their trust responsibilities to tribal governments are upheld.

U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service is charged with protecting those species listed under the Endangered Species Act and the Migratory Bird Treaty Act and the habitats those species rely upon.

National Oceanic and Atmospheric Administration (NOAA) Fisheries

The NOAA National Marine Fisheries (NMFS) is responsible for protection of marine and freshwater species under the Endangered Species Act and the Marine Mammal Protection Act. NMFS is also responsible for consultation under the Magnuson-Stevens Fishery Conservation and Management Act and the designation of critical fish habitat. NOAA also tracks vessel traffic using U.S. Coast Guard Automatic Identification System (AIS) records and makes the data available to the public.

Washington State Department of Health

The state Department of Health regulates opening and closing of recreational and commercial shellfish zones and advises the public as to the healthy recreational harvest of shellfish.

Washington State Department of Ecology

The Washington State Department of Ecology (Ecology) contributes to resource protection through the Spill Prevention, Preparedness and Response Program; Air Quality; Water Quality; Toxics Cleanup; Shorelands Assistance; Water Resources; Solid Waste (Industrial Section – permitting); Hazardous Waste and Toxic Reduction Programs. The Ecology Spill Prevention, Preparedness and Response Program focuses on prevention of oil spills to Washington waters and land, as well as planning for an effective response to any oil and hazardous substance spills that may occur. Vessel traffic in Washington State is tracked by Ecology's spill program and published in Vessel Entries and Transits (VEAT) for Washington Reports. Ecology reviews and must approve local Shoreline Master Programs and all applications for major substantial development permits involving construction in waters of the state.

Ecology also works to maintain water and sediment quality standards, such that listing of waterbodies or segments as impaired under Section 303(d) of the Clean Water Act is unnecessary. They are responsible for developing and approving National Pollutant Discharge Elimination System (NPDES) permits for industrial and municipal discharges. Nonpoint source pollution is managed through a variety of state and local programs; Ecology has developed a nonpoint pollution plan that focuses on local land use activities. Finally, Ecology issues water quality consistency certifications under Section 401 of the CWA, which help ensure compliance with the law's Antidegradation Policy (Ecology website 2008).

Washington State Department of Fish and Wildlife

The Washington Department of Fish and Wildlife (WDFW) has authority over the management of the non-tribal commercial and recreational shellfish harvesting and fisheries. WDFW is a co-manager with tribal governments and collaborates on the management of commercial and recreational finfish and shellfish harvesting. WDFW also plays an important role in oil spill response, ballast water

monitoring and Natural Resources Damage Assessments. The agency also protects natural resources from development through its Hydraulic Project Approval (HPA) process.

The State Legislature gave WDFW the responsibility of preserving, protecting, and perpetuating all fish and shellfish resources of the state. To assist in achieving that goal, the State Legislature in 1949 passed a state law now known as the "Hydraulic Code" (Chapter 77.55 RCW). The law requires that any person, organization, or government agency wishing to conduct any construction activity that will use, divert, obstruct, or change the bed or flow of State waters must do so under the terms of a permit (called the *Hydraulic Project Approval-HPA*) issued by WDFW. The purpose of the permit is to address any damage or loss of fish and shellfish habitat which is considered to result in direct loss of fish and shellfish production.

Washington State Parks and Recreation Commission

The State Parks and Recreation Commission plays a vital role in educating the public regarding appropriate recreation. Washington State Parks manages the Birch Bay State Park to the north of Cherry Point Aquatic Reserve, and has an existing lease for aquatic lands offshore of the state park. Birch Bay State Park is a 194-acre camping park with 8,255 feet of saltwater shoreline on Birch Bay and 14,923 feet of freshwater shoreline on Terrell Creek. The park is rich in archeological significance and offers panoramic views of the Cascade Mountains and Canadian Gulf Islands. Birch Bay State Park is one of the largest recreational shellfish areas in the state.

Puget Sound Partnership

In 2007, the Legislature established the Puget Sound Partnership. The Partnership periodically updates the Action Agenda for Puget Sound, which aims to restore the environmental health of Puget Sound. DNR is a member of the Ecosystem Coordination Board that advises the Partnership's Leadership Council. In December 2018, the Partnership released an update to the Action Agenda. The following vital signs and regional priorities relate to management of the Cherry Point Aquatic Reserve:

- Marine Water Quality: Indicators include dissolved oxygen and ocean acidification
- Chinook salmon: Protect and restore vital habitat for salmon populations
- Orca: Implement Southern Resident Orca Task Force recommendations
- Shoreline Armoring: Implement landscape scale plans and projects for the protection and restoration of shoreline processes
- Birds: Marine bird population abundance
- Pacific Herring: 2020 Recovery Goal for Cherry Point Herring = 5,000 tons spawning biomass
- Eelgrass: Conserve existing habitat, monitoring and restoration

Achieving many of the actions in Chapter 6 of this plan will depend on funding and implementation of the state's Puget Sound Action Agenda. DNR will continue to work with the Puget Sound Partnership and other cooperating agencies to implement the Action Agenda.

Whatcom County

Whatcom County regulates upland and shoreline land uses within its jurisdiction. The Whatcom County Comprehensive Plan and the Whatcom County SMP, described in Chapter 3, are the key tools for managing land use. Whatcom County's geographical jurisdiction extends to the centerline of

the Georgia Strait; county ordinances require environmental review of impacts to the waters, seabed and shoreline within the reserve area from land-side industrial proposals. The county also manages parks and recreational lands, the local public transportation network, and other public facilities. Point Whitehorn Marine Reserve is an upland site managed by the county, and was established in 2007 adjacent to the aquatic reserve. The county-managed marine reserve provides the only formal public access to beaches on the aquatic reserve. In addition, the county regulates clearing, grading, and construction activities and provides pollution control through management of stormwater runoff and regulation and inspection of onsite septic systems.

In 2022, through an extensive public process, the county adopted Ord. No. 2022-046 requiring that certain projects review environmental impacts to air and water resources, including impacts to the reserve area.

Birch Bay Watershed and Aquatic Resources Management (BBWARM) District

Whatcom County Council established BBWARM in 2007 to address public concerns regarding water quality, flooding and erosion, and loss of aquatic habitat in the Birch Bay Watershed. BBWARM contributes to the protection and management of resources through outreach and education, water quality monitoring, capital improvement projects, and the development of subwatershed master plans. The BBWARM stormwater program developed the Birch Point, Terrell Creek Urban Area, and Point Whitehorn Subwatershed Master Plan in 2016 to protect water quality and reduce stormwater impacts. The Point Whitehorn subwatershed drains into the northern portion of the reserve, both to Birch Bay and the Strait of Georgia.

2. Ecosystem Description, Human Impacts and Stressors

This chapter briefly describes the key elements of ecosystems – habitats, ecological processes and functions of the Cherry Point Aquatic Reserve (CPAR), and includes potential impacts and stressors to the reserve ecosystem. This information creates the context and lays the groundwork to help inform other components of this plan, such as the *important conservation elements* (Table 1), and *management objectives* and *strategies* (see Chapter 5). For a more detailed description of ecosystem characteristics, elements, and potential stressors described below, see Appendix A.

Ecosystem Description

Geographic Context

The Cherry Point Aquatic Reserve (CPAR) extends along the eastern shores of the Strait of Georgia, in northwestern Whatcom County. The larger marine geographic region referred to as the Southern Salish Sea (Washington’s inland marine waters), encompasses the Puget Sound, Hood Canal, the Strait of Juan de Fuca, and the southern Strait of Georgia. The reserve incorporates the nearshore waters of the Strait of Georgia with the coastline stretching from Neptune Beach northward to Cherry Point, then continuing northwest to Point Whitehorn. The reserve area wraps around the point to the east for a short stretch along Birch Bay’s south shore, then turns to the north extending for another moderate stretch of shoreline until ending at the western boundary of Birch Bay State Park. For a map of the reserve, see Figure 2.

Physical Description

Geomorphic characteristics in the region feature glacially deposited sediments, forming prominent high to moderate backshore bluffs fringed by rock strewn gravel beaches. The reserve experiences normal tidal ranges for the region, but considerable fetch (exposure) and wave action merged with the glacial framework including “moderate uplift” (1.17 millimeter/year – Zervas et. al 2013), create a dynamic landscape. These processes and components maintain a distinctive beach face often dominated by cobble and scattered boulders with mixed sand and pebble infill. Adjacent to the northeastern boundary of the reserve, a low barrier berm and road separate the Terrell Creek freshwater wetland from the gentle sloping beach face, sandflats, and boat ramp of Birch Bay State Park. Slightly above sea level to the southwest, Birch Bay’s backshore topography gradually rises to moderate bluffs, progressively elevating westward to the high sea cliffs of Point Whitehorn. Point Whitehorn forms the prominent headland punctuating the most northwestern extent of upland area adjacent to the aquatic reserve. The high, exposed bluffs sweep southeast from the Point, maintaining an elevated profile along the Cherry Point reach and Strait of Georgia coastline. Continuing southeast down the coast, Cherry Point contains both a natural stretch of shoreline as well as three industrial piers that are located within existing lease areas (aquatic reserve “cutouts”). Although the piers are a substantial presence, they are spread out along the reach with most of their associated development inland and minimally visible from the reserve area. Altogether, the dramatic vegetated high bluffs and lengthy spans of undeveloped beaches with rich marine shoreline habitat embody distinctive and diverse aquatic reserve terrain.

Oceanography

The location of Cherry Point Aquatic Reserve within the Georgia Basin sets it apart from other marine areas in northwestern Washington State. Oceanographic processes in the southern Strait of Georgia are characteristic of the circulation pattern in a fjordal estuary, with seaward flow at the surface and landward flow at depth (MacLennan et al. 2013). Specifically, the nutrient rich waters from the Pacific Ocean mix with the voluminous freshwater discharge from the Fraser River giving the Strait of Georgia its unique oceanographic regime. This classic estuarine circulation is also the regional driving force with the net seaward outflow of freshwater from the Fraser River in the upper portion of the water column, and a net landward inflow of the lower portion of the water column through the Strait of Juan de Fuca and Rosario Strait (Thompson 1994).

Like all of the Salish Sea, the Strait of Georgia experiences two low and two high tides of different elevations each day (mixed semidiurnal tide cycle). Tidal data records for the Cherry Point Tide Station provide an average range between lows and highs of 5.7 feet (1.74 meters) and moderate tidal currents (NOAA 2020). During more extreme tidal cycles (spring tides), the Strait of Georgia encounters relatively strong mixing via tidal currents, which can be responsible for a large amount of water movement in the region. Birch Bays' open configuration, extensive tidal flats and shallow sloping bathymetry also allows for significant water exchange with strong tidal flushing. Additionally, winds contribute substantially to mixing in surface waters. Seasonal changes in wind and wave energy, along with a broad range of exposure and fetch, produce and maintain a productive nearshore area.

Habitat Characteristics

The aquatic reserve area contains diverse nearshore habitats that include broad sandy intertidal flats, sand and gravel beaches, exposed cobble-boulder beaches with terraced foreshore and large areas of shallow water submerged aquatic vegetation. Extensive native eelgrass beds, bull kelp and mixed macroalgae habitats provide essential benefits to the reproductive, foraging, and rearing success of many fishes, birds, and invertebrate species using the reserve area.

Intertidal substrates include an assortment of mixed fine sediments, with sand and mixed gravels dominating the upper beach face in more protected areas. The substrates along the northern outer coastal reaches of the reserve are mostly mixed coarse gravels, featuring areas of cobble and boulders with patchy pebble and sand infill. The beach face slopes to lower intertidal flats, or low tide terraces where shifting sands and varied finer sediments form bars and swales. Clusters of large boulders with some scattered glacial erratics are common throughout littoral areas in the reserve. Waterward of the intertidal flats and surf zone along the Cherry Point reach, the nearshore subtidal shorebed slopes moderately to about 60 ft MLLW, then drops steeply to deeper waters with fine-grained bottom sediments. Whereas in Birch Bay, the tidal flats continue with a more gradual slope, maintaining a relatively shallow embayment throughout.

Above the beaches of Birch Bay are moderate backshore bluffs rimmed by residential development focused close to the shore. Below these residences and along the southwestern course of the Birch Bay shoreline, various types of bulkheads and armoring are common structures (Appendix C, Map C-3). Fill, structural material, and other alterations have eliminated upland, backshore berm, and salt marsh vegetation, greatly changing the local water and sediment movement in this part of the bay. Although mostly outside the reserve boundaries, changes to beach and nearshore morphology and composition have disrupted other local processes and functions in the reserve area. In some locales, these conditions promote small failures or landslides that inundate the beach, while other areas result in a sediment-starved intertidal zone with significant coarsening of substrate on the upper beach faces

and flats. Slightly southeast from Point Whitehorn looking over the outer western reach of the reserve, a few houses sit atop these west facing bluffs, but with minimal shoreline modification below. Most other upland areas adjacent to the reserve are undeveloped and unarmored allowing for naturally eroding bluffs to feed sediments to relatively pristine beaches. Consistent tree cover and other riparian vegetation influence the diversity and quality of beach habitat by contributing to slope stability, moderating temperatures, protecting water quality, and adding important ecosystem elements like large woody debris, nutrients, and insects.

Two primary drift cells characterize the net shore-drift in the reserve (Appendix C, Map C-4). The exceptional feeder bluffs at Point Whitehorn along with contiguous high bluffs to the south, feed sediment and nutrients northward and around the point, then east and northeastward into Birch Bay. Sediment movement and deposition along this southwestern sector of Birch Bay sustains broad intertidal sand flats with mixed upper beach substrates. Along the west facing shoreline of the reserve, unarmored high bluffs continue southward down the reach, contributing a regular sediment supply to the long drift cell terminating at Sandy Point. The strong connectivity between unimpeded sediment supply and drift cells are important shoreline process components in the aquatic reserve. For more detail on drift cells see in Appendix A and C.

In addition to the significant freshwater influence from the Fraser River (located north of the reserve), it is also a source of fine river sediments and nutrients that contribute to nourishing habitat areas that support clams, beach spawning forage fish and submerged aquatic vegetation (Center for Biological Diversity et al. 2004).

Other year-round freshwater inputs influence the aquatic reserve area, such as Terrell Creek, that parallels southeastern Birch Bay emptying into the head of the bay. Along the Cherry Point outer reach, a perennial creek and secondary intermittent drainages flow into the backshore emergent marsh near Gulf Road. Additional flow into the marsh persists through a culvert that runs under Gulf Road and drains the “filled” marsh area to the southeast (Wenger, B., CPAR Implementation Committee, personal communication, 2020). A small estuary area and delta mark the outflow of the perennial creek and marsh into the Strait of Georgia. A few other small drainages and ravines seasonally flow and discharge onto beaches in the reserve. Groundwater seepage through bluff faces, surface runoff, and outfalls - including numerous residential tight-lines, are also notable intermittent local water sources. During periods of higher precipitation and saturation, surface water runoff and groundwater seepages are a predominant freshwater source with substantial flow.

Habitat - Flora and Fauna

Eelgrass (*Zostera marina*), is a foundation species in the Salish Sea and offers shelter and protection, while providing nursery and foraging habitat for birds, young fish and invertebrates. Eelgrass also helps protect the shoreline by stabilizing sediment and moderating wave energy. Eelgrass covers a significant portion of the lower intertidal and shallow subtidal areas in the reserve. The majority of the eelgrass beds are in the broad undulating flats of Birch Bay where the soft-bottom sediments provide extensive habitat for colonization. The native eelgrass, *Z. marina* is the dominant species with the diminutive non-native eelgrass, *Nanozostera japonica*, commonly intermixing at tidal elevations around “0 MLLW” (mean lower low water) and higher. *N. japonica* is most frequently in patchy areas in the lower intertidal zone on the sand and gravel beaches of Birch Bay and more sporadically along the Cherry Point reach. Eelgrass beds are frequently found interspersed with macroalgae (seaweed) throughout the reserve, appearing with a more diverse mix of species along the outer reach from Point Whitehorn to Neptune Beach.

Most of the reserve contains a high diversity of macroalgal species which represent another key habitat component of the area. Macroalgae functions in many of the same ways as eelgrass, providing structural habitat, nursery grounds and foraging areas that support salmon, forage fish, Dungeness crab, and numerous other species. Along with eelgrass, macroalgae is an important component of nearshore primary production. Several species of macroalgae, especially red algae, are more persistent in the winter months and are often found amongst or adjacent to eelgrass. Many of the green and brown algae species die back or are present in low densities during the winter. As water temperatures warm, brown and green algae increase in abundance with occasional problematic summer blooms of ulvoid-like green algae.

Since 2017, more than 30 species of mostly intertidal/shallow subtidal macroalgae have been documented by WDFW during herring spawn rake surveys (Sandell, T., WDFW, personal communication, 2020a). The most regularly encountered species include large bladed non-floating brown macroalgae, such as *Saccharina latissima*, *Alaria marginata* and *Desmarestia ligulata*, many varieties of foliose and filamentous red algae, several species of ulvoids and other green algae, as well as the pervasive non-native brown alga *Sargassum muticum*. *S. muticum* is common in most areas of the CPAR lower intertidal zone where coarse gravel and cobble substrate persist, and generally occurs in relatively dense bands. *S. muticum* is considered an invasive floating brown alga which is widely distributed throughout the Southern Salish Sea, and often preferentially used as herring spawn substrate (Sandell, T., WDFW, personal communication, 2020a). In the CPAR region, *S. muticum* predominantly grows in the lower intertidal zone (Kyte, M.A., CPAR Implementation Committee, personal communication, 2020a). Elsewhere in Puget Sound *S. muticum* more commonly occurs in both the intertidal and shallow subtidal areas.

See Appendix B, Table B-5 for a list of documented macroalgae species found within the aquatic reserve.

Bull kelp (*Nereocystis leutkeana*) mixes with other seaweeds and is common in many rocky shallow subtidal areas from Point Whitehorn south along the outer coastal reach of the reserve. It will often appear as a separate deeper band of floating vegetation (Sandell, T., WDFW, personal communication, 2020a). Annually since 2012, the DNR Nearshore Habitat Program has mapped the distribution of bull kelp in the aquatic reserve. As an annual species, bull kelp populations and distribution can vary significantly year to year. During suitable environmental conditions with cooler waters and sufficient nutrients, recurring bull kelp beds are regionally more prevalent throughout shallow subtidal environs including the aquatic reserve area. Starting in 2014, the effects of warming waters and lack of nutrients from the large mass of warm water in the north Pacific Ocean, “the blob”, had an observable deleterious effect on bull kelp populations and distribution throughout the Salish Sea and in CPAR. By 2017, bull kelp populations had noticeably increased in many areas in the southern Salish Sea with Cherry Point area lagging in recovery. By 2018, bull kelp populations and distribution throughout the area and in the reserve were on the rebound (Berry, H., WDNR, personal communication, 2020). More details on bull kelp mapping and status in the reserve are in Appendix A. Maps showing the distribution of submerged aquatic vegetation and bull kelp in the reserve are also shown in Appendix A, Figures A-3 and A-5, and Appendix C, Map C-5.

There are very few remaining emergent salt marsh areas in northern Whatcom County near the reserve. Salt marsh and emergent freshwater marsh vegetation is found to a limited degree in a couple of backshore areas adjacent to or in the vicinity of the aquatic reserve: the Terrell Creek tidal estuary to the east bordering the coastal area of Birch Bay State Park, and the backshore wetland north of Gulf Road. The Gulf Road wetland complex is the only location along the Cherry Point reach with an extensive high quality estuarine salt marsh, emergent freshwater marsh, and scrub-

shrub wetland vegetation. Several obligate and indicator species for various saltmarsh habitat areas observed in the saltmarsh include pickleweed (*Salicornia virginica*), arrow-grass (*Triglochin maritima*), spike-rush (*Eleocharis palustris*), and chairmaker's bulrush (*Schoenoplectus americanus*). Broad representation of transitional brackish and freshwater wetland plants are also interspersed throughout the wetland including *Carex lyngbyei*, *Oenanthe sarmentosa*, and *Typha* sp. (Hitchman, M., CPAR Implementation Committee, personal communication, 2020).

A backshore barrier berm with scattered logs and dune grass (*Leymus mollis*) persists along the seaward side of the Gulf Road marsh. Subjected to salt spray and infrequent inundation, this unique "splash zone" habitat promotes a different specialized plant community. The vegetation observed in this zone includes gumweed, yarrow, and silver burweed. Small patches of dune grass and berm vegetation are present in Birch Bay and intermittently along the toe of bluffs adjacent to the reserve area. See Appendix B, Table B-6 for a more complete list of vegetative species observed.

Fish and Wildlife Resources

As part of the unique oceanographic regime in this part of the Strait of Georgia (SOG), CPAR has a wide variety of habitat types that support a slightly different assemblage of species with higher biodiversity. Compared to Puget Sound, many more oceanic species are relatively common in the SOG (Parametrix & Adolfson Associates, Inc. 2006).

Despite the residential and commercial development in some adjacent upland areas, most of the aquatic lands within the reserve support high quality habitat for numerous fishes and invertebrates, migratory and resident birds, and marine mammals. Extensive aquatic vegetation, diverse substrates and relatively intact ecosystem functions within the upland-marine interface provide for these productive habitat areas.

Fishes

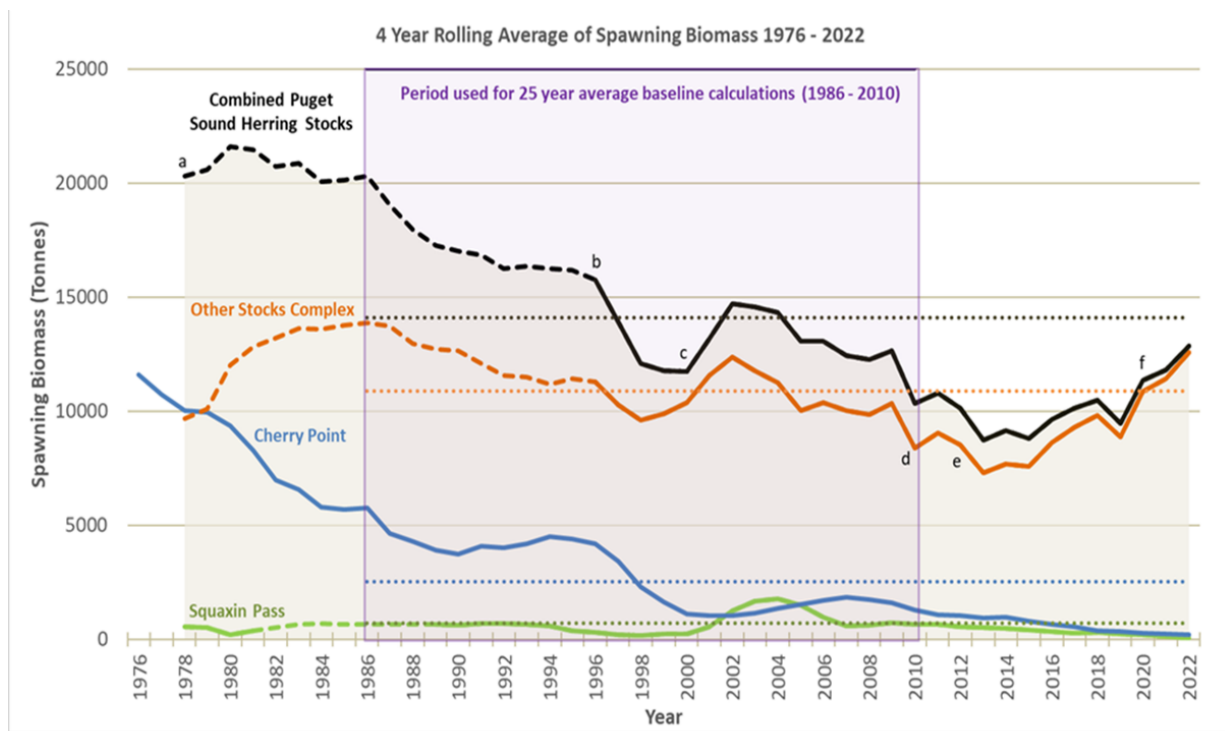
Seven species of salmon and trout have historically been or are currently found in the nearshore environment at Cherry Point and Birch Bay, including pink salmon (*Oncorhynchus gorbuscha*), chum (*O. keta*), coho (*O. kisutch*), sockeye (*O. nerka*), steelhead (*O. mykiss*), coastal cutthroat trout (*O. clarki clarki*) and Chinook salmon (*O. tshawytscha*). Nearshore areas are designated as habitat for the following salmon species listed under the Federal Endangered Species Act: Puget Sound Chinook salmon, Nooksack coastal cutthroat, Puget Sound bull trout, and Puget Sound steelhead. The Cherry Point nearshore is also used by char and cutthroat tagged in British Columbia (Ptolemy, R., Rivers biologist, British Columbia Ministry of the Environment, personal communication, 2009). Terrell Creek flows into Birch Bay just north of the reserve boundary and supports coho and chum salmon, steelhead and coastal cutthroat trout. Out-migrating juvenile salmonids move into shallow water areas of the reserve to forage, rear and use for migratory habitat (Parametrix & Adolfson Associates, Inc. 2006).

The Puget Sound Evolutionary Significant Unit (ESU) for Chinook salmon was listed as federally threatened in March of 1999 and includes runs from the North Fork of the Nooksack River to the southern Puget Sound watersheds, Hood Canal and the Strait of Juan de Fuca. There are two independent populations of Puget Sound Chinook salmon in the Nooksack basin: North Fork Nooksack River (including Middle Fork), and South Fork Nooksack River. These salmon are distinctive from Chinook salmon in the rest of Puget Sound in their genetic attributes, life history and habitat characteristics. They are the only populations in the southern Strait of Georgia and are two of only six Chinook runs left in Puget Sound that return to their natal rivers in spring (as opposed to fall spawners). For these reasons, the Nooksack populations are essential to the recovery of the Puget

Sound Chinook ESU (Puget Sound Technical Recovery Team 2006). Strait of Georgia/Puget Sound coho are also in decline and listed as a federal species of concern.

Four species of forage fish regularly use the Cherry Point Aquatic Reserve: surf smelt (*Hypomesus pretiosus*), Pacific sand lance (*Ammodytes personatus*), northern anchovy (*Engraulis mordax*), and Pacific herring (*Clupea pallasii*). Surf smelt and Pacific sand lance spawn on fine gravel and sand beach sediment in the upper intertidal zone. Surf smelt spawn has been documented on beaches throughout the aquatic reserve (Appendix C, Map C-6). The DNR Puget SoundCorps has surveyed for forage fish eggs in the reserve since 2012 and have determined that the maximum surf smelt spawning period in the reserve is from May to September, with the peak in August. Pacific sand lance spawning habitat has also been documented in the reserve at one location in Birch Bay. With a shorter spawning season in the winter and a preference for lower energy beaches and sandier substrate, sand lance habitat areas are more ephemeral and sparser in the reserve. As pelagic (deeper open waters) spawners, northern anchovy have been recorded spawning offshore from Semiahmoo Bay to Bellingham Bay including waters in the reserve (Sandell, T., WDFW, personal communication, 2020b). All forage fish species are a critical link in food web energy flow in the Salish Sea and an important food source for seabirds, local salmon and other fishes and marine mammals.

The area between the south shore of Birch Bay and along the Strait of Georgia south to Neptune Beach was once one of the most important Pacific herring spawning areas in Washington State. This area served as the “core” region of spawn deposition for the largest single herring spawning stock in



a. Surveys of stocks other than Cherry Point did not begin in earnest until 1975, so the four-year average starts in 1978. The 1978 estimate includes 14 stocks of the Other Stock Complex in addition to cherry Point and Squaxin Pass; by 1986 at least two years of estimates were available for all Puget Sound stocks that had been identified up to that time.
 b. 1996: surveys transitioned from a rotating sampling schedule to attempted annual surveys of all known stocks.
 c. 2000: Wollochet Bay stock was identified, surveyed, and included in estimates of the Other Stocks Complex biomass.
 d. 2010: acoustic trawl surveys were discontinued, and spawn deposition surveys became the only regular source of Puget Sound herring abundance data.
 e. 2012: Elliott Bay stock was identified, surveyed, and included in estimates of the Other Stocks Complex biomass.
 f. 2020: COVID-19 pandemic interrupted surveys at the peak of what was likely the largest herring spawning season in Puget Sound since the 1980s.

Figure 3. Estimated herring spawning biomass and the stock status profile 1976-2022 (Puget Sound Info 2023).

Washington State waters. The Cherry Point (CP) herring stock historically accounted for more than 50 percent of the entire herring population of Puget Sound and the Strait of Juan de Fuca. Cherry Point herring were estimated at a peak of over 13,000 tons in the early 1970s (Figure 3). Overall, the CP herring stock biomass has been declining since the early 1970s and shows no signs of recovery from its low level of abundance (Sandell et al. 2019).

Based on surveys by WDFW, the spawning biomass in 2022 hit a published low of 95 metric tons (Puget Sound Info 2023) while this year, scientists have found no evidence of spawn from the Cherry Point stock (RE Sources 2023). For the past two decades CP herring stock status has been categorized as ‘depressed,’ meaning “a stock with recent abundance 51-80% below the 25-year mean,” though recent mean 4-year abundance ending in 2022 places the stock in the ‘critical’ category. However, this rolling 25-year mean no longer reflects the long-term decline from initial measured abundance of 13,606 metric tons in 1973 (Sandell et al. 2019). According to an assessment by the Salish Sea Pacific Herring Assessment and Management Strategy Team (2018), potential causes for their decline are contaminate exposure, disease, predation and habitat degradation, with citations and additional stressors included in Appendix A.

Historically, CP herring spawned from the Canadian border to Hale Passage (Appendix C, Map C-7), but in recent years the primary spawning grounds have diminished immensely. From 2016 - 2021, spawning has mostly occurred to the north of the aquatic reserve around Birch Head, outside of the reserve boundary (Sandell, T., WDFW, personal communication, 2020b, 2021). In March 2021, a large spawning event was witnessed along the southwestern shoreline in the reserve (Figures 4 and 5), however WDFW confirmed through genetic analysis that this early spawn event was not from Cherry Point herring (Sandell, T., WDFW, personal communication, 2021). The same aerial documenter reported seeing no spawning events within the reserve in April or May of 2023, supporting spawning survey results for this year (Lerner 2023).



Figure 4. Aerial view of herring spawn on March 18, 2021, near the Phillips 66 pier. Photograph taken by Mike MacKay.



Figure 5. Herring spawn collected by WDFW within a few days of the March 18, 2021, observations. Photograph taken by Todd Sandell, WDFW.

In the Salish Sea, Pacific herring congregate in offshore areas near their spawning grounds approximately three to four weeks prior to spawning. This pre-spawn holding area for CP herring is in deeper waters along the Whatcom County shoreline between Birch Head and Sandy Point and includes some deep-water habitat within the aquatic reserve (Sandell et al. 2019) (Appendix C, Map C-10).

Several studies have shown that the CP herring stock are genetically distinct from other Washington and British Columbia stocks (Beacham et al. 2002; Small et al. 2005; Mitchell 2006). Unlike other Pacific herring populations found in Puget Sound, the CP herring spawn in more open, higher energy shoreline areas. While other stocks spawn between early January and early April, the CP herring spawn from early April through early-June. Research provides a preliminary indication that the CP herring may have evolved a tolerance for warmer water than other regional herring due to their late spawning time (Dinnel et al. 2008). If so, these genes would be important to ensuring species resilience and adaptation to climate change. Conservation of herring spawning habitat and minimizing disturbance in pre-spawning holding areas is a critical element for preservation of the herring stocks within the southern Salish Sea.

