Port of Seattle®

PORT OF SEATTLE

UNDERWATER NOISE MITIGATION AND MANAGEMENT PLAN (UNMMP)

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ACKNOWLEDGEMENT

The Port of Seattle exists on Indigenous land. We acknowledge the ancestral homelands of those who walked here before us and those who still walk here, keeping in mind the integrity of this territory where Native peoples identify as the Duwamish, Suquamish, Snoqualmie, and Puyallup, as well as the tribes of the Muckleshoot, Tulalip, other Coast Salish peoples, and their descendants. We are grateful to respectfully live and work as guests on these lands with the Coast Salish and Native people who call this home. This land acknowledgement is one small act in the ongoing process of working to be in good relationship with the land and the people of the land.

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

The Port's Interest in Underwater Noise

Central Puget Sound is habitat for several species of threatened and endangered marine mammals, birds, and fish—most notably southern resident killer whales, a "keystone" species for conservation efforts. Underwater noise impacts the southern resident killer whales ability to feed, communicate, navigate, reproduce, and avoid danger. Without action, underwater noise will continue to impact killer whales.

The Port of Seattle (Port) is committed to helping ensure that commerce, communities, and southern resident killer whales can co-exist. While the Port does not have direct control over most port-related activities that generate underwater noise, it plays an important role in addressing the issues by focusing on these areas:

- Leadership in environmentally responsible stewardship of marine facilities
- Advocacy for sound policy, regulations, and practices related to underwater noise
- Financial investments and studies to advance scientific knowledge
- Partnerships with industry, government agencies, tribes, and non-profits

The Plan

This Underwater Noise Mitigation and Management Plan (Plan) describes the Port's approach to reduce potential adverse effects of underwater noise on marine mammals and other sensitive species. It focuses on two main port-related sources of underwater noise: vessel movement and in-water construction. The Plan is designed to meet the Level 3 Criteria for the Green Marine Underwater Noise Performance Indicator, and will provide the framework for achieving Level 4 and Level 5 Criteria.

Plan Objectives

- Increase the Port's knowledge of underwater noise sources, levels, and impacts in and around the Port from construction, terminal operations, and near-port vessel movement
- Raise awareness among Port users and tenants of the effects of underwater noise on marine mammals
- Identify and implement opportunities for underwater noise reduction within Port, tenant, and user operations
- Collaborate with regional ports, agencies, tribes, industry, and other organizations as a member of the Quiet Sound program to reduce impacts of underwater noise from commercial vessels on marine mammals in Puget Sound
- Develop recommendations for future actions, including an underwater noise assessment program to inform development of noise reduction targets

Plan Scope

The Plan focuses on the seaport-related functions of the Port, as well as associated near-port vessel and freight movements. The Port's facilities included in the Plan are its cruise terminals, fishing and commercial marinas, recreational marinas, grain terminal, maritime properties, and waterfront parks. To a more limited extent, the Plan also addresses underwater noise from marine container and breakbulk terminals that are owned by the Port but managed by the Northwest Seaport Alliance, a marine cargo partnership between the Port of Seattle and the Port of Tacoma.

The geographic scope of the Plan is limited to the Port operations area in Central Puget Sound, which includes Elliott Bay, Shilshole Bay, Salmon Bay, Lake Washington Ship Canal, and the Duwamish River.

Noise Sources and Impacts

Primary sources of underwater noise in the Port operations area are in-water construction and vessel operations. In-water construction noise sources include pile driving, pile removal, and, to a lesser extent, dredging. Pile driving can increase noise levels to volumes that cause hearing threshold shifts in marine mammals if not mitigated.

Vessels contribute noise to the aquatic environment through propulsion systems, machinery, and flow from the hull shape as it passes through the water. Vessel noise reduces communication spaces for aquatic species that rely on sound for communication, navigation, orientation, and hunting.

Noise volume and its effects on marine species vary by activity and associated sound intensity, frequency, duration, and timing.

Species found within the Port Operations Area

Nine Endangered Species Act-listed species may occur within the marine Port operations area. These include:

- Puget Sound Chinook salmon
- Puget Sound steelhead trout
- Bull trout
- Bocaccio and yelloweye rockfish
- Southern Resident Killer Whales
- Humpback whales
- Marbled murrelets
- Leatherback turtles.

In addition, transient killer whales, gray whales, minke whales, bottlenose and common dolphins, harbor porpoises, Steller sea lions, California sea lions, and harbor seals use the area and also benefit from strategies employed to protect target species.

Strategies to Understand and Reduce Underwater Noise

The Port complies with its legal responsibilities as a facility owner and operator but does not have direct or regulatory control over many noise-generating activities that may impact marine mammals, fish, and birds. Thus, the Plan focuses on how the Port can leverage its influence through leadership, investment, collaboration, and advocacy.

The Port's role in the state's recently launched Quiet Sound program is a key example of this approach: the Port collaborated with regional ports, agencies, tribes, and other organizations to develop a blueprint to reduce impacts of underwater noise from large commercial vessels on marine mammals. Those plans evolved into Quiet Sound, a voluntary, collaborative program now led by Washington Maritime Blue. The Port is an active founding member, providing funding, leadership, and technical support on three of the program's five working groups and membership in its Leadership Committee.

In addition to its Quiet Sound work, the Plan identifies other strategies and actions to be taken through 2024 to address underwater noise, as shown in Table ES-1.

Targets

This first edition of the Plan does not include numeric targets for underwater noise level reduction. Targets will be set after baseline sound levels have been established through data collection efforts planned over the next several years.

Adaptive Management

The Port will take an adaptive management approach to monitoring and updating the Plan. As strategies are implemented, progress will be assessed. The Port will revise goals and targets as they are met and develop new tactics as needed to achieve success. The Plan will be reviewed and updated every two years.

Table ES-1. Summary of Port of Seattle Underwater Noise Mitigation and Management Plan strategies and recommended actions.

UNDERWATER NOISE MANAGEMENT PROGRESS AND RECOMMENDED ACTIONS

	2022 PROGRESS TO DATE	2023-2024 RECOMMENDED ACTIONS
Best Management Practices (BMPs)	• Before starting pile-driving projects, exclusion zones are determined to ensure protected species are not harmed • During pile driving projects, monitors are onsite to observe for presence of target species; work is halted if target species are sighted • In-water construction coincides with published in-water work windows during which protected species are less likely to be present • Construction BMPs are maintained, communicated, and followed	• Continue to follow existing BMPs • Update BMPs as new technologies or methods (e.g., use of double-walled pile or custom bubble curtains) are developed
Research and Development	• Funding was provided for design and testing of innovative pile design—double-walled pile; the design aimed to reduce noise during in-water construction • An innovative, custom bubble curtain was designed and implemented to attenuate noise during pile driving of sheet pile	• Continue to develop and t technologies and methodologies that may reduce underwater noise levels as opportunities arise

Leadership in environmentally responsible stewardship of marine facilities

Financial investments and studies to advance scientific knowledge

Advocacy for sound policy, regulations, and practices related to underwater noise

Partnerships with industry, government agencies, tribes, and non-profits

	2022 PROGRESS TO DATE	2023-2024 RECOMMENDED ACTIONS
Underwater Noise Studies	• Underwater noise levels were measured during dredging to assess noise levels compared to background levels • The Port funded a study by UW/ NOAA to conduct a gap analysis of the hydrophone network in the Salish Sea • The Port launched an Ambient Noise Assessment Program in 2022 to collect baseline underwater noise data in Elliott Bay • Port Environmental staff sit on the Monitoring Whales and Vessel Noise working group as part of the Quiet Sound program which oversees various underwater noise studies	• Purchase hydrophone equipment to improve the regional monitoring network with any remaining funds from the UW/ NOAA study • Continue to measure background noise levels in Elliott Bay through the Ambient Noise Assessment Program • Maintain a seat on the Monitoring Whales and Vessel Noise Quiet Sound working group • Establish plan-specific noise reduction target(s) will be set once background noise levels are established
Outreach & Education	• Signs are posted at recreational marinas to educate boaters about best practices and laws when operating around marine mammals • Through Quiet Sound, funding was provided for the WhaleReport Alert System (WRAS) which notifies mariners of the presence of whales in the area • The Port contracted with OceanWise to provide training and promote use of the WRAS • Port Environmental staff sit on the Quiet Sound program's Whale Notification to Vessels working group as part of the Quiet Sound program • The Port uses social media and other platforms to share information with the public about underwater noise	• Maintain and improve educational signage at marinas • Maintain a seat on the Quiet Sound Whale Notification to Vessels working group; the group will work to fund the WRAS and improve WRAS accessibility • Continue to communicate about impacts of underwater noise via this Plan, blogs, social media, and web posts • Consider hosting a one-day voluntar event offering measurement of underwater vessel noise levels to recreational boaters

Leadership in environmentally responsible stewardship of marine facilities

Financial investments and studies to advance scientific knowledge

Advocacy for sound policy, regulations, and practices related to underwater noise