Groundfish that utilize the CPAR area include Dover sole (*Microstomus pacificus*), English sole (*Parophrys vetulus*), rock sole (*Lepidopsetta bilineata*), starry flounder (*Platyichthys stellatus*), and Pacific and speckled sanddabs (*Citharichthys sordidus* and *C. stigmaeus*, respectively) (Palsson, W., WDFW, personal communication, 2009). Adult butter sole (*Isopsetta isolepsis*) and lingcod (*Ophiodon elongatus*) have also occasionally been found (Whatcom County MRC 2007). During the juvenile phase of their lives, many species of groundfish, such as true cods and rockfish, use submerged aquatic vegetation for feeding, refuge from predators, and nursery grounds. Several rockfish species in Puget Sound are in decline due to factors such as overfishing, derelict gear, water quality degradation, and food web interactions (Palsson et al. 2009). In addition to the four species of federally listed salmonids occurring in the reserve, other listed fish species are green sturgeon, eulachon, and three species of rockfish (Appendix B, Table B-2). In 2010, NOAA National Marine Fishery Service (NMFS) listed three populations of rockfish in Washington's Georgia Basin for protection under the Endangered Species Act. The populations of yelloweye rockfish are designated as "threatened", bocaccio rockfish are designated as "endangered", while the third rockfish species – canary rockfish, was delisted in 2017.

Birds

Approximately 160 species of birds use the coastal and marine resources in the CPAR vicinity during some portion of the year (Wahl et al. 1981). Cherry Point is considered one of 18 significant bird habitats in the Strait of Juan de Fuca and Strait of Georgia (Wahl et al. 1981), attracting thousands of scoters, brants, cormorants, grebes, loons, and other fish-eating birds and migratory waterfowl. The area between Sandy Point and Point Whitehorn provides year-round habitat for high numbers of loons, grebes, alcids, and diving ducks, as well as critical habitat for migrating waterfowl every spring and fall. Additionally, it is an important wintering ground brant, harlequin duck, loons, buffleheads, goldeneyes, and scoters. The National Audubon Society has designated Semiahmoo, Drayton Harbor, and Birch Bay as "Important Bird Areas." In general, the diversity and abundance of birds near the reserve are highest during winter and the spring and fall migration periods.

Historically, birders observed flocks of up to 25,000 scoters, Pacific loons, gulls, murres and other species that came to feed on forage fish and herring eggs (Seattle Audubon Society n.d.). Surveys conducted in the last several years indicate that more than 14 of the 37 most common over-wintering species in the SOG are experiencing significant declines. For Cherry Point, a 79 percent decline in species was documented. Studies of the role of herring spawn in movements and energetics of scoters have found that herring spawn at Cherry Point is a critical resource used by surf scoters to acquire adequate fat reserves for migration and breeding (Anderson et al. 2009). They gather energy reserves and nutrients to fuel migration, moving inland to more northern latitudes where they breed. Concurrent with declines in spawning herring biomass, numbers of scoters foraging on spawn at

Cherry Point have declined from about 60,000 to 6,000 for the period 1980-1999 (Nysewander et al. 2005).

Marbled murrelet, listed as threatened under the Endangered Species Act, are well documented in the Cherry Point area, foraging on herring or herring eggs. The area also supports peregrine falcon, bald eagle, and great blue heron. One of the Pacific Northwest's largest great blue heron rookeries had been located inland of Birch Bay, along Terrell Creek; it supported more than 300 breeding pairs. Sometime between 2007 and 2009 this colony was abandoned (Borso, P., North Cascades Audubon Society Educator, personal communication, 2020). There are presently three colonies in the region that have expanded as a result of the Terrell Creek heronry collapse. Heron regularly forage along marine shorelines, and are commonly seen in intertidal areas in Birch Bay, as well as riparian and wetland areas adjacent to the aquatic reserve. Migratory and wintering eagles are found in seasonally high numbers along the reserve's shoreline (Eissinger 1994). Osprey and peregrine falcon also use the marine waters of the Cherry Point reach for foraging habitat (Hayes and Buchanan 2002).

Invertebrates

The reserve is home to diverse and extensive shellfish populations, including clams, mussels, oysters, shrimp, and crabs. The most popular and economically significant of these shellfish are Dungeness crabs, which are both recreationally and commercially sought after in the aquatic reserve area. Dungeness crabs are important predator and prey organisms at all life stages in the southern Strait of Georgia. Their pelagic larvae, particularly megalopae, are preyed upon by rockfish, coho and Chinook salmon, halibut, dogfish, hake, lingcod, forage fish, and other crabs. The primary predators of adult Dungeness crab include seals, sea lions and a variety of fishes. Juvenile and adult Dungeness crab feed on crustaceans, mollusks and fishes. A variety of clams are common on the beaches in the reserve and recreational clam digging is a popular activity. Many other marine benthic invertebrates thrive in the varied habitat areas in the reserve including sea stars, urchins, sea cucumbers, snails and anemones. Since 2013 local community members and scientists with the CPAR Citizen Stewardship Committee have carried-out intertidal biota and sea star surveys documenting the summer populations of invertebrates, seaweeds, and some fishes in the reserve. Invertebrate species also serve an integral role in the complex of marine food webs supporting migratory birds, fishes and mammals.

Mammals

Marine mammals that may use the reserve area based on their presence in the southeast SOG include harbor seal, Pacific harbor porpoise, Dall's porpoise, Stellar sea lion, California sea lion, Pacific minke, gray, humpback and orca whales - including transient ecotypes as well as Southern Resident killer whales (SRKW) (Calambokidis and Baird 1994; Falcone et al. 2005). The SRKW population is an extended family group consisting of three pods, J, K and L, and has shown an overall declining trend since 1995, falling from 98 to 81 individuals in March 2015 (WDFW n.d.c). As of July 2023, the total population of the SRKW population was 75, with 2 births in the past year in the L pod. Also, with the death of Tokitae/Sk'aliChelt-tenaut in August 2023, no SRKW lives in captivity (Center for Whale Research 2023). A significant portion of the habitat critical to the SRKW survival is within the SOG (Georgia Strait Alliance 2021), and they spend much of their time in coastal areas, including inland marine waters, where their preferred prey is typically found. Chinook salmon comprise up to 80% of the Southern Resident killer whale's diet, with salmon abundance determining the whale's year-round distribution and habitat use. SRKW are occasionally observed in the Cherry Point area. In 2005, Southern Resident killer whales were designated endangered under the Endangered Species Act because of population declines and a reduction in their overall health status. Lack of food, environmental contaminants and noise and vessel disturbance are the primary threats facing the SRKW (Center for Whale Research 2023). Also, "the small population size, combined

with their socially cohesive nature, makes them susceptible to catastrophic risks, such as oil spills or a disease outbreak” (Federal Register 2006). See Appendix A and B for additional information on marine mammal species and lists.

Harbor seals are commonly seen using the outer beaches of the reserve shoreline for foraging and haul-out areas. The area around Point Whitehorn is a harbor seal haul-out and resting area. River otters, raccoons, mink and Columbia black-tailed deer are also known to forage along the shoreline within the reserve area. More complete sightings and lists for mammals are available in Appendix A and B.

Human Impacts

Various forces, both natural and human-caused, may impact the creatures, habitats and ecosystems of the Cherry Point Aquatic Reserve. These can be grouped into two categories: large-scale or societal forces driving observed and future changes and the actual physical or biological stressors affecting organisms and systems. When combined, these can profoundly impact ecosystem health.

Potential Drivers of Future Change

Multiple human-derived pressures may contribute to (or “drive”) future changes that could affect the reserve’s species, habitats and ecosystems. In particular, human population increase and climate change are expected to drive future changes substantially. Understanding these drivers can help managers anticipate and plan more carefully, preparing for possible contingencies. Each potential driver is described below.

Regional and Local Population Increase

Population growth, both regionally and locally, will influence future conditions and likely increase ecosystem stressors in the reserve. Regional population increase and economic growth will continue to drive demand for petroleum, energy, and other products that are manufactured, loaded and unloaded adjacent to, and shipped through the reserve. Increases in manufacturing may require additional shipping activity, placing further stresses on ecosystems. Demand for salmon, crab, and other species will continue to drive recreational and commercial fishing in the reserve. As population increases, recreational demand for boating, wildlife viewing, beachcombing and picnicking on the shores of the reserve will also rise.

According to Washington’s Office of Financial Management, Washington has experienced strong growth gaining about 1,000,000 people per decade. The 2020 Whatcom County population estimate is 233,755 and it has increased by approximately 12 percent over the last decade. In 2019 Bellingham was the 12th most populated city in the state. By 2030 under OFM’s moderate growth scenario, the county’s population is projected to increase another 17 percent and gain 36,000 more people (OFM 2017, OFM 2019).

However, many existing programs, zoning laws, and shoreline designations will help mitigate potential impacts of population growth. For instance, shoreline land uses are controlled by Whatcom County’s SMP, while upland uses are restricted in Urban Growth Areas (UGAs) like the Cherry Point and Birch Bay UGAs governed by the county’s Comprehensive Plan. For more details see Chapter 3—Ownership and Uses, Zoning and Land Use Designations. Additionally, any changes to existing DNR authorized uses adjacent to the reserve must be compatible with goals of the reserve.

Climate Change

Physical, biological and chemical changes to the marine environment associated with climate change will intensify naturally occurring events and conditions in the Cherry Point Aquatic Reserve area. Current trends in climate change may contribute to the following ongoing fluctuations in ocean conditions (Snover et al. 2013), all of which could have an impact on existing physical and biological resilience in the aquatic reserve:

- Sea level rise and storm surge will inundate low-lying areas adjacent to the reserve.
- Sea level rise will further submerge current subtidal and intertidal habitat areas, having the potential to adversely affect fish and wildlife resources and associated habitat.
- Rising water temperatures will create additional stressors on marine organisms.
- Lower dissolved oxygen concentrations, related to increases in water temperature, will create additional stressors for fish and at extreme levels can be fatal.
- More frequent and heavy precipitation events can contribute more pollutants and alter water chemistry.
- Increased nutrient loading can cause eutrophication⁴, which intensifies the effects of decreased pH and low dissolved oxygen.

Ocean acidification can make it difficult for calcifying organisms, such as Olympia oysters and other shellfish to produce shells. It can also affect biological processes such as bio-sensory functions in salmon and forage fish, inhibiting their ability to locate natal areas, food sources, and to detect predators.

Sea-level rise due to human-caused climate change is predicted to increase in the Puget Sound Region. Projections for the Cherry Point area range from a 0.5 to +9.4 foot rise in average sea level by 2050. Localized data on sea level projections for Cherry Point can be seen on the University of Washington Climate Impacts Group web site: <http://wacoastalnetwork.com/chrm/research/sea-level-rise/>.

Compounding the effects of sea level rise, increasing storm intensity and frequency will also produce greater wave energy, more wave runup⁵, and more extreme storm surges (Grossman et al. 2018). Since Birch Bay is a relatively shallow, “U-shaped” bay, it is more vulnerable to the impacts of increased storm intensity and frequency. The developed and armored shoreline in southern Birch Bay also intensifies effects and limits opportunities to buffer these impacts. This could result in altered substrate composition, changes to nearshore bathymetry, increased scour, and undermining at the toe of bluffs and bulkheads. Other armored/developed areas adjacent to the reserve include a few limited residential bulkheads south of Point Whitehorn, the two refineries and the Petrogas facility south of Cherry Point. Additional repercussions from sea level rise could result in damage or destruction to adjacent upland infrastructure and vegetation.

⁴ Eutrophication: Excessive richness of nutrients in a water body, frequently due to runoff from land, which causes a dense growth of plant life and death of animal life from a lack of oxygen.

⁵ Wave runup: The additional height that a broken wave attains as they run up the shore before their wave energy is dissipated due to friction and gravity.

Increased coastal erosion will also dramatically affect changes to sediment dispersal and transport, habitat types and area, and species abundance and distribution. Submerged aquatic vegetation is especially vulnerable to burial or reduced light availability. A reduction in the availability of tidal flat habitat, beach width, and tidal marshes, such as the estuarine marsh habitat complex found along Gulf Road south of Cherry Point are likely to occur. Intertidal biota, including shellfish species (e.g., oysters and clams), juvenile fishes and crabs, and migratory shorebird populations that utilize these flats for nursery and foraging habitat may also decline.

DNR's Acidification Nearshore Monitoring Network (ANeMoNe) measurement instruments were deployed in 2018 at CPAR in Birch Bay. The purpose of the monitoring study is to assess climate change and ocean acidification in nearshore environments and to test practical management options to reduce the negative impacts of changing ocean conditions on state-owned aquatic lands. At ten sites across the marine waters of Washington State, ANeMoNe uses sensors to measure temperature, pH, dissolved oxygen, chlorophyll, salinity, and water levels inside and outside of eelgrass beds. Analysis of eelgrass and shellfish data will explore the effects of warming and acidification on critical natural resources.

Land Use Changes

Changes in adjacent ownership or future land uses could affect the reserve. For example, if substantial changes were made to industrial, residential, or open space designations near the reserve, it could affect water quality and the potential for toxic spills. Additional public access sites could cause more human disturbance to ecosystems, while on the other hand, enhanced protective status for adjacent uplands could reduce ecosystem stressors.

Any significant future land use changes will be guided by requirements of Washington's Growth Management and Shoreline Management Acts, involving ample public input (see Chapter 3—Ownership and Uses, Zoning and Land Use Designations).

Environmental Restoration

Restoration actions occurring in and adjacent to the reserve can drive observed ecological conditions and remediate for potential negative impacts. For example, many creosote pilings have been wrapped or removed from the existing industrial pier structures at Cherry Point. Removing creosote pilings, including the hundreds remaining that support both the Phillips 66 and the Petrogas/Intalco piers, would eliminate a source of local contaminants and improve long-term sediment and water quality. Planting trees and other native riparian vegetation in altered backshore areas could promote slope stability, increase shading and nutrient supply, as well as improve habitat functions. In addition, design improvements to freshwater drainage can also contribute to sediment and slope stability while remediating point source water quality failures. Removing old bulkheads and replacing them with "soft shore" protections which include logs and rocks anchored to the beach in a more natural configuration could help reduce shoreline erosion while enhancing ecosystem function. Other complimentary actions, such as strategically renourishing beach habitat or restoring submerged aquatic vegetation, could provide greater spawning opportunity for forage fish and improve foraging activity for juvenile salmonids and other wildlife in the area.

A few projects along the Birch Bay shoreline near Point Whitehorn and several projects in the southern portion of the CP reach are identified as top or high priority by the WRIA 1 Nearshore Assessment and Restoration Prioritization (MacLennan et al. 2013). These projects propose removing or modifying armoring to restore the sediment supply for downdrift accretion, improving habitat areas in Birch Bay and along the CP reach.

Land Conservation and Protection

Additional aquatic land parcels could be added to the reserve, protecting a larger portion of the local ecosystem and expanding the management boundary. This could include either private tidelands donated to DNR, or state-owned bedlands to the north of the reserve. Also, protection or restoration of upland parcels could protect freshwater inputs (i.e. enhance water quality) as well as important marine riparian and other habitats. For example, as part of the WRIA 1 effort to identify and prioritize protection projects, a parcel east of Point Whitehorn adjacent to the projects mentioned in the previous section, is identified to “protect shoreline that delivers large amounts of sediment down-drift”. Particularly, fostering partnerships to acquire or improve adjacent critical habitat areas will reinforce connectivity and provide additional protection to underrepresented critical habitat areas, such as the Gulf Road wetland complex. This wetland area was also ranked as a top restoration priority by the WRIA 1 nearshore assessment prioritization (MacLennan et al. 2013).

Ecosystem Stressors

The larger scale drivers affecting change discussed above contribute to the level of stress experienced by the organisms, habitats and ecosystems in the CPAR area. A number of ecosystem stressors and potential future impacts have been identified in the reserve, which may affect the health of the reserve. The term *ecosystem stressor* refers to any condition or agent causing a potential stress response or impact to the ecosystem, whether physical or biological. Knowledge of the stressors affecting reserve ecosystems can help managers anticipate, alleviate and avoid further impacts through management actions. Additional details on each stressor can be found in Appendix A. The following are known and potential stressors to regional natural resources: shoreline modification, including overwater structures, loss of riparian vegetation, armoring, and derelict gear; pollution from groundwater contamination, stormwater runoff, point discharges, marine debris, and air deposition; disturbance from recreational activities; artificial light and excessive intermittent sound; vessel impacts including traffic, noise, potential oil spills, ballast water and invasive species; and habitat impacts due to climate change. The Cherry Point Technical Advisory Committee (TAC) earlier identified a number of threats to the aquatic reserve, including impacts of fill and pilings associated with the piers and industries in adjacent aquatic lease areas, and the expanding threats posed by residential development along the northern and southern boundaries of the reserve. A more detailed description of risks to the aquatic habitats and species of the Cherry Point Aquatic Reserve is provided in Appendix A.

Effects of Shoreline Modifications on Habitat

Shoreline modifications, including filling of historic backshore, saltmarsh and upper intertidal areas, shoreline armoring, overwater structures, and loss of shoreline riparian vegetation, are the primary contributors to altered physical processes and the reduction of important habitat areas in the reserve. The potential impacts of additional shoreline modifications such as the construction of new structures or expansion of existing overwater structures could further degrade shoreline ecological processes, habitats and species. Vulnerable fishes, such as juvenile salmon, rockfish, and forage fish species can be compromised by affecting migratory corridors, refuge and foraging grounds, as well as spawning habitat areas.

Effects of Overwater and In-Water Structures on Habitat

All the industrial facilities possess wharves and piers for commerce of their materials; in-water development directly adjacent to the reserve includes three large piers supporting the major industrial

facilities (EVS 1999), a derelict conveyor structure at Gulf Road and one municipal outfall. Location, design, level and timing of use, as well as management, dictate the level of potential impact on ecosystems from these structures. The extent of the impacts from shading by piers depends on the height and orientation of the structure, the substrate below it, as well as the bathymetry of the site. Many potential environmental impacts tend to be correlated with the level of light intensity below and adjacent to the structures. A study completed in 2018, by Jhanek Szypulski and DNR, revealed significantly less kelp coverage and biomass at docks than their paired controls (Szypulski et al. 2018). More on the effects of shading and overwater structures can be found in Appendix A.

The reduction of light available for photosynthesis for submerged aquatic vegetation can also alter species behavior, abundance and distribution, degrade habitat structure, complexity, and affect local associated food webs. Another locally significant potential impact from piers/overwater structures is its effect on many migratory species. For example, anadromous juvenile salmon (*Oncorhynchus* spp.) rely heavily on light perception to orient themselves in space, capture prey, avoid predators, and migrate along the shoreline to the ocean (Ono and Simenstad 2014). Scientists have long observed that salmon are hesitant to go under docks, floats and other overwater structures during daytime hours, often stopping at the sharp lines of shadow. Juvenile salmon tend to stay in the sunlight because their success in finding food is dependent on their ability to see. To avoid the shade of the Seattle piers, some fish even travel through more treacherous deep water, going out and around the piers. Other fishes and congregations of salmon predators are also differently affected by nighttime artificial lighting from piers and associated docked vessels. Some consequences to fishes from attraction to nighttime lighting include disorientation, inability to forage, delayed migration, and increased predation.

Vessel disturbance, wave shading from pilings and other in-water structures may disrupt sediment distribution and flow, water flow patterns, and energy and propeller wash can often result in physical habitat alterations. Other indirect impacts from overwater structures may include water quality impacts from increased impervious surfaces, ballast and wastewater discharges, fuel and material spills and other activities associated with overwater structures (Nightengale and Simenstad 2001).

Otherwise, associated fill covers a relatively small intertidal area on private tidelands supporting footings for the Phillips 66 and Petrogas piers. The footings extend into the intertidal and are heavily armored with riprap and likely intercept sediment flow within the drift cell during high tide cycles.

The bp Cherry Point Refinery Marine Terminal extends 2,100 feet offshore into the southeast Strait of Georgia in a “Y” configuration and terminates in two vessel berths - the North & South Dock Wings. The Cherry Point dock is constructed of concrete on steel pilings and there is a minimum of 65 feet of water alongside each dock wing at MLLW.

The Intalco aluminum smelter occupies approximately 300 acres of a 1,500 acre tract fronting the Strait of Georgia between Cherry Point and Sandy Point. The smelter curtailed operations in 2020. Intalco Aluminum Corporation transferred ownership and operations of their marine terminal to Petrogas in 2016. The causeway extends 1,425 feet from extreme low tide into the Strait, forming an “L” configuration with the pierhead wharf, which extends northward for 400 feet. The Petrogas dock is constructed of an asphalt causeway and wharf supported by a mixture of ACZA and creosote-treated wood pilings.

The Phillips 66 Ferndale Refinery pier extends 1,800 feet from extreme low tide in the Strait of Georgia, forming an “L” configuration with the pierhead wharf, which extends southward for 500 feet. The causeway is constructed of asphalt supported by treated wood pilings and the wharf is

constructed of a concrete surface supported by concrete pilings. The causeway is in the process of being completely replaced by a steel pilings-supported concrete structure, which is scheduled for completion in 2025.

The majority of the adjacent shorelines are undeveloped and unarmored (Appendix C, Map C-3) with intact riparian vegetation. Armoring occurs along approximately nine percent of the reserve shoreline including many residential bulkheads in south Birch Bay, a few south of Point Whitehorn along the outer reach, around the industrial piers and a relatively short length along Gulf Road.

Additional shoreline armoring, fill, and land clearing associated with industrial, residential, recreational land use and activities have the potential to adversely impact riparian and bluff habitat and submerged aquatic vegetation, leading to loss of habitat functions. Removal of native riparian vegetation can impair water quality, reduce accumulation of large woody material and terrestrial insects that serve as salmon prey, affect sediment transport processes by either accelerating or limiting input, and increase erosion. Construction of new hard shoreline armoring could result in similar impacts, such as interrupting sediment transport processes that sustain healthy beach habitats, modifying intertidal substrates, and disturbing riparian and aquatic vegetation. As a result, degradation of habitats used by forage fish, salmon, other fishes, shellfish and crabs, birds and other wildlife species could occur.

Effects of Vessel Traffic on Habitat and Species

Vessel traffic has the potential to impact the reserve by increasing the risk of spills, discharges, noise, fugitive dust, derelict gear, marine debris, wildlife strikes, and the introduction of non-native species. Several safety measures have been enacted over the last decade to reduce these risks, including international, federal, and state standards, collaboration by government, tribes, and stakeholders, and voluntary efforts by industry and marine operators. However, with the frequency of vessels transiting through and berthing adjacent to the reserve, vessel traffic remains a threat to the ecological resources of the reserve.

Documented vessels that frequent the reserve include large cargo ships, tankers, and their associated tug/tow boats on route to and from the three marine terminals. Other vessels that enter the reserve are commercial and recreational fishing boats, commercial trawlers, pleasure craft/sailing vessels, and seasonal whale watching tours. Of the vessels that used AIS (Automatic Identification System), overall vessel traffic patterns in the reserve were similar from 2015-2019 (Appendix C, Map C-11). Although AIS data most likely under-represents smaller vessels as it is only required on certain types and sizes of vessels, it can be useful in determining typical locations that vessels frequent. In 2019, most pleasure craft/sailing vessels stayed in the northern portion of the reserve near Point Whitehorn, while fishing vessels were more frequent around the bp terminal (Appendix C, Map C-12).

Large vessels such as tankers and cargo ships load and unload raw materials and products at the three industrial facilities adjacent to the reserve. A significant increase in productivity, expansion, and commercial growth from these industries could result in an increase in vessel traffic or other transportation modes such as truck, pipeline or rail. In recent years the amount of oil transported by vessel in Washington has slightly decreased, with an increase by rail and pipeline (Washington Department of Ecology 2019). Within Whatcom County, the amount of overwater oil transfers remained steady between 2012 and 2019, with no apparent increase over time (Figure 6).

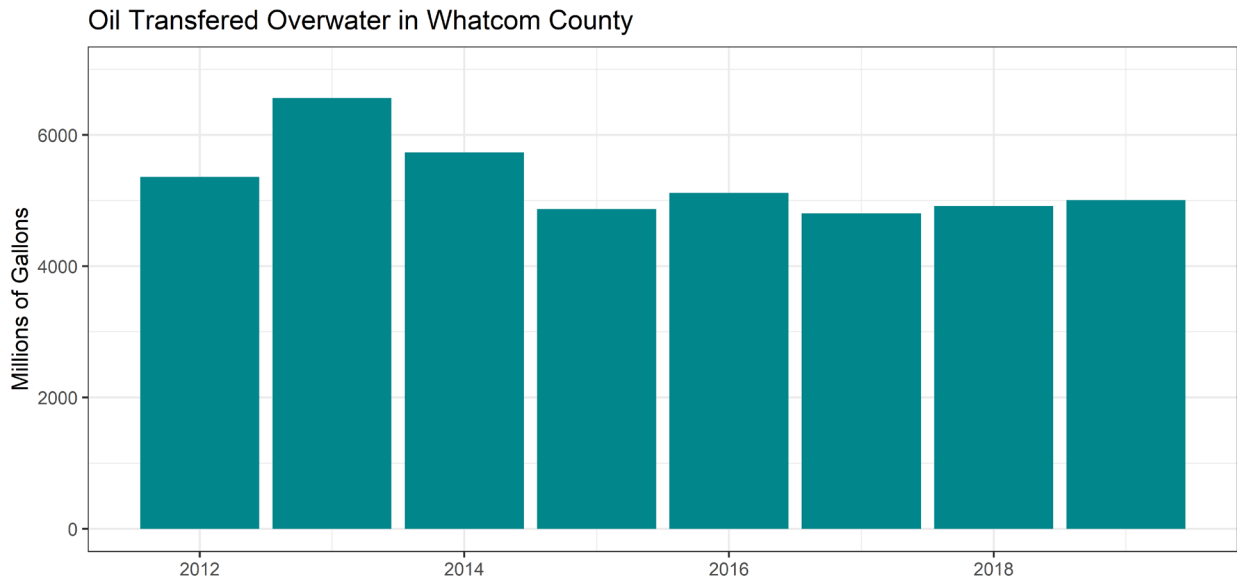


Figure 4. The annual volume of oil transfers overwater in Whatcom County 2012-2019. Data source: Washington Department of Ecology spills maps, data downloaded 04-29-2020 (Washington Department of Ecology 2020b).

Legislation passed in 2018 and 2019 aims to improve vessel traffic safety in the Salish Sea and increase readiness to respond to spills of heavy oils. The 2019 Reducing Threats to Southern Resident Killer Whales by Improving the Safety of Oil Transportation Act (ESHB 1578) requires tug escorts for all oil tankers between 5,000 to 40,000 deadweight tons by 2025. This requirement will likely increase the level of tug/tow vessel use within the reserve. Other actions include creating a vessel traffic risk model, producing a synopsis of vessel activities, and updating both contingency and geographic response plans.

Maritime shipping increases the risk of introducing non-native and invasive species to Washington waters. Invasive aquatic plants and animals can be unintentionally discharged through ballast water or vessel biofouling. Ballast water management in Puget Sound is implemented by WDFW under the following laws: Chapter 77.120.RCW and Chapter 220-650 WAC. These laws require approved treatment or open water exchange prior to ballast discharge into waters of the state. WDFW, in coordination with Ecology, also regulates in-water vessel hull cleaning to prevent the introduction of organisms and pollutants. These laws and regulations help minimize non-native introductions which have the potential to displace, disturb, consume, and compete with native species.

Vessel traffic also has the potential to harm wildlife through vessel strikes. Species affected could include fish, diving birds, seals, whales and dolphins. Although collisions often go unnoticed or unreported, the International Whaling Commission reported three ship strikes in Washington during

2019; one gray whale in Jefferson County, one humpback whale in King County, and one harbor porpoise in San Juan County. There were also 105 stranded cetaceans in Washington throughout 2019, 6 of which were harbor porpoises in Whatcom County. Although strandings may result from various factors including age, disease, and environmental degradation, they also can result from vessel collisions. Raverty et. al (2020) studied the pathology results of stranded killer whales and found that vessel strikes may be an important threat to the southern resident killer whales which frequent the southern Salish Sea including areas with greater vessel traffic.

The underwater noise caused by vessel traffic of all kinds can have both short and long-term effects on marine life, especially marine mammals including the critically endangered southern resident killer whales. Vessel traffic noise can mask or impair communication and echolocation, required by the southern residents for socialization and locating prey. The disturbance from noise and vessel traffic on the southern residents is one of the main focal threats that Governor Inslee's Southern Resident Orca Task Force is addressing, along with the availability of Chinook salmon and exposure to toxic pollutants. Vessel noise has also been identified as a potential stressor to Pacific herring (EVS 1999, Schwarz and Greer 1984).

Water and Sediment Quality Impacts

Water and sediment quality within the aquatic reserve are likely affected by the reserves' proximity to areas of urban development and industry, yet the limited upland development along the reserve's eastern boundary and the regulation of industrial and municipal discharges has helped minimize these impacts compared to more developed areas of Puget Sound. The overall quality of the Cherry Point reach also benefits from open exposure and tidal currents. In the concentrated upland areas of development, increases in stormwater runoff from impervious surfaces could adversely affect biotic communities by carrying pollutants into the reserve. Non-point pollution is a leading cause of water and sediment quality impairments and can be harmful to wildlife, habitats, and recreation.

Contaminants to the reserve could include excess nutrients, bacteria and pathogens through poor agricultural and residential practices, outfalls, septic system failures, or direct discharges. Oil, grease, metals and toxic chemicals may enter through road runoff and industrial facilities. Flora and fauna within the reserve may also be directly or indirectly impacted by industrial activities such as ballast water and waste discharges, surface run-off, and spills from fuel, materials, and hydraulic fluid. Lastly, siltation can impact the reserve from construction projects and eroding bluffs due to improper management and drainage.

Impervious surfaces are overall relatively low upland to the reserve (Appendix C, Map C-13). Stormwater runoff is generated from industrial piers, buildings, roads, and upland residential development. Several stormwater outfalls exist along the shoreline adjacent to the reserve (Figure 7). In addition, many residential properties along the shoreline in Birch Bay use tightlines to alleviate stormwater runoff over bluffs and direct the discharge onto the beach. This northern portion of the reserve and all of Birch Bay to the northeast has successfully improved water quality over the last decade. Shellfish harvesting was closed in Birch Bay in 2008 due to elevated levels of fecal coliform bacteria, but was recently re-opened in 2018 after environmental clean-up efforts by many local entities and community members. Future residential and industrial development at Cherry Point will inevitably increase the amount of impervious surfaces, thus potentially increasing stormwater and wastewater discharges into waters of the reserve. The Birch Bay Watershed and Aquatic Resources Management (BBWARM) District and Whatcom County Public Works conducts a comprehensive water quality monitoring program in Birch Bay which includes monthly bacteria sampling and identifies areas for water quality improvement efforts.

All industrial facilities at Cherry Point have National Pollutant Discharge Elimination System (NPDES) permits to discharge effluent into the reserve. There are currently eight active industrial NPDES permits at Cherry Point that discharge effluent via single or multiple outfalls into the Strait of Georgia, as well as one municipal permit for the Birch Bay Water and Sewer District's wastewater treatment plant. Each facility is permitted to discharge treated wastewater, process water, ballast water, and/or stormwater into receiving waters. There are also three small municipal stormwater outfalls within the Birch Bay urban growth area near Point Whitehorn which fall under Whatcom County's NPDES Phase II permit. Together, these industrial and municipal outfalls contribute millions of gallons of freshwater and runoff into the Strait of Georgia each day. All NPDES permits mandate sampling and reporting protocols to maintain compliance with water quality standards. For a list of all relevant NPDES permits, see Appendix A.