Partnerships with industry, government agencies, tribes, and non-profits

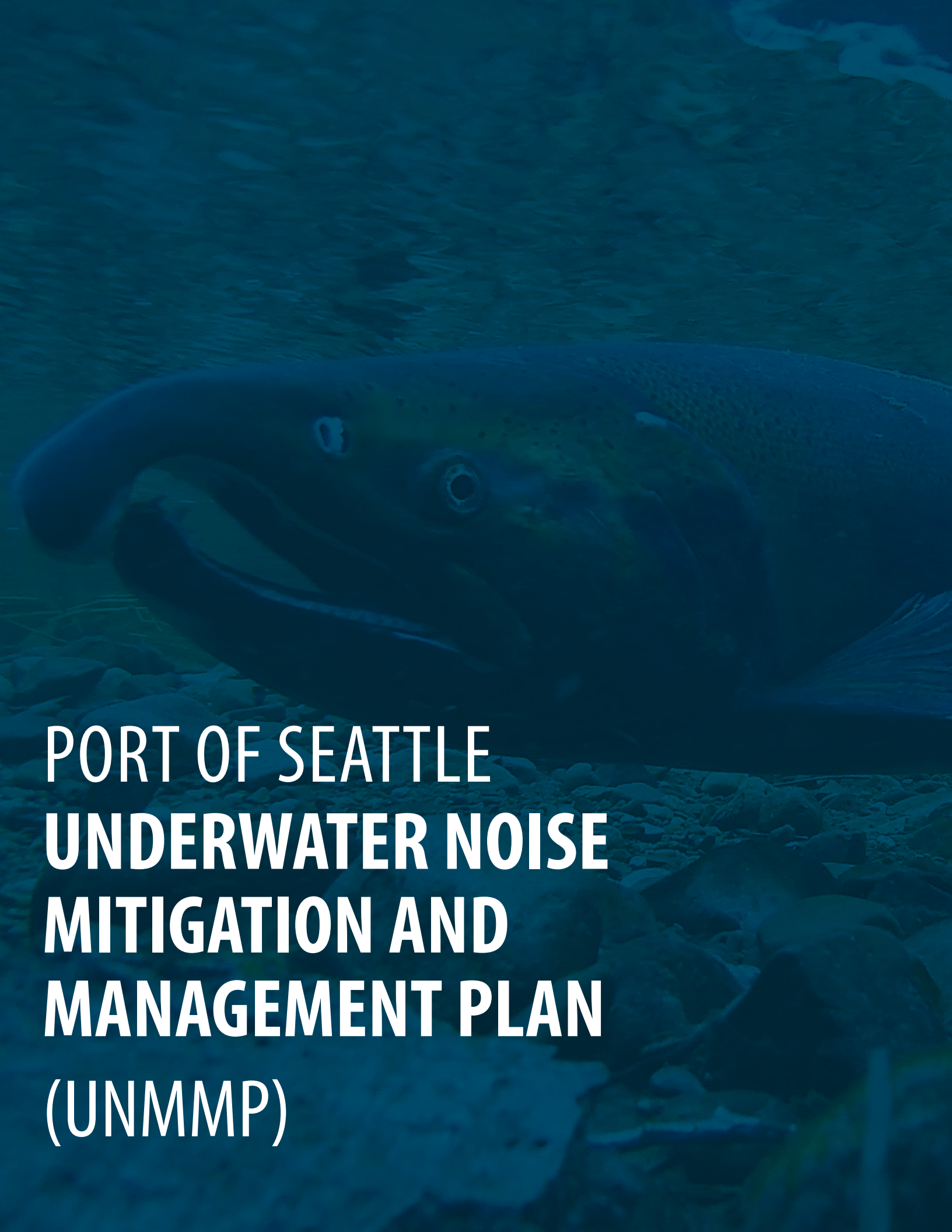
	2022 PROGRESS TO DATE	2023-2024 RECOMMENDED ACTIONS
Improvements in Vessel Design/Operation	• The scope of the Port's Sustainable Century Awards was expanded to recognize efforts of customers, tenants, and partners to reduce underwater noise • Port Environmental staff sit on the Quiet Sound program's Vessel Operations and Incentives working group which is planning a pilot study to test seasonal vessel slowdowns	• Explore feasibility of financial and non-financial incentives for vessel owners to reduce underwater noise via vessel design or operations • Explore expansion of a proposed "Green Corridor" — a zero emissions cruise operation zone—to include noise reduction • Install shore power at the Pier 66 cruise terminal to enable cruise engines to shut down while at berth • Maintain a seat on the Quiet Sound Vessel Operations and Incentives working group
COllaboration & Amplification	• The Port was a founding member of the Quiet Sound program, launched in 2021 to reduce underwater noise from large commercial vessels • The Port provided funding for the Seattle Aquarium's new Ocean Pavilion • The Port is an active member with a variety of industry associations that can advance underwater noise programs	• Continue to provide annual funding to Quiet Sound • Encourage Seattle Aquarium to highlight underwater noise in its Ocean Pavilion exhibits • Consider partnering with Maritime Blue to engage small vessel manufacturers on developing quieter mechanical components • Seek opportunities to partner with University of Washington, Maritime Blue, and others on new BMP technologies
Legislative Advocacy	• The Port strongly supports underwater noise regulation by the International Maritime Organization • The Port advocates for adoption of federal regulations such as HR 6987 — Protecting Our Marine Mammals Act	• Continue to advocate for policy, laws, and regulations at the international, national, state, and local levels • Participate in potential Department of Ecology rulemaking in response to Governor's Southern Resident Orca Task Force Recommendation #27

Leadership in environmentally responsible stewardship of marine facilities

Financial investments and studies to advance scientific knowledge

Advocacy for sound policy, regulations, and practices related to underwater noise

Partnerships with industry, government agencies, tribes, and non-profits



PORT OF SEATTLE **UNDERWATER NOISE MITIGATION AND MANAGEMENT PLAN** (UNMMP)

1 ABOUT THE PORT & THIS PLAN

1.1 The Port's Interest in Underwater Noise

The Port of Seattle (Port) aims to be the "cleanest, greenest, most energy efficient Port in North America." The Port commits to this goal in its Century Agenda, a long-term strategic plan to stimulate economic development while remaining committed to social and environmental responsibility. Addressing underwater noise and its impact on endangered species, including southern resident killer whales, humpback whales, and marbled murrelets, is a logical extension of that goal. Underwater noise refers to sounds made by human activities that can interfere with or obscure the ability of marine animals to hear natural sounds in the ocean.

The Port's operations area in central Puget Sound is habitat for several species of threatened and endangered marine mammals, birds, and fish. Southern resident killer whales, in particular, are ecologically, culturally, and economically important to the region and have become a "keystone" species for conservation efforts. Underwater noise generated by nearshore construction projects, large commercial vessels, and other sources, adversely impacts the southern resident killer whales' ability to hunt for salmon, communicate, navigate, and avoid danger. Without action, underwater noise will continue to impact southern resident killer whales. The Port is committed to helping ensure that commerce, communities, and killer whales can co-exist.

Figure 1. Southern resident killer whale chases a Chinook salmon. Credit: John Durban/NOAA et al.

1.2 Plan Objectives

This Underwater Noise Mitigation and Management Plan (UNMMP or the Plan) describes the Port of Seattle's approach to better understand and reduce potential adverse effects of underwater noise on marine mammals and other sensitive species.

The Plan provides a framework to meet the following objectives:

- Increase the Port's knowledge of underwater noise sources, levels, and impacts in and around the Port from construction, terminal operations, and near-port vessel movement
- Raise awareness among Port users and tenants of the effects of underwater noise on marine mammals
- Identify and implement opportunities for underwater noise reduction within Port, tenant, and user operations
- Collaborate with regional ports, agencies, tribes, industry, and other organizations as a member of the Quiet Sound program to reduce impacts of underwater noise from commercial vessels on marine mammals in Puget Sound
- Develop recommendations for future actions

To meet these objectives, the Port will focus on actions in these four strategic categories:

- Leadership in environmentally responsible stewardship of marine facilities
- Advocacy for sound policy, regulations, and practices related to underwater noise
- Financial investments and studies to advance scientific knowledge
- Partnerships with industry, government agencies, tribes, and non-profits

The Plan will also lay out the strategy for future development of an underwater noise assessment program, including noise reduction targets. The Plan is designed to meet the Level 3 Criteria for the Green Marine Underwater Noise Performance Indicator, and will provide the framework for achieving Level 4 and Level 5 Criteria.

1.3 Plan Scope

The UNMMP focuses on the seaport-related functions of the Port, including the operations of the waterside and upland facilities of the Port's Economic Development, Real Estate, and Maritime Divisions, as well as associated near-port vessel and freight movements. The geographic scope of the Plan is limited to the Port operations area in Central Puget Sound, which includes Elliott Bay, Shilshole Bay, Salmon Bay, Lake Washington Ship Canal, and the Duwamish River (Figure 2).

To a more limited extent, the Plan also addresses underwater noise from marine container and breakbulk terminals that are owned by the Port but managed by The Northwest Seaport Alliance (NWSA), a separate port development authority. The NWSA is a marine cargo partnership formed by the Ports of Seattle and Tacoma in 2015 to unify the Puget Sound marine cargo gateway. While each port operates as a distinct organization and runs its own environmental stewardship programs, the Port and NWSA have aligned goals and collaborate regularly. (For example, the Port does not interface with NWSA tenants or cargo-shipping operations but may oversee construction projects

on NWSA-managed terminals.) This Plan does not address operations of Seattle-Tacoma International Airport.

1.4 Port Operations

The Port, founded in 1911, is a special purpose government under Washington State law. The Port is governed by five Commissioners elected at large by the voters of King County. The mission of the Port is to promote economic opportunities and quality of life in the region by advancing trade, travel, commerce, and job creation in an equitable, accountable and environmentally responsible manner.

The Port runs a world-class seaport in the City of Seattle in Central Puget Sound. Due to the naturally deep waters, the Port can serve some of the largest vessels in the world. The key lines of business include cruise, grain export, commercial fishing, recreational and commercial marinas, and commercial real estate management, as summarized below:

Cruise Terminals

Seattle is the largest and fastest growing cruise market on the West Coast. The Port has two cruise terminals (Bell Street Pier Cruise Terminal at Pier 66 and Smith Cove Cruise Terminal at Pier 91) which serve as homeport for cruise ships headed to Alaska. The cruise season generally runs between April and early October.

Fishing and Commercial Marinas

Fishermen's Terminal and Terminal 91 serve as homeport for the North Pacific Fishing Fleet and factory trawlers from September through June. The Port also offers commercial moorage for work boats and other commercial vessels at marinas and marine terminals throughout the seaport.

Recreational Marinas

The Port operates marinas for a wide range of boat types and sizes. Recreational moorage is offered at Bell Harbor Marina, Fishermen's Terminal, Harbor Island Marina, Salmon Bay Marina, and Shilshole Bay Marina.

Grain Terminal

Terminal 86, a fully automated grain terminal, is leased out to Louis Dreyfus Corporation. The terminal is served by two major railroads. Grain is moved from rail cars to on-terminal silos and then to ships' holds.

Maritime Properties

The Port operates the Maritime Industrial Center and leases out other industrial properties connected with maritime activities and businesses, as well as the Bell Harbor International Conference Center.

In addition, the Port owns container and breakbulk cargo terminals (Terminals 5, 18, 30, 46 and 115) that are managed by the Northwest Seaport Alliance (NWSA). These terminals import and export cargo via ship, rail, and truck.

Waterfront Parks

The Port has more than 60 acres of parks and public access sites that include trails, habitat restoration areas, fishing piers, shoreline access, and public plazas at several marinas. The parks are located throughout the seaport properties.

1.5 Port Responsibilities & Leadership

The Port has certain legal responsibilities as a facility owner and operator but does not have direct or regulatory control over many noise-generating activities that may impact marine mammals, fish, and birds. In alignment with its Century Agenda, the Port also leverages its influence by demonstrating leadership on underwater noise issues with its tenants, users, and others in the maritime community.

Leadership in environmentally responsible stewardship of marine facilities

The Port complies with all laws and regulations in operating, maintaining, and improving its properties, and requires tenants to do likewise. The Port operates its commercial and recreational marinas but leases its cruise and grain terminals and other facilities. As such, it is considered a "landlord port" that can influence, but not directly control, some operations on its properties. Leasing agreements require tenants to obtain Port approval before making any modifications to Port property; these agreements can be an opportunity for the Port to ensure environmental best management practices are followed.

Potential impacts of noise-generating activities on marine mammals, fish, and/or birds are evaluated through the environmental review processes required under the State Environmental Policy Act, National Environmental Policy Act (when applicable), the Endangered Species Act, the Marine Mammal Protection Act, and the Washington State Hydraulic Code. The Port abides by protective conditions imposed through the permitting process, follows published lists of Best Management Practices (BMPs) for in-water construction, and maintains its own list of BMPs to reduce impacts on marine species.

The Port goes beyond compliance by encouraging tenants to operate sustainably through educational outreach efforts, including environmental best management practices as lease terms and requirements in operational agreements with cruise lines, as well as environmentally focused recognition programs. Enhancements to these programs are on-going and can increase the emphasis on noise-generating activities and marine mammal protection over time.

Per state laws governing port authorities, the Port does not have jurisdiction over the waters of the state; therefore, it does not control vessel movement outside of Port property lines. Vessel traffic is regulated by the U.S. Coast Guard. In that sense, this Plan may refer to "near-port vessel movements" that may be influenced by the Port but excludes off-property vessel traffic regulated by the U.S. Coast Guard.

Advocacy for sound policy, regulations, and practices

As a member of Green Marine, a voluntary environmental certification program for the maritime industry, the Port is taking meaningful actions to continually reduce its environmental footprint above and beyond regulatory requirements — including developing this Plan and collaborating with member organizations to establish best practices for underwater noise mitigation. The Port also supported Governor Jay Inslee's 2018-2019 Southern Resident Orca Task Force process, which developed recommendations to protect southern resident killer whales. The Port has, and will continue to, advocate for sound policy and practices through its membership in industry associations and support regulatory change through its legislative agenda which is guided by Century Agenda goals.

Financial investments and studies to advance scientific knowledge

The Century Agenda's economic objectives include advancing maritime industries through innovation and strategic investment. To that end, the Port has conducted various studies to advance scientific knowledge, including an evaluation of underwater noise generated from of various methods of pile driving, testing of novel pile designs to improve on noise attenuation methods, and monitoring of ambient underwater noise in the Port operations area. Moreover, the Port — together with the NWSA and Port of Tacoma—serves as a significant funding partner in the broader Quiet Sound program (discussed below).

Partnerships with industry and government

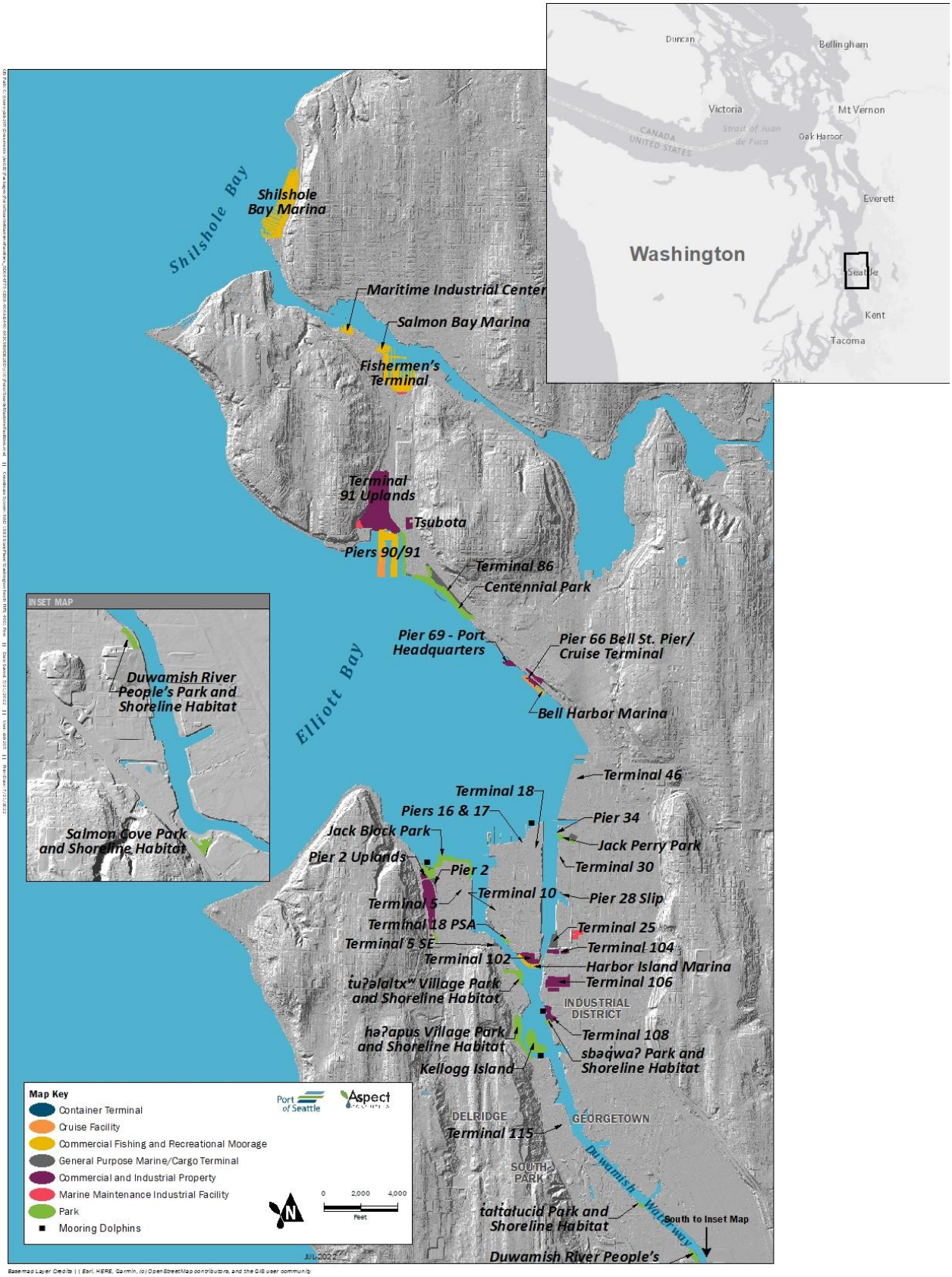
Governor Inslee's Orca Task Force identified three primary issues that threaten southern resident killer whale recovery: prey availability, toxins, and physical and acoustic disturbance from vessels. In response to the third issue, the Port collaborated with regional ports, agencies, tribes and other organizations to develop a blueprint for a program to reduce impacts of underwater noise from large commercial vessels on marine mammals in Washington waters. The recently launched Quiet Sound program is a voluntary collaborative program aimed at reducing the impacts to southern resident killer whales from large commercial vessels. Key program areas include notification to mariners regarding whale presence, monitoring whales and vessel noise, promoting voluntary operational changes to reduce underwater noise, supporting innovations that result in quieter commercial vessels, and adaptive management to ensure the program is achieving its goals. The Port is an active founding member of the Quiet Sound program, which is led by Washington Maritime Blue.