Figure 5. Image of stormwater runoff onto the beach in Birch Bay (DNR 04/08/2014).

Several short-term water quality assessments conducted within the reserve boundaries have found minimal to no contamination. Amec Environment & Infrastructure, Inc. conducted a baseline water quality characterization report in 2013 for the proposed Gateway Pacific Terminal. The assessment consisted of five offshore sites over 2 days, however all results including dissolved metals, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and in-situ parameters fell within standard criteria levels (AMEC Environment & Infrastructure, Inc. 2014). Bioassays on Pacific herring embryos were also run and concluded that no significant impacts existed. In 2014, the Aquatic Reserves Program led a shoreline assessment in which six stormwater outfalls were sampled for dissolved metals and fecal coliform bacteria. All results for dissolved metals were far below regulatory action levels. Three elevated concentrations (> 100 cfu/100mL) occurred for fecal coliform bacteria, however this parameter is extremely variable and requires a long-term sampling approach. Several tightlines were also sampled for fecal coliform bacteria and concentrations were generally low with elevated concentrations at only two locations. These assessments are detailed in Appendix A.

Through participation in WDFW's Mussel Watch Program, data on mussel ingestion of waterborne contaminants in the reserve has shown generally low concentrations of organic contaminants and heavy metals. Mussels were transplanted to several sites (Appendix C, Map C-14) in or near the reserve during the winters of 2013, 2016, and 2018, and tested for various contaminants. Except for a few heavy metals (see Appendix A, Figure A-10), most results were low in contaminants and consistently lower relative to other Puget Sound locations, especially in comparison to more urban areas such as Elliott Bay and Commencement Bay.

The southern portion of the reserve, extending down to Sandy Point, is currently closed for commercial and recreational harvesting of clams, geoduck, scallops, mussels and oysters due to proximity to the Lummi Sewer & Water wastewater treatment plant outfall. Similarly, the offshore bedlands within approximately a quarter mile radius of the Birch Bay Water and Sewer District's wastewater treatment plant outfall off Point Whitehorn is also closed for shellfish harvest. Shellfish harvest closures are common near wastewater treatment outfalls and are a result of annual sanitary

surveys which identify potential impacts to water quality. The shellfish growing area in Birch Bay is sampled six times each year for fecal coliform bacteria and all nine sites were compliant with water quality standards as of the 2019 Annual Shellfish Growing Area Review (Jahraus 2019).

All known sediment quality monitoring conducted since 2011 in Cherry Point has returned results that were compliant with the Washington State Sediment Management Standards Marine Sediment Quality Standards, indicating chemical concentrations in sediments to be relatively low (see Appendix A). Despite a few instances of contamination found in the previous decade (see 2010 Cherry Point Management Plan), recent studies by Ecology’s marine sediment program from 1997 to 2019 have found no impairments to the offshore benthic communities, overall good sediment chemistry, and no evidence of contamination harmful to human health (see Appendix A for details). A core monitoring site west of Cherry Point in the Strait of Georgia characterizes the general region as displaying an increase in benthic species abundance since 1989 and a decrease in high molecular weight PAH’s (Patridge et al. 2018). Legacy sources of sediment contamination exist on upland areas adjacent to the reserve. One site of concern is that of Treoil Industries Limited located approximately 1.8 miles from the shoreline. In 2017, the U.S. EPA removed thousands of gallons of hazardous waste. During the large removal effort, oil pockets were found within excavated sediment below the storage tanks (Figure 8). The EPA final report concluded that the depth of potential contamination within the soil was unknown and required an archeological assessment prior to further excavation (Ecology and Environment Inc. 2017). Contaminants within the soil remain a threat to groundwater and surface water contamination which could ultimately flow into the reserve. A second EPA cleanup effort was conducted in 2022 where large quantities of hazardous, oily, and corrosive materials were removed from the site. As of early 2024, Ecology’s Toxics Cleanup Program is in process of conducting a remedial investigation and feasibility study to propose further cleanup actions.



Figure 6. Oil pockets in soil from prolonged leaking under storage tanks. Photo taken by Valeriy Bizyayev, 7/31/17. EPA Assessment and Emergency Removal Final Trip Report (Nov. 2017).

One threat to water and sediment quality within the reserve is the existence of creosote pilings in adjacent waters. Creosote–related contaminants are toxic to some marine life including Pacific herring embryos (Duncan et al. 2017 and Vines et al. 2000) and can accumulate in marine sediments. Several Cherry Point industries have made significant efforts to minimize the harmful effects of exposed creosote by either replacing the wood pilings with steel/concrete or sealing them with an impermeable substance such as epoxy.

Oil Spills

Oil spills threaten organisms, ecosystems and wildlife and impacts can vary depending on the type of oil, weather, tides, and other conditions. Effects could vary from minor to catastrophic. Several spills

have occurred historically around Cherry Point and are detailed in the previous Cherry Point Management Plan (2010). Since 2010, there have been 6 additional spills ranging from 1 to 75 gallons of oil spilled to marine waters in or near the reserve (Appendix A, Table A-4).

Since 2012, businesses in Whatcom County have conducted 47 percent (43,827.19 million gallons) of regulated overwater oil transfers in the state of Washington (Washington Department of Ecology, 2020b). The refineries have several procedures and technologies in place to reduce the chance of spills. The many efforts by regulators, industries, and vessel handlers have lowered the number and volume of oil spills. Historically, the majority of oil spills by volume in Washington state waters occurred from overwater transfers. Since 2004, when the Department of Ecology adopted a “zero spills to water” goal and began regulating overwater oil transfers, only three percent of annual oil spills have occurred from overwater transfers. Other potential sources of oil spills are releases from cargo or bunker fuel in the event of vessel collisions/allisions.

Ecology aims to minimize spill occurrences and impacts by operating a spill preparedness and response program. This program requires oil handlers to have an oil spill contingency plan and hold oil spill drills, develops local geographic response plans (GRPs) to protect important resources, stages equipment around the state for rapid and aggressive response, and ensures restoration of resources after an incident. Ecology also requires Advance Notice of Transfers (ANTs) for facility and vessel operators involved in transfers of bulk oil to prepare for and prevent oil spills. Cherry Point is a part of the North Puget Sound GRP (Sector NPS-3) which was last updated in 2011. The nearest disaster response team is located in Bellingham.

The 2015 Vessel Traffic Risk Assessment (Van Dorp and Merrick 2017), directed by Washington Legislation, found that vessel standards through requirements and inspections as well as current waterway management activities dramatically lessen the chance of oil spills in Puget Sound. It also demonstrated actions which could further reduce risk including the use of tug escorts, stationing rescue tugs at key stations, and keeping tanker tonnage restrictions in place. In 2019, the Washington legislature passed ESHB 1578 which requires all oil tankers between 5,000 to 40,000 deadweight tons and barges over 5,000 deadweight tons to require a tug escort in Puget Sound by 2025.

A large oil spill would be detrimental to fish and wildlife including the Cherry Point herring population. Studies from the 1989 Exxon-Valdez oil spill indicated that oil spills can result in significant reproductive impacts to Pacific herring (Marty et al. 1999 and Carls et al. 1999). A growing threat from oil spills is the type of crude oil transported, including tar sands and extracted bitumen. In the case of a spill, bitumen has the potential to sink and remain on the benthic substrate for decades. This would have drastic effects on marine life and habitats within the reserve. A bitumen spill in Michigan which occurred in 2010 impacted in-stream habitats, birds, mammals, fish, crustaceans, and benthic invertebrates. Recovery was estimated to require 5 to 15 years depending on location and types of response actions conducted (USFWS et al. 2015).

Air Quality Impacts

Airborne contaminants via atmospheric deposition have the potential to affect water and sediment quality within the reserve. Of the six air pollutants that have standards under the federal Clean Air Act, all but sulfur dioxide (SO₂) met the more restrictive Washington Ambient Air Quality Standards in Whatcom County during 2017. After further investigation, it was determined that most of the county was in compliance with the federal standard, however SO₂ levels near the Intalco aluminum smelter were in exceedance (Caudill 2020). An air quality technical report was submitted to the EPA in 2020 and Whatcom County remains awaiting attainment designation for SO₂. Intalco recently

curtailed its operations in May 2020 and temporarily shut down in August 2020. It is unknown how this temporary closure will affect the SO₂ attainment status.

Sulfur dioxide in the air originates from the burning of fossil fuels. As of 2017, regulations now require marine vessels to use fuel with a lower sulfur content near the coast. Currently, the majority of SO₂ emissions come from point sources. Industrial emissions of SO₂ near the reserve have the potential to impact both humans and the nearshore ecosystem. Human exposure to SO₂ can lead to respiratory harm, particularly for children or adults with asthma. Plants and trees can be impacted as high concentrations can damage foliage and decrease growth (Varshney et al. 1979). Sulfur dioxide pollution can also lead to the acidification of soils, lakes and streams. High concentrations of SO₂ in the air can react with other compounds to form small particles which contribute to particulate matter pollution. Particulate matter in the air is a risk to human health as well as reduces visibility through forming smog. Particulate matter in the air may enter the reserve through wind transport and deposition. The direct effects that increased local levels of SO₂ have on the reserve remain unstudied.

All industries with the potential to emit more than 10 tons per year of hazardous air pollutants are required to hold air operation permits (AOPs). There are currently five AOP holders upland to the reserve: Intalco, bp, Phillips 66, PSE Ferndale Generating Station, and PSE Whitehorn. Annual emissions of regulated air pollutants are shown in Appendix A, Figure A-14.

The effects of air pollution on the species and habitats within the reserve remain unknown. Various air pollutants may precipitate out directly into waters of the reserve, concentrate in stormwater runoff, or fall as acid rain.

Non-native Fauna and Flora

Non-native species can disturb native ecosystems by physically displacing, outcompeting, or consuming native species, and upsetting the balance of the natural ecosystem. In other cases, a non-native species may not have an immediate, obvious, or significant long-term impact on the native biological communities or habitat. A few non-native species have been deliberately introduced to Washington State, such as the Virginian Oyster (*Crassostrea virginica*) and the Pacific oyster (*Magallana gigas*). The Pacific oyster along with non-indigenous Manila clams are sought-after recreational species in the reserve. Another more recent introduction, the purple varnish clam (*Nuttallia obscurata*), was apparently introduced via ballast water from Asia. Varnish clams are common on several beaches in Birch Bay and are becoming more popular for human consumption.

Before 2000, ballast water discharge went unmonitored in Washington State marine waters; as a result, it is unknown how many non-native species were introduced into the CPAR area from ballast water discharge at the CP terminals. As of 2000 ballast water discharge is managed by federal and Washington State regulations that prohibit discharge of untreated ballast water into the waters of the State and the U.S., unless the ballast water has been subject to an off-shore oceanic ballast water exchange (based upon originating port). However, ballast and fouling communities on ships using the industrial piers and anchoring-out in the reserve area still pose a potential vector for the introduction of non-native species. A comprehensive survey of non-native organisms established at Cherry Point has not been adequately characterized.

Other well-established non-native species in the reserve are: the Japanese brown alga, *Sargassum muticum*, has a widespread distribution throughout the reserve, and the diminutive non-native Japanese eelgrass, *Nanozostera japonica*, is documented in numerous patches from Birch Bay to south of Gulf Road. *N. japonica* is classified as a Class C Noxious weed if interfering in commercial aquaculture. In most other areas of the Salish Sea, including the CPAR vicinity, the potential impacts

of *N. japonica* are considered benign and ecological functions are potentially beneficial to waterfowl, such as grazing by brant (Kyte, M.A., CPAR Implementation Committee member, personal communication, 2020b). Habitat limitations and seasonally shifting sandbars and swales in Birch Bay and along the outer reach of the reserve appear to curtail the permanent displacement of unvegetated flats by *N. japonica*. On the other hand, *Sargassum* is not a regulated species in Washington State, and has been shown to be an invasive species by definition. *Sargassum* has become one of the most pervasive macroalgal in lower intertidal areas in the reserve and vicinity, outcompeting and even displacing many of the native macroalgal species in this highly productive zone. Unlike many other regions in the Southern Salish Sea, *Sargassum* is observed to be limited to lower intertidal areas in the Cherry Point Aquatic Reserve area (Kyte, M.A., CPAR Implementation Committee, personal communication, 2020a), and does not infringe upon the local prime bull kelp habitat.

Most relevant to current conditions is the expansion of European green crab (*Carcinus maenas*) in the marine waters of northern Whatcom County in 2020. In the summer of 2019, European green crab (EGC) were found in Lummi Bay and Drayton Harbor, with a later sighting in October 2019 in Birch Bay, near Birch Bay Resort. Trapping efforts had a late start in 2020, due to the COVID-19 pandemic, but were extensive with numerous EGC caught in both Drayton Harbor and Lummi Bay. In October 2020, a single effort at the end of the trapping season captured a young-of-the-year EGC at the mouth of Terrell Creek in Birch Bay, (Buffington, C., WDFW, personal communication, 2020). The European green crab is one of the most successful and damaging invasive species in the world. Its recent arrival along Washington's inland shorelines poses a threat to critically important estuarine ecosystems including native species and shellfish resources. WDFW and other local organizations agree that "recent detections of EGC in the Drayton Harbor Action Area meet an imminent danger threshold. There is need to work quickly and cooperatively to inventory, monitor, control, and prevent the spread of EGC across the Drayton Harbor Action Area and the broader Salish Sea." As an offshoot of this effort, regularly assessing EGC populations in Birch Bay and possibly in other potentially vulnerable areas adjacent to the reserve, will be a part of a Salish Sea Regional action area plan (Pleus, A., WDFW, personal communication, 2020). More detail about non-native species can be found in Appendix A.

Increased Recreational Use and Habitat Disturbance

Although no detailed study of recreational use of the reserve itself has been undertaken, activities like boating, fishing, shellfish and seaweed harvesting, swimming, and beach walking are known to be popular throughout the reserve. As human populations in Whatcom County, Birch Bay and around Bellingham increase, the demand for recreation in and adjacent to the reserve will only continue to intensify.

Increased public access and recreation could affect the reserve in many ways. Physical disturbance as well as the recreational harvest or capture of organisms can negatively affect the ecosystems of the reserve. Extractive recreation like fishing, crabbing, clamming and waterfowl hunting can affect local populations of organisms – either through the removal of individuals or the physical stress of harvest on adjacent (non-harvested) individuals. For example, during clam harvest, trampling of intertidal vegetation and organisms, including leaving unfilled clam-digging holes undermines habitat integrity and species vulnerability and resilience. Also, increased boating and hunting activity can exacerbate the total stress on foraging and resting waterbirds, as well as marine mammals. Escalated use of beaches and tidelands may further disturb wildlife using the beaches, particularly if human recreation includes unleashed dogs. Additional physical degradation to habitat and water quality can occur from increased beach recreational boat traffic, especially from mooring and anchoring in eelgrass and seaweed beds. In order to reduce the risk of physical habitat degradation, DNR district staff have

monitored unauthorized mooring in Birch Bay (Chapter 4, Table 5). Finally, derelict gear from recreational and commercial fishing activities continue to catch crabs, groundfish and other species and potentially snag or entangle marine mammals.

Both public and private property and habitat areas from Birch Bay State Park along the reserve shoreline to south of Gulf Road have been impacted by human uses. As public access increases, many of these issues will probably escalate. This highlights the need and opportunity for increased public education and outreach regarding the sensitive nature of many of the systems and resources in the reserve.

3. Ownership and Uses

This chapter describes the reserve’s boundary, ownership, current and historical uses of the reserve. It includes a description of land use designations, zoning and protections nearby.

For a discussion of the potential effects that uses can have on the reserve, see Chapter 2 and Appendix A. A chronological history of uses and significant events affecting the Cherry Point Aquatic Reserve is provided in Appendix E.

Cherry Point Aquatic Reserve Boundary

The reserve boundary includes all state-owned tidelands and bedlands⁶ extending out one-half statutory mile (2,640 ft.) from the shoreline, along with any state-owned bedlands beyond this distance but shallower than 70 feet in depth (see Appendix C, Map C-15 and Appendix G). Private tidelands are excluded from the reserve, and in these cases the reserve boundary begins at the extreme low tide line. The northern reserve boundary originates in the east where the shoreline meets the Birch Bay State Park tidelands, running directly west to the 70-foot bathymetric depth contour line. To the south, the reserve is bounded by an east-west line separating Townships 38 and 39 North, Range 1 East, extending out into the water. This line corresponds to the northern (tideland) boundary of the Lummi Indian Reservation.

When the reserve was originally established in 2000, the Commissioner’s Order explicitly omitted the operations of four leased and one proposed lease activity footprint from the reserve. These are often referred to as “cutouts” from the reserve. Thus, the reserve boundary is defined in these “cutout” locations as the actual surveyed lease footprint. In January 2017 the Commissioner of Public Lands expanded the reserve boundary to include the undeveloped 45-acre aquatic parcel originally included as one of the “cutouts”. (This process was described in Chapter 1.) A complete legal description of the reserve boundary is contained in the 2017 Commissioner’s Withdrawal Order (Appendix G).

Aquatic Ownership in and Adjacent to the Reserve

The reserve comprises 3,050 acres, including roughly 211 acres of tidelands and 2,839 acres of bedlands (Appendix C, Map C-15).

Historically, waterfront property owners had preference rights to purchase tidelands from the state located in front of their properties. A number of upland owners purchased tidelands until this program was discontinued in 1971. Between the reserve’s northern and southern boundaries, roughly one-third of the tidelands are privately owned, representing approximately 63 acres. Private tidelands extend down to extreme low tide, and are not publically accessible during low tides without

⁶ Tidelands are generally defined as lands that are exposed during low tides; whereas the “Beds of navigable waters” (bedlands) are never exposed at even the lowest tide. Tidelands generally extend from ordinary high tide down to extreme low tide (See RCW 79.105.060).

permission of the owner. The state's Public Trust Doctrine preserves public use of navigable waters below the ordinary high water mark.

Upland ownership adjacent to the reserve includes: industrial and refinery-owned parcels (75%), private residential or undeveloped lands (20%), and county park lands (5%). Much of the industry-owned land is currently undeveloped forest, wetlands or pasture land. Located just north of the industrial area, Whatcom County's 54-acre Point Whitehorn Marine Reserve (see Figure 2) offers access to over 1,900 feet of state-owned tidelands. Uplands north of the county park to Birch Bay State Park are mostly private residential lots. The Lummi Indian Reservation is located on tidelands and uplands south of the reserve.

All of the bedlands within the reserve boundary are state-owned and managed by Washington DNR.

Cultural and Historical Uses

Humans have used the waters and shorelines of the reserve for millennia. Recent human uses have altered the shoreline, ecosystems, habitats and natural processes of the reserve. Knowledge about the type and intensity of past and current uses of the reserve helps us better understand the ecological conditions observed today.

Cultural Uses and Traditional Cultural Properties

The tidelands and associated beaches, tidal benches and uplands at or near Cherry Point have long been used for tribal gathering, fishing and villages by Coast Salish Tribes. Multiple archaeological sites near the area have documented use by native peoples from time immemorial (Grabert 1988, Blodgett 1976).

Prior to European contact, this area was shared by the Semiahmoo and Lummi Tribes (Suttles 1951, Suttles 1990, Dougherty 2009). To the north, the Semiahmoo people originally inhabited Boundary, Semiahmoo, and Birch Bays. The Semiahmoo people eventually split up to locations at the Semiahmoo Indian White Rock Reserve, Lummi Reservation and just across the Canadian border. To the south, the Lummi Nation occupies reservation lands ceded in 1855 to the Lummi Nation (see Appendix C, Map C-15). Traditionally, the shorelines near Cherry Point provided excellent tribal access to catch the then abundant summer Fraser River sockeye, and in odd years, pink salmon (see Tribal and Commercial Fishing, below). Late spring spawning herring were caught, herring roe was harvested with herring rakes, halibut were caught singly in deeper water, and flounder in shallow embayments like Birch Bay (Suttles 1990, Grabert 1988, Blodgett 1976).

The aquatic reserve lies within the traditional homeland of the Lummi Nation. This reserve is an important component of their traditional homelands, used since time immemorial for hunting, fishing and gathering. The area near Cherry Point, known to the Lummi Nation as *Xwe'chi'eXen*, was an important summer fishing village. Used for centuries prior to Euro-American settlement, it is considered an important sacred place by the Lummi's (Late Chief Bill James 2013). The Lummi Nation's hereditary chief, Bill James, has called it "a revered place that is the home of the Ancient Ones" (Royale 2016). A 2016 letter from the Lummi Nation to Commissioner of Public Lands Peter Goldmark in support of reserve expansion states:

The waters and tidelands associated with the Reserve are an integral part of the usual and accustomed fishing places of the Lummi Nation....In addition, the Reserve is located within an especially rich and fertile marine environment that serves as important habitat for a number of

forage fish, finfish, and shellfish (including several threatened and/or endangered species) that are inextricably linked to the Lummi Schelangen, (“Way of Life”). Significantly, the area we know as Xwe’Ch”eXen (Cherry Point) is of profound cultural and spiritual significance to our people. We insist that the reserve be managed in a manner that neither violates our treaty rights, nor our cultural values.

Euro-American Settlement and Homesteading

The southern Strait of Georgia was first explored by the Spanish in 1791, followed closely by the British under George Vancouver in 1792, who named many prominent geographic features still recognized today. From 1827 - 1846 the Hudson’s Bay Company operated a trading post at Fort Langley, in Canada just north of modern day Lynden, Washington. For decades the Fort influenced local tribes through trade and commerce, introducing them to Euro-American technology, goods, food, language and customs; along with diseases, social and economic distress. Tribal people introduced settlers to native foods and subsistence practices (Langley Centennial Museum 2020, Wikipedia 2020). Other expeditions like the expedition lead by U.S. Navy Lieutenant Charles Wilkes in April 1841 assisted in mapping and further naming local geographic features, including Point Whitehorn within the reserve (Dougherty 2011).

During the 1850s, newly established lumber mills and coal mines supplying west-coast ventures brought settlers to Bellingham and the surrounding area. As forests were cleared in the following decades, agricultural production became common. In the 1870s and 1880s, records show that homesteaders received pre-statehood land patents for many parcels along the bluffs and shorelines adjacent to the reserve (DNR aquatic plates, 2020). During the first half of the 20th Century, the Scandinavian and Mennonite community of Whitehorn built residences and farms in the area between Point Whitehorn and Cherry Point. Whitehorn supported a small school, two churches, and small farms with roads and infrastructure until the community declined and the lands were purchased by industry in the late 1960’s (Dougherty 2011).

Tribal and Commercial Fishing

Offshore areas have traditionally been used for tribal commercial, ceremonial, and subsistence harvest of numerous species including salmon, herring, Dungeness crab, and bottomfish using a variety of methods, including gillnets, setlines, trawl, and purse seine and crab pots. Tribal fishing for subsistence and trade in the waters of the reserve has likely occurred for at least 3,000 years (Grabert 1988), while intensive commercial harvest has greatly impacted the fishing resource over the past 120 years (Boxberger 2000). Past commercial fishing practices in the reserve were substantial, far greater than occurs today. A description of these historic uses and methods provides context for understanding current fishing in the reserve.

Reef nets (Figure 9) were used by countless generations of tribal fishers to catch the Fraser River sockeye, and pink salmon along the shorelines of the reserve. As described by Suttles (1990) tribal reef net systems,

...consisted of a rectangular net suspended between two canoes in the path of the migrating salmon. Anchor lines were arranged in such a way as to resemble a rising reef; this guided in the fish, which were promptly hauled up. ...At the height of a good run, a reef net might take several thousand fish a day. The fish were preserved by drying outside on high racks that stood permanently at the reef-net camp (Suttles 1990 p. 457).

In his book *To Fish In Common: The Ethnohistory of the Lummi Indian Salmon Fishing*, anthropologist Daniel Boxberger (2000) has documented the Lummi Nation's involvement in the commercial salmon industry going back more than 100 years. He states that prior to signing the Treaty of Point Elliott in 1855 there were likely around 20 distinct tribal reef net fishing locations in Puget Sound. These sites were used exclusively by Straits Salish speaking Tribes - Lummi, Samish, Suquamish, Clallam and others. They were located at key salmon migration points in the San Juan and Gulf Islands, and mainland areas where the Fraser River sockeye and pink salmon congregated in great numbers returning from the Pacific Ocean, including bedlands of the reserve.

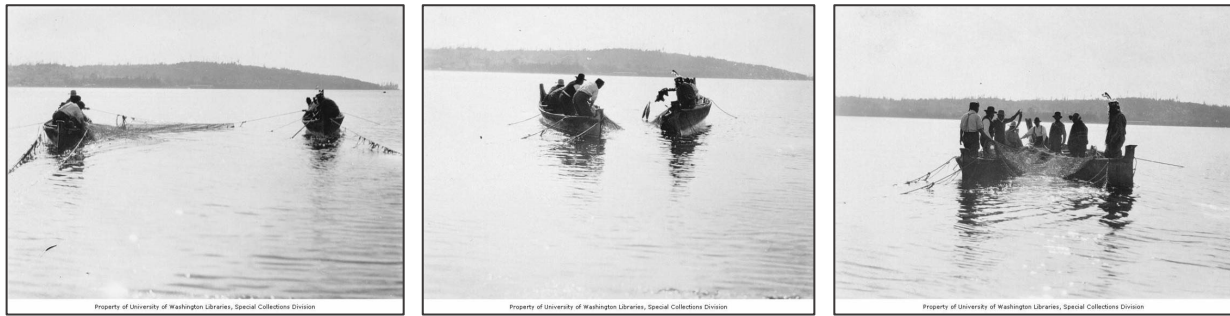


Figure 7. Lummi Native American fishermen catching salmon with reef net between two canoes, Bellingham, Washington, ca. 1930-1933 (Courtesy: University of Washington Libraries, Special Collections [na1814, 1813, 1810]; Eugene H. Field Lummi Indian Photograph Collection.)

The waters of the reserve are located in what was one of the most productive commercial salmon fishing areas of the state. As Boxberger states,

The traditional fishing grounds of the Lummis were certainly the most productive in the state of Washington north of the Columbia River. In 1899, eleven of the largest salmon canneries in the state were in Whatcom County, six near Blaine and five at Fairhaven. In 1901 twelve of the 19 Puget Sound canneries were in Whatcom County, and those twelve accounted for two-thirds of the total Puget Sound salmon pack (Roth 1926 quoted in Boxberger p. 63).

From the 1890s to the 1930s, canneries at Point Roberts, Fairhaven (Bellingham), Anacortes, and even at Legoe Bay on the northwest side of Lummi Island (Figure 10, Carlisle Packing Co.) supported the commercial salmon fishing industry. Many tribal members worked in the canneries.

These canneries controlled scores of very efficient fish traps. Fish traps consisted of nets that were fixed to the shoreline, then strung hundreds of feet out to structures forming a series of angled smaller nets which funneled fish into traps (Figure 11). Fish were removed from the traps and barged to the canneries at day's end. Commercial fish traps were extremely productive at catching fish. It's estimated that over 150 million sockeye salmon were caught in fish traps in Puget Sound until the practice was banned in 1934.

Commercial fish traps were often purposely placed in prime fishing locations where tribal reef nets had been located for generations (Boxberger 2000). For example, just south of Cherry Point a Euro-American fish camp with seasonal residences and facilities operated fish traps from the 1890s-1934 at a location which had, for millennia, hosted and sustained tribal fishing culture, including extensive use of reef nets (Blodgett 1976, Markham 1993, Boxberger 2000).

In 1934, Washington State's Initiative 77 permanently banned the use of fish traps and other fixed fishing gear. In the decades that followed, purse seining and gillnetting became the dominant salmon

fishing techniques. Today, limited reef net fishing at specific locations is co-managed jointly by the tribes and WDFW (see <https://wdfw.wa.gov/fishing/commercial>).

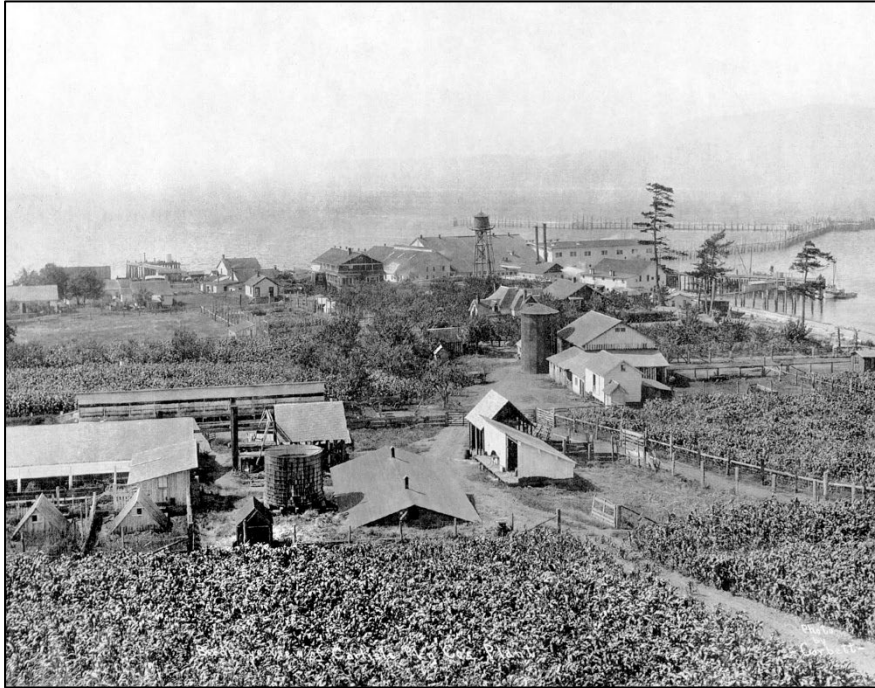


Figure 8. Carlisle Cannery at Village Point on northwest side of Lummi Island, c.a. 1920s. Note extensive fish trap structure in the bay out beyond cannery buildings. (Photo by Leslie R. Corbett, Whatcom Museum).

Besides salmon, Pacific herring stocks were heavily fished in Puget Sound. Archaeological evidence near the reserve supports the use of herring rakes for harvesting going back centuries (Graber 1988). Herring fishing was regulated in 1915, with fishing harvest quotas set annually based on boom and bust population cycles. The early commercial herring harvest was mainly for export. The fishery transitioned to in the early part of the 20th century primarily to provide bait to the growing recreational salmon fishery in the 1950s. In the late 1950s herring were commercially

harvested for oil, fish meal and crab bait. In 1972, the Cherry Point herring sac-roe fishery began. The landings of the treaty and non-treaty fishery topped 4,000 tonnes in 1974. In 1979, the Lummi Nation lobbied for closure of the Cherry Point herring stock to protect the resource (James 2013). Declines in the northern herring stocks, particularly the Cherry Point stock, led to the closure of both the general purpose and sacroe fisheries by the mid-1980s. In 1988, a non-tribal spawn-on-kelp (SOK) and treaty sac-roe fisheries were resumed on the Cherry Point stock. A dramatic decline in Cherry Point stock abundance in the mid-1990s again closed this fishery which has remained closed to date due to low biomass. A minimum spawning biomass of 2,900 metric tonnes for the Cherry Point stock is currently required before harvest is considered (Sandell et al. 2019). The 2020 herring



Figure 9. Lummi harvesting herring in Hale Passage. (Photo by Jack Carver, June 1973, Whatcom Museum).

spawning biomass for Cherry Point was 274 metric tonnes (Sandell T., WDFW, personal communication, 2021).