1.6 Public Engagement in developing the Plan

In developing this Plan, the Port engaged with Quiet Sound partners who represent various constituencies including industry, government, academia, and environmental groups. These partners provided valuable input on Quiet Sound priorities, potential mitigation actions, improving the underwater noise monitoring network, proposed legislation, and additional partnership, grant funding, and advocacy opportunities.

In addition, the Port plans to hold an online open house of the draft Plan via social media and Port content distribution networks. The opportunity will be advertised via the Port's website and electronic newsletters. It will also be presented to the Port of Seattle Commission in a public meeting.

Figure 2. Port of Seattle Maritime Facilities.



2 SOURCES & IMPACTS OF UNDERWATER NOISE IN PORT OPERATIONS AREAS

Primary sources of underwater noise in the Port operations area are in-water construction and vessel noise. Volume of in-water construction noise varies by activity: impact pile driving results in instantaneous impulses well above background levels, vibratory pile driving and removal result in continuous noise that is much quieter than impact driving, and dredging is barely detectable above background conditions in Elliott Bay (Grette Associates 2022). In-water construction noise is present only during the designated in-water work window, and is temporary, as it only occurs during project work.

Vessel operations are a constant source of noise in the Port operations area, both from vessels calling at Port properties and other vessels transiting the area. Vessel noise is typically quieter than some in-water construction but contributes to the elevated background levels within Elliott Bay.

Figure 3. A crane prepares for vibratory pile driving as various vessels maneuver throughout Elliott Bay. Credit: Sasha Ertl/Grette Associates

2.1 In-Water Construction

Pile driving is necessary for upkeep, maintenance, and construction of waterfront facilities such as docks, wharfs, and piers. The Port and many other maritime users regularly improve and maintain their waterfront facilities. Impact pile driving is the source of

underwater noise that produces the highest peak decibel levels with the Port operations area. Vibratory pile installation and removal operations also contribute to a raised ambient noise level. If not mitigated, underwater noise from pile driving activity can impact protected species by causing hearing threshold shifts (temporary or permanent), interference with communication (through masking), and/or a change in behavior (such as feeding, breeding, or migration). Each of these impacts is analyzed through the federal permitting process to ensure that adverse effects to protected species are not likely to occur. The Port consistently adheres to current Best Management Practices for pile driving operations, including those promulgated by the Washington State Department of Natural Resources and the U.S. Environmental Protection Agency.

Additional in-water construction elements with the potential to introduce noise to the marine environment include dredging, placement of sand or riprap, diver-assisted underwater work such as installation of cathodic protection or pile cutting, mechanical demolition that utilizes heavy equipment, shoreline regrading, sediment sampling using a vibracore, and bubble curtains used to insulate the water from impact pile driving noise. None of these activities are known to be considerably louder than vessel and other ambient noise occurring in Elliott Bay; however, they do contribute noise to the aquatic environment during the in-water work window. Dredging is not known to increase underwater noise beyond background levels (Grette Associates 2022).

Figure 4. Cranes prepare for pile installation as morning dawns at a Duwamish River restoration site. Credit: Sasha Ertl/Grette Associates

2.2 Vessel Movement

Vessel traffic is a significant contributor to elevated levels of noise in the Port operations area, both from vessels calling at the Port and vessels calling elsewhere. Many ocean-going vessels passing through Elliott Bay do not call or berth at Port of Seattle facilities; as shown in Table 1, most large vessel traffic throughout the Salish Sea is not associated with the Port's cruise and grain business lines.

In addition to cruise and grain ships, smaller vessels call at Port marinas and terminals, including commercial fishing vessels and factory trawlers, harbor tugs (used to escort grain ships in/out of port, among other work), other large and small commercial harbor vessels, and recreational vessels including superyachts.

Table 1. 2016 Origin/destination of ocean-going vessel movements (inbound, outbound, and shift) within U.S. portion of the Salish Sea.

Vessel Origin/Destination	Number of Vessel Movements
Port of Seattle	535
Northwest Seaport Alliance North Harbor (Elliott Bay)	928
All other origin/destination points	5,115
Total vessel movements	**6,578**

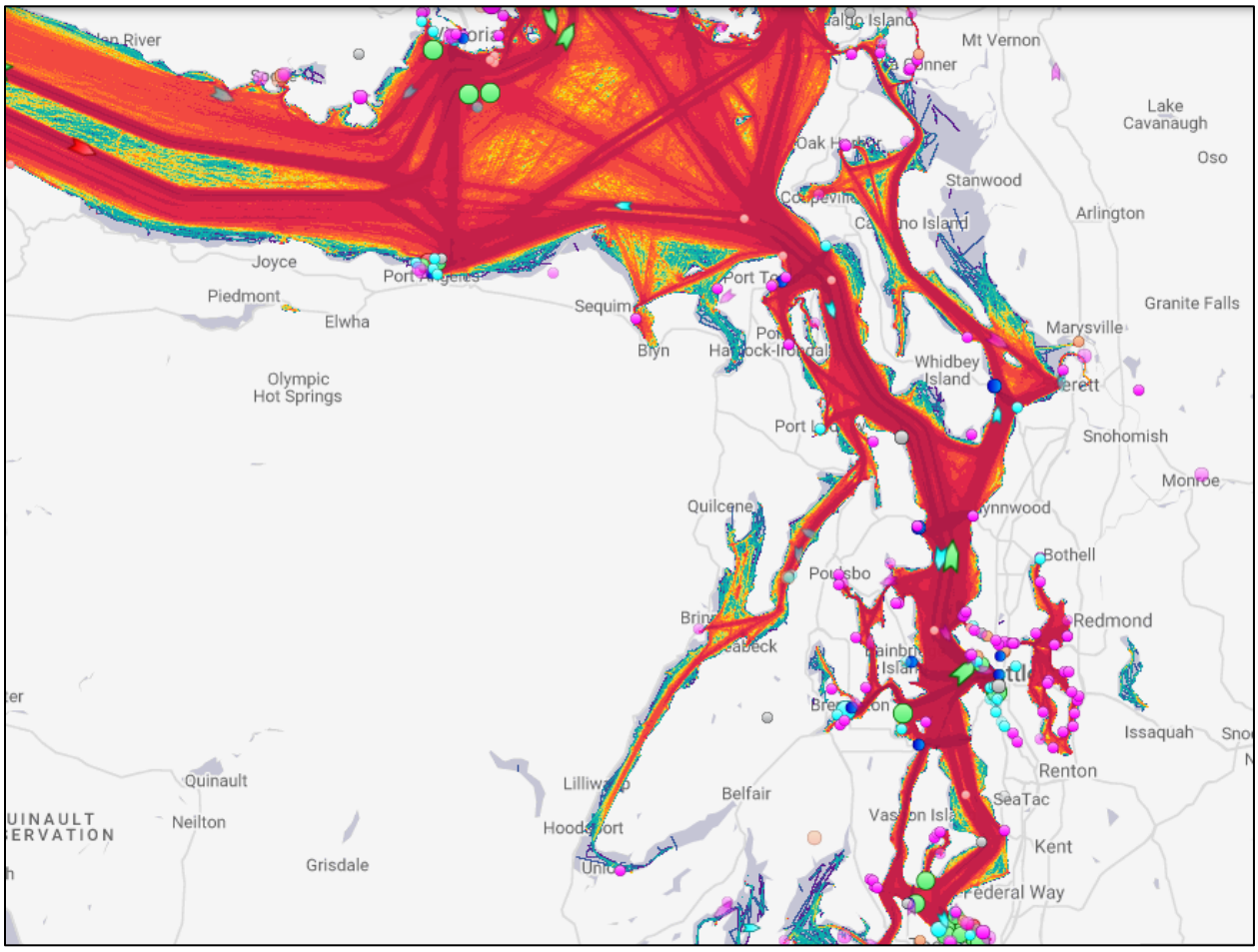
Source: 2016 Puget Sound Maritime Air Emissions Inventory

Sources of noise from vessels include propellers and thrusters, machinery, and flow (Abrahamsen 2012). Propeller noise is load-dependent – the main noise source is from cavitation caused as load increases and pressure fluctuations occur. Machinery noise may be caused by various sources contained within the hull of a ship. Any machinery coupled to pipes, ducts, shafts, etc. that are within the hull that is partially submerged in water will contribute to underwater noise. Flow noise is caused by the hull itself passing through the water. Flow noise is dependent on hull shape and design features (e.g., thruster tunnels, sea chests, etc.).

Elevated levels of vessel noise reduce communication space for species in the aquatic environment, which can lead to displacement from habitat (Putland et al. 2017; Tyack 2008). Aquatic species rely on sound for communication, navigation, orientation, and hunting. Increased noise causes interference that limits the communication range and the efficacy for those sounds to be interpreted, which can lead to abnormal behavior.

A large commercial vessel passing within 10 km of a habitat area can reduce the communication space for both marine mammals and fish by up to 99 percent compared to ambient noise levels (Putland et al. 2017). This can have lasting impacts on these populations. Studies indicate that for most vessel propulsion technologies, a reduction in vessel speed results in a reduction in sound source levels from the vessel. Speed and distance restrictions for southern resident killer whales are currently enforced, but those protections are designed to reduce the risk of collision rather than to reduce underwater noise.