Industrial, Refinery and Transportation Activities

Beginning in the mid-1950s DNR issued a number of short-term exploratory oil and gas leases for locations offshore of Cherry Point. In 1977 three large oil drilling platforms were proposed, and more than 200 acres of adjacent uplands were purchased for constructing the platforms. The project could only move forward by amending the state's Shoreline Management Act, so in 1982 Whatcom County successfully lobbied the state legislature amending the Act to allow the project to go forward. The bill successfully passed both houses, but was finally vetoed by Governor John Spellman, putting an end to the proposal (Whatcom Watch 2012).

Between 1954 and 1971, three large industries were fully developed in the Cherry Point vicinity taking advantage of the natural deep-water shipping, pipeline and rail capacity. In 1954, General Petroleum Corporation constructed an oil refinery south of Cherry Point, subsequently managed as the Ferndale Mobil, bp, Tosco, and now Phillips 66 refinery. In 1971 Atlantic Richfield Company (ARCO) constructed another oil refinery even further north, later selling it to British Petroleum (bp). This is the northernmost pier adjacent to the reserve. In 1966, Intalco Aluminum built an aluminum smelter north of Phillips 66. The aluminum smelter is owned by Alcoa-Intalco Works, who also own the tidelands. However, the causeway and wharf that make up the marine terminal are now owned by Petrogas. For further details on these facilities see Appendix D.

Current Uses

This section describes uses currently occurring in and adjacent to the reserve including: tribal use of culturally important areas, recreational and enjoyment uses, commercial fishing and shellfishing, shipping and transport/transit activities, and DNR-authorized uses. This section also contains a description of current land use zoning designations which affect allowable uses in and near the reserve.

Regular shipping from the three industrial terminals at Cherry Point dominates the commercial activity in the reserve, with commercial and tribal fishing and crabbing occurring at various times and intensities throughout the year. The relatively remote, exposed nature of this section of the Strait of Georgia along with somewhat restricted public access tends to limit recreational use of the reserve – especially south of Point Whitehorn. Most recreational activity occurs during boating season from May through September.

Public Access and Recreation

Public Access

Providing public access to state-owned aquatic lands for recreation and enjoyment is an essential component of DNR's aquatic land management. Access allows the public to experience the aquatic reserve's habitats, intertidal life and views, and enables the field collection of important monitoring data.

Although all state-owned bedlands and tidelands in the reserve are open year-round for enjoyment, public access from the uplands is currently limited. The main public access is either at Birch Bay State Park or Whatcom County Parks' Point Whitehorn Marine Reserve (see Figure 2), both located in the northern section of the reserve. At Point Whitehorn Park a steep section of stairs at the beach

currently prevents full accessibility to the public. Public parking for trail access is available at marked parking lots or trailheads at these two locations.

The nearest boat launch for smaller boats accessing the reserve is the public boat launch at Birch Bay State Park. From the boat launch, the reserve extends approximately seven nautical miles around Point Whitehorn and further south. Other public boat launches are available to the south at Sandy Point Marina and Bellingham Bay. Overnight anchoring is allowed in the reserve. However, DNR rules stipulate a maximum stay of 30 days and prohibits live-aboards (WAC 332-52-155).

The best view access to the reserve is from the trail at Point Whitehorn Marine Reserve, with bluffs above the beach providing good views north and south.

Whatcom County's SMP encourages public access where compatible with existing uses, including the Cherry Point Management Area specifically (Whatcom County code 23.100.17.A.4). Private beach access to industry-owned tidelands just south of Cherry Point at Gulf Road is currently allowed, at the discretion of the landowners. However, the county road is subject to winter storm damage, parking is limited, there are no services of any kind, and vehicle break-ins may occur. Some view access is afforded from the road. Due to recent land use decisions, the future of this access point is uncertain.

Recreation

Public access supports outdoor recreational uses of the reserve. The importance of outdoor recreation, including any potential effects it has on the ecosystems and habitats of the reserve was discussed previously in Chapter 2.

Recreational uses occurring within the reserve include boating (all types), wildlife viewing, birding, clamming, crabbing, fishing, waterfowl hunting, picnicking and beachcombing.

Recreational fishing, shellfish and seaweed harvesting, and waterfowl hunting in the reserve are managed by the Washington Department of Fish and Wildlife (see <https://wdfw.wa.gov/>). All are currently allowed in the reserve.

The Washington Department of Health (DOH) regularly monitors recreational shellfish harvesting for health and safety on beaches near Point Whitehorn and Birch Bay State Park. Beaches are mapped and monitored for bio toxins and water quality conditions (<https://fortress.wa.gov/doh/biotoxin/biotoxin.html>). Two locations within the reserve are permanently closed to shellfish harvesting due to ongoing pollution from municipal sewage treatment outfalls:

- The offshore bedlands within approximately ¼ mile radius of the Point Whitehorn municipal outfall (Birch Bay Water and Sewer District);
- All tidelands and bedlands south of the Phillips 66 Terminal within ½ mile of the shore (Lummi Nation wastewater outfall).

Environmental Stewardship and Research

Environmental stewardship and research are a major focus of the reserve. DNR works collaboratively with other agencies and governments, citizens and local non-government organizations to promote environmental stewardship, community science, and research opportunities in the reserve. Important sampling that occurs in and adjacent to the reserve throughout the year includes bird, forage fish

spawning, water quality, invertebrate, aquatic vegetation, and environmental monitoring surveys. These activities are described in detail in Chapter 4—Progress Made Toward Achieving Plan Goals.

The industrial facilities located at Cherry Point provide monitoring data to the Department of Ecology as a requirement for their respective National Pollutant Discharge Elimination System (NPDES) industrial and stormwater discharge permits. For detail, see Chapter 2, *Sediment and Water Quality Impacts* section, and Chapter 5, *Reauthorization of Existing Uses* section.

Oil Spill Prevention Strategies

Both of the refineries are involved in the oil spill Prevention, Planning, Preparedness and Response programs for Cherry Point area. These include the U.S. Coast Guard led Northwest Area Contingency Plan (NWACP) and Washington’s own state-run spills program. Washington’s state program extends beyond NWACP requirements and include the following:

- ❖ Requirement to conduct spill response drills to show preparedness to perform the elements of their respective facility contingency plans.
- ❖ Inspection for compliance with plans.
- ❖ Required Safe and Effective Transfer Reports that document compliance with transfer condition requirements listing in their plans.

Contacts for information on State Facility Oil Spill Contingency Plans for bp and Phillips 66 can be found at <https://ecology.wa.gov/Regulations-Permits/Plans-policies/Contingency-planning-for-oil-industry/Approved-contingency-plan-holders>. The NWACP and state level plans are continuously updated based on federal and state required upgrades.

The Washington State legislature passed ESHB 1109 in 2019 directing the Department of Ecology to produce a model to analyze maritime vessel activity, navigation lanes and anchorages throughout the year for the Strait of Juan de Fuca and the Canadian portions of transboundary waters (Washington Department of Ecology 2021a). The draft is due to the legislature in June 2021. The Department of Ecology is also developing a risk modeling planning tool that will evaluate projects that expand vessel transport in the Salish Sea, associate carrying capacity and assess current and future risk of oil spills (Washington Department of Ecology 2021b)

Commercial and Industrial Uses

Commercial activities in the reserve include tribal and commercial fishing at various times throughout the year, regular shipping and transport activities to and from Cherry Point’s three industrial terminals, and sporadic commercial vessel transits through the reserve (shipping lanes do not intersect the reserve). Shipping activities associated with the bp Refinery, Petrogas and Phillips 66 terminals – all immediately adjacent to the reserve (located in the “cutouts”) - are described in the *DNR Authorized Uses* section, and Appendix A.

Intensive commercial fishing for salmon, herring, crab, and other species has occurred in the reserve since the late 1800s (see *Cultural and Historical Uses* section). Unfortunately, the fishing catch data maintained by WDFW covers a large geographic area (Marine Area 7) and is not specific to the southern Strait of Georgia, so meaningful long-term catch data for the reserve is not available.

A 2014 report estimated the yearly average vessel activity in the vicinity of Cherry Point over a 25 year period from 1995-2010 (Glosten Associates Inc. 2014, cited in some reports as Kirtley 2014). The average number of vessel traffic days per year, by vessel type included: tankers (613); bulkers

(204); cargo ships (107); tank barges (409); tugs (1,152); passenger and fishing (323). In 2019 approximately 5500 commercial deep draft vessels travel north and south bound transits to the Port of Vancouver, British Columbia and about 3700 transit through Admiralty Inlet entering the Puget Sound (Van Dorp and Merrick 2017). Vessel transit records and commercial vessel traffic are discussed in detail in Chapter 2, *Effects of Vessel Traffic on Habitat and Species* section and further in Appendix A.

Intalco's curtailment of operations at its Cherry Point smelter in August 2020 could mean fewer ship transits into the reserve in the future.

Although whale watching tours have operated out of Bellingham over the years, tour routes generally transit from Bellingham directly to Friday Harbor on San Juan Island and do not enter the reserve (Bellingham Tourism Bureau 2020).

DNR Authorized Uses

Projects taking place on or over state-owned aquatic lands require a written use authorization from DNR. Examples include placement of overwater structures such as piers or docks, any item placed in or on the seafloor (outfall pipes, pipelines, telecommunication, and power cables), fixed anchors and mooring buoys. Use authorizations are legal contracts between DNR and the project proponent, outlining the terms and conditions of the use, and conveying certain property rights or permissions to the user in exchange for rent or fees. DNR issues different types of authorizations for the use of state-owned aquatic lands (for example, leases, easements, and licenses [rights-of-entry]) depending on the type and timeframe of the uses. Any such activities occurring within the reserve must demonstrate compatibility with the goals and objectives of the Cherry Point Aquatic Reserve Management Plan. Authorized uses adjacent to the reserve contain site-specific habitat stewardship lease clauses in support of the reserve goals. Table 2 contains a list of current DNR use authorizations in or near (within one mile of) the reserve. Planned or completed uses are not included. Each use is described in much greater detail in Appendix D.

Table 2. List of currently authorized DNR uses in or nearby (within 1 mile of) the reserve.

Description of Authorized Use	Proximity to Reserve	Footprint Area (acres)	DNR Agreement ID	Agreement Expiration Date
Lease: Birch Bay State Park recreational use (Parks & Rec. Commission)	Adjacent: Directly north of reserve boundary at Pt. Whitehorn	346	20-B12230	7/31/2038
Outfall easement: Birch Bay Water and Sewer District	Adjacent: Within cutout of the reserve, at Pt. Whitehorn	5.3	51-082214	3/22/2039
Lease: bp West Coast Products Refinery	Adjacent: Within cutout of the reserve	190.9	20-A09122	3/31/2029
Lease: Petrogas Pacific	Adjacent: Within cutout of the reserve	46.6	20-A08488	1/31/2033
Outfall easement: Intalco Aluminum (south of Petrogas footprint)	Within reserve (not within a cutout)	0.19	51-034983	No expiration (In Perpetuity)
Outfall easement: Intalco Aluminum (within Petrogas footprint; under or alongside the pier)	Adjacent: Within cutout of the reserve	0.57	51-073039	1/31/2033
Lease: Phillips 66 Company	Adjacent: Within cutout of the reserve	48.9	20-B11714	5/31/2036
Outfall easement: Phillips 66 Company	Adjacent: Within cutout of the reserve	0.3	51-076895	5/31/2036
Outfall Lease: Lummi Indian Business	Roughly 1,300 ft. south of reserve	Unknown	20-012638	In Hold-over

When lands that now make up the reserve were originally withdrawn from leasing in the 2000 Withdrawal Order, the boundaries were described to intentionally exclude the authorized footprints of four existing long-term DNR authorized uses (Appendix C, Map C-16). This included the Birch Bay Water and Sewer District municipal outfall and three existing deep-water terminals (bp, Petrogas, and Phillips 66). The footprint for a proposed industrial terminal, which was removed from leasing consideration in 2017 and is now included as part of the reserve itself, was also excluded. As discussed elsewhere, these locations are sometimes referred to as “cutouts” of the reserve.

The Intalco industrial outfall located directly south of the Petrogas terminal/footprint is the only current authorization located within the actual reserve boundary. It is unknown why the right-of-way for this long-term authorization was not excluded with all other existing uses when the reserve was established.

Some authorized uses are quite short in duration (a few months to a few years) and have occurred in the reserve in the past decade. Examples include exploratory geo-technical drilling, buoys containing scientific data collection instruments, and installing temporary emergency stabilizing anchors at shipping terminals, all of which were authorized using licenses.

Future proposals for DNR use authorizations within or adjacent to the reserve will only be considered if they clearly support the goals and objectives of the reserve. In addition, new proposals will be evaluated by DNR's Habitat Stewardship Program staff to ensure there is no net loss of ecological function on the reserve. For lands nearby or adjacent to the reserve, re-authorizations of existing uses must also demonstrate that continued operations will have a net reduction of impacts to species, ecosystems and habitats. For instance, reauthorization of a facility that still has creosote pilings could include a plan for replacement or wrapping a percentage or remainder of these pilings.

In 2021, DNR evaluated a project proposed by the Northwest Indian College to install traditional tribal reef net fishery equipment to demonstrate and teach this traditional fishery. The reef nets would be placed on bedlands within the Cherry Point Reserve just south of Cherry Point. The license, if authorized, is consistent with plan goals of supporting and promoting Lummi cultural heritage (see Chapter 5).

Zoning and Land Use Designations

The Growth Management Act (GMA) and the Shoreline Management Act (SMA) are Washington state laws implementing zoning and land uses in and around the reserve. The GMA requires counties and other local entities to develop Comprehensive Plans (Comp Plans) while the SMA identifies acceptable uses of the shorelines through Shoreline Master Programs.

DNR staff participate in the local planning process and provide agency input on all draft Shoreline Master Programs and Comp Plans as needed, reviewing for congruency with DNR policy, legal mandates and management objectives - including for aquatic reserves. Whatcom County has incorporated protective language supporting the goals of the reserve through both GMA and SMA (see below).

Current maps of upland zoning and shoreline area designations can be found in Appendix C, Maps C-15 and C-16.

Whatcom County passed an ordinance amending the county Comp Plan in 2021 with specific land use regulations regarding uses adjacent to the reserve. The Zoning Code amendments also provide consistency with this management plan and the order of the Commissioner regarding further aquatic leasing for piers, docks and wharves. From the text of Whatcom County Ordinance 2021-046:

“It is the policy of Whatcom County to limit the number of industrial piers at Cherry Point to the existing three piers, taking into account the need to:

- Act conservatively in land use matters at Cherry Point to prevent further harm to habitat important to the Cherry Point Herring stock and Southern Resident Killer Whales;
- Optimally implement the Whatcom County Shoreline Master Program to fulfill the Shoreline Management Act's shorelines of statewide significance policy to preserve natural character, result in long-term over short-term benefit, and protect the resources and ecology of the shoreline;

- Encourage the continued agency use of best available science;
- Support and remain consistent with the state Department of Natural Resources' withdrawal of Cherry Point tidelands and bedlands from the general leasing program and the species recovery goals of the Cherry Point Aquatic Reserve designation and Management Plan;
- Recognize federal actions upholding treaty rights;
- Protect traditional commercial and tribal fishing; and
- Prevent conflicts with vessel shipment operations of existing refineries that could lead to catastrophic oil or fuel spills.”

The Growth Management Act (RCW 36.70A) was passed in 1990 to comprehensively plan for future population growth in the state. Under the GMA, local entities must specify within their Comp Plans land zoning and their allowable uses, and anticipated population growth. In particular, they must designate Urban Growth Areas (UGA’s) to contain growth and reduce urban sprawl. In 2016, Whatcom County updated its Comp Plan, affirming its designation of the Cherry Point UGA located on uplands adjacent to the reserve as a major industrial Urban Growth Area (Appendix C, Map C-17). In addition, the Birch Bay area, adjacent to the northern section of the reserve, was designated as an Urban Growth Area in order to concentrate residential growth and reduce urban sprawling. Since activities occurring in the uplands can potentially affect the reserve, a look at allowed uses and practices in these areas is warranted.

Birch Bay UGA

The Birch Bay UGA is adjacent to the northern portion of the Cherry Point Aquatic Reserve. The Birch Bay community was historically a resort community of primarily second residences. The housing use in the UGA have changed over time to permanent housing as is common in much of Puget Sound’s shoreline communities. The Birch Bay area was adopted as a subarea of the Whatcom County Comprehensive Plan in 2004 to provide more direction to the area’s growth and development. The Birch Bay Water and Sewer District was formed in 1968 to provide water and sewer service to most of the UGA (Birch Bay Water and Sewer District 2021) and to deal with the transition to more permanent housing in the UGA.

Cherry Point UGA

The 7,000 acre Cherry Point UGA adjacent to the reserve possesses a unique combination of elements, making it very attractive for industrial uses. As described in the Comp Plan, these include:

- Proximity to Canada, Alaska and the Pacific Rim: Shorter distances for shipments to and from Alaska; access to Canadian raw materials and markets; and proximity to Canadian shipping terminals;
- Industrial rail transportation systems in place for access to the UGA;
- Three deep-water shipping terminals/loading berths (located within the “cutouts” of the reserve) for receiving raw materials and shipping finished products.

Whatcom County emphasizes the economic importance of this multi-modal industrial area in their Comprehensive Plan:

The industries currently located at Cherry Point are a substantial part of the economic base of Whatcom County and the region and the economic welfare of the county is strongly tied to the

health of these industries and their ability to flourish and expand as opportunities present themselves.” (2021 Whatcom Co. Comp Plan p. 2-57)

The County has zoned the Cherry Point UGA as “Heavy Impact Industrial” (HII, see Appendix C, Map C-15) to support the requirements of heavy manufacturing uses that require water deep enough to accommodate large vessels. This zoning protects the area from incompatible uses, particularly residential uses that could otherwise prevent industry’s ability to adapt and expand (2021 Whatcom Co. Comp Plan p. 2-57). Approximately 4,400 acres of the UGA are currently owned by active use industries.

While protecting these industrially-derived economic benefits is clearly important, the plan also affirms the importance of environmental protections within and adjacent to the UGA,

These industries need to be protected from the inappropriate encroachment of incompatible uses... at the same time, the expansion of these industries needs to be done in ways that do not significantly impact the ecology of the Salish Sea or encourage expanded transshipment of unrefined fossil fuels. (2021 Whatcom Co. Comp Plan p. 2-57)

The County’s Comprehensive Plan (amended date: July 27, 2021) includes specific language affirming congruency of management of the Cherry Point UGA to DNR’s Cherry Point Aquatic Reserve management goals. These include:

- Policy 2CC-2: Encourage developments in the Cherry Point UGA to maintain and operate under management plans consistent with the Aquatic Reserve Management Plan;
- Policy 2CC-11: It is the policy of Whatcom County to limit the number of industrial piers at Cherry Point to the existing three piers, taking into account the need to:
 - Act conservatively in land use matters at Cherry Point to prevent further harm to habitat important to the Cherry Point Herring stock and Southern Resident Killer Whales;
 - Optimally implement the Whatcom County Shorelines Master Program to fulfill the Shoreline Management Act’s shorelines of statewide significance policy to preserve natural character, result in long-term over short-term benefit, and protect the resources and ecology of the shoreline;
 - Encourage the continued agency use of best available science;
 - Support and remain consistent with the state Department of Natural Resources’ withdrawal of Cherry Point tidelands and bedlands from the general leasing program and the species recovery goals of the Cherry Point Aquatic Reserve designation and Management Plan;
 - Recognize federal actions upholding treaty rights;
 - Protect traditional commercial and tribal fishing; and
 - Prevent conflicts with vessel shipment operations of existing refineries that could lead to catastrophic oil or fuel spills.
- Policy 2CC-14: Cooperate with DNR and existing industries to monitor the effects of industrial activities on water quality and habitat functions in and adjacent to the Cherry Point Aquatic Reserve.

Chapter 2 of the Whatcom County Comprehensive Plan provides the goals and policies for the management for the Cherry Point Urban Growth Area (UGA) and promotes consistency with the “Aquatic Reserve Management Plan.”

The 2021 update to the County Comprehensive Plan (Whatcom County Ordinance 2021-046) also strengthens requirements for State Environmental Policy Act (SEPA) permits for industrial facilities, including analysis of direct, indirect, and cumulative impacts arising from:

1. Windborne transport of fossil or renewable fuel emissions across Whatcom County;
2. Lifecycle greenhouse gas emissions for the projects incremental change for renewable facilities and fossil fuel facilities;
3. Transit of tankers or barges and their support vessels that have the potential to create risks of spills or explosion or interfere with commercial and treaty tribe fishing areas;
4. Releases of stormwater and wastewater to groundwater, marine waters, intertidal wetlands, streams within the shorelines, and to their headwaters; and
5. Potential for loss of life and/or property related to risks from spills or explosions associated with refining and transport of renewable or fossils fuels or related feedstocks within Whatcom County.

Shoreline Management Act

The Shoreline Management Act (RCW 90.58) was passed by the Washington Legislature in 1971 and adopted by voters in 1972. The Act’s overarching goal is "to prevent the inherent harm in an uncoordinated and piecemeal development of the state’s shorelines." (RCW 90.58.020). The SMA requires counties, towns and cities to develop Shoreline Master Programs to regulate shoreline uses. Whatcom County finalized its SMP in 2007. Each Shoreline Master Program includes *Shoreline Environment Designations*, which specify the intensity of allowable uses along the shoreline. These designations are based on an inventory of shoreline conditions, an assessment of local community needs and goals, and requirements to protect Shorelines of Statewide Significance (see below). For marine areas, these designations apply to all bedlands, tidelands, and adjacent uplands within 200 feet of the ordinary high water mark. However, individual exceptions/differences may be approved by the Washington State Legislature. Whatcom County’s Cherry Point Management Area environment designation is one such area (see Appendix C, Map C-18, and description below). This is a geographically expansive and uniquely defined boundary, intended to protect shoreline industrial shipping capacity.

Table 3 contains a description of each Whatcom County SMP Shoreline Environment Designation in and near the reserve, and Map C-18 in Appendix C displays their boundaries. For a complete description, see Whatcom County Comprehensive Plan Chapter 11.

Under RCW 90.58.080(4), each SMP is reviewed and updated every 8 years, with full revisions every 20 years. In 2021, the Whatcom County’s 2007 SMP is undergoing periodic review and update if necessary, to ensure it remains consistent with legislative changes, and making any functional improvements. The most significant revisions to the 2022 SMP affecting the reserve are linked with the Comprehensive Plan changes described above, and include the following updates to the *Cherry Point Management Area* Environment Designation:

- Reducing the allowed number of deep water industrial terminals from four to three within the SMP's Cherry Point Management Area designation
- Prohibiting the export of coal from any Cherry Point terminal

These changes have occurred in tandem with Whatcom County's Comprehensive Plan changes to the Cherry Point UGA described earlier.

Table 3. Description of Whatcom County Shoreline Environment Designations.

Whatcom County Shoreline Environment Designation	Description (pending SMP update)
<i>Cherry Point Management Area</i>	The focus is on preserving shipping capacity that supports upland industrial activities, while protecting the environment and allowing for public access. This designation is unique to Whatcom County’s SMP, spatially overlapping much of the reserve and extending out 5,000 feet waterward of the shoreline. Due to the scale and importance of shipping activities located at Cherry Point, this designation contains very specific details on intent and allowed uses (see WCC 23).
<i>Conservancy</i>	The focus is on protecting, enhancing and restoring shoreline ecological function and maintaining the natural character of the shoreline. Development is restricted to only actions shown compatible with these goals. Near the reserve this includes shorelines stretching from Point Whitehorn approximately 1,200 feet to the South. This shoreline designation by definition may only occur outside of any UGA.
<i>Shoreline Residential</i>	The focus is on single-family residential lots abutting the shoreline with densities of at least one residence per acre. Uses must be compatible with a residential setting. This designation covers most of the shoreline from Point Whitehorn to Birch Bay State Park, an area of established residential development.
<i>Urban Conservancy</i>	The focus is on protecting ecological functions within areas of UGA like the Birch Bay UGA, and allowing for residential, low intensity commercial and recreation, and other uses that support this goal. A narrow section of tideland receives this designation, located in the southwest portion of Birch Bay just east of Point Whitehorn between the state meander line and the top of the bluff. Its purpose is to protect the tidelands.
<i>Aquatic</i>	This designation applies to all aquatic lands waterward of any other SMP designations. For all shorelines designated as <i>Conservancy</i> , <i>Shoreline Residential</i> and <i>Urban Conservancy</i> , the <i>Aquatic</i> designation applies waterward of the ordinary high water mark. For the unique <i>Cherry Point Management Area</i> this designation applies waterward of a line 5,000 feet from (and parallel to) the shoreline.

Integral to each Shoreline Master Program are rules protecting “shorelines of statewide significance” under RCW 90.58.020. These statutorily designated shorelines help protect the natural character and features of specific areas for all Washingtonians. Here the statewide interest always takes priority over local interests. For these designated areas, all tidelands as well as upland properties within 200 feet of the shoreline (defined by the ordinary high water mark) are included. For marine waters, all bedlands are managed under this RCW, regardless of location. Shorelines of statewide significance associated with the reserve include; all bedlands within the reserve and all shorelines and marine wetlands from Point Whitehorn northward (See RCW 90.58.020 (2) (f) (iii)). Shorelines outside of

Birch Bay are excluded from this designation (except that marine bedlands are always included). Whatcom County has adopted additional more specific protections for Shorelines of Statewide Significance through Whatcom County Code 23.40.030, proposed to be moved to Comp.Plan Chapter 11.

Lands in Protective Status

The Cherry Point Aquatic Reserve was originally designated for environmental protection through a 90-year Commissioner’s Withdrawal Order in 2000. In 2010 the Order was updated, affirming the environmental importance of the reserve. In 2017 the Order was amended once more, expanding the reserve boundary by 45 acres (see Appendix G).

Protections for the Cherry Point Aquatic Reserve are described in the intent, goals, and specific prohibitions described in this management plan.

Managed and owned by the Whatcom County Parks Department, the Point Whitehorn Marine Reserve opened in 2008 and contains a conservation easement protecting it from development in perpetuity. The easement, owned by the Whatcom Land Trust, stipulates long-term conservation and protection, maintaining lands in a natural condition. The tidelands fronting the park parcel are owned by the state and are part of the Cherry Point Aquatic Reserve.

Birch Bay State Park anchors the northern boundary of the reserve, providing conservation, public access, education and enjoyment on 664 acres of upland and over 8,250 feet of shoreline in perpetuity.

Future Land Use Changes and Stewardship

As the population of Whatcom County, along with tourism, adjacent industries and the local economy continues to grow, changes will inevitably affect the reserve. Anticipated future “drivers” of these changes are described under Potential Drivers of Future Change in Chapter 2, along with ecosystem stressors connected in various ways to land use changes.

As described above, locally implemented state laws are intended to help mitigate and ameliorate potential future impacts from land use changes. For example, Whatcom County recently made draft detailed revisions to both their Comprehensive Plan and Shoreline Master Programs amending acceptable uses for the Cherry Point Aquatic Management area. Changes now require tighter review of new or expanded uses in the industrial area, restrict or eliminate coal shipments, and reduce the number of industrial shipping terminals from four (originally allowed) to the current number of three. These plan updates are pending review by Ecology and completion is likely in 2022.

4. Progress Made Toward Achieving Plan Goals

This Chapter outlines the progress made over the past ten years toward achieving the 2010 management plan goals. It represents a record of the invaluable partnerships and work accomplished during this period. Each reserve has a community of stakeholders, volunteers, and partners that help support the site. Ecological protection through the community is a strength of the Aquatic Reserves Program, and the progress outlined in this chapter exemplifies the program’s mission to bring together partners to inspire science-based stewardship of Washington's exceptional aquatic resources.

Partners and Accomplished Projects 2010–2020

Since its creation in 2012, the Cherry Point Aquatic Reserve Citizen Stewardship Committee (CSC) has provided initiative and essential support toward achieving reserve management goals. The CSC is a volunteer group comprised of local community members with a strong interest in community science (sometimes called citizen science), environmental education, and conservation of the reserve. The group helps garner support for the reserve, providing a local point of contact and an information conduit with DNR on issues affecting the reserve. CSC-sponsored community science projects have included intertidal monitoring and seasonal shore-based marine bird surveys (Appendix C, Map C-19, Figure 14). The CSC also raises awareness of important issues affecting the reserve, conducts outreach and beach clean-ups, and plans and hosts annual events. “What’s the Point?” is an annual community event focused on environmental education and responsible beach etiquette (Figure 12). This one-day event has occurred annually since 2015 and is co-hosted by Whatcom Land Trust, the Port of Bellingham’s Marine Life Center, and the Birch Bay Watershed and Aquatic Resources Management (BBWARM) District. The Cherry Point Science Forum, an event occurring every fall since 2013, is geared towards adult learners and is an opportunity for scientists to share research related to the reserve and the greater Salish Sea with the community (Figure 13).



Figure 12. A beach naturalist teaches community members about CPAR’s tidelands at “What’s the Point?” (DNR photo).



Figure 10. A Citizen Stewardship Committee member welcomes the audience at the Cherry Point Science Forum (DNR photo).

RE Sources for Sustainable Communities (RE Sources), a Bellingham-based non-profit organization, has been a fiscal sponsor providing staff support for the CSC’s many efforts since 2013. From 2013–2015, the CSC was supported by a grant from the Environmental Protection Agency’s National Estuary Program (NEP) that was managed by the Washington Environmental Council. Continued

support was provided by a second NEP grant from 2016–2018 managed by DNR. RE Sources provides a home for the CSC’s meetings as well as administrative and policy support on issues affecting the reserve. RE Sources assists the CSC in volunteer coordination for community science opportunities in the reserve and arranges outreach and educational opportunities for the local community. Examples include field trips and targeted outreach like the “Don’t Drip and Drive” program and assisting in the creation of an educational video about the reserve.

The Whatcom County Marine Resources Committee (MRC) trains local community science volunteers through their North Sound Stewards program; these knowledgeable volunteers go on to assist the Aquatic Reserves Program with many projects. The MRC has also provided expertise, coordination, and support for outreach projects such as the interpretive signs currently being designed about the Cherry Point area.



Figure 11. Community scientists estimate percent coverage of species during an intertidal monitoring event on the shores of the reserve (*DNR photo*).

The Lummi Nation has supported reserve goals to ensure that reserve management remains consistent with their treaty rights and cultural values. One important example is through advocacy for the boundary change of the reserve to include the “cutout” formally intended for the Gateway Pacific Terminal (Ballew 2016).

Public access to the reserve is limited and multiple partners generously allow access through private property so that many of the projects mentioned in tables 4-7 can occur. These partners include Phillips 66, Intalco, bp, Lummi Nation, and private landowners. The Whatcom Land Trust and Whatcom County Parks also provide support for access to the reserve as well as protection of adjacent upland areas via the establishment, preservation, and maintenance of the Point Whitehorn Marine Reserve. With 54 acres of mature forest and wetlands, nearly a mile of accessible trail featuring stunning views of the reserve, and access to a rocky shoreline to explore, this reserve is truly a jewel in the Whatcom County Parks system. Through the creation of trailheads, parking, interpretive signage (Figure 15), regular maintenance, and beach access, the upland Point Whitehorn Marine Reserve provides long-term opportunities for the community to access and enjoy Cherry Point Aquatic Reserve.