Figure 5. Snapshot of Puget Sound vessel traffic based on data from ships' Automatic Identification Systems. Red shows highest density of traffic, blue shows lowest. Credit: ShipTraffic.net



2.3 Other Sources of Noise

In addition to in-water construction and vessel noise, Elliott Bay is an active industrial area with a variety of on-dock and upland activities that contribute to the general ambient noise levels through transmission to the water. Pier operations, including cargo/catch loading and unloading, vessel maintenance, and cargo and catch processing may transmit noise into the water, though any increase in noise is likely negligible. Underwater noise monitoring adjacent to a cargo terminal did not reveal elevated noise while containers were being craned onto trucks (Grette Associates 2022). Upland jackhammering or other construction in and around the Seattle waterfront may also contribute to elevated ambient noise levels.

Figure 6. A crane is positioned above a container to prepare for loading onto a ship at a Port terminal facility. Credit: Sasha Ertl/Grette Associates

3 SPECIES FOUND WITHIN THE PORT OPERATIONS AREA

Nine Endangered Species Act-listed species occur within the marine Port operations area. The species and their use of the waters of the Port operations area are outlined below and discussed in Appendix A. In addition, several species of marine mammals that are classified as "Species of Least Concern" under the Endangered Species Act may be found in the area. These include transient killer whales, gray whales, minke whales, bottlenose and common dolphins, harbor porpoises, Steller sea lions, California sea lions, and harbor seals. These species benefit from all the Best Management Practices employed to protect target species.

Table 2. Endangered Species Act-listed species found within the Port operations area.

Listed Species	Species Background
Puget Sound Chinook Salmon[1] (*Oncorhynchus tshawytscha*) 	**ESA:** Threatened **Designated Critical Habitat?** Yes **Stocks:** Green/Duwamish River Lake Washington **Present:** Adults: June–Oct Juveniles: Feb–Oct
Puget Sound Steelhead Trout[2] (*Oncorhynchus mykiss*) 	**ESA:** Threatened **Designated Critical Habitat?** No **Stocks:** Green/Duwamish River – Winter/Summer Lake Washington – Winter **Present:** Adults: Rare Juveniles: May–July
Bull Trout[3] (*Salvelinus confluentus*) 	**ESA:** Threatened **Designated Critical Habitat?** Yes **Stocks**: Cedar/Sammamish River **Present:** Adults: Rare Juveniles: Rare
Bocaccio Rockfish[2] (*Sebastes paucispinis*) 	**ESA:** Endangered **Designated Critical Habitat?** Yes **Stocks:** Puget Sound/Georgia Basin **Present:** Adults: Not documented since 2001 Juveniles: Unknown – not identified to species

Listed Species		Species Background
Yelloweye Rockfish[2] (*Sebastes ruberrimus*)		**ESA:** Threatened **Designated Critical Habitat?** Yes **Stocks:** Puget Sound/Georgia Basin **Present:** Adults: Rare Juveniles: Unknown – not identified to species
Southern Resident Killer Whale[2] (*Orcinus orca*)		**ESA:** Endangered **Designated Critical Habitat?** Yes **Stocks:** Southern Resident **Present:** Spring–Winter
Humpback Whale[4] (*Megaptera novaeangliae*)		**ESA:** Endangered, Threatened **Designated Critical Habitat?** No **Stocks:** Central America (Endangered) Mexico (Threatened) **Present:** Spring, Fall
Marbled Murrelet[5] (*Brachyramphus marmoratus*)		**ESA:** Threatened **Designated Critical Habitat?** No **Stocks:** Washington/Oregon/California **Present:** Transient; may be present during fall and spring migrations
Leatherback Turtle[2] (*Dermochelys coriacea*)		**ESA:** Endangered **Designated Critical Habitat?** No **Stocks:** Considered one stock **Present:** Undocumented in Puget Sound

[1]Credit: The Nature Conservancy
[2]Credit: NOAA Fisheries
[3]Credit: Joel Sartore/National Geographic and Wade Fedenberg/USFWS
[4]Credit: Ed Lyman/NOAA Fisheries
[5]Credit: USFWS

4 STRATEGIES TO UNDERSTAND & REDUCE UNDERWATER NOISE

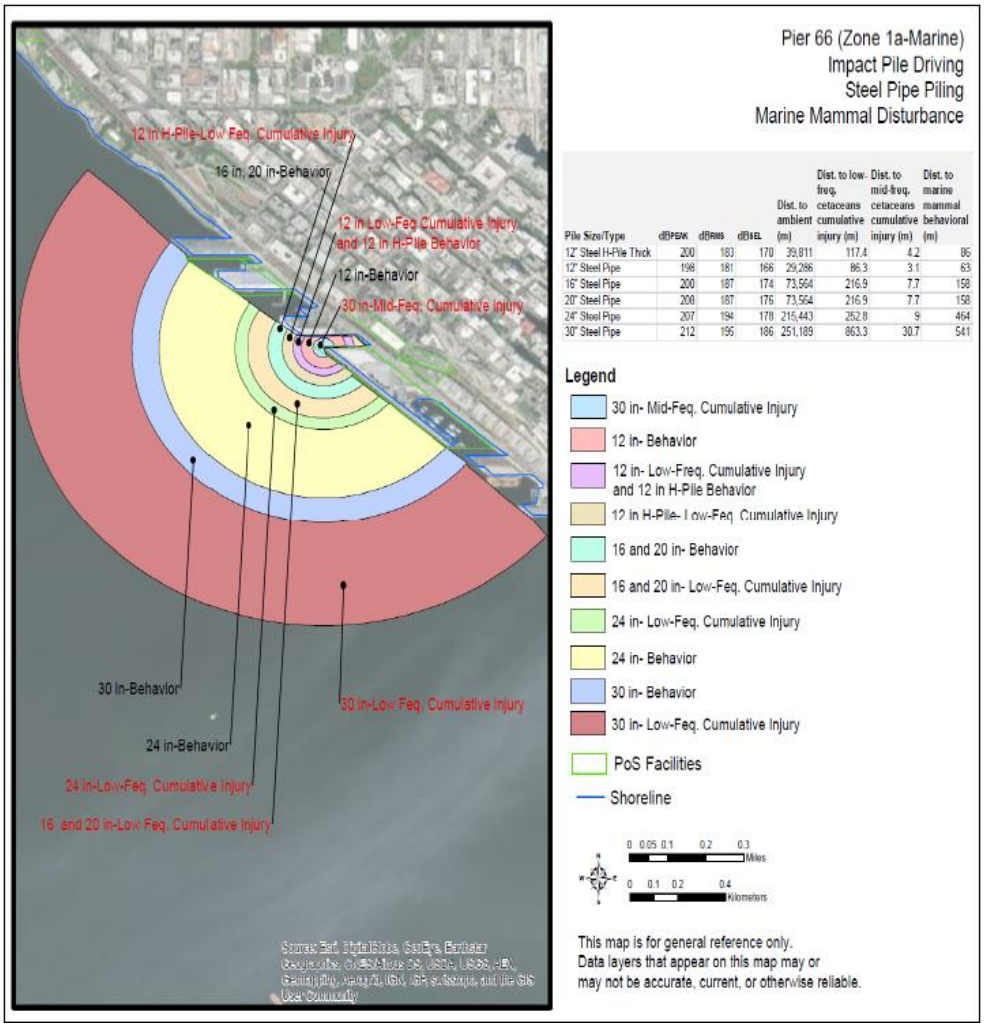
4.1 Best Management Practices

All Port in-water construction is conducted only when approved through federal, state, and local permitting, within the designated work windows (when protected species are least likely to be present) and following strict Best Management Practices (BMPs). Environmental analyses are completed to ensure projects are conducted in the least impactful way for the aquatic environment.

Pile Driving Analysis

During the environmental permitting process, biologists use modeling and project details to estimate the distances at which pile driving noise attenuates below harmful limits to wildlife. Maps are created showing boundaries around the noise source at which all endangered marine mammals and marbled murrelets may be disturbed. This creates the "monitoring zone" for each species for each project.

Figure 7. Monitoring zones for marine mammals based on a pile driving analysis. Credit: Port of Seattle



Marine Mammal/Marbled Murrelet Monitoring

During all in-water pile driving, marine mammal monitors are onsite to ensure no ESA-listed marine mammals enter the pre-determined (during the pile driving analysis) potential disturbance zones. If target species are sighted within the zone, pile driving operations are halted until the animal is no longer sighted within the zone. When applicable, marbled murrelet monitors are also onsite and follow the same protocol.

Figure 8. A marine mammal observer watches for protected marine mammals during pile driving operations in Elliott Bay. Credit: Sasha Ertl/Grette Associates

Work Windows

The U.S. Army Corps of Engineers and Washington Department of Fish and Wildlife designate in-water work windows – times during which protected fish species are not likely to be utilizing the waters of Puget Sound. The in-water work window for most of Elliott Bay and surrounding waters is August 1 through February 15, although this varies by specific location, type of construction activity, and species potentially present. The Port adheres to all in-water work windows and does not conduct in-water work outside of those times without special permission.