Besides the partners mentioned above, various researchers, organizations and agencies have also contributed to knowledge of the reserve. These include researchers from academic institutions like Western Washington University and the University of Washington. The Washington Department of Fish and Wildlife (WDFW) has contributed scientific data about species that rely on CPAR’s habitats. For example, aerial seabird surveys have been conducted annually since 1990 and the Mussel Watch program has deployed mussel cages in the reserve biennially since 2014 to monitor for



Figure 12. Interpretive sign installed at the final overlook on the Point Whitehorn Marine Reserve trail (DNR photo).

toxic contaminants. WDFW has also completed significant work in the past ten years to advance understanding of the Cherry Point herring stock. Herring spawning surveys have been conducted annually since 1972. In 2011, DNR approached WDFW to conduct an acoustic trawl survey to estimate pre-spawning biomass. In 2016-17, DNR contracted WDFW to conduct herring gillnetting and midwater trawl surveys to determine the age composition, sex ratios, and ongoing genetics work that is being completed in partnership with University of Washington researchers. Additional research in the reserve is conducted by DNR’s Nearshore Habitat and

Aquatic Assessment and Monitoring Programs.

After numerous inspections and site visits by Ecology and Whatcom County, in 2017 the US Environmental Protection Agency conducted an emergency cleanup of the Treoil site, a derelict biofuels plant upland of the reserve. The cleanup of poorly contained and leaking tall oil and derivative wastes, hazardous chemicals, and other contaminants at the site meets an important objective for long term protection of ecosystem health of the reserve (Ecology and Environment Inc. 2017).

Completed and Ongoing Activities

Tables 4 through 8 illustrate a more comprehensive look at the activities carried out over the past ten years in support of the 2010 reserve management plan goals. For simplicity, each activity is listed only once under the primary 2010 goal that it supports. This record was gleaned from various sources, and may be incomplete.

Activities in Table 4 primarily support the reserve goal to *identify, protect, restore and enhance the functions and natural processes of aquatic nearshore and subtidal ecosystems that support endangered, threatened and sensitive species and aquatic resources identified for conservation.* Projects have included establishing a baseline inventory of habitats and species; protection of upland habitat; and improvement of public access to CPAR’s shorelines.

Table 4. Completed activities in or near the reserve supporting the 2010 goal of identification, protection, restoration and enhancement of the functions and natural processes that support endangered, threatened and sensitive species and aquatic resources.

Activity	Description	Lead Organization	Event Completion Year(s)
Intertidal Biota of Neptune Beach, Cherry Point Region of the Salish Sea	To fill a spatial gap in data for the northern Salish Sea, scientists from the University of Washington and the DNR Nearshore Habitat Program conducted intertidal surveys at three beaches along the Cherry Point reach.	University of Washington (UW)	2013
Intertidal Monitoring	Surveys include beach elevation profiles, species identification, and individual counts or percent cover estimations of all species or species groups within quadrats. Four sites were monitored from 2013–2018. Starting in 2019, two sites per year are monitored on alternate years (Hines and Jaeren 2018a). Phillips 66 has provided tideland access and coordination. See Appendix C, Map C-19.	Cherry Point Aquatic Reserve Citizen Stewardship Committee (CSC), RE Sources, DNR, Phillips 66	2013–present
Bird Surveys	Since 2013, three sites are monitored monthly from September to May. (Figure 17) See Appendix C, Map C-19. The survey aims to provide baseline data and assess long-term changes in migratory marine bird abundance by identifying and counting offshore birds. The survey started by looking at 7 species, and has expanded to 29 (Hines and Jaeren 2018b).	CSC, RE Sources, DNR, North Cascades Audubon, WWU	2013–present
Aerial Seabird Surveys	Since 1990, aerial surveys are conducted every winter and cover the entire shoreline of WA inland waters using predetermined zigzag patterns. https://data-wdfw.opendata.arcgis.com/datasets/midwinter-aerial-seabird-surveys	Washington Department of Fish and Wildlife (WDFW)	1990–present
Sea Star Wasting Surveys	Surveys are done twice a year along established 100-m swaths parallel to the beach. Surveys identify sea stars by species and categorize their health status. https://marine.ucsc.edu/explore-the-data/index.html	Multi-Agency Rocky Intertidal Network (MARINE), RE Sources, Michael Kyte	2014–present
Bull Kelp Surveys	Two sites are monitored at least once a year from July to September. Perimeters of kelp beds are mapped with GPS by kayak and aerial photos taken when possible. https://www.whatcomcountymrc.org/projects/bull-kelp-monitoring/	Whatcom Marine Resources Committee (MRC), NW Straits Initiative	Gulf Road, Cherry Point site: 2017–present Point Whitehorn site: 2019–present
Bull Kelp Mapping	Aerial surveys for floating kelp species in Cherry Point, Cypress Island and Smith and Minor Islands Aquatic Reserves.	DNR through an annual contract with Ecoscan	2011–present

Activity	Description	Lead Organization	Event Completion Year(s)
Beach Cleanups	Periodic beach cleanups are planned. The CSC has adopted the section of Gulf Road that fronts the beach at the road’s end and leads at least two cleanups per year there (Figure 16). The PSC conducts opportunistic marine debris removal during routine monitoring events.	CSC, DNR, Surfrider, bp, Phillips 66, Ocean Conservancy, RE Sources, Whatcom County Public Works, MRC	2013–present
Reserve Maintenance and Access at Point Whitehorn Marine Reserve	Whatcom Land Trust acquired 54 acres of forest, feeder bluffs and beaches adjacent to CPAR then transferred it to Whatcom County Parks for management.	Whatcom Land Trust, Whatcom County Parks	2007–present
Forage Fish Surveys	Sand lance and surf smelt surveys collect 7 to 12 samples every other month. Sampling is spread along entire shoreline and is opportunistic, happening more often when known spawning occurs. Beach characteristics and upland impacts are also noted.	DNR, Puget SoundCorps (PSC)	2012–present
Shoreline Systematic Qualitative Monitoring	Annual or biannual walking examinations of Cherry Point shoreline by biologist during max summer low tides. Includes documentation of intertidal biota, significant changes to the shoreline riparian and intertidal zones, and human-caused disturbances. Beach cleanup and use of the myCoast platform to report large marine debris and creosote is also done. The Wildlife Habitat Council Marine Intertidal Project Award was given to bp in 2021 for this project.	Michael Kyte, independent biologist for Intalco Aluminum, Petrogas, Phillips 66 and bp	1987–present
SeagrassNet	SeagrassNet monitoring and labwork is implemented on 5 aquatic reserves to assess status and trends of seagrass habitat. Data is collected quarterly at an established CPAR site, contributed to http://www.seagrassnet.org and saved to the Aquatic Reserves database.	DNR, PSC, SeagrassNet	2012–present
European Green Crab Removal	Detection of invasive European green crab (EGC) in Drayton Harbor and Lummi Bay have necessitated large removal efforts led by WDFW and Lummi Nation respectively. DNR is supporting these efforts as well as trapping efforts in Birch Bay and Terrell Creek. Molt surveys are conducted opportunistically in areas that may be suitable for EGC.	WDFW, UW, WA Sea Grant, Lummi Nation, DNR	2019–present



Figure 14. Volunteers at bp’s 2019 Cherry Point Community Beach Cleanup (*DNR photo*).



Figure 13. Community scientists document bird species using CPAR’s waters (*DNR photo*).

Activities in Table 5 primarily support the reserve goal *to improve and protect water quality to protect public health, support fish and wildlife species and healthy functioning habitats*. Projects have included the removal of creosote treated wood, marine debris, and unauthorized buoys and the monitoring and addressing of point and nonpoint sources of pollution.

Table 5. Completed activities in or near the reserve supporting the 2010 goal of improving and protecting water quality in support of fish, wildlife, and surrounding communities.

Activity	Description	Lead Organization	Event Completion Year(s)
ANeMoNe	A network of ten sites across WA set up to track changing ocean conditions. One site is in CPAR (Figure 18). Environmental data collected year-round and biological data collected during the spring and summer (Washington Department of Natural Resources 2019a).	DNR, Puget SoundCorps (PSC)	2015–present
Stormwater Fecal Coliform and Contaminant Sampling	Puget SoundCorps and Aquatic Reserves Program staff located private tight line drains, stormwater outfalls, and other areas of possible groundwater seepage. Water samples were collected and analyzed for bacteria and metals to help identify areas potentially affected by stormwater.	DNR Aquatic Reserves Program, PSC	2014
Stormwater Conveyance Structural Improvements	In the creation of their Subwatershed Master Plan, Birch Bay Watershed and Aquatic Resources Management (BBWARM) identified and recommended solutions to stormwater problems in the Point Whitehorn/Terrell Creek subwatershed master plan.	BBWARM, Whatcom County Public Works	2011–present

Activity	Description	Lead Organization	Event Completion Year(s)
Treoil Site Cleanup	An Environmental Protection Agency (EPA) emergency response removal of thousands of gallons of tall oil, oily soil, toxic waste and a variety of other hazardous wastes from the Treoil site. Oil and other wastes had been leaking into the ground for many years, and into a drainage ditch that outlets to the Strait of Georgia (Figure 19).	Department of Ecology (Ecology) & EPA	2017
Buoy Monitoring and Removal	DNR’s Northwest Land Management Team monitors unauthorized buoy use in the reserve. DNR conducted unauthorized buoy removals in 2016 and 2018.	DNR	2015–present
Marine Debris Removal	DNR’s Aquatic Restoration program completed a 16,800 pound marine debris removal in the Birch Bay and Point Whitehorn area in May, 2016.	DNR	2016
Don’t Drip and Drive	Educational programs assessing cars for leaks and providing information about leak effects on streams and the Salish Sea.	RE Sources, Intalco, bp	2016
Mussel Watch Program	Transplanted mussels are caged and placed every two years in nearshore urban growth areas of the Salish Sea. The mussel tissue is used to compare contaminant loads between sites throughout the state. https://wdfw.wa.gov/publications/02184	WDFW, Puget Sound Ecosystem Monitoring Program, Stormwater Work Group, Regional Stormwater Monitoring Program, Ecology	2014–present, every two years
Marine Sediment Monitoring	Benthic invertebrates and sediment quality have been sampled at several offshore sites within and near the reserve as part of a Puget Sound-wide monitoring effort. Over six sediment sampling events have happened in or near the reserve, Ecology found good sediment chemistry and no impairments to benthic communities See Appendix C, Map C-14.	Ecology	1997–present
NPDES Permit Mandated Sampling	Water and sediment monitoring occurs by entities as required by each individual National Pollutant Discharge Elimination System (NPDES) permit.	Ecology, bp, Phillips 66	variable–present
Sediment Quality Monitoring	Every other year, DNR collects sediment samples from three sites in Cherry Point to establish a baseline of parameters associated with potential oil spill impacts: TOC, PAHs, TPHs, and sediment grain size. To date, no evidence of contamination has been found.	DNR	2012–present, every two years
Wetland Restoration	Construction of over 350 acres of wetland restoration/advance mitigation within the Terrell Creek subwatershed, adjacent to Terrell Creek. All restoration areas are permanently protected from future development.	bp	2007–present

Activity	Description	Lead Organization	Event Completion Year(s)
Creosote Piling and Timber Removal	Replacement of creosote piles with steel-wrapped piles and replacement of pile caps and cross-bracing with non-creosote material at Phillips 66 causeway.	Phillips 66	1990s–2018
Causeway Improvement Project	Project will replace creosote piles with steel-wrapped piles and will replace creosote timbers with pre-cast concrete structures at Phillips 66 causeway.	Phillips 66	2019–present
Wetland Restoration	Constructed 18 acres of wetland restoration/mitigation at the southwest corner of the Phillips 66 property. All restoration areas are permanently protected from future development.	Phillips 66	2013–present
Terrell Creek Salmon Habitat Enhancement and Stream Stewards Program	bp granted a conservation easement to the Whatcom Land Trust for 101 acres along Terrell Creek. The Land Trust conducts periodic monitoring and inspections of the easement property.	bp	1999
	Supporting efforts of Nooksack Salmon Enhancement Association to monitor and restore salmon habitat in Terrell Creek.		2003–present



Figure 16. Site Guardians collecting data at the Cherry Point ANeMoNe site (DNR photo).



Figure 15. Impacted soil at Treoil site during EPA cleanup (Photo: Valeriy Bizyayev, 2017).

Activities in Table 6 primarily support the reserve goal to *protect and help recover indicator fish and wildlife species and habitats, with primary focus on Cherry Point herring, Nooksack Chinook salmon, groundfish, marine mammals, seabird/duck and shorebird communities, Dungeness crab, and submerged aquatic vegetation*. Projects have included multiple studies of the Cherry Point herring stock.

Table 6. Completed activities in or near the reserve supporting the 2010 goal to protect and recover wildlife species and habitats.

Activity	Description	Lead Organization	Event Completion Year(s)
WDFW Herring Spawning Surveys	Annual herring rake spawn deposition surveys provide yearly biomass estimates of CP herring during spawning season from 1 st week in April – mid June. https://wdfw.wa.gov/sites/default/files/publications/02105/wdfw02105.pdf	WDFW Forage Fish Management Group	1972–present
WDFW Herring Gillnetting for Age Composition	CP herring gillnet study spanned 2016 - 2017 spawning seasons to determine age composition, sex ratios, fecundity, and genetics of 2016 – 2017 spawning stock.	WDFW contracted by DNR	2017
Report to DNR on Cherry Point Herring Acoustic Trawl Survey	DNR approached WDFW to conduct an acoustic trawl survey in 2011 of the Cherry Point pre-spawning herring stock (Stick 2011).	DNR, WDFW	2011
Final Report on Pacific Herring Test Development and Validation	Development of bioassay protocols for assessing and monitoring water quality associated with industrial discharges in CPAR. Includes an appendix on herring larval chronic bioassay testing including ambient water toxicity testing and embryo temperature tolerance comparisons between west coast stocks, as required by NPDES permit. This is a requirement for herring chronic bioassay testing by Intalco, Phillips 66, and bp as part of their TMDL (Marshal 2012).	Ecology	Test development 2011. Phillips 66 started testing in 2013, Intalco started testing in 2014, and bp started testing in 2013.
Herring Polycyclic Aromatic Hydrocarbons (PAHs) Study	An evaluation of background levels and sources of PAHs in five herring stocks across Puget Sound, including the CP stock (West et al. 2014).	WDFW, National Oceanic and Atmospheric Administration (NOAA), Ecology	2014
Midwater Trawl Survey and Herring Genetic Work	Sound-wide midwater trawl survey and associated genetic work on herring collected at trawl sites. 2,000 herring fin clips were collected from all trawl sites. Initial genetic work will focus on sites closest to CP to determine if they are CP herring stock.	WDFW, UW genetic Lab, partially funded by DNR	2016 trawl survey, genetic work ongoing
Study of Effects of Industry on Macro-algae	Comparative study of the effects of industrial development and piers on macroalgae abundance along Cherry Point prepared for WWU Biology 456 course.	Western Washington University	2012
Lummi Intertidal Baseline Inventory Project	An ecological assessment implemented to document baseline conditions of Lummi Reservation tidelands in order to provide a pre-disaster ecological assessment. https://www.lummi-nsn.gov/Website.php?PageID=77	Lummi Nation	2008–2010

Activity	Description	Lead Organization	Event Completion Year(s)
Cherry Point Herring Light Trap Study	To gain better understanding of survival and distribution of larval Cherry Point herring, a light trap study was piloted in 2021. Data on other larval species were also collected.	DNR, Lummi Nation, WDFW	2019–present

Activities in Table 7 primarily support the reserve goal to *facilitate stewardship of habitats and species by working in cooperation with lessees, tribes, recreational users and resource agencies to minimize and reduce identified impacts of human activities on the species and habitats of the reserve.* Projects have included educational hands-on interpretive events like “What’s the Point?”, naturalist-led field trips, and volunteer trainings; the creation and installation of ID and interpretive signage; the creation of an outreach video about Cherry Point Aquatic Reserve; and development of a public education facility.

Table 7. Completed activities in or near the reserve supporting the 2010 goal to cooperate with partners to facilitate stewardship of habitats and species and reduce human impact on the reserve.

Activity	Description	Lead Organization	Event Completion Year(s)
What’s the Point?	A low tide beach exploration event for all ages with local naturalist guides held annually at Point Whitehorn Marine Reserve.	CSC, RE Sources, DNR, Whatcom Land Trust, Marine Life Center, Whatcom County Conservation District, Whatcom County Parks	2015–present
Cherry Point Science Forum	A forum for scientists to share their research related to CPAR and the Salish Sea at large with the community.	CSC	2013–present
ID and Interpretive Signage	An interpretive “Welcome Sign” was installed at a Point Whitehorn Marine Reserve overlook. ID and map signs were installed next to the boat launch at Birch Bay State Park. An ID sign was installed at Gulf Road.	DNR, Whatcom County Parks, Washington State Parks, CSC	2016–2017
Advocacy for Reserve Through Comments and Letters	The CSC members, assisted by RE Sources staff, track, evaluate, and comment on public policy decisions that may affect the reserve.	CSC	2013–present
Visitor Use Surveys	CSC members documented visitors’ answers to questions about how often they visit, where they come from, how they know about the reserve, etc.	CSC	2013–2015

Activity	Description	Lead Organization	Event Completion Year(s)
Implementation Committee Meetings	Presentations from multiple stakeholders including industry, agencies, scientists, etc. to collaborate on management.	DNR	2010–present
Cherry Point Aquatic Reserve Brochure	Created a brochure to hand out at Point Whitehorn Marine Reserve kiosk that informs the public about CPAR.	CSC, DNR	2014–present
Cherry Point Naturalist Field Trip	Biologists and Lummi Tribal members were hosted periodically to talk about the importance of Cherry Point.	RE Sources, Surfrider, Whatcom Action Coalition	2012–2014
Cherry Point Herring Field Trip	Naturalist-led field trips when herring were expected to spawn. Focused on the importance of forage fish and how to protect them.	RE Sources	2017
Outreach Videos	Three educational videos created to highlight the aquatic reserves: an overview of the aquatic reserves, a video highlighting CPAR, and a video highlighting Nisqually Reach Aquatic Reserve.	DNR, RE Sources, CSC, Nisqually Reach Aquatic Reserve CSC	2018
Heron Center for Environmental Education	Supported development of the bp Heron Center at Birch Bay State Park. The center continues to be used by Washington State Parks and the Friends of Birch Bay to provide environmental and cultural heritage education opportunities for the public.	bp	2010–2014

Activities in Table 8 primarily support the reserve goal to *identify, respect, and protect archaeological, cultural, and historical resources on state-owned aquatic lands*. Projects have included the inclusion of the Gateway Pacific Terminal “cutout” into the aquatic reserve.

Table 8. Completed activities in or near the reserve supporting the 2010 goal to identify, respect, and protect archeological, cultural, and historical resources on state-owned aquatic lands.

Activity	Description	Lead Organization	Event Completion Year(s)
Inclusion of Gateway Pacific Terminal cutout	DNR incorporated the SSA Marine Deepwater “cutout” into Cherry Point Aquatic Reserve (CPAR), adding 45 acres to the reserve.	Department of Natural Resources (DNR), Lummi Nation	2017

Administrative Support

Aquatic Reserve management by DNR includes the administrative support necessary to accomplish the stated goals. Such work includes providing ongoing collaboration with the Citizen Stewardship Committee; creating signs, maps, videos, brochures and interpretive materials; maintaining and

updating websites; coordinating with partners; and participating in environmental education and community science.

Land Acquisition/Transactions for Habitat Conservation

DNR has been involved in aquatic land management in the Cherry Point area since the 1950s when the first refinery pier was constructed on state-owned aquatic lands. As additional facilities were proposed, the need to strike a balance between economic development and environmental protection was recognized. In 2000, then Commissioner of Public Lands Jennifer Belcher established the Cherry Point Aquatic Reserve and set in motion DNR's actions to develop a plan that protects CPAR's unique ecosystem while managing the area consistent with Whatcom County's special "Cherry Point Management Area" shoreline designation. In response to a request from the Lummi Nation in 2017, then Commissioner Peter Goldmark signed a Commissioner's Order that removed 45 acres of state-owned aquatic lands from the DNR's general leasing program and incorporated them into CPAR (Washington Department of Natural Resources 2016).

Achievement of 2010 Plan Goals and Lessons Learned

A number of the 2010 Management Plan goals were not realized for a variety of reasons. The primary obstacle to goal attainment was limited time, staff and resources within the program, and insufficient partner commitments to fill in the gaps. The goals and actions outlined in the 2010 plan were extremely ambitious, numerous, and assumed greater support and resources than were available.

Following establishment of the Cherry Point Aquatic Reserve, DNR management focused on responding to urgent issues on reserves as well as establishing five new reserves. At Cherry Point, the research focus was narrowed to understanding the genetics, age class, spawning distribution and potential recovery needs of the Cherry Point herring. Reserve baseline monitoring plans were developed in conjunction with community science projects, and system-wide projects like forage fish, eelgrass, sediment, heavy metal contaminants, ocean acidification, and water quality monitoring. The Puget SoundCorps team was established in 2012 and has taken a key role in carrying out the baseline and trend monitoring that continues on all the reserves. They collaborate with community scientists and academic and agency scientists on a number of projects. The team also helps keep the beaches clean of marine debris and works with the restoration program on creosote removal. This team forms the basis for our field research and management, and will continue to be a key resource for the program going forward.

During the next ten years, DNR seeks to continue development and refinement of monitoring and research projects in conjunction with partners. Pilot projects proposed during the 2020 update promise new hope for protecting herring spawn and the possibility of species recovery.

5. Management Guidance

The Cherry Point Aquatic Reserve is established as an environmental reserve to protect and restore important native ecosystems, to foster environmental stewardship, and to facilitate collaborative partnerships. This chapter of the plan identifies the long-term vision for the reserve and provides goals and objectives to support this vision. The management guidance was developed collaboratively with reserve stakeholders through public meetings and written feedback during the 10-year management plan update process.

Long-Term Vision

The long-term vision describes the overall target or ideal conditions through the 90-year term of the aquatic reserve. The vision provides a framework for developing the management goals and conditions. Vision:

Over the 90-year term of the reserve, the Management Plan ensures strong protection of the state-owned aquatic lands to prevent further habitat degradation and to enhance the natural character of the shorelines. Natural processes and functions that support a healthier nearshore environment will be restored to the extent possible. Research and adaptive management will lead to improved habitats for native species and enhance spawning, refuge and rearing fish habitat. Improved ecological conditions will also promote foraging opportunities for resident and migratory birds and marine mammals.

Partnerships with adjacent landowners, lessees and land managers are essential to address potential impacts from conditions adjacent to the Cherry Point Aquatic Reserve. Efforts will focus on reducing water quality impacts to the aquatic reserve and the adjacent nearshore areas, improving riparian shoreline characteristics, and supporting research and recovery efforts to restore Cherry Point herring populations.

The Cherry Point Aquatic Reserve will also be an essential resource to the community for environmental education, research, monitoring, recreational and cultural use, as well as aesthetic enjoyment of scenic views.

Achieving the goals of this plan will require partnerships between regulatory and proprietary agencies, tribes, businesses, non-governmental organizations, property owners, resource users and the public. Several objectives require actions to be taken on a broader scale, such as implementation of the state's Puget Sound Action Agenda⁷, and actions to address climate change.

⁷ See Puget Sound Partnership Action Agenda: https://www.psp.wa.gov/action_agenda_center.php

Goals

The following management goals have been established for the Cherry Point Aquatic Reserve:

- 1) **Natural functions and processes:** Protect, enhance and restore the natural functions and processes of nearshore ecosystems.
- 2) **Water quality:** Improve and protect water quality to protect public health, fish and wildlife, and functional habitats.
- 3) **Species protection and marine habitats:** Protect and recover priority fish and wildlife species and habitats, with primary focus on Cherry Point Pacific herring.
- 4) **Stewardship, partnerships, environmental education and access:** Promote stewardship of the reserve through environmental education and community science, strengthening partnerships with aquatics lessees, tribes, recreational users and resource agencies, and promoting appropriate public use and access.
- 5) **Cultural and archeological resource protection:** Respect and protect recognized archaeological, cultural, and historical resources on state-owned aquatic lands. DNR recognizes Northwest Tribes as sovereign nations and will engage in government to government discussions when requested or warranted.
Old version: Honor and protect traditional cultural properties of native tribes through cooperative development of the reserve's educational materials. Protect tribally identified cultural features within the reserve. Support demonstration of traditional methods in the reserve.
- 6) **Authorized uses:** Ensure that any authorized uses of state-owned aquatic lands in the reserve are consistent with the aquatic reserve's long-term vision and management goals.

Objectives and Strategies

Goal 1: Natural functions and processes	
<i>Protect, enhance and restore the natural functions and processes of nearshore ecosystems.</i>	
Objectives & Strategies	
1.1	Nearshore processes and drift cells – Maintain or enhance nearshore processes, proper drift cell function, and sediment movement on tidelands managed as part of the reserve.
	a) Protect and restore naturally functioning environmental processes (nearshore drift and high energy intertidal environment) through application of DNR’s habitat stewardship measures (DNR, 2019b) for new and expanded uses and activities. Work with partners, adjacent landowners and managers to reduce shoreline modification.
	b) Support the protection of undeveloped shorelines and bluffs adjacent to the reserve to allow for beach migration and natural erosion processes.
	c) Prohibit new “hard” structured shoreline armoring on state-owned aquatic lands within the reserve. Replacement of existing shoreline armoring with hard armoring may be authorized when consistent with the Whatcom County SMP and it is the only alternative to adequately protect existing structures. Work with Whatcom County Shoreline Planners to encourage soft shoreline stabilization and alternatives to shoreline armoring.
	d) Work with Whatcom County, DNR lease managers, tribes, and other entities to ensure future land use and permit decisions do not alter natural system forming processes, degrade habitat or result in impacts to key species.
1.2	Restoration and enhancement – Restore and enhance impaired or degraded native nearshore habitat and natural processes on the reserve.
	a) On reserve tidelands, enhance shoreline habitat and processes through removal of shoreline modifications and cooperatively restoring adjacent riparian buffers.
	b) In coordination with partners, identify and remove creosote soaked wood from reserve beaches. Volunteers should use MyCoast App to report debris.
	c) Work with tribes and partners to remove marine debris, derelict crab pots and fishing gear, and reduce plastics.
	d) Support annual marine debris shoreline cleanups in conjunction with communities, industries, MRC, and the Cherry Point Citizens Stewardship Committee (CSC).
e) Support partnerships to protect aquatic areas and uplands adjacent to the reserve through acquisition and conservation easements. Protection of the salt marsh/pocket estuary at Gulf Road is an important conservation priority.	

Goal 1: Natural functions and processes

Protect, enhance and restore the natural functions and processes of nearshore ecosystems.

<p>1.3</p>	<p>Climate change adaptation and resiliency – Cooperate with tribes and partners to advance climate change adaptation planning and coastal resilience.</p>
	<p>a) Coordinate with tribes, United States Geological Survey (USGS) and partners to conduct a vulnerability assessment through Puget Sound Coastal Storm Modeling System (CoSMoS) to identify potential climate change impacts, especially related to sea-level rise and ocean acidification.</p>
	<p>b) Identify and pursue opportunities to enhance ecosystem and coastal resilience, at sites such as Gulf Road. Monitor high tide and storm surge inflows to Gulf Road marsh to track changes related to sea level rise.</p>
	<p>c) Incorporate sea level rise and other climate change adaptations into long-term planning efforts associated with the reserve, and ensure that protection and restoration plans address mitigating the effects of climate change.</p>
	<p>d) Support research and monitoring to identify actions to increase resilience of habitats in the face of climate change, and reduce uncertainty about habitat and species interactions and threats. Current example: ANeMoNe ocean acidification monitoring site at Birch Bay.</p>

<p>Goal 2: Water quality</p> <p><i>Improve and protect water quality to protect public health, fish and wildlife, and functional habitats.</i></p>	
<p>Objectives & Strategies</p>	
<p>2.1</p>	<p>Water quality impacts – Support local and regulatory agency efforts to minimize water quality impacts on the nearshore environment resulting from outfalls, runoff, groundwater contamination, ballast, airborne sources, and other discharges to the reserve. DNR management actions specific to adjacent aquatic land leases are addressed at the end of this chapter.</p>
	<p>a) Monitor nearshore water quality including pH, temperature and other parameters (ANeMoNe research site) and support local monitoring and efforts such as stormwater management to reduce adverse impacts over time.</p>
	<p>b) Support Whatcom County to implement recommendations in the Birch Bay Watershed and Aquatic Resources Management (BBWARM) subbasin master plan – an amendment to the Birch Bay Comprehensive Stormwater plan (2006). The area adjacent to the reserve is in the Birch Point, Terrell Creek Urban Area, and Point Whitehorn Subwatershed Master Plan (2016).</p>
	<p>c) Work with WFDW to assess ballast water exchanges to determine the potential for invasive species introduction at Cherry Point. Evaluate methods for reducing invasives in the future consistent with Chapter 77.120 RCW, WDFW ballast water management, and recommendations of the Ballast Water Working Group. See 3.4 a) and c).</p>
	<p>d) Coordinate with partners, such as Ecology, Whatcom County, BBWARM, Lummi Nation, the Birch Bay Shellfish Protection District, and the Cherry Point Aquatic Reserve Citizen Stewardship Committee, to identify and address sources of water quality impairment, including stormwater and nonpoint sources.</p>
<p>2.2</p>	<p>Water pollution – Protect the reserve from new sources of water pollution, including airborne sources.</p>
	<p>a) When reviewing project proposals, DNR will consider information collected on Strait of Georgia climate, microclimate, and sea level rise collected by the Office of the Washington State Climatologist (OWSC), CoSMoS, ANeMoNe, and the Climate Impacts Group to assess the sources and associated impacts to the reserve.</p>
	<p>b) Collaborate with WDFW on Mussel Watch Program: heavy metal and organics contaminant monitoring; deployment and retrieval of mussel cages, and continue to sponsor analysis as budget allows.</p>
	<p>c) Support baseline cumulative impact studies of combined industrial impacts on the reserve.</p>

<p>Goal 2: Water quality</p> <p><i>Improve and protect water quality to protect public health, fish and wildlife, and functional habitats.</i></p>	
<p>2.3</p>	<p>Spill reduction and cleanup – Oil spill prevention, reducing the risk of oil and toxic spills and increase regional capacity to respond.</p>
	<p>a) Encourage Ecology to continue surface and groundwater monitoring in the vicinity of the Treoil Industries site where substantial cleanup has been achieved. https://apps.ecology.wa.gov/gsp/Sitepage.aspx?csid=950.</p>
	<p>b) Work through staff from the DNR Aquatics, Sediment Quality Unit (SQU) for their continued involvement with the Department of Ecology and industries on up-to-date spill response planning. DNR seeks to ensure adequate spill response coordination, planning and financial proof of ability to respond, and to restore the reserve in case of a large spill incident. Emphasis on Geographic Response Plan updates focusing on protecting herring spawning areas.</p>
	<p>c) Through DNR’s SQU, review and comment on Ecology’s five-year review of Oil Handling Facility Operations Manuals and Oil Spill Contingency Plans, and stay apprised of changes that occur in the interim. Coordinate with WDFW, affected tribes, ship, tug and barge companies, and Puget Sound Pilots.</p>
	<p>d) Through DNR’s SQU, review and comment on any proposed changes to tug escort requirements. Coordinate with WDFW, affected tribes, non-profit organizations, and Puget Sound Pilots.</p>
	<p>e) Monitor for and address derelict vessels through DNR’s Derelict Vessel Program.</p>
<p>2.4</p>	<p>Water and sediment quality – Coordinate with resource agencies to continue to maintain state and federal standards for water and sediment quality.</p>
	<p>a) Request that Ecology and dischargers to provide information on significant permit or regulatory violations to the Implementation Committee.</p>
	<p>b) Encourage Whatcom County to provide technical assistance and incentives to property owners to retrofit existing tightline drains with an energy dissipating pad at discharge point. Inadequate tightline maintenance can result in erosion due to leaks, breaks or improper installation.</p>

Goal 3: Species protection and marine habitats

Protect and recover indicator fish and wildlife species and habitats, with primary focus on Cherry Point Pacific herring, and vulnerable aquatic vegetation such as eelgrass and bull kelp.