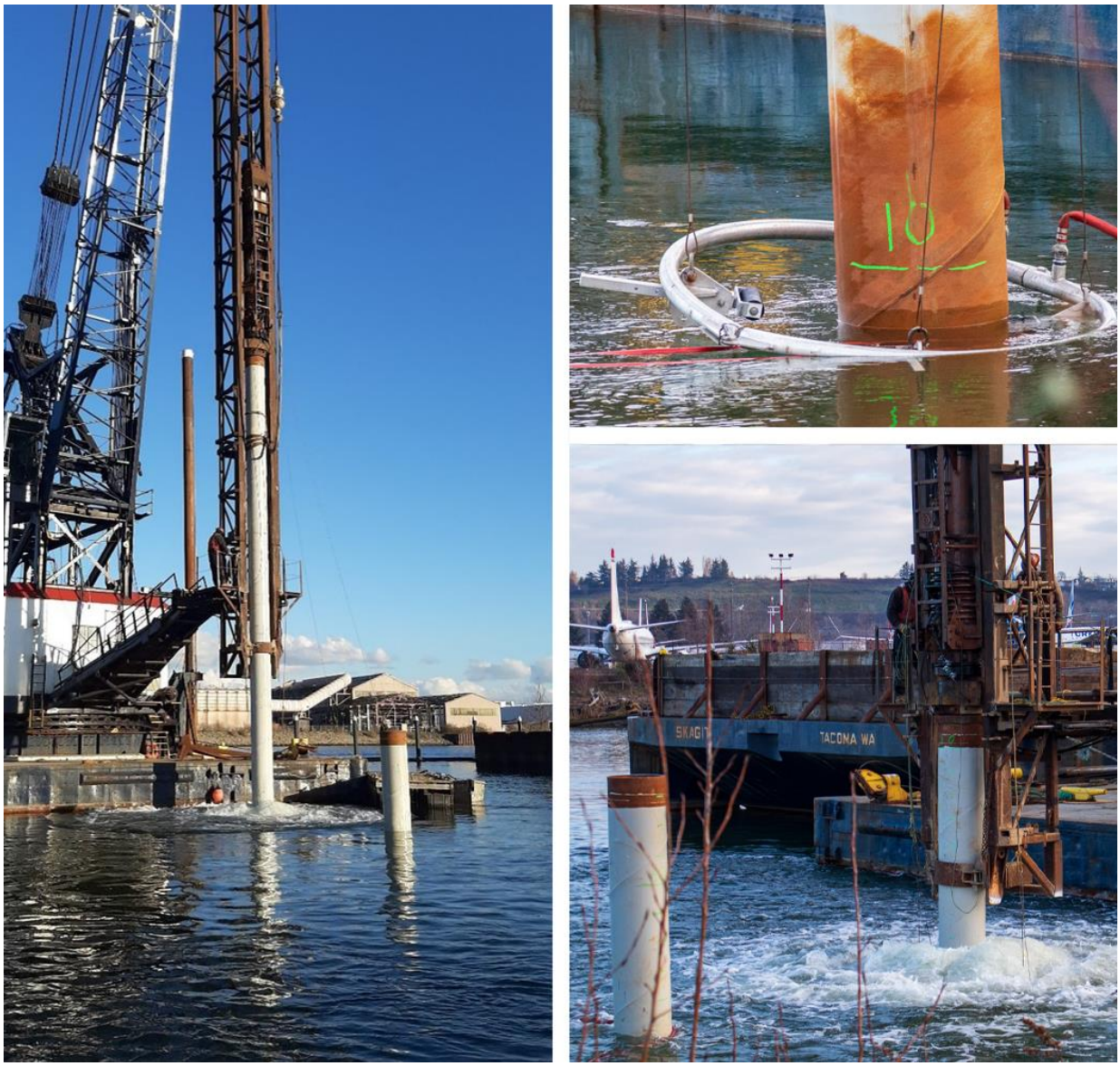
Construction BMPs

Impact driving has the greatest possibility of causing injury to protected species. Because of this, all Port pile driving operations are conducted using a vibratory hammer to the greatest extent possible. Vibratory hammers result in continuous noise that is considerably quieter than impact hammer operations, and thus are less likely to have harmful effects on protected species. However, studies have shown that due to the continuous nature and longer duration of this sound (it may take an hour to drive a pile rather than 15 minutes), marine mammals may change their behavior at lower volumes than for impact driving. To mitigate possible effects to marine mammals from vibratory pile driving, the Port employs qualified Marine Mammal Observers to ensure that no ESA-listed marine mammals are within the area at which the noise may cause behavioral changes. If, at any time, marine mammal observers sight a marine mammal within that radius, operations are shut down until the animal is no longer sighted within the zone.

Impact hammers are only used after pile have “met refusal,” or reached the point at which the vibratory hammer is no longer embedding the pile into the substrate. When employing an impact hammer, Port contractors are required to use approved attenuation methods to reduce the volume of the noise. The most common attenuation devices include a wood block and a bubble curtain. A wood block is a cross-section of timber that is placed on the top of the pile so that the metal hammer strikes the wood, rather than the metal or concrete pile directly. A bubble curtain is a circular piece of PVC (or similar) tubing with holes drilled in the top several inches apart. The tubing is connected to an air compressor at the surface, and, when activated, air is forced into the tube and a continuous stream of bubbles is released through each of the holes. The air bubbles for a “curtain” of bubbles that encircles the pile, effectively creating a layer of air to insulate the noise. Bubble curtains have been shown to reduce decibel levels from impact pile driving by as many as 38 decibels. The Port approaches activities with the potential to cause impacts conservatively, and thus assumes only a 9 decibel decrease from a bubble curtain when analyzing potential impacts to protected species.

The Port will apply innovative approaches when possible – working with agencies to test new technologies such as double-wall pile. The Port will also continue to incorporate underwater noise best practices into criteria for project design/construction.

Figure 9. Impact hammer working to install a pile with the bubble curtain in use at a Duwamish River restoration site. Credit: Sasha Ertl/Grette Associates and Port of Seattle



4.2 Research & Development

The Port conducts and funds research and development of new technologies used in its everyday operations and facilities to reduce its underwater noise footprint.

Double-Walled Pile

Marine pile driving, which is used to install a deep foundation in water, produces high sound pressure levels in both the surrounding air and underwater environment. In 2021, Port contractors were planning to install a pile-supported public access pier at Duwamish River People's Park. The Port saw an opportunity to test out a new type of double-walled pile in the construction of the pier, designed to reduce the spread of noise underwater.

The Port worked with the pile manufacturer to fabricate steel piles for the project, and Conducted underwater noise, in-air noise, and ground-vibration monitoring to assess how well the piles worked to reduce noise during installation. Data collected as part of this project provided valuable information to improve the technology and understand how it works in different environments.

When pile work is needed in the future, the Port will assess whether double-walled pile may be appropriate, based on the scale and location of work.

Figure 10. Graphic depicting the design of the innovative double-walled pile. Credit: Marine Construction Technologies