Objectives & Strategies

<p>3.1</p>	<p>Support recovery efforts for Cherry Point herring and listed species.</p> <p>a) Support the recovery and protection efforts for federal and state threatened and endangered species, species of special concern and conservation elements identified in this plan.</p> <p>b) Support efforts to increase the Cherry Point herring population to a sustainable and increasing population. See research and monitoring projects listed in 3.6 below. If Cherry Point herring continue to decline at a statistically significant level, DNR will review current site conditions with WDFW, and determine actions to ensure protection of herring. (These actions are potentially needed north of Cherry Point leaseholds and the aquatic reserve.)</p> <p>c) Coordinate with NOAA, WDFW, industries, pilot associations (Puget Sound Pilots), USCG, Center for Whale Research, commercial and tribal fishermen, scientists and researchers to collect a tabulation of presence/absence of marine mammals, to improve advice to mariners on when and where whales are most likely to occur:</p> <ul style="list-style-type: none"> • Proximity to vessel or ship if seen • Behavior (feeding, breaching, other) • Species (if known) • Habitat use (if known) • Date/time, tide and season • Seasonal presence and habitat use of Southern Resident Killer Whales
<p>3.2</p>	<p>Native habitats – Protect and restore the documented extent and diversity of native aquatic vegetation, kelp, eelgrass, and other important habitats.</p> <p>a) Support enhancement and restoration projects that benefit marine aquatic vegetation, and other important habitats. For instance, eelgrass surveys are carried out in conjunction with the ANeMoNe project.</p> <p>b) Support local efforts to restore areas impacted by recreational shellfish digging activities to natural beach contours, and documentation of the impacts/effects of restoration.</p> <p>c) Encourage voluntary landowner removal of the derelict gravel conveyor at Gulf Road to eliminate creosote pilings and allow recolonization of marine vegetation in the footprint of the structure.</p>

Goal 3: Species protection and marine habitats

Protect and recover indicator fish and wildlife species and habitats, with primary focus on Cherry Point Pacific herring, and vulnerable aquatic vegetation such as eelgrass and bull kelp.

<p>3.3</p>	<p>Fish habitat – Protect fish spawning and rearing habitat, and movement corridors with a focus on surf smelt, sand lance, herring and salmon.</p> <p>a) Prevent impacts from new structures, shoreline modification, intakes and outfalls on aquatic vegetation, forage fish spawning, and fish migration through rigorous evaluation of projects in relation to this plan</p> <p>b) Minimize risks of environmental impacts from existing industrial, residential, and recreational uses through communication, review and adaptation to protect habitat.</p>
<p>3.4</p>	<p>Non-native invasive species – Prevent non-native species from invading or disrupting the reserve ecosystem.</p> <p>a) Work with WDFW, Ecology, Coast Guard, EPA, leaseholders, the Invasive Species Council, U.W. Sea Grant and others to develop and implement a plan to reduce the risks of non-native species to the reserve. Strategies will include controlling the introduction of non-native plant and animal species, and management to protect native species. Protocols should be expanded to address threat of non-native species from increased vessel traffic.</p> <p>b) Aquatic Reserves to participate in review when the Coast Guard, NOAA and industries update the ballast water harbor care safety plan.</p> <p>c) Continue to assist invasive European green crab control efforts to the north of Cherry Point in Drayton Harbor. Support WDFW through interagency agreement to control green crab in area, and monitor within the reserve.</p>
<p>3.5</p>	<p>Trend monitoring – DNR will investigate partnerships to identify and conduct trend monitoring with comparable methodology for ecological conditions affecting the reserve. If funding is available, monitoring plans will be developed to establish ecological trends and conditions at the site.</p> <p>a) In conjunction with CSC and other organizations, continue annual surveys to determine abundance, distribution, and population trends of marine bird and duck species. Avian studies should be conducted seasonally when populations are at maximum levels for a complete understanding of the use and trends in the reserve.</p> <p>b) Coordinate with the CSC to monitor the reserve intertidal community condition at regular intervals, and evaluate trends and environmental changes.</p> <p>c) Partner with WDFW, Lummi Nation and others to undertake annual fish surveys along the reach and continue to refine studies of herring spawn timing, behavior and life history.</p>

Goal 3: Species protection and marine habitats <i>Protect and recover indicator fish and wildlife species and habitats, with primary focus on Cherry Point Pacific herring, and vulnerable aquatic vegetation such as eelgrass and bull kelp.</i>	
	<p>d) Continue the mapping of submerged aquatic vegetation, specifically eelgrass, bull kelp, and macroalgae communities within the reserve to provide a dynamic inventory. Evaluate trends and environmental effects of management. Methodologies should be comparable with previous inventories. Continue annual aerial floating kelp survey and consider actions identified in the WA State kelp recovery plan. Evaluate impacts of Sargassum on native communities.</p>
3.6	<p>Research – Promote and support research within the reserve with an emphasis on Cherry Point herring genetic and population studies, climate change impacts, and emerging science relevant to management.</p>
	<p>a) Promote and support research such as the ANeMoNe project that focuses on the potential effects of climate change (sea level rise, ocean acidification, changes in water temperature and salinity) on the resources within the reserve.</p>
	<p>b) In cooperation with WDFW, continue genetic, age class structure, and larval light trap studies of Cherry Point herring, and support related objectives of WDFW predator bird exclosure study planned for 2021.</p>
3.7	<p>Data gaps and data organization – Identify data gaps and improve access to data and research results.</p>
	<p>a) Use a standardized metadata collection method; address QA/QC needs, standardize data collection and protocols and make results available. (Data quality model)</p>
	<p>b) Coordinate with partners to inventory data and identify gaps, and then prioritize strategies to address gaps.</p>
	<p>c) Coordinate monitoring and research efforts with tribes, local and state agencies, local nonprofits, universities and community science groups.</p>
	<p>d) Prepare annual summary reports of vessel traffic and spill data within the reserve.</p>

Goal 4: Stewardship, partnerships and environmental education

Promote stewardship of the aquatic reserve through environmental education and community science, strengthening partnerships with aquatics lessees, tribes, recreational users and resource agencies, and promoting appropriate public use and access.

Objectives & Strategies

4.1	Coordination with aquatic lands lessees – Work with lessees to promote responsible management consistent with reserve goals. Support research efforts, monitoring, and adaptive management that will reduce impacts over time.
	a) Aquatic reserves manager will continue to periodically join land manager site inspection visits to pier facilities to receive updates on facility management and build relationships with industry neighbors.
4.2	Cooperation with partners – provide education and outreach about managing runoff, riparian vegetation protection and other habitat values for homeowners abutting the shoreline and site users. Support:
	a) Shore Friendly Program and efforts by Whatcom County, WDFW, and Ecology to provide technical assistance and incentives to shoreline property owners to assist with removal of bulkheads or their replacement with soft bank or other alternatives that promote natural processes. Sites include north side of Point Whitehorn and armoring at Gulf Road.
	b) Whatcom County projects that encourage enhancement of native vegetation along shoreline, particularly along county-designated setback zones landward of the tops of bluffs.
	c) Continued and improved availability of data and results to the public, regulatory agencies, tribes and educational institutions.
4.3	Work with partners to preserve and enhance opportunities for public access and environmental education.
	a) Provide educational resources about the sensitivities of the Cherry Point ecosystem with emphasis on trampling of aquatic vegetation and disturbance of birds and seals (in haulout areas).
	b) Support annual public events such as beach marine debris cleanups and “What’s the Point?” family focused low tide educational event at Point Whitehorn.

Goal 4: Stewardship, partnerships and environmental education

Promote stewardship of the aquatic reserve through environmental education and community science, strengthening partnerships with aquatics lessees, tribes, recreational users and resource agencies, and promoting appropriate public use and access.

4.4	Education and stewardship – Increase public awareness and stewardship of the reserve through environmental education, outreach, and community science.
	a) Promote education programs and signs that engage the public in reserve stewardship and increase understanding of the importance of ecological, geologic, cultural and historic components of Cherry Point.
	b) Promote and support community science that fills data gaps, establishes long-term trends and increases stewardship of the reserve.
	c) Provide outreach to the public regarding issues and progress on the reserve. Continue to enhance the reserve webpage, data viewer, and online resources. Expand reserve email list for management updates. Continue working with the CSC and interested parties to co-sponsor periodic conferences on Cherry Point Reserve science, progress, and other relevant topics. Upgrade reserve brochure and outreach card.
	d) Increase outreach to shellfish harvesters, fishing and crabbing industry, and recreational boaters about location of forage fish habitat. Provide signage at appropriate locations specifying regulations, and educational information related to impacts of recreational shellfish harvest, in cooperation with WDFW and Whatcom MRC.
	e) Promote partnerships with WDFW, Whatcom County, Whatcom County MRC North Sound Stewards, and others to place informational signs and placards at key beach access points, and provide educational materials and resources.
4.5	Stewardship and community values – Foster public engagement, stewardship and volunteerism that promotes community and cultural values.
	a) Integrate historic and ongoing cultural uses of Cherry Point in outreach materials.
	b) Incorporate community uses and values (for scenic beauty, history, recreation, ecological value, fish and shellfish resources, etc.) in outreach and education programs to increase stewardship and sense of ownership of the reserve.
	c) Conduct surveys to understand the public use and values related to Cherry Point (potential CSC project).

Goal 4: Stewardship, partnerships and environmental education

Promote stewardship of the aquatic reserve through environmental education and community science, strengthening partnerships with aquatics lessees, tribes, recreational users and resource agencies, and promoting appropriate public use and access.

<p>4.6</p>	<p>Partnerships – Develop partnerships with tribes, local and state governments, universities, local schools, nonprofits, local businesses and citizens to increase the Aquatic Reserve Program’s effectiveness.</p> <p>a) Organize a minimum of two Implementation Committee meetings each year to evaluate progress and prioritize strategies for management plan implementation.</p> <p>b) Coordinate with the Cherry Point CSC and other partners on environmental education, outreach and community science; support annual events such as What’s the Point? and the Cherry Point Science Forum.</p> <p>c) Work with Whatcom County during updates to the Shoreline Management Program and the Comprehensive Plan to ensure they are compatible with the goals and objectives of this plan.</p> <p>d) Encourage Whatcom County to continue implementation of restrictions/recommendations for Point Whitehorn Marine Reserve:</p> <ul style="list-style-type: none"> • No dogs on beach, to protect birds and marine mammals • No beach fires • Advise visitors to avoid removal of marine organisms (see WDFW regulations), wood and substrate
<p>4.7</p>	<p>Public access – Foster sustainable use and public access to state-owned aquatic lands within and adjacent to the reserve.</p> <p>a) Collaborate with adjacent land owners and managers to provide safe public access.</p> <p>b) Provide information on public access areas, including additional installation of aquatic reserve identification signs.</p> <p>c) Inventory types and impacts of recreational and other human use activities, and work cooperatively with partners to manage use and reduce human impacts.</p> <p>d) Encourage Whatcom County to coordinate with beach/tideland owner adjacent to Gulf Road to improve public access, with higher levels of protection for resources.</p>

Goal 5: Archaeological and cultural resources

Identify, respect, and protect archaeological, cultural, and historical resources on state-owned aquatic lands. DNR recognizes Northwest Tribes as sovereign nations and will engage in government to government discussions when requested or warranted. DNR has stated: “we recognize that tribes have an integral and interdependent relationship with their natural areas as a place of spiritual connection and a landscape of cultural and emotional meaning, beyond the historical and contemporary provision of subsistence.”

“The management of Washington’s natural resources must be carried out so as to meet the needs of current and future beneficiaries of these resources, while giving equal respect to tribal and non-tribal present and future generations.”

Objectives and Strategies

<p>5.1</p>	<p>Ensure that authorized activities in or directly adjacent to the reserve cause no harm to the archaeological, cultural or historical resources in or adjacent to the reserve.</p> <p>a) DNR will ensure that existing and proposed restoration and development activities on state-owned aquatic lands comply with all applicable mandated federal, state, and tribal cultural protection laws prior to any construction commencing along the Cherry Point shoreline and bedlands.</p>
<p>5.2</p>	<p>Significant historical findings – Ensure documentation as a condition of any new or expanded use authorizations.</p> <p>a) DNR will work with tribes, in coordination with the applicant, and the State Historic Preservation Office, the U.S. Army Corps of Engineers, and WDFW, to develop a ‘Cultural Resources Protection Protocol’ for activities on state-owned aquatic lands within or adjacent to the reserve.</p>
<p>5.3</p>	<p>Support cultural uses at the site – Responsible management of natural resources that are part of tribal traditions and that sustain the quality of life of the tribes. Actions aimed at ensuring these resources are protected and preserved for sustainable use.</p> <p>a) DNR will ensure plan implementation is consistent with protection of tribal culture, values and treaty rights.</p> <p>b) Protect cultural resources, traditional uses and partner with tribes to promote public awareness of cultural values.</p> <p>c) Work with tribes to develop educational and interpretive materials that incorporate cultural and historical topics and current environmental stewardship.</p>

Goal 6: Uses and Activities

Authorized uses on state-owned aquatic lands must be consistent with the aquatic reserve long-term vision and management goals. The DNR Orca Straits District and Aquatic Reserves Program together review proposed uses and changes to existing uses in and directly adjacent to the reserve.

Objectives and Strategies

<p>6.1</p>	<p>DNR assessment of uses – DNR will take the following actions when considering new uses:</p> <ul style="list-style-type: none"> a) DNR will perform a critical review of new use proposals pursuant to WAC 332-30-151 and make a determination about the consistency of the proposed use with the reserve management guidance. b) Ensure proposed new uses meet or exceed DNR’s Aquatic Habitat Stewardship Measures. https://www.dnr.wa.gov/programs-and-services/aquatics/stewardship-measures c) DNR will work with partners to ensure restoration projects and monitoring plans are consistent with the reserve goals and for adaptive management.
<p>6.2</p>	<p>Allowable uses – DNR will review applications for all uses of state-owned aquatic lands within or directly adjacent to the reserve, and will only consider the following uses:</p> <ul style="list-style-type: none"> a) Public access that provides opportunity for low intensity recreation and sustainable use where consistent with the long-term plan vision and management goals; b) Ecological monitoring if conducted under a monitoring plan approved by DNR; c) Research in support of the reserve’s goals and objectives; d) Restoration projects that are consistent with the management of the reserve and conducted under a restoration plan approved by DNR; e) Easement for Birch Bay Water and Sewer District outfall (see below for specific guidance); f) Existing industrial piers and associated outfalls (see below for specific guidance); g) Commercial and recreational fisheries managed by WDFW, responsible tribal governments, and DNR shellfish section staff; h) Authorize commercial mooring buoys when doing so will support the reserve’s goals and objectives for resource protection.

Goal 6: Uses and Activities

Authorized uses on state-owned aquatic lands must be consistent with the aquatic reserve long-term vision and management goals. The DNR Orca Straits District and Aquatic Reserves Program together review proposed uses and changes to existing uses in and directly adjacent to the reserve.

6.3	Prohibited uses – DNR will not authorize any uses that do not comply with the objectives and strategies in 6.1 and 6.2 (allowable uses) above.
	a) Any uses proposed on state-owned aquatic lands adjacent to the reserve must not conflict with the purpose of the reserve designation and specifically with the habitat and species identified for conservation within the reserve.
	b) Unauthorized uses must be removed by the owner.
	c) DNR will remove the unauthorized use when the owner cannot be identified and funding sources are available.
	d) Prohibit the following in the reserve: new overwater structures, underwater cable or pipeline structures, or new saltwater intakes, except when necessary for the installation and use of firefighting equipment at industrial piers.
	e) Prohibit additional residential docks within the reserve.



Figure 20. Phillips 66 Pier. (DNR photo).

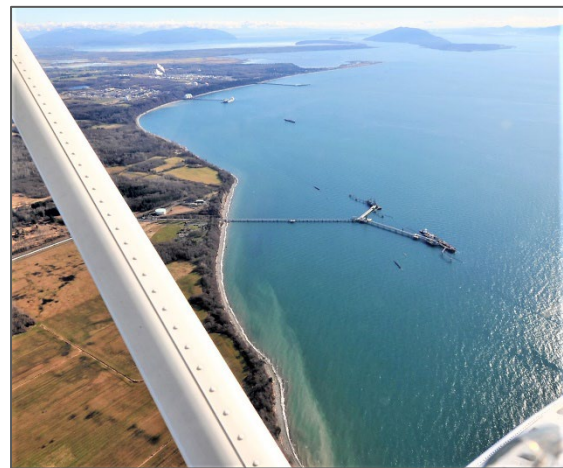


Figure 17. Aerial view of Cherry Point piers (Photo: Christopher Krembs, Eyes Over Puget Sound, WA Ecology).

State-owned Aquatic Land Management

Existing Use Authorizations

This section primarily refers to management of leaseholds adjacent to the reserve. As described in Chapter 3, there is only one existing use authorization on state-owned aquatic lands within the Cherry Point Aquatic Reserve (lease 51-034983, a stormwater outfall.) Other existing use authorizations are located in the “cutouts” directly adjacent to the reserve. DNR cannot alter the terms and conditions of an existing lease, easement, or other use authorization without consent of the tenant or grantee.

This management plan does not alter existing contractual rights and obligations to leaseholds adjacent to the reserve. Existing tenants or grantees may continue to conduct their activities in conformance with their current use authorization and in compliance with other local, state and federal regulations. The DNR’s Aquatic Reserves Program communicates with DNR land managers who manage leaseholds on adjacent state-owned aquatic lands to remain aware of activities that may impact aquatic habitats on the reserve.

Water-dependent, industrial uses that require marine access are the preferred use of the Cherry Point Management Area in the Whatcom County Shoreline Management Plan (SMP). The SMP also recognizes the importance of the area as herring spawning habitat and other key habitat characteristics that warrant special consideration. Compliance with Whatcom County’s 2021 comprehensive plan amendments that regulate impacts to air and water (noted above, page 50) is also important for protection of the reserve and environs. Similarly, DNR recognizes the Cherry Point reach to be of both great economic and ecological importance to the region. This plan provides guidance for DNR to facilitate modifications or renewals to existing leases at Cherry Point, while ensuring environmental protection and promoting species recovery.

The existing industrial uses at Cherry Point are compatible with goals for the long-term protection of the aquatic resources within and adjacent to the aquatic reserve. Therefore, the existing industrial uses do not conflict with aquatic reserve status at Cherry Point. The lessees continue to evaluate and incorporate elements of this plan and actively take steps to enhance compatibility of their facilities with protection of the reserve. Decisions for reauthorization for existing uses will be made by DNR, based on the facts and circumstances at the time of request for approval.

Reauthorization of Existing Uses

DNR will achieve the desired future outcomes for the Cherry Point Aquatic Reserve by integrating contemporary knowledge and research findings into future lease and use agreements. Additionally, DNR land managers will continue cooperative efforts with existing lessees to implement the elements of this plan.

Consistent with statutory authority and agency policy for all applications to use any state-owned aquatic land, DNR will consider an application to reauthorize existing uses at Cherry Point upon initiation of lease renewal process. At the time of application for reauthorization, DNR will evaluate whether the applicant’s proposal conforms to this management plan based on the criteria specified below. As needed, DNR will work with the applicant to develop plans to reduce, over the term of the new agreement, any environmental impacts that may arise from existing facilities and uses. Such plans will be based on best available science, research and monitoring findings at the time of reauthorization. The content of such plans may vary between leaseholds depending on the extent to which a lessee had addressed environmental impacts during the term of the expiring agreement. The

primary objective is that existing uses and facilities will continue to reduce environmental impacts over time.

Consistent with DNR proprietary authority, reauthorizations may include terms requiring monitoring to help identify or reduce uncertainty regarding environmental impacts. This will allow DNR to determine conditions to include in subsequent future use authorizations in order to successfully provide environmental protection for the Cherry Point Aquatic Reserve, while also fostering water-dependent uses. Since the 2010 plan was completed, DNR developed habitat stewardship measures for all state-owned aquatic lands. These measures are tailored to meet the circumstances and opportunities for each use at each property and provide improved protection for aquatic species and habitats.

DNR land managers will consider the following questions when evaluating applications from existing Cherry Point lessees and to determine consistency with this plan:

- Is the lessee in good financial and contractual standing with DNR?
- Is the lessee in compliance with conditions of federal, state and local laws and permits?
- If the application for reauthorization includes a discharge outfall, have the additional reauthorization requirements related to discharge outfalls (see below) been met?
- What habitat stewardship measures can be implemented to avoid/reduce impacts to priority aquatic resources?

Between 2010 and 2024, significant progress was made toward developing environmental baseline data for the Cherry Point Aquatic Reserve. While more detailed environmental data is being developed, DNR's habitat stewardship measures provide a scientific basis for informed decisions about use authorizations. DNR will work with other resource management authorities to identify regulatory and proprietary actions necessary to protect resources.

The 2010 plan listed studies related to discharge outfalls and their potential impacts on habitats and species, many of which have been completed or modified. The work required in Ecology's Herring Agreed Order No. 3192 was completed and the results are documented in the report titled *Final Report on Pacific Herring (*Clupea pallasii*) Test Development and Validation with an Appendix on Herring Embryo Temperature Tolerance Comparisons between West Coast Stocks* dated November 2011, revised September 2012 (Washington Department of Ecology 2012). The EPA topsmelt acute survival test and EPA echinoderm (sea urchin) chronic embryo test were shown to be more sensitive than the comparable herring tests. These tests are included in bp's NPDES permit renewal.

The EPA mysid shrimp chronic larval test was shown to be the most sensitive of the EPA-approved chronic toxicity tests in the bp chronic biomonitoring but it was not as sensitive as the herring chronic larval survival and growth test. Ecology used the results of bp's chronic side-by-side tests to calculate a modifying factor or herring translator. Ecology has determined that routine effluent monitoring can be performed by bp using the mysid chronic survival and growth test if the acute critical effluent concentration (ACEC) and chronic critical effluent concentration (CCEC) are adjusted by the herring translator. The adjusted ACEC and CCEC were calculated from test results using herring protocols that have not been approved for compliance testing. Therefore, Ecology entered into an agreement (Agreed Order 20840) with bp to gather additional data regarding the potential toxicity of their wastewater discharge on herring in the receiving water. Further evaluation will be needed if toxicity is shown at the adjusted critical values (Ecology, 2023).

The bp Cherry Point Refinery operates a wastewater treatment plant that discharges to the Strait of Georgia. Ecology previously issued a NPDES permit for this facility on February 14, 2012 with a modification on December 2, 2013. Effective July 1, 2022, Ecology has renewed the NPDES waste discharge permit for bp and is currently working to complete re-authorizations for the Phillips 66 and Intalco permits. The monitoring requirements are expected to be similar but not identical to the bp permit.

The renewed bp permit retains the effluent limits and monitoring frequencies for the conventional pollutants Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solids (TSS), Oil and Grease (O&G), and sulfide and reduces the monitoring frequencies for phenols, ammonia, and hexavalent chromium at Outfall 001. The permit retains the stormwater benchmarks from the previous permit for stormwater Outfalls 002, 003, 004, 005, and 007 and revises dioxin monitoring.

The permit adds the following requirements:

- Nutrient monitoring at Outfall 001
- Construction stormwater discharge authorization and monitoring
- Mixing zone study
- Sediment monitoring study
- Wastewater treatment efficiency study and updated engineering report
- Fire system test water discharge at Outfalls 002 and 007
- Alternative stormwater discharge at Outfall 006
- Per- and Polyfluoroalkyl Substances (PFAS) study

The permit also requires bp to conduct chronic Whole Effluent Toxicity (WET) testing in the first summer and first winter of the new permit cycle. The Agreed Order (20840) accompanies the permit requiring bp to conduct additional biomonitoring of the effluent at Outfall 001 for potential impacts to Pacific herring. (<https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Industrial-facilities-permits>)

In regard to the Birch Bay municipal outfall: Ecology re-issued the Birch Bay wastewater treatment NPDES permit effective March 1, 2021 (Washington Department of Ecology 2020c). The permit requires Whole Effluent Toxicity (WET) testing in July and December 2024, and Priority Pollutants testing to be done quarterly in 2025 (Fricke, L., Ecology, personal communication, 2021).

Additional Studies: The Department of Fish and Wildlife has led a Puget Sound-wide project using transplanted caged mussels to assess bioaccumulation of heavy metals and organic contaminants such as PAHs since 2014, including a site located near Cherry Point. DNR has supported deployment and analysis of one or two cages when the study is carried out every other year.

In the first decade of the management plan, DNR and lessees have cooperated on a number of projects that furthered protection of the adjacent reserve. In the next ten year period, DNR will continue to cooperate with lessees, and with the support of other interested parties, work to enhance the quality of upland and adjacent aquatic habitats to provide increased long-term protection to the reserve.

For example, plan objectives that would require cooperative efforts to restore and protect the reserve

include:

- Work with WDFW, Whatcom County, Ecology, and industrial pier owner proposals to evaluate and encourage options for restoring natural transport processes of sediment across impediments at the reserve, such as the pier aprons at Alcoa-Intalco Works (Petrogas Pacific pier) and Phillips 66 marine facilities, to help reduce impacts from existing structures and fill.
- Support cooperative efforts by Ecology, WDFW, affected tribes, and owners of overwater structures to encourage voluntary retrofitting improvements on older facilities with wave and light shading impacts that meet DNR stewardship measures and industrial safety requirements.

Additional Reauthorization Requirements Related to Discharge Outfalls

Consistent with RCW 79.105.210, RCW 90.48.386 and WAC 332-30-122(2)(a) DNR may reauthorize, or approve lease modifications for existing discharge outfalls, or allow new discharge outfalls serving existing authorized uses under the following conditions:

- The outfalls must meet all current local, state and federal regulatory requirements, and water quality standards.
- The applicant must take all appropriate steps to avoid or minimize substantial or irreversible damage to the environment.
- The applicant must complete studies as determined by Ecology, and in negotiation with DNR for outfall reauthorization, to determine potential impacts of the proposed activities on habitats and species, and identify appropriate measures for impact avoidance and minimization. DNR will use the results of such studies to ensure that leases include conditions to avoid or minimize damage to the environment.
- For stormwater outfalls discharging to Birch Bay, continue to implement the solutions recommended in the Birch Bay Comprehensive Stormwater Plan (2006) for the Birch Bay watershed, and in the more recently completed sub-watershed plans that include detailed solutions for stormwater management.

Approval of Authorizations for New Uses

New Discharge Outfalls

Consistent with RCW 79.105.210, RCW 90.48.386, and WAC 332-30-122(2)(a) DNR may issue new authorizations for outfalls. As a condition of an authorization, DNR will require studies to be completed to determine the potential impacts of the proposed activities on habitats and species and identify appropriate measures for impact avoidance and minimization. DNR land managers will use the results of such studies to ensure the authorizations are conditioned to avoid or minimize damage to the environment. The conditions and studies required for authorization consideration include:

- The outfalls meet all local, state and federal regulatory requirements, and water quality standards.
- Appropriate steps are taken to avoid or minimize substantial or irreversible damage to the environment. Conduct ambient water toxicity study using protocols accepted by EPA and Ecology to evaluate cumulative effects of existing industrial wastewater outfalls and groundwater seeps on nearshore species survival and water quality. Caged mussel studies to

assess bioaccumulation of PAH, PCB, and heavy metals may be used as biological indicators of toxicity. Study design may be based on recommendations in Ecology report #11-10-086.

Approvals for Changes to Existing Uses and Facilities

Under certain conditions, DNR allows for new uses of existing facilities, as well as expansion and significant modification of existing facilities (the type of work that under DNR's standard lease agreement would be considered new work rather than routine maintenance and repair). The proposal for such modifications must meet requirements described below for alterations to existing facilities. Additionally, any structural modifications or operational changes to existing facilities that would result in increased artificial light, noise, wave or light shading, runoff, pollution, or other discharges must meet the requirements below for alterations to existing facilities.



Figure 18. bp Pier (*Ecology Coastal Atlas*).

Alterations to Existing Facilities: Overwater Structures

DNR will not authorize alterations to the overwater footprint of existing facilities until the following conditions are met or studies completed showing negligible environmental impact. The purpose of these conditions is to assess potential adverse impacts of the proposed alteration on species and habitats, and to inform development of measures for impact avoidance and minimization that can be incorporated into lease agreements.

- Proposed changes to DNR authorized uses at Cherry Point shall avoid or minimize noise and artificial light impacts based on the recommendations formulated in existing studies, future research and monitoring.
- Modification to existing structures must be designed to avoid disruption of herring migratory patterns from deep water to the nearshore and along the nearshore.
- Proposed alteration of existing overwater structures must minimize wave and light shading to the maximum extent feasible and avoid adverse impacts to areas with significant biological aquatic resource value, such as sediment transport processes, aquatic vegetation, spawning areas, pre-spawn holding areas and migratory corridors. This should be accomplished through managing location, orientation, design, materials, construction best management practices, operation of structures and activities contributing to shading.

6. Implementation Guidance

The successful management of the Cherry Point Aquatic Reserve requires coordination and collaboration with public and private entities as well as local, state, federal, and tribal government, and non-government organizations, referred to here as resource managers. Prioritizing management actions while incorporating sound scientific data helps guide future development, restoration and protection decisions in the reserve.

Cherry Point Aquatic Reserve Implementation Committee

The Implementation Committee (IC) represents stakeholders with a broad array of knowledge, skills, experience, interests and perspectives. The committee was created to promote collaboration and input into localized and informed decision-making about the management of the reserve. Committee meetings help guide implementation of this plan and coordinate stewardship strategies that improve and protect the long-term health of the Cherry Point ecosystem (Figure 23).



Figure 19. Members of Cherry Point Aquatic Reserve Implementation Committee and DNR staff at a planning session in February 2020.

Committee meetings will include updates on the statewide operation of the Aquatic Reserves Program and reports from Aquatic Land Managers on adjacent activities, facility visits, and updates directly related to leasehold management. DNR staff will periodically invite speakers to present on research and monitoring results, and other topics related to the reserve.

The Cherry Point IC will advise and assist with the cooperative implementation of this management plan. This includes:

1. Identifying partnerships for implementing management actions.
2. Recommending and evaluating proposals for restoration, research, monitoring, and educational needs, with emphasis on results that will facilitate collaborative adaptive management.
3. Evaluating and considering potential sources of funding for implementing management actions.

The group is not required to operate on consensus, and DNR will consider comments from individual group members. The IC meets twice per year, unless an additional meeting is required, with at least one interim email update. The group includes members from a broad spectrum of representation, including:

- Adjacent landowners/residents

- Scientific community, including Western Washington University and local scientists
- Cherry Point Citizens Stewardship Committee
- Whatcom Marine Resources Committee
- Environmental non-profit organizations, such as ReSources for Sustainable Communities, Whatcom Land Trust, Whatcom County Audubon Society, and Friends of the San Juans
- Local industries, including Petrogas, bp, Intalco Alcoa, and Phillips 66 representatives
- Local and State government, including City of Bellingham, Whatcom County, Port of Bellingham, and Department of Fish and Wildlife
- Birch Bay Water and Sewer District
- Tribal government, including Lummi Nation and Nooksack Indian Tribe (DNR may also communicate with tribes about reserve management outside the IC process when a tribe requests “government-to-government communication)

Potential new members will be invited to join the group by means of formal invitation, either by email or by letter.

Cherry Point Aquatic Reserve Work Plan

The Implementation Committee identified priority management and implementation strategies during a series of meetings and these will be incorporated into a draft two-year work plan and tracking tool for the reserve (Appendix F). The work plan helps reserve staff, volunteers and partners grasp logical next steps for beginning and completing important projects for the reserve.

Vision for the Future: Continued Partnerships and Data Sharing

In the first ten years since the reserve’s establishment in 2010, DNR and partners have learned a great deal about the status of species and ecosystem function in the reserve. These projects are detailed in Chapter 4, Progress Made Toward Achieving Plan Goals. Over the next ten-year period, we plan to collaborate with researchers and partners to refine monitoring objectives and methods to track status of key ecosystem indicators, and also understand how proposed species recovery actions may affect the reserve. The Implementation Committee will help with this process by confirming the key resources and issues that management should focus on and learn about in the next decade. Management decisions will be made based on objective data developed by partners, including organizations represented on the committee, focused on shared goals and commitment to adapt and incorporate new information.

The Citizen Stewardship Committee’s regular meetings and organized efforts throughout the year provide ongoing monitoring, communication with DNR staff, and essential community education for building long-term support for the reserve. Each year, a member of the reserve’s Puget SoundCorps team is responsible for attending these meetings and coordinating with the CSC.

The Aquatic Reserves Program maintains an interactive online map that allows anyone to view and access research and monitoring data collected in the aquatic reserves. Data includes information from monitoring efforts by both DNR and the CSC, and potentially additional partners. Data sharing is a vital tool that promotes collaborative adaptive management in the reserve. The online map can be accessed at <https://aquarim.dnr.wa.gov/default.aspx>.

DNR believes that collaborative partnerships are vital to reserve management and strategy implementation. Excellent stewardship and management of a reserve stems from close working relationships with the community, stakeholders, agencies, tribes, and non-profit organizations. The work of program staff is leveraged through volunteer organizations, grants, and local partners. High quality monitoring programs can be developed and research conducted with the collaboration from university and college faculty that use and support the reserve. All these efforts lead to synergy among project partners and positive outcomes for both the site and the community that surrounds it.

Plan Implementation

The successful management of the reserve requires coordination and collaboration with local partners. Review and evaluation of scientific data and management information by the implementation committee guides decisions for the reserve. DNR will continue to facilitate the Implementation Committee and partners noted above to guide the implementation of this plan and coordinate decisions that will affect the long-term health of resources and ecosystems of the reserve.

To enhance coordination and cooperation, resource managers are encouraged to establish Memorandums of Understanding (MOU), contracts, and interagency agreements to address issues of mutual interest in the Cherry Point area. The agreement should define how entities will coordinate their authorities and responsibilities, and state how they intend to work together to achieve desired outcomes for resource protection as presented in the management plan. For example, Department of Fish and Wildlife staff led research work on herring age class and other studies in the reserve vicinity as part of a contracted agreement with DNR. The Aquatic Reserves Program worked with the Lummi Nation to collaborate on a light trap monitoring project (for larval herring distribution and abundance) implemented from 2021-2023.

Resource managers may choose to establish technical advisory committees to review and provide input on specific research, protection or restoration efforts. In 2013, a short term expert review committee was created to provide recommendations on localized herring research, and in 2018 a temporary technical committee was tasked with reviewing the boundary expansion. DNR will defer to governmental regulators for managing all regulated activities. DNR will work with the regulatory agencies as appropriate to support the long-term objectives of the management plan.

In addition, DNR will look for opportunities to coordinate on decisions and activities related to the maintenance of navigation, water quality, and habitat protection with U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration (NOAA) Fisheries, and U.S. Environmental Protection Agency. Decisions and activities related to vessel traffic management, spill prevention, and clean-up should be coordinated with U.S. Coast Guard, Washington Department of Ecology, Northwest Area Committee, interested tribes, and the fishing industry. Significant decisions and documents should be shared and discussed with resource managers prior to implementation.

Coordination with Community Groups

Monitoring, research, restoration and environmental education actions are supported by the assistance of local non-government organizations (NGOs). NGOs support plan implementation and their involvement requires coordination and clear delineation of responsibilities. DNR will coordinate with NGOs and provide information to the public and resource managers.

Cherry Point Aquatic Reserve Citizen Stewardship Committee (CSC)

Currently, the Cherry Point Aquatic Reserve Citizen Stewardship Committee (CSC) meets monthly to collaborate on projects, events, educational efforts, and provide input to DNR on reserve management. The CSC is composed of representatives from various groups interested in the reserve, and residents at large. The results of their many initiatives and projects are well documented in other chapters of the plan. The CSC also provides a critical and regular conduit of information between local interests and DNR.

Funding

Implementation of this plan will require a cooperative effort of all entities identified in this chapter. Where possible, a cooperative effort will be developed to fund and implement the actions of this management plan. Lessees will fund required regulatory studies and mitigation associated with the ongoing operations of their facilities. DNR will look for opportunities to partner with lessees and other governmental agencies, tribes and NGOs to provide funding for actions identified in this plan.

Collaborative Adaptive Management

Adaptive management is a systematic process that will be utilized for improving management programs by learning from the outcomes of actions taken. DNR will coordinate adaptive management with the Implementation Committee and technical advisors to track progress in carrying out the plan. This will include making technical assessments about effectiveness of plan actions and monitoring projects, managing and sharing data, and evaluating and communicating progress. The group will determine whether course corrections are needed, if data gaps are sufficiently addressed, and adjust the reserve work plan accordingly. DNR will ensure coordination with partners in the review and evaluation of scientific and management information that supports the process.

DNR will be responsible for tracking implementation of actions, research, and monitoring for the reserve. DNR will assist with management of data, and continue to develop a monitoring database that compiles the data collected by DNR and other entities within and adjacent to the reserve. This will include promoting the cooperation of government agencies, affected tribes, industry, community groups, NGOs, and research institutions.

Actions in this plan are prioritized to identify those actions that should be completed in the next five years, with periodic development of a two year work plan in coordination with the Implementation Committee. These priority actions focus on continuing research into the cause of species declines and developing effective strategies to reverse declines. Management actions will be assessed to evaluate progress toward the goals in this plan. Quantifiable management goals and actions will be adjusted over time to help achieve the desired conditions for the resources of the reserve.

Coordinated adaptive management of the reserve will integrate changes in scientific knowledge concerning the site, conditions of habitats and species, and existing uses of state-owned aquatic lands. DNR will use data and reports generated from research and monitoring activities to determine if management actions are meeting the goals and objectives of the reserve. If management actions are not meeting objectives, they will be modified as needed and also evaluated during the following 10-year review process. Changes in scientific knowledge concerning the site, condition of habitats and species, and existing encumbrances will be included in the updates.

7. References

Note: This reference chapter contains all references cited, including those in Appendix A.

AMEC Environment & Infrastructure, Inc. 2012. 2011 Baseline sediment sampling report, Gateway Pacific Terminal, Whatcom County, Washington. Prepared for Pacific International Terminals, Inc., Seattle, WA.

AMEC Environment & Infrastructure, Inc. 2014. 2013 Baseline water quality characterization report, Access trestle and wharf vicinity, Whatcom County, Washington. Prepared for Pacific International Terminals, Inc., Seattle, WA.

Anderson, E.M., Lovvorn, J.R., Esler, D., Boyd, W.S., & Stick, K.C. 2009. Using predator distributions, condition, and diet to evaluate seasonal foraging sites: sea ducks and herring spawn. *Marine Ecology Progress Series* 386:287-302.

Bailey, A., Ward, K., & Manning, T. 1993. A field guide for characterizing habitats using a marine and estuarine habitat classification system for Washington State. Nearshore Habitat Program, Washington Department of Natural Resources. Olympia, WA.

Ballew, T., II. 2016. Timothy Ballew II, Chairman Lummi Indian Business Council to Commissioner Goldmark, September 12, 2016. [Letter].

Bandaragoda, C., J. Greenberg, C. Lindsay, and M. Dumas. (2013). WRIA 1 Groundwater Data Assessment: Overview. In Bandaragoda, C., J. Greenberg, C. Lindsay and M. Dumas, editors. WRIA 1 Groundwater Data Assessment, Whatcom County PUD #1, Whatcom County, WA. WRIA 1 Joint Board.

Bassett, C., Polagye, B., Holt, M.M., & Thompson, J. 2012. A vessel noise budget for Admiralty Inlet, Puget Sound, Washington (USA). *The Journal of the Acoustical Society of America* 132(6):3706-19.

Beacham, T.D., Schweigert, J.F., MacConnachie, C., Le, K.D., & Flostrandv L. 2008. Use of microsatellites to determine population structure and migration of Pacific herring in British Columbia and adjacent regions. *Transactions of the American Fisheries Society* 137:1795-1811.

Beacham, T.D., Schweigert, J.F., MacConnachie, C., Le, K.D., Labaree, K., & Miller, K.M. 2002. Population structure of herring (*Clupea pallasii*) in British Columbia determined by microsatellites, with comparisons to southeast Alaska and California. Canadian Science Advisory Directorate. Report No. 2002/109.

Bellingham Tourist Bureau. 2020. Personal communication with Bellingham Tourist Bureau. Phone, record on file—DNR Aquatic Reserves Program, Olympia, WA.

Berger/ABAM Engineers Inc. 2000. ARCO Products Company Cherry Point Refinery Marine Terminal Pier Addition, Endangered Species Act Biological Evaluation. Prepared for the ARCO Cherry Point Refinery, Blaine, WA.

Berry, H. 2020. Personal communication with Helen Berry, Nearshore Habitat Program manager, DNR, Aquatics Division. Zoom meeting communication, record on file—DNR Aquatic Reserves Program, Olympia, WA.

- Berry, H.D., Harper, J.R., Mumford, T.F. Jr., Bookheim, B.E., Sewell, A.T., Tamayo, L.J. 2001. The Washington State ShoreZone inventory user's manual. Washington State Department of Natural Resources, Olympia, WA. Available from <https://www.dnr.wa.gov/programs-and-services/aquatics/aquatic-science/nearshore-habitat-publications>
- Berry, H.D., Mumford, T.F., Christiaen, B., Dowty, P., Calloway, M., Ferrier, L., Grossman, E.E., & VanArendonk, N.R. 2021. Long-term changes in kelp forests in an inner basin of the Salish Sea. PLoS ONE 16(2):e0229703.
- Birch Bay Water and Sewer District. n.d. [Internet]. Our District. [Cited 10-Feb-21]. Available from <https://bbwsd.com/about-the-district/>
- Blackmon, D., Wyllie-Echeverria, T., & Shafer, D.J. 2006. The role of seagrasses and kelps in marine fish support. 2006. Prepared by USACE Wetlands Regulatory Assistance Program for the Seattle District of the U.S. Army Corps of Engineers, Regulatory Branch. Report No. ERDC TN-WRAP-06-1.
- Blodgett, M.E. 1976. Cherry Point: A Strait of Georgia Fishing Station. Unpublished master's thesis, Department of Anthropology, Western Washington University, Bellingham, WA.
- Borso, P. 2020. Personal communication with Pam Borso, North Cascades Audubon Society educator. Email, record on file—DNR Aquatic Reserves Program, Olympia, WA.
- Bower, J.L. 2009. Changes in marine bird abundance in the Salish Sea: 1975 to 2007. Marine Ornithology 37:9-17.
- Bower, J.L. 2016. Marine bird abundance in the Cherry Point Aquatic Reserve: 2013-2016. Online accessed on 4/25/21. Available from <https://www.aquaticreserves.org/wp-content/uploads/CPAR-Bird-Monitoring-Report-2013-2016.pdf>
- Boxberger, D.L. 2000. To Fish in Common: The ethnohistory of Lummi Indian salmon fishing. Report Version 1.2. University of Washington Press, Seattle, WA.
- Brennan, J.S. 2007. Marine riparian vegetation communities of Puget Sound. Puget Sound Nearshore Partnership Report No. 2007-02. Published by Seattle District, U.S. Army Corps of Engineers, Seattle, Washington.
- Britton-Simmons, K.H. 2003. Establishment, spread, and impact of the introduced Japanese seaweed, *Sargassum muticum*, in the San Juan Islands, WA. PhD thesis, The University of Chicago, Chicago, IL.
- Britton-Simmons, K.H. 2004. Direct and indirect effects of the introduced alga *Sargassum muticum* on benthic, subtidal communities of Washington State, USA. Marine Ecology Progress Series 277:61–78.
- Buffington, C. 2020. Personal communication with Chelsey Buffington, European Green Crab Lead, WDFW AIS Unit. Emails, record on file—DNR Aquatic Reserves Program, Olympia WA.
- Calambokidis, J. & Baird, R.W. 1994. Status of marine mammals in the Strait of Georgia, Puget Sound, and the Juan de Fuca Strait, and potential human impacts. Abstract. Canadian Technical Report of Fisheries and Aquatic Sciences 1948:282-300.

- Calambokidis, J., Klimek, A., & Schendler, L. 2009. Summary of collaborative photographic identification of gray whales from California to Alaska for 2007. Report No. AB133F-05-SE-5570. Cascadia Research, Olympia, WA.
- Carls, M.G., Rice, S.D., & Hose, J.E. 1999. Sensitivity of fish embryos to weathered crude oil: Part 1. Low-level exposure during incubation causes malformations, genetic damage and mortality in larval Pacific herring (*Clupea pallasii*). *Environmental Toxicology and Chemistry* 18(3):481-493.
- Caudill, A. 2020. Analysis of sulfur dioxide monitoring data in Whatcom County: Air quality technical report. Report No. 20-02-015. Washington Department of Ecology and Northwest Clean Air Agency, Olympia, WA.
- Center for Biological Diversity, Northwest Ecosystem Alliance, Ocean Advocates, People for Puget Sound, Public Employees for Environmental Responsibility, Wright, S. and Friends of the San Juans. 2004. Petition to list the Cherry Point population of Pacific herring, *Clupea pallasii*, as “threatened” or “endangered” under the Endangered Species Act. 16 U.S.C. § 1531 *et seq.* (1773 as amended). Online accessed on 10/6/21 at https://media.fisheries.noaa.gov/dam-migration/cherry_point_pacific_herring_petitions-accessible.pdf
- Center for Whale Research. [Internet]. Southern Resident Killer Whale population. [Cited 10-Oct-23]. Available from <https://www.whaleresearch.com/orca-population>
- Christiaen, B. 2020. Personal communication with Bart Christiaen, SVMP Lead Scientist, DNR, Aquatics Division. Email communication, record on file—DNR Aquatic Reserves Program, Olympia, WA.
- Climate-Data.org. [Internet]. Birch Bay climate data. [Cited 13-Oct-21]. Available from <https://en.climate-data.org/north-america/united-states-of-america/washington/birch-bay-871525/>
- Cohen, A. 2004. An exotic species detection program for Puget Sound. San Francisco Estuary Institute Report No. OTH04-02. Prepared for the Puget Sound Action Team, Olympia, WA.
- Cohen, A.N. and J. T. Carlton 1995. Nonindigenous Aquatic Species in a United States Estuary: A Case Study of the Biological Invasions of the San Francisco Bay and Delta (U.S. Fish and Wildlife Service, Washington, DC, 1995); A. N. Cohen, thesis, University of California, Berkeley (1996).
- Cohen, A.N., Berry, H., Mills, C., Milne, D., Britton-Simmons, K., Wonham, M., Secord, D., Barkas, J.A., Bingham, B., Bookheim, B., Byers, J., Chapman, J.W., Cordell, J., Dumbauld, B., Fukuyama, A., Harris, L.H., Kohn, A., Li, K., Mumford, T., Radashevsky, V., Sewell, A., & Welch, K. 2001. Report of the Washington State Exotics Expedition 2000: A rapid assessment survey of exotic species in the shallow waters of Elliott Bay, Totten and Eld Inlets, and Willapa Bay. Nearshore Habitat Program, Washington State Department of Natural Resources, Olympia, WA.
- Cohen, A.N., Mills, C.E., Berry, H., Wonham, M.J., Bingham, B., Bookheim, B., Carlton, J.T., Chapman, J.W., Cordell, J.R., Harris, L.H., Klinger, T., Kohn, A., Lambert, C.C., Lambert, G., Li, K., Secord, D., & Toft, J. 1998. Report of the Puget Sound expedition, September 8-16, 1998; A rapid assessment survey of nonindigenous species in the shallow waters of Puget Sound. Washington State Department of Natural Resources and United States Fish and Wildlife Service, Olympia, WA.
- Cordell, J., Kalata, O., Pleus, A., Newsom, A., Strieck, K., & Gersten, G. 2015. Effectiveness of ballast water exchange in protecting Puget Sound from invasive species: Results from WDFW/UW ballast water sampling, 2001-2014. Report prepared by UW School of Aquatic and Fishery Sciences

for the Washington Department of Fish and Wildlife and Washington State Department of Natural Resources, Olympia, WA.

Darling, J.D. 1984. Gray whales off Vancouver Island, British Columbia. In Jones, M.L., Swartz, S.L., & Leatherwood, S. (Eds.), *The gray whale: *Eschrichtius robustus**. (p. 267–287). Academic Press, Orlando, FL.

Davidson, I., Zabin, C., Ashton, G., and Ruiz, G. 2014. An assessment of biofouling introductions to the Puget Sound Region of Washington State. Report to the Washington Department of Fish & Wildlife and Washington Department of Natural Resources, Olympia, WA.

De Robertis, A. & Handegard, N.O. 2013. Fish avoidance of research vessels and the efficacy of noise-reduced vessels: a review. *ICES Journal of Marine Science* 70(1):34-45.

Dethier, M. 1990. A marine and estuarine habitat classification system for Washington State. Prepared for Washington Natural Heritage Program, Washington Department of Natural Resources, Olympia, WA.

Dinnel, P., Robinette, J., Dolph, I., & Schwertner, M. 2005. Restoration of Olympia oysters in Fidalgo Bay, with an update on Pacific oyster enhancement at March's Point: Three year report. Prepared by Skagit County Marine Resources Committee for the Northwest Straits Commission, Mount Vernon, WA.

Donaldson, J. 2021. Hazardous sites list for February 24, 2021. Report No. 21-09-042A. Washington Department of Ecology, Olympia, WA.

Donovan, H. & Bower, J.L. 2004. [Internet]. Study finds substantial declines in local marine bird species. *Whatcom Watch*. [15 -Dec-21]. Available from http://www.whatcomwatch.org/php/WW_open.php?id=496

Dougherty, P. 2009. Semiahmoo people. [Internet]. HistoryLink.org Essay 9123. [Cited 10-Feb-21]. Available from <https://www.historylink.org/File/9123>

Dougherty, P. 2011. Whitehorn — Thumbnail History. [Internet]. HistoryLink.org Essay 9776. [Cited 10-Feb-21]. Available from <https://www.historylink.org/File/9776>

Downing, J. 1983. *The coast of Puget Sound, its processes and development*. Seattle, WA: Washington Sea Grant, University of Washington Press. 126 p.

Duncan, D.L., Carls, M.G., Rice, S.D., & Stekoll, M.S. 2017. The toxicity of creosote-treated wood to Pacific herring embryos and characterization of polycyclic aromatic hydrocarbons near crested pilings in Juneau, Alaska. *Environmental Toxicology and Chemistry* 36(5):1261-1269.

Dungan, C. 2016. Invasive stowaways threaten Puget Sound ecosystem. [Internet]. *Encyclopedia of Puget Sound*. [Cited 10-Feb-21] Available from <https://www.eopugetsound.org/magazine/invasive-stowaways>

Easterbrook, D. 1973. *Environmental geology of western Whatcom County, Washington*. U.S. Geological Survey Report.

Ecology and Environment, Inc. 2017. Final trip report for Treoil Industries bio-refinery assessment and emergency removal site. U.S. Environmental Protection Agency, Region 10. Contract Number EP-S7-13-07, Technical Direction Document Numbers 17-01-0012 and 17-03-0003.

- Eissinger, A.M. 1994. Marine and shoreline wildlife areas. Prepared by Nahkeeta Northwest. Whatcom County, WA.
- Emmett, R.L., Stone, S.L., Hinton, S.A., & Monaco, M.E. 1991. Distribution and abundance of fishes and invertebrates in west coast estuaries, Volume II: Species life history summaries. NOAA's Estuarine Living Marine Resources Program, Rockville, MD.
- Erbe, C. 2012. Effects of underwater noise on marine mammals. *Advances in Experimental Medicine and Biology* 730:17-22.
- EVS Environment Consultants. 1999. Cherry Point screening level ecological risk assessment. Report No. 2/868-01.1. Prepared for Washington Department of Natural Resources, Seattle, WA.
- Falcone, E., Calambokidis, J., Steiger, G.H., Malleon, M. & Ford, J. 2005. Humpback whales in the Puget Sound/Georgia Strait Region. Presented during the Puget Sound Georgia Basin Research Conference, Seattle, WA. March 29-31, 2005.
- Federal Register. 2006. Endangered and Threatened Wildlife and Plants: Endangered Status for Southern Resident Killer Whales; Final Rule 70(222):69903-69912.
- Feely, R.A., Klinger, T., Newton, J.A., & Chadsey, M. [Eds.] 2012. Scientific summary of ocean acidification in Washington State marine waters. NOAA OAR Special Report. Seattle, Washington.
- Flaherty, C. 1990. Whales of the Northwest: A guide to marine mammals of Oregon, Washington, and British Columbia. Cherry Lane Press. Seattle, WA.
- Fricke, L. 2021. Personal communication with Laura Fricke, Water Quality Program Municipal Unit Supervisor, Washington Department of Ecology. Phone and email, record on file.
- Georgia Strait Alliance. 2021. n.d. [Internet]. Southern Resident Orcas: Endangered killer whales. [Cited 02-02-2021]. Available from <https://georgiastrait.org/orca-our-endangered-killer-whales/>
- Glosten Associates, Inc. 2014. Gateway Pacific Terminal (GPT) vessel traffic and risk assessment study. Report No. 12096.02. Prepared for Washington Department of Ecology, Pacific International Terminals, and Lummi Natural Resources Department, Lacey, WA.
- Grabert, G.F. 1988. Prehistoric and historic land uses of Cherry Point, Ferndale, Washington. Unpublished report. Department of Anthropology, Western Washington University.
- Grette Associates. 2007. New Whatcom redevelopment project: Plants and animals technical report. Prepared for the Port of Bellingham by Grette Associates, Wenatchee, WA.
- Grosholz, E.D. & Ruiz, G.M. 1996. Predicting the impact of introduced marine species: Lessons from the multiple invasions of the European green crab *Carcinus maenas*. *Biological Conservation* Volume 78(1): 59-66.
- Grossman, E., Labiosa, B. & Barnard, P. n.d. [Internet]. PS-CoSMoS Puget Sound coastal storm modeling system. USGS Pacific Coastal and Marine Science Center. [Cited 03-Apr-19]. Available from https://www.usgs.gov/centers/pcmsc/science/ps-cosmos-puget-sound-coastal-storm-modeling-system?qt-science_center_objects=0#qt-science_center_objects
- Gustafson, R.G., Wainwright, T.C., Winans, G.A., Waknitz, F.W., Parker, L.T. & Waples, R.S. 1997. Status review of sockeye salmon from Washington and Oregon. Report No. NMFS-NWFSC-33. Northwest Fisheries Science Center.

- Haas, M.E., Simenstad, C.A., Cordell, J.R., Beauchamp, D.A. & Miller, B.R. 2002. Effects of large overwater structures on epibenthic juvenile prey assemblages in Puget Sound, Washington. Report No. WA-RD 550.1. Prepared by University of Washington School of Aquatic and Fishery Sciences for Washington State Department of Transportation Commission, Seattle, WA.
- Hansen, J., Nazarenko, L., Ruedy, R., Sato, M., Willis, J., Del Genio, A., Koch, D., Lacin, A., Lo, K., Menon, S., Novakov, T., Perlwitz, J., Russel, G., Schmidt, G.A., & Tausnev, N. 2005. Earth's energy imbalance: Confirmation and implications. *Science* 308:1431- 1435.
- Harding, L.B., Tagal, M., Scholz, N.L., Incardona, J.P., & McIntyre, J.K. 2018. Cardiac injury and reduced growth in Pacific herring exposed to urban stormwater runoff. Presented during the Salish Sea Ecosystem Conference, Seattle, WA. April 4-6, 2018.
- Harrison, P.G. & Bigley, R.E. 1982. The recent introduction of the seagrass *Zostera japonica* Aschers. and Graebn. to the Pacific Coast of North America. *Canadian Journal of Fisheries and Aquatic Sciences* 39(12):1642-1648.
- Hayes, G.E. & Buchanan, J.B. 2002. Washington state status report for the peregrine falcon. Washington Department of Fish and Wildlife, Olympia, WA.
- Healey, M.C. 1979. Utilization of the Nanaimo River estuary by juvenile Chinook salmon *Oncorhynchus tshawytscha*. *Fishery Bulletin* 77(3):653–668.
- Healey, M.C. 1982. Juvenile Pacific salmon in estuaries: The life support system. p. 315–341. In Kennedy, V.S. (Ed.), *Estuarine Comparisons*. (p. 315-341). Academic Press, New York, NY.
- Hines, E. & Jaeren, L. 2018a. Intertidal biota monitoring in the Cherry Point and Fidalgo Bay Aquatic Reserves: 2013-2018 Monitoring Report. Prepared for Washington State Department of Natural Resources, Olympia, WA.
- Hines, E. & Jaeren, L. 2018b. Marine bird abundance in the Cherry Point and Fidalgo Bay Aquatic Reserves: 2013-2018 Monitoring Report for the National Estuaries Program. Prepared for Washington State Department of Natural Resources, Olympia, WA.
- Hitchman, M. 2020. Personal communication with Marie Hitchman, CPAR Implementation Committee member via phone and letter on July 13, 2020. Record on file—DNR Aquatic Reserves Program, Olympia WA.
- Holt, M.M., Noren, D.P, Veirs, V., Emmons, C.K., & Veirs, S. 2009. Speaking up: Killer whales (*Orcinus orca*) increase their call amplitude in response to vessel noise. *Journal Acoustical Society of America*. 125(1):EL27-32.
- Horwith, M. 2019. Personal communication with Micah Horwith, Coastal Scientist, Aquatic Assessment and Monitoring Team, DNR, Aquatics Division. Record on file—DNR Aquatic Reserves Program, Olympia, WA.
- Hruby, T. 2004. Washington State wetland rating system for western Washington Revised. Report No. 04-06-025. Washington State Department of Ecology. Olympia, WA.
- Jacobsen, E.E & Schwartz, M.L. 1981. The use of geomorphic indicators to determine the direction of net shore-drift, *Shore and Beach* 49: 38-42.

Jägerbrand, A.K., Brutemark, A., Svedén, J.B., & Gren, I.-M. 2019. A review on the environmental impacts of shipping on aquatic and nearshore ecosystems. *Science of The Total Environment* 695:133637.

Jahraus, T. 2019. Birch Bay annual shellfish growing area review. Shellfish Growing Area Section 360-236-3330. Washington Department of Health. Tumwater, WA.

James, J.P.W. 2013. [Internet]. The Search for integrity in the conflict over Cherry Point as a coal export terminal. *Whatcom Watch*, special insert from the Lummi Nation. [Cited 10-Dec-20]. Available from <http://whatcomwatch.org/wpww/?p=348>

Jeffries, S.J., Gearin, P.J., Huber, H.R., Saul, D.L., & Pruett, D.A. 2000. Atlas of seal and sea lion haulout sites in Washington. Washington Department of Fish and Wildlife, Olympia, WA.

Johannessen, J. & MacLennan, A. 2007. Beaches and bluffs of Puget Sound. Puget Sound Nearshore Partnership Report No. 2007-04. Seattle District, U.S. Army Corps of Engineers, Seattle, WA.

Kovanen, D.J., Haugerud, R.A., & Easterbrook, D.J., 2020. Geomorphic map of western Whatcom County, Washington: U.S. Geological Survey Scientific Investigations Map 3406, pamphlet 42 p., scale 1:50,000. Available from <https://doi.org/10.3133/sim3406>

Kyte, M.A. 1990. Results of 1990 biological and chemical monitoring in the Southeast Strait of Georgia for the BP Oil Company - Ferndale Refinery. Prepared for bp by Ardea Enterprises, Seattle, WA.

Kyte, M.A. 2009. Personal communication with Michael Kyte, marine biologist consultant and CPAR Implementation Committee member. Email, record on file—DNR Aquatic Reserves Program, Olympia, WA.

Kyte, M.A. 2020a. Personal communication with Michael Kyte, marine biologist consultant and CPAR Implementation Committee member. Phone, record on file—DNR Aquatic Reserves Program, Olympia WA.

Kyte, M.A. 2020b. Personal communication with Michael Kyte, marine biologist consultant and CPAR Implementation Committee member. Phone, record on file—DNR Aquatic Reserves Program, Olympia WA.

Langley Centennial Museum. 2020. “The establishment of Fort Langley” exhibit. Virtual Tour of Museum.

Langness, M. & West, J. 2020. Stormwater action monitoring 2017/18 mussel monitoring survey. Report No. FPT 20-13. Washington Department of Fish and Wildlife. Olympia, WA.

Langness, M. 2020. Personal communication with Mariko Langness, biologist at Washington Department of Fish and Wildlife. Email, record on file—DNR Aquatic Reserves Program, Olympia, WA.

Lanksbury, J., Lubliner, B., Langness, M., & West, J. 2017. Stormwater action monitoring 2015/16 mussel monitoring survey. Report No. FPT 17-06. Washington Department of Fish and Wildlife. Olympia, WA.