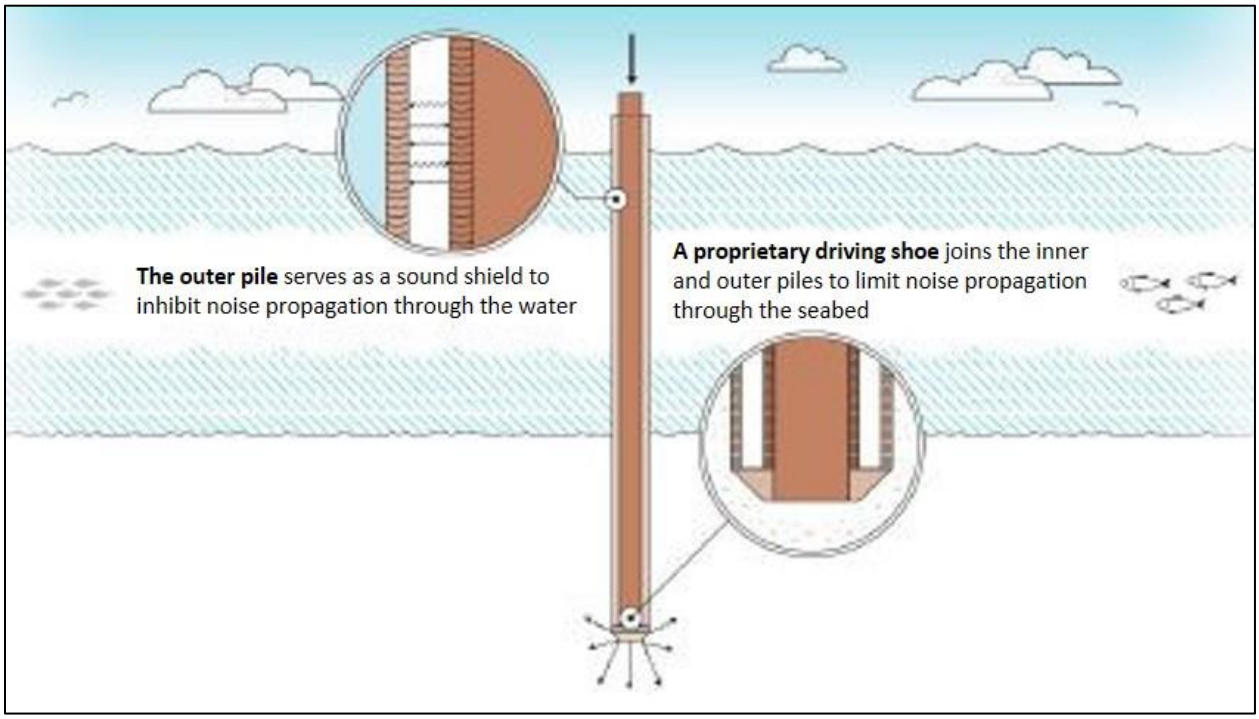
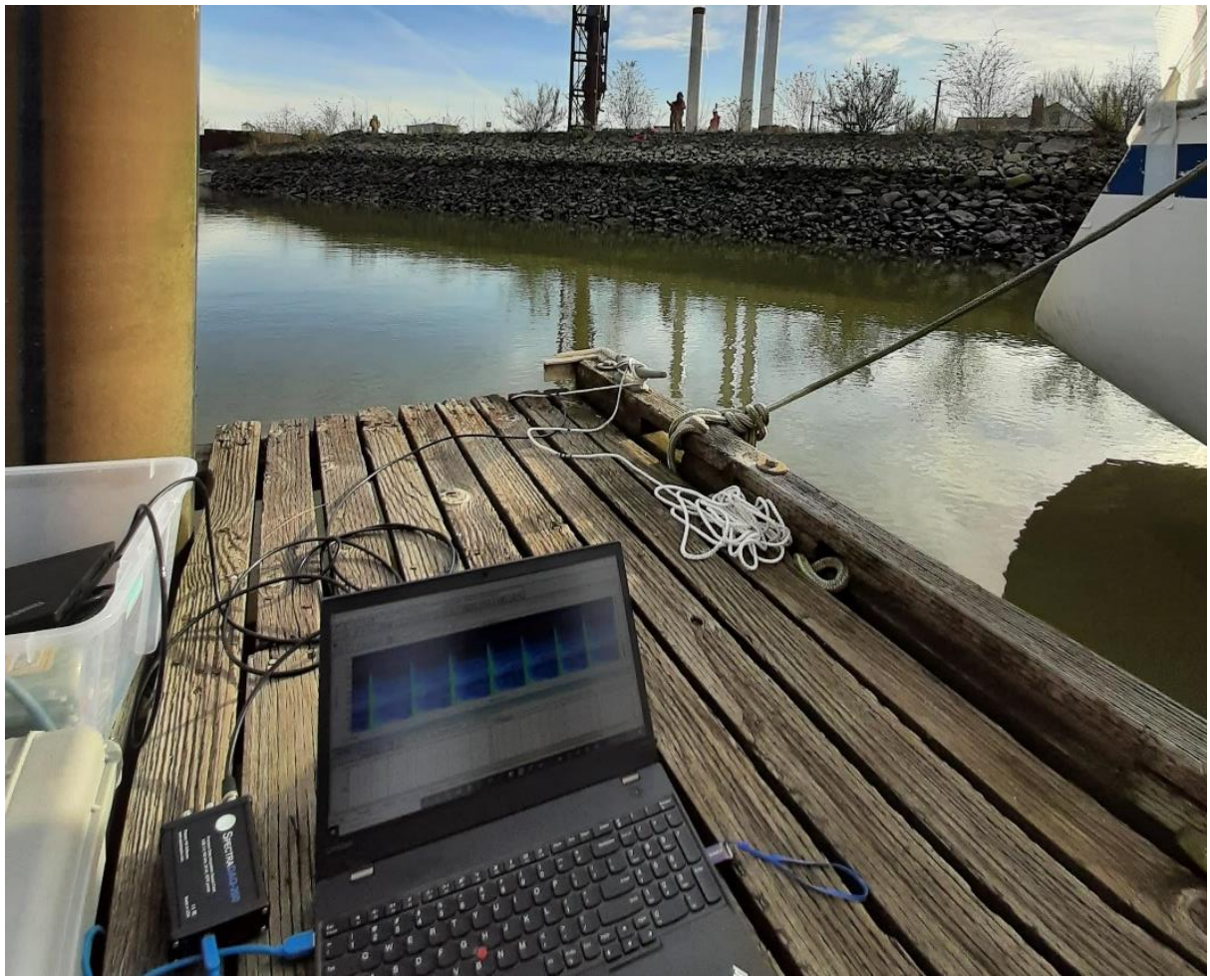


Figure 11. Double-walled pile being suspended above the water in preparation for installation. Credit: Reinhall 2015

Figure 12. Hydroacoustic monitoring during driving of double-walled pile at a Duwamish River restoration site. Credit: Sasha Ertl/Grette Associates



Custom Bubble Curtain

The Port's Terminal 5 Rehabilitation and Berth Deepening project required extensive pile driving to reconstruct the north vessel berth. The scale of the project called for extra protections to prevent negative impacts to marine mammals and other protected species. Bubble curtains, described above, are often used to absorb noise from in-water construction activities, thus reducing the distance noise travels underwater. This methodology has been tested and verified for pipe pile but is not typically used for the sheet pile being installed at Terminal 5.

The Port collaborated with underwater noise experts at Washington State Department of Transportation and an underwater noise consulting firm to design two 83-foot-long custom bubble curtains to accommodate the full length of the sheet pile wall. Subsequent underwater noise monitoring in the project vicinity showed that the device successfully decreased noise to the levels approved by the United States Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration (NOAA), Fisheries Division.

When sheet pile is required for future projects, the Port will consider use of a customized bubble curtain as appropriate.

4.3 Underwater Noise Studies

There is a paucity of data on underwater noise and underwater acoustics within Puget Sound and the Salish Sea. Various hydrophone networks, managed by many different organizations, are installed throughout the area and collect a variety of data. Still, gaps exist, both geographically and in the subject of the recordings (i.e., tracking orca/marine mammal communications versus tracking anthropogenic sources of underwater noise). Further, the data lack synthesis—there is currently not a single database through which to share and compare data.

The Port supports research to increase the general understanding of underwater noise and acoustics in the Port operations area. While sporadic data exist on ambient underwater noise levels in the Port operations area, comprehensive data do not; thus, these noise levels are not well-understood. The Port both funds external research projects through the Quiet Sound program and conducts its own studies to add to the body of knowledge on underwater noise and underwater acoustics.

Dredge Monitoring

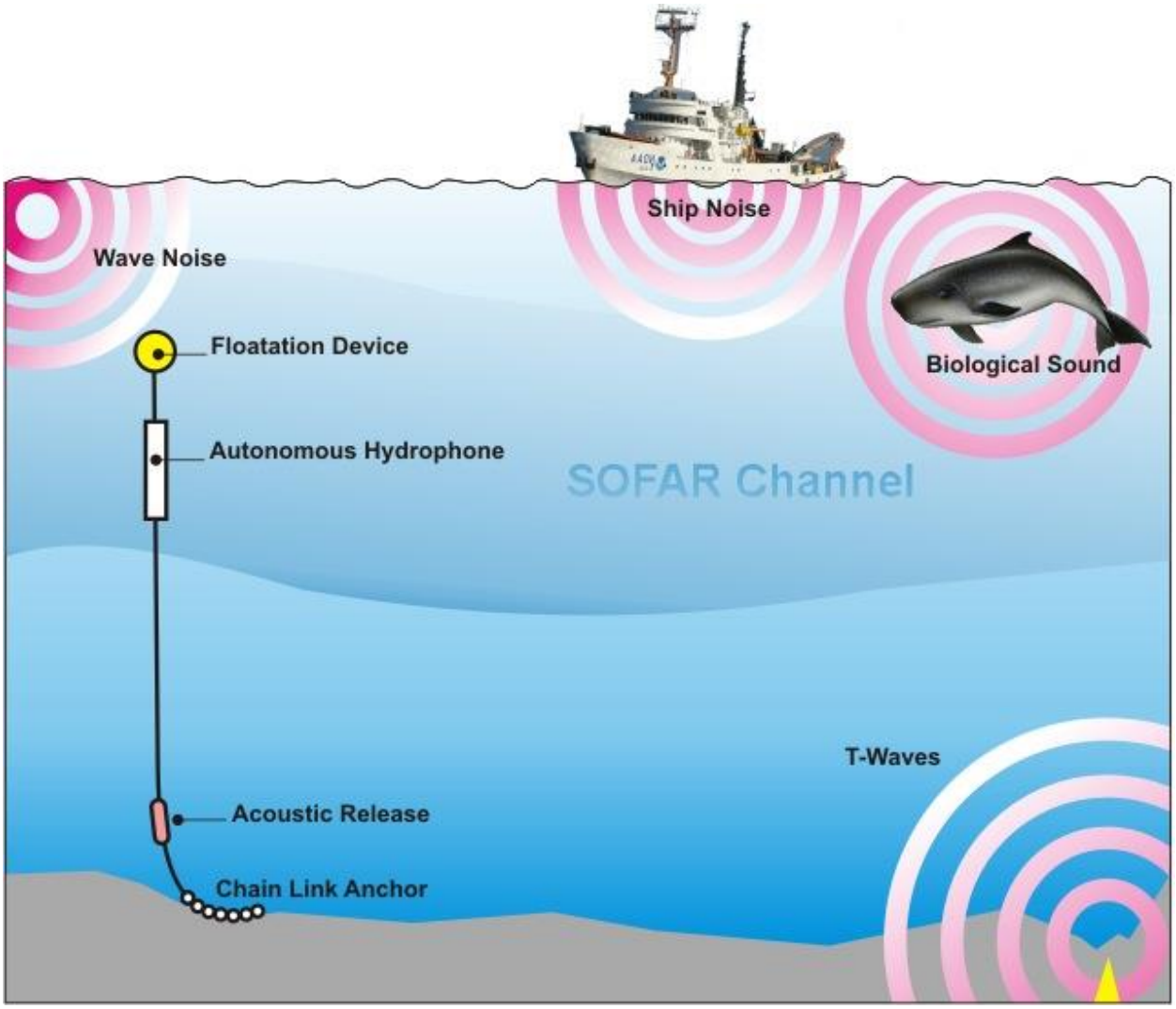
In 2022, the Port collected underwater noise data during dredging operations in the Port operations area. Data were also collected during other operations that generate underwater noise, such as tug and barge activity, ferries transiting, skiffs passing by, and pile driving. The hydrophone was recording during periods when no operations, including dredging, were occurring, which allowed for comparison of noise levels between the different operations and background (ambient) noise levels.