- Lerner, J. 2023. [Internet]. Missing Cherry Point herring spawn is personal to local biologist. Cascadia Daily News. [Cited 24-Oct-2023]. Available from <https://www.cascadiadaily.com/news/2023/jul/25/missing-cherry-point-herring-spawn-is-personal-to-local-biologist/>
- Lewis, T.L., Esler, D., & Boyd, W.S. 2007. Foraging behaviors of surf scoters and white-winged scoters during spawning of Pacific herring. *The Condor* 109(1):216–222.
- Lewis, T.L., Esler, D., Boyd, W.S., & Zydalis, R. 2005. Nocturnal foraging behavior of wintering surf scoters and white-winged scoters. *The Condor* 107(3):637–647.
- Lublinter, B., Redding, M., & Ragsdale, D. 2010. Pharmaceuticals and personal care products in municipal wastewater and their removal by nutrient treatment technologies. Report No. 10-03-004. Washington State Department of Ecology, Olympia, WA.
- Lummi Natural Resources Department Water Resources Division. 2019. 2014, 2015, 2016, 2017 Lummi Nation water quality assessment report. Lummi Indian Business Council. Available from https://www.lummi-nsn.gov/userfiles/85_2014151617WaterQualityAssessmentReportReportAppendices.pdf
- MacLennan, A., Schlenger, P., Williams, S., Johannessen, J., & Wilkinson, H. 2013. WRIA 1 nearshore & estuarine assessment and restoration prioritization. Prepared by Coastal Geologic Services for the City of Bellingham. Bellingham, WA.
- Malins, D.C., Krahn, M.M., Myers, M.S., Rhodes, L.D., Brown, D.W., Krone, C.A., McCain, B.B., & Chan, S. 1985. Toxic chemicals in sediments and biota from a creosote-polluted harbor: Relationships with hepatic neoplasms and other hepatic lesions in English sole (*Parophrys vetulus*). *Carcinogenesis* 6(10):1463-1469.
- Markham, M.V. 1993. A historic Euroamerican fish trap camp at Cherry Point (45WH1). Unpublished master's thesis, Western Washington University, Bellingham, WA.
- Marshall, R. 2009. Personal communication with Randall Marshall, WET Coordinator at Washington State Department of Ecology. Record on file—DNR Aquatic Reserves Program, Olympia, WA.
- Marshall, R. 2012. Final report on Pacific herring (*Clupea pallasii*) Test development and validation. Report No. 11-10-086. Washington Department of Ecology, Olympia, WA.
- Marty, G.D., Okihiro, M.S., Brown, E.D., Hanes, D., & Hinton, D.E. 1999. Histopathology of adult Pacific herring in Prince William Sound, Alaska, after the Exxon Valdez oil spill. *Canadian Journal of Fisheries and Aquatic Sciences* 56(3):419-426.
- Masson, D., & P.F. Cummins, P.F. 2007. Temperature trends and interannual variability in the Strait of Georgia, British Columbia. *Continental Shelf Research* 27: 634-649.
- Matthews, M.-N. R., L. Horwich, H. Yurk, H. Frouin-Mouy, J. Delarue, A. MacGillivray, & D.E. Hannay. 2017. Assessment of vessel noise within Southern Resident Killer Whale critical habitat: Final report. Version 2.0. Report No. 01448. Report prepared by JASCO Applied Sciences for Transportation for Innovation Centre of Transport Canada.
- Misund, O.A., Ovredal, J.T., & Hafsteinsson, M.T. 1996. Reactions of herring schools to the sound field of a survey vessel. *Aquatic Living Resources* 9:5-11.

- Mitchell, D.M. 2006. Biocomplexity and metapopulation dynamics of Pacific herring (*Clupea pallasii*) in Puget Sound, Washington. Master's thesis submitted in partial fulfillment for the requirements of Master of Science, Aquatic and Fisheries Science Program, University of Washington. Hard copy on file with Washington Department of Natural Resources, Olympia, WA.
- Moore, S.K., Mantua, N.J., Kellogg, J.P., & Newton, J.A. 2008. Local and large-scale climate forcing of Puget Sound oceanographic properties on seasonal to interdecadal timescales. *Limnology and Oceanography* 53(5):1746-1758.
- National Marine Fisheries Service. 2006. Review of the status of the right whales in the North Atlantic and North Pacific Oceans. National Marine Fisheries Service, Washington, D.C.
- National Marine Fisheries Service. 2008. Recovery plan for southern resident killer whales (*Orcinus orca*). National Marine Fisheries Service Northwest Region, Seattle, WA.
- National Marine Fisheries Service. 2018. 2018 Revisions to: Technical guidance for assessing the effects of anthropogenic sound on marine mammal hearing (Version 2.0): Underwater thresholds for onset of permanent and temporary threshold shifts. Report No. NMFS-OPR-59. Silver Spring, MD.
- National Oceanic and Atmospheric Association. 2020. Cherry Point, WA – Station ID: 9449424. [Internet]. [Cited 5-May-2020]. Available from <https://tidesandcurrents.noaa.gov/stationhome.html?id=9449424>
- Nightingale, B. & Simenstad, C. 2001. Overwater structures: Marine issues. Report No. WA-RD-508.1. Prepared by University of Washington Wetland Ecosystem Team School of Aquatic and Fishery Sciences for Washington Department of Fish and Wildlife, Washington Department of Ecology, and Washington Department of Transportation. Seattle, WA.
- Northwest Indian Fisheries Commission (NWIFC). 2003. Tribal Policy Statement on Marine Protected Areas, Marine Reserves, Marine Sanctuaries, and Fishery Conservation Zones. Letter signed by Billy Frank, Jr. to Hon. Donald Evans, Secretary of Commerce, Washington D.C., dated July 11, 2003. Hard copy on file at Washington Department of Natural Resources, Aquatic Resources Program, Olympia, WA
- Nysewander, D.R., Evenson, J.R., Murphie, B.L. & Cyra, T.A. 2005. Report of marine bird and marine mammal component, Puget Sound Ambient Monitoring Program, for July 1992 to December 1999 period. Prepared for Washington Department of Fish and Wildlife and Puget Sound Action Team, Olympia, WA.
- Office of Financial Management. 2017. Washington State Office of Financial Management GMA Population Projections by County (2017). Available from <https://ofm.wa.gov/washington-data-research/population-demographics/population-forecasts-and-projections/growth-management-act-county-projections/growth-management-act-population-projections-counties-2010-2040-0>
- Office of Financial Management. 2019. 2019 Population Trends Washington State Office of Financial Management, Forecasting & Research Division, August 2019. Available from <https://www.ofm.wa.gov/washington-data-research/population-demographics>
- Ono, K. & Simenstad, C.A. 2014. Reducing the effect of overwater structures on migrating juvenile salmon: An experiment with light. *Ecological Engineering* 71:180-189.

- Ort, B.S., Cohen, C.S., Boyer, K.E., Reynolds, L.K., Tam, S.M., & Wyllie-Echeverria, S. 2014. Conservation of eelgrass (*Zostera marina*) genetic diversity in a mesocosm-based restoration experiment. *PLoS ONE* 9(2):e89316.
- Palsson, W.A. 2009. Personal communication with WDFW research scientist Wayne Palsson. No record on file—DNR Aquatic Reserves Program, Olympia WA.
- Palsson, W.A., Tsou, T., Bargman, G.G., Buckley, R.M., West, J.E., Mills, M.L., Cheng, Y.W., & Pacunski, R.E. 2009. The biology and assessment of rockfishes in Puget Sound. Report No. FPT 09-04. Washington Department of Fish and Wildlife.
- Parametrix & Adolphson Associates, Inc. 2006. Shoreline master program update background information – Volume 1: Shoreline inventory and characterization report (Parts I-IV) & map folio. Prepared for Whatcom County Planning and Development Services, Bellevue, WA.
- Partridge, V., Weakland, S., Dutch, M., Burgess, D., & Eagleston, A. 2018. Sediment quality in Puget Sound: Changes in chemical contaminants and invertebrate communities at 10 sentinel stations, 1989-2015. Report No. 18-03-005. Washington Department of Ecology, Olympia, WA.
- Penttila, D. 2007. Marine forage fishes in Puget Sound. Report No. 2007-03. Prepared by Washington Department of Fish and Wildlife for Puget Sound Nearshore Partnership.
- Petrou, E.L. 2019. Diversity and population structure of Pacific herring (*Clupea pallasii*) along the Northwest coast: An interdisciplinary investigation using high-throughput sequencing and ancient DNA. Dissertation, University of Washington, Seattle, WA.
- Pfister, C.A., Berry, H.D., & Mumford, T. 2017. The dynamics of kelp forests in the Northeast Pacific Ocean and the relationship with environmental drivers. *Journal of Ecology* 106:1520–1533.
- Pimentel, D., McNair, S., Janecka, J., Wightman, J., Simmonds, C., O'Connell, C., Wong, E., Russel, L., Zern, J., Aquino, T., Tsomondo, T. 2001. Economic and environmental threats of alien plant, animal, and microbe invasions. *Agriculture Ecosystems & Environment* 84(1):1–20.
- Pleus, A. 2020. Personal communication with Alan Pleus, WDFW Aquatic Invasive Species and Ballast Water Unit lead. Email, record on file —DNR Aquatic Reserves Program, Olympia WA.
- Prinslow, T.E., Salo, E.O., & Snyder, B.P. Studies of behavioral effects of a lighted and an unlighted wharf on outmigrating salmonids – March - April 1978. Report No. FRI-UW-7920. University of Washington Fisheries Research Institute.
- Ptolemy, R. 2009. Personal communication with Ron Ptolemy, Rivers Biologist/Instream Flow Specialist. Email, record on file —DNR Aquatic Reserves Program, Olympia WA.
- Puget Sound Action Team. 2007. 2007 Puget Sound update: Ninth report of the Puget Sound Assessment and Monitoring Program. Report No. PSAT 07-02. Olympia, WA.
- Puget Sound Technical Recovery Team. 2006. Draft working paper: Ecological integrity of Chinook salmon watersheds in the Puget Sound. [Accessed October 4, 2008]. Seattle, WA.
- Puget Sound Info. 2023. [Internet]. Biomass of spawning Pacific herring. [Cited 23-Oct-2023]. Available from <https://vitalsigns.pugetsoundinfo.wa.gov/VitalSignIndicator/Detail/36>
- Puget Sound Water Quality Action Team. 2000. 2000 Puget Sound update: Seventh report of the Puget Sound Ambient Monitoring Program. Olympia, WA.

Raverty, S., St. Leger, J., Noren, D.P., Huntington, K.B., Rotstein, D.S., Gulland, F.M.D., Ford, J.K.B., Hanson, M.B., Lambourn, D.M., Huggins, J., Delaney, M.A., Spaven, L., Rowles, T., Barre, L., Cottrell, P., Ellis, G., Goldstein, T., Terio, K., Duffield, D., Rice, J. & Gaydos, J.K. 2020. Pathology findings and correlation with body condition index in stranded killer whales (*Orcinus orca*) in the northeastern Pacific and Hawaii from 2004 to 2013. PLoS ONE 15(12): e0242505. Available from <https://doi.org/10.1371/journal.pone.0242505>.

Ritter, R.A., Berry, H.D., Bookheim, B.E., & Sewell, A.T. 1999. Puget Sound intertidal habitat inventory 1996: Vegetation and shoreline characteristics classification methods. Nearshore Habitat Program, Department of Natural Resources, Olympia, WA.

RE Sources. 2023. [Internet]. The Cherry Point herring stock decline: What you need to know. [Cited 23-Oct-2023]. Available from <https://www.re-sources.org/2023/08/the-cherry-point-herring-stock-decline/>

Rogers-Bennett, L., & Catton, C.A. Marine heat wave and multiple stressors tip bull kelp forest to sea urchin barrens. Scientific Reports 9:15050.

Royale, R. 2016. James, Bill (1944-2020). [Internet]. HistoryLink.org Essay 11252. [Cited 10-Feb-21]. Available from <https://www.historylink.org/File/11252>

The Salish Sea Pacific Herring Assessment and Management Strategy Team. 2018. Assessment and management of Pacific herring in the Salish Sea: Conserving and recovering a culturally significant and ecologically critical component of the food web. Prepared for The SeaDoc Society, Orcas Island, WA.

Sandell, T. 2020a. Personal communication with Todd Sandell, Senior forage fish biologist, Puget Sound Marine Fish Unit, Washington Department of Fish and Wildlife. Email, record on file—DNR Aquatic Reserves Program, Olympia WA.

Sandell, T. 2020b. Personal communication with Todd Sandell, Senior forage fish biologist, Puget Sound Marine Fish Unit, Washington Department of Fish and Wildlife. Email, record on file—DNR Aquatic Reserves Program, Olympia WA.

Sandell, T. 2021. Personal communication with Todd Sandell, Senior forage fish biologist, Puget Sound Marine Fish Unit, Washington Department of Fish and Wildlife. Email, record on file—DNR Aquatic Reserves Program, Olympia WA.

Sandell, T., Lindquist, A., Biondo, P., Lowry, D., & Dionne, P. 2018. Cherry Point Composition Study (2016-2017). Prepared for Aquatic Reserves Program, Washington Department of Natural Resources, Olympia, WA.

Sandell, T., Lindquist, A., Dionne, P., & Lowry, D. 2019. 2016 Washington State herring stock status report. Report No. FPT 19-07. Washington Department of Fish and Wildlife. Olympia, WA.

Scagel, R.F., Garbielson, P.W., Garbary, D.J., Golden, L., Hawkes, M.W., Lindstrom, S.C., Oliveira, J.C., & Widdowson, T.B. 1989. A Synopsis of the benthic marine algae of British Columbia, Southeast Alaska, Washington and Oregon (Phycological Contribution Number 3). Department of Botany, University of British Columbia, Vancouver, BC.

Schwartz, M.L., Fackler, R.C., Hoeraut, E.A., Larsen, C.E., Lingbloom, K.L., & Short, M.A. 1972. Nearshore currents Southeastern Strait of Georgia. Syesis 5:117-130.

Schwarz, A. & Greer, G. 1984. Responses of Pacific herring, *Clupea harengus pallasii*, to some underwater sounds. Canadian Journal of Fisheries and Aquatic Sciences. 41:1183-1192.

Seattle Audubon Society. n.d. [Internet]. BirdWeb. [Cited 10-Oct-08]. Available from http://www.birdweb.org/birdweb/bird_details.aspx?id=10

Shapiro and Associates Inc. 2003. BP Cherry Point Cogeneration Project Draft Environmental Impact Statement: Volumes 1 and 2. Prepared for BP West Coast Products, LLC., Blaine, WA.

Shapiro and Associates, Inc. 1994. Cherry Point natural resources baseline studies. Prepared for Pacific International Terminals, Seattle, WA.

Shared Strategy for Puget Sound. 2007. Puget Sound salmon recovery plan. Prepared for the National Marine Fisheries Service, Washington, D.C.

Simenstad, C.A., Fresh, K.L., & Salo, E.O. 1982. The role of Puget Sound and Washington coastal estuaries in the life history of Pacific salmon: an unappreciated function. In Kennedy, V.S. (Ed.), Estuarine Comparisons. (p. 343-364). Academic Press, New York, NY.

Simenstad, C.A., Nightingale, B.J., Thom, R.M., & Shreffler, D.K. 1999. Impacts of ferry terminals on juvenile salmon migrating along Puget Sound Shorelines - Phase I: Synthesis of state of knowledge. Prepared for Washington State Transportation Center, Washington State Transportation Commission, and U.S. Department of Transportation.

Simpson, S.D., Radford, A.N., Nedelec, S.L., Ferrari, M.C.O., Chivers, D.P., McCormick, M.I., & Meekan, M.G. 2016. Anthropogenic noise increases fish mortality by predation. Nature Communications 7:10544.

Small, M.P., Loxterman, J.L., Frye, A.E., Von Bargaen, J.F., Bowman, C. & Young, S.F. 2005. Temporal and spatial genetic structure among some Pacific herring populations in Puget Sound and the Southern Strait of Georgia. Transactions of the American Fisheries Society 134:1329–1341.

Snover, A.K., Mauger, G.S., Whitely Binder, L.C., Krosby, M., & Tohver, I. 2013. Climate change impacts and adaptation in Washington State: Technical summaries for decision makers. Prepared by the University of Washington Climate Impacts Group for Washington State Department of Ecology. Seattle, WA.

Speich, S.M. & Wahl, T.R. 1989. Catalog of Washington seabird colonies. Report No. 88(6); MMS 89-0054. U.S. Fish and Wildlife Service, Washington, D.C.

Stalmaster, M.V. 1987. The bald eagle. New York, NY: Universe Books.

Stick, K. 2011. Report to Washington Department of Natural Resources – Results of 2011 Cherry Point Herring Acoustic/Trawl Survey. Report No. IAA 11-276. Prepared by Washington Department of Fish and Wildlife for Washington Department of Natural Resources. Olympia, WA.

Stick, K.C. & Lindquist, A. 2009. 2008 Washington State herring stock status report. Report No. FPA 09-05. Washington Department of Fish and Wildlife, Olympia, WA.

Stick, K.C., Lindquist, A., & Lowry, D. 2014. 2012 Washington State herring stock status report. Report No. FPA 14-09. Washington Department of Fish and Wildlife, Olympia, WA.

Stocking, J.J. & Wiles, G.J. 2021. Periodic status review for the Steller sea lion. Washington Department of Fish and Wildlife, Olympia, WA.

- Sussman, B. 2019. Green Apple Renewable Fuels Project Transportation Study. Bellingham, WA.
- Suttles, W. 1951. Economic life of the Coast Salish of Haro and Rosario Straits. Dissertation in Anthropology, University of Washington. Seattle, WA.
- Suttles, W. 1990. Handbook of North American Indians, Volume 7: Northwest Coast. Sturtevant, W.C. (Ed.) Washington D.C.: Smithsonian Institution. 796 p.
- Szypulski, E.J., Gabriel, A., and Donoghue, C. 2018. Ecological effects of overwater structures on subtidal kelp, northern Puget Sound, Washington. Presented during the Salish Sea Ecosystem Conference, Seattle, WA. April 4-6, 2018.
- Terich, T.A. 1977. Coastal processes of the Whatcom County mainland. Report No. 77-1. Prepared by Department of Geography and Regional Planning, Western Washington University in cooperation with the U.S. Geological Survey for Department of Natural Resources.
- Tetra Tech. 2016. Birch Point, Terrell Creek Urban Area, and Point Whitehorn subwatershed master plan. Report No. 100-SET-T34645. Prepared for Whatcom County Public Works Department Stormwater Division and Birch Bay Watershed and Aquatic Resources Management District, Seattle, WA.
- Thom, R.M., & Hallum, L. 1990. Long-term changes in the areal extent of tidal marshes, eelgrass meadows and kelp forests of Puget Sound. Prepared by Wetland Ecosystem Team, Fisheries Research Institute, University of Washington for U.S. Environmental Protection Agency, Washington, D.C.
- Thompson, J.N. 1994. The coevolutionary process. Chicago, IL; University of Chicago Press. 383 p.
- Tollit, D., Joy, R., & Wood, J. 2017. Estimating the effects of noise from commercial vessels and whale watch boats on Southern Resident Killer Whales. Prepared by SMRU Consulting for the ECHO Program of Vancouver Fraser Port Authority. Vancouver, BC.
- Trumble, R.J., Thorne, J., & Lemberg, N.A. 1982. The Strait of Georgia herring fishery: A case history of timely management aided by hydroacoustic surveys. *Fishery Bulletin* 80(2):381-388.
- U.S. Army Corps of Engineers. 2016. Gateway Pacific Terminal Project and Lummi Nation's Usual and Accustomed Treaty Fishing Rights at Cherry Point, Whatcom County. Memorandum CENWS-OD-RG.
- U.S. Energy Information Administration. n.d. [Internet]. Refinery capacity report archives. [Cited 02-June-2020]. Available from <https://www.eia.gov/petroleum/refinerycapacity/>
- U.S. Environmental Protection Agency. n.d. [Internet]. Ecosystems and air quality. [Cited 09-Feb-2021]. Available from <https://www.epa.gov/eco-research/ecosystems-and-air-quality>
- U.S. Fish and Wildlife Service, Nottawaseppi Huron Band of the Potawatomi Tribe, and Match-E-Be-Nash-She-Wish Band of the Pottawatomi Indians. 2015. Final damage assessment and restoration plan/environmental assessment for the July 25-26, 2010 Enbridge Line 6B oil discharges near Marshall, MI. Marshall, MI.
- U.S. Fish and Wildlife Service. 2006 September 12. Revised critical habitat proposed for marbled murrelet. [Press release].

- Van Dorp, J.R. & Merrick, J. 2017. 2015 Vessel traffic risk assessment (VTRA): A POTENTIAL oil loss comparison of scenario analyses by four spill size categories. Report No. 17-08-009. Washington State Department of Ecology, Washington D.C.
- Varshney, C.K., Garg, J.K., Lauenroth, W.K., & Heitschmidt, R.K. 1979. Plant responses to sulfur dioxide pollution. *Critical Reviews in Environmental Science and Technology* 9(1):27-49.
- Vines, C.A., Robbins, T., Griffin, F.J., & Cherr, G.N. 2000. The effects of diffusible creosote-derived compounds on development in Pacific herring (*Clupea pallasii*). *Aquatic Toxicology* 51(2):225-239.
- Wahl, T.R., Speich, S.M., Manuwal, D.A., Hirsch, K.V., & Miller, C. 1981. Marine bird populations of the Strait of Juan de Fuca, Strait of Georgia, and adjacent waters in 1978 and 1979. Report No. Report No. PB-82-132622. Prepared by the University of Washington for the MESA (Marine Ecosystems Analysis) Puget Sound Project of the Environmental Protection Agency. Seattle, WA.
- Wale, M.A., Simpson, S.D., & Radford, A.N. 2013. Size-dependent physiological responses of shore crabs to single and repeated playback of ship noise. *Biology Letters* 9:20121194.
- Washington Department of Ecology. 2012. Final report on Pacific herring (*Clupea pallasii*) test development and validation with an appendix on herring embryo temperature tolerance comparisons between west coast stocks. Publication No. 11-10-086. Olympia, WA.
- Washington Department of Ecology. 2012-2023. VEAT - Vessel Entries and Transits for Washington Waters. Annual Report No. 12-08-003, 13-08-003, 14-08-004, 15-08-012, 16-08-006, 17-08-001, 18-08-001, 19-08-001, 20-08-004, 21-08-007, 22-08-002, 23-08-005. Olympia, WA.
- Washington Department of Ecology. 2014. Eyes over Puget Sound: 2013 Review. Publication No. 13-03-081. Olympia, WA.
- Washington Department of Ecology. 2018a. Washington State 2014 Comprehensive Emissions Inventory. Air Quality Program. Olympia, WA.
- Washington Department of Ecology. 2018b. Washington State Implementation Plan Revision: Interstate Transport of Sulfur Dioxide and Ozone. Report No. 18-02-005. Olympia, WA.
- Washington Department of Ecology. 2019. 30 years of spill prevention, preparedness, and response. Report No. 18-08-012. Olympia, WA.
- Washington Department of Ecology. 2019b. Report of Vessel Traffic and Vessel Traffic Safety: Strait of Juan de Fuca and Puget Sound Area. Report No. 19-08-002. Olympia, WA.
- Washington Department of Ecology. 2020a. 2017 Washington comprehensive emissions inventory technical support document. Report No. 20-02-012. Olympia, WA.
- Washington Department of Ecology. 2020b. [Internet]. Spills maps. [29-April-2020]. Available from https://apps.ecology.wa.gov/coastalatlant/storymaps/spills/spills_sm.html?&Tab=nt3
- Washington Department of Ecology. 2020c. [Internet]. Fact sheet for NPDES permit WA0029556. [Cited 12-Apr-2021]. Available from <https://apps.ecology.wa.gov/paris/DownloadDocument.aspx?Id=353544>
- Washington Department of Ecology. 2021a. [Internet]. Synopsis of vessel activity. [Cited 10-Feb-2021]. Available from <https://ecology.wa.gov/About-us/Get-to-know-us/Our-Programs/Spills-Prevention-Preparedness-Response/Legislative-work/Vessel-activity-synopsis>

Washington Department of Ecology. 2021b. [Internet]. Risk modeling. [Cited 10-Feb-2021]. Available from <https://ecology.wa.gov/Spills-Cleanup/Spills/Oil-spill-prevention/Safety-of-Oil-Transportation-Act/Risk-model>

Washington Department of Ecology. 2021c. Vessel Activity Synopsis: Maritime activity in the Northern Puget Sound and Strait of Juan de Fuca. Report No. 21-08-08. Olympia, WA.

Washington Department of Fish and Wildlife. 2005. Washington's comprehensive wildlife conservation strategy. Olympia, WA.

Washington Department of Fish and Wildlife. 2011. Puget Sound rockfish conservation plan. Olympia, WA.

Washington Department of Fish and Wildlife. 2015. State wildlife action plan update: Appendix A-2 - Species of greatest conservation need fact sheets: Birds.

Washington Department of Fish and Wildlife. 2020. Draft Drayton Harbor European green crab (*Carcinus maenas*) response MOU.

Washington Department of Fish and Wildlife. n.d.a [Internet]. Birch Bay State Park: Clam, mussel and oyster season OPEN for harvest year-round. [Cited 07-Apr-2021]. Available from <https://wdfw.wa.gov/places-to-go/shellfish-beaches/200060>

Washington Department of Fish and Wildlife. n.d.b [Internet]. European green crab (*Carcinus maenas*). [Cited 07-Apr-2021]. Available from <https://wdfw.wa.gov/species-habitats/invasive/carcinus-maenas#desc-range>

Washington Department of Fish and Wildlife. n.d.c [Internet]. Killer whale (*Orcinus orca*). [Cited 02-Feb-2021]. Available from <https://wdfw.wa.gov/species-habitats/species/orcinus-orca#desc-range>

Washington Department of Fish and Wildlife. n.d.d [Internet]. Varnish clam (*Nuttallia obscurata*). [Cited 02-Feb-2021]. Available from <https://wdfw.wa.gov/species-habitats/invasive/nuttallia-obscurata>

Washington Department of Natural Resources. 2001. The Washington State ShoreZone Inventory. Nearshore Habitat Program. Olympia, WA. Available from: <https://www.dnr.wa.gov/programs-and-services/aquatics/aquatic-science/nearshore-habitat-inventory>

Washington Department of Natural Resources. 2016. Proposed boundary change for the Cherry Point Environmental Aquatic Reserve. Online accessed on 4/7/21. Available from https://www.dnr.wa.gov/publications/aqr_resv_cp_boundary_proposal_final.pdf

Washington Department of Natural Resources. 2019a. Acidification Nearshore Monitoring Network: 2019 State of ANeMoNe. Online accessed on 4/7/21. Available from https://www.dnr.wa.gov/publications/aqr_aamt_2019_anemone_report.pdf

Washington Department of Natural Resources. 2019b. Habitat Stewardship Standards [Factsheet].

Washington Sea Grant. n.d. [Internet]. Washington State's boat fleet – 2018. [Cited 09-Feb-2021]. Available at <https://wsg.washington.edu/community-outreach/outreach-detail-pages/washington-state-boat-fleet/>

Weakland, S. 2020. Personal communication with Sandra Weakland, Washington Department of Ecology natural resource scientist. Email, record on file—DNR Aquatic Reserves Program, Olympia, WA.

Weather Spark. n.d. [Internet]. Climate and average weather year round in Birch Bay. [Cited 09-Feb-2021]. Available from <https://weatherspark.com/y/993/Average-Weather-in-Birch-Bay-Washington-United-States-Year-Round>

Wenger, B. 2020. Personal communication with Barry Wegner, CPAR Implementation Committee member. Zoom meeting communication, record on file—DNR Aquatic Reserves Program, Olympia WA.

West, J.E., O'Neill, S.M., Ylitalo, G.M., Incardona, J.P., Doty, D.C., & Dutch, M.E. 2014. An evaluation of background levels and sources of polycyclic aromatic hydrocarbons in naturally spawned embryos of Pacific herring (*Clupea pallasii*) from Puget Sound, Washington, USA. *Science of the Total Environment* (15)499:114-124.

Whatcom County Code § 23.30.022 Shoreline area designations. 2021. Available from <https://www.codepublishing.com/WA/WhatcomCounty/html/WhatcomCounty23/WhatcomCounty2330.html#23.30.022>

Whatcom County Code, § 23.100.170 Cherry Point management area. 2021. Available from <https://www.codepublishing.com/WA/WhatcomCounty/html/WhatcomCounty23/WhatcomCounty23100.html#23.100.170>

Whatcom County Marine Resources Committee. 2001. The marine resources of Whatcom County. Prepared by Anchor Environmental, LLC for Whatcom County MRC. Online accessed on 6/18/08. Available from www.whatcommrc.wsu.edu/mrc/projects/studies/MarineResourcesReport_finalApril2001.pdf

Whatcom County Marine Resources Committee. 2007. Whatcom County Marine Resources Committee – Fish Facts. Online accessed on 7/13/2007. Available from www.whatcommrc.wsu.edu/Fact_Sheets/

Whatcom County Planning and Development Services. 2016. Whatcom County Comprehensive Plan: Adopted August 9, 2016. Available from <https://www.whatcomcounty.us/1171/Current-Comprehensive-Plan>

Whatcom County Ordinance 2021-046. Ordinance adopting amendments to the Whatcom County Comprehensive Plan and Whatcom County Code relating to the Cherry Point UGA fossil fuel facilities, renewable fuel facilities, piers, SEPA, greenhouse gas emissions, and other matters. 2021. Available from: <http://documents.whatcomcounty.us/weblink8/0/doc/4795624/Page1.aspx?searchid=398a4877-53fd-4483-94f0-7a7befcf395f>

Whatcom Watch. 2012. [Internet]. Our living jewel – Cherry Point Aquatic Reserve. [Cited Nov-2019]. Available from http://www.whatcomwatch.org/pdf_content/OurLivingJewelOct2012.pdf

Wigfield, K. 2021. Personal communication with Kim Wigfield, Washington Department of Ecology. Email, record on file—DNR Aquatic Reserves Program, Olympia WA.

Wikipedia. [Internet]. Fort Langley National Historic Site. [Cited 04-16-2020]. Available from https://en.wikipedia.org/wiki/Fort_Langley_National_Historic_Site

Wiles, G.J. 2015. State of Washington periodic status review for the Steller sea lion. Washington Department of Fish and Wildlife, Olympia, WA.

Williams, B.K., & Brown, E.D. 2012. Adaptive Management: The U.S. Department of the Interior applications guide. Adaptive Management Working Group, U.S. Department of the Interior, Washington, DC.

Williams, G.D., Thom, R.M., Starkes, J.E., Brennan, J.S., Houghton, J.P., Woodruff, D., Striplin, P.L., Miller, M., Pedersen, M., Skillman, A., Kropp, R., Borde, A., Freeland, C., McArthur, K., Fagerness, V., Blanton, S., & Blackmore, L. 2001. Reconnaissance assessment of the state of the nearshore ecosystem: eastern shore of Central Puget Sound, including Vashon and Maury Islands (WRIAs 8 and 9). J.S. Brennan, Editor. Prepared for King County Department of Natural Resources, Seattle, WA.

Williams, R., Wright, A.J., Ashe, E., Blight, L.K., Bruintjes, R., Canessa, R., Clark, C.W., Cullis-Suzuki, S., Dakin, D.T., Erbe, C., Hammond, P.S., Merchant, N.D., O'Hara, P.D., Purser, J., Radford, A.N., Simpson, S.D., Thomas, L., & Wale, M.A. 2015. Impacts of anthropogenic noise on marine life: Publication patterns, new discoveries, and future directions in research and management. *Ocean and Coastal Management* 115:17-24.

Williams, R.W., Laramie, R.M., & Ames, J.J. 1975. A catalog of Washington streams and salmon utilization. Volume 1: Puget Sound Region. Prepared for Washington Department of Fish and Wildlife, Olympia, WA.

Wonham, M.J., O'Connor, M., & Harley, C.D.G. 2003. Multiple positive interactions among mudflat invaders. Presented during the Third International Conference on Marine Bioinvasions, La Jolla, CA. March 16-19, 2003.

WoRMS Editorial Board (2021). World Register of Marine Species. Available from <http://www.marinespecies.org> at VLIZ. Accessed 2021-12-16. doi:10.14284/170

Xiao, Y., Simonsen, J., & Morrell, J.J. 2002. Effects of water flow rate and temperature on leaching from creosote-treated wood. Report No. FPL-RN-0286. Prepared by Oregon State University for the U.S. Department of Agriculture. Madison, WI.

Yoshinaka, M.S. & Ellifrit, N.J. 1974. Hood Canal, Priorities for tomorrow: An initial report on fish and wildlife, developmental aspects and planning considerations for Hood Canal, Washington. Prepared for U. S. Fish and Wildlife Service. Portland, OR.

Zervas, C., Gill, S., Sweet, W. 2013. Estimating vertical land motion from long-term tide gauge records. Report No. NOS CO-OPS 065. National Oceanic and Atmospheric Association, Silver Spring, MD.