Figure 13. Bucket dredge in use. Credit: Sasha Ertl/Grette Associates

UW/NOAA Gap Analysis

Ocean acoustics is the study of sound and its behavior in the sea. The Port is providing $200,000 for a desktop study to evaluate gaps in the hydrophone underwater acoustic network and recommend improvements to effectively monitor underwater acoustics from vessels in the Salish Sea. The study is being conducted in 2022-2023 by the National Oceanic and Atmospheric Administration (NOAA), Northwest Fisheries Science Center (NWFSC) and the University of Washington Applied Physics Lab (UW). The study will characterize existing underwater acoustic monitoring efforts in Puget Sound and make recommendations for next steps, including hydrophones or other equipment to supplement the existing network. Any funds left over from the study will be used to purchase hydrophones or listening stations to collect vessel noise data that will address gaps noted in the report.

Figure 14. Hydrophone setup for open-water monitoring/recording. Credit: AZO Sensors



Ambient Noise Assessment Program

The Port will collect ambient underwater noise data within the Port operations area during four hydrophone deployments in 2022. The timing of deployments will coincide with cruise ship season, cargo ship season, recreational boating season, and a period free from scheduled vessel transits. The goal of this program is to begin to understand the acoustic environment of Elliott Bay during each of these periods. This will lay the groundwork for the Port to design future noise assessments and develop goals for reducing underwater noise levels over time.

Future efforts for the program will include continued ambient noise assessments and a system for reporting data that allows for trends to be illustrated. This will allow the Port to regularly set targets and to assess whether the targets are being met. The Port may also consider a more permanent hydrophone deployment in Elliott Bay that can provide real-time data on underwater noise levels. This would be in conjunction with the hydrophone gap analysis being conducted by UW and NOAA and the underwater noise study being conducted by Quiet Sound (see next section).

Figure 15. Equipment staged to record ambient underwater noise in Elliott Bay. Credit: Sasha Ertl/Grette Associates

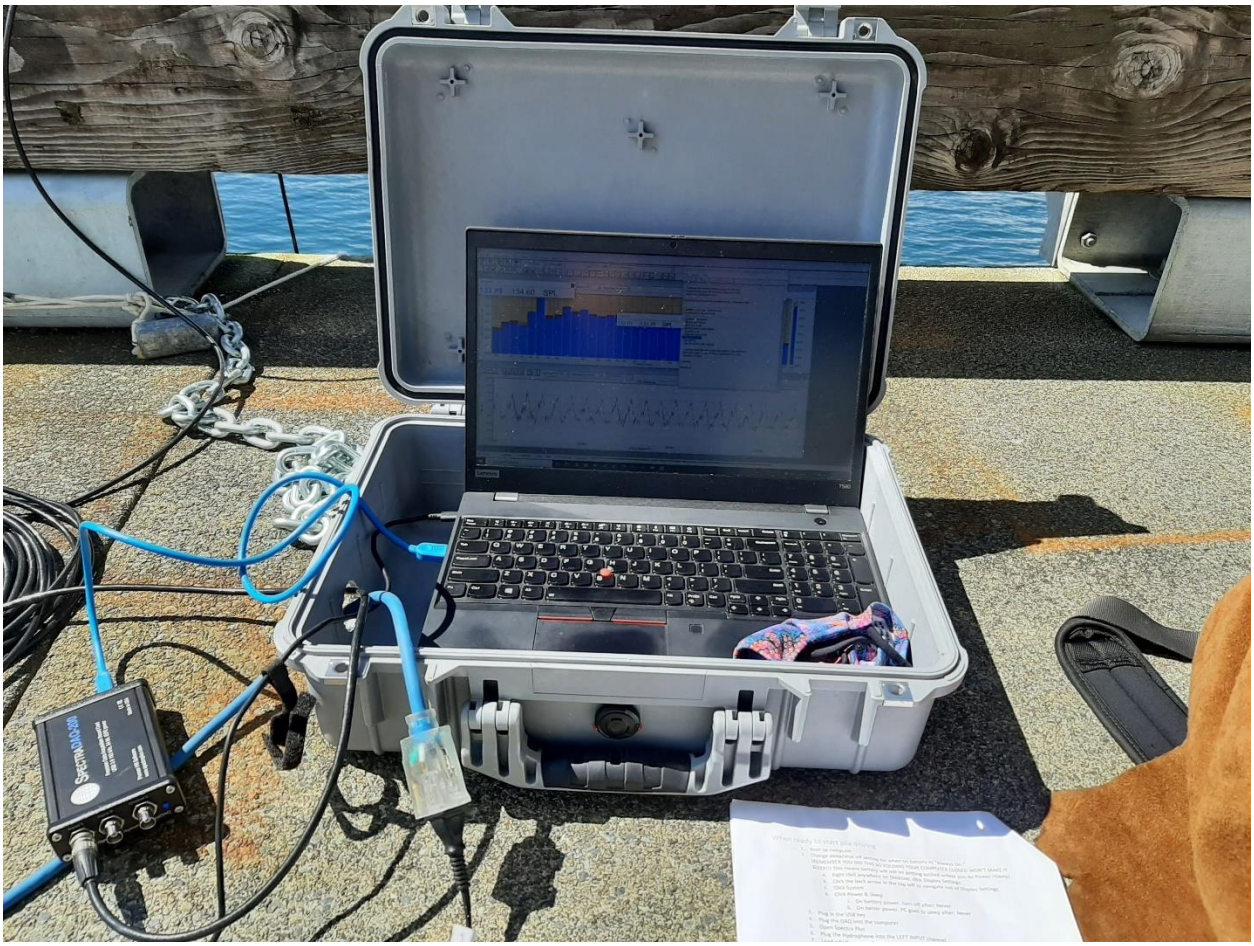


Figure 16. Equipment recording ambient underwater noise in Elliott Bay. Credit: Sasha Ertl/Grette Associates and Port of Seattle

Monitoring Whales & Vessel Noise – Quiet Sound Working Group #1

The Port is a member of the Quiet Sound working group addressing whale monitoring and vessel noise. Over the coming year the group will oversee the UW/NOAA gap analysis described above, and a Puget Sound underwater noise study funded by Bonneville Environmental Foundation and Puget Sound Ecosystem Monitoring Program.

4.4 Outreach

The Port is active in its community and industry outreach efforts and will continue to build awareness and educate Port users, tenants, and others about the impacts of underwater noise on marine species.

Marina Signage

In 2020, the Port worked with the Seattle Aquarium to update signage at marinas targeting recreational boaters regarding best practices and legal requirements around marine mammals. The Port will maintain the signage and update it as needed.

Figure 17. Marina signage at Fisherman's Terminal. Credit: Port of Seattle

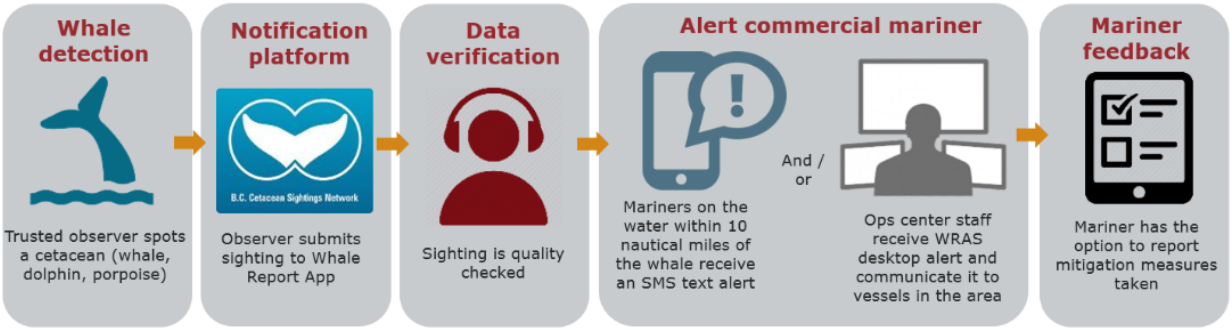
Whale Notification to Vessels – Quiet Sound Working Group #2

In late 2019 through 2021 the Port contracted with the nonprofit organization Ocean Wise (value of ~$25,000) to deliver whale identification and notification training to mariners in Washington State. Ocean Wise is the proprietor of the WhaleReport Alert System [WRAS] and the associated app. The goal of the WRAS is to provide "…an alert system that broadcasts pertinent details of whale presence to large commercial vessels. Information on whale presence is obtained from real-time observations reported to the B.C. Cetacean Sightings Network via the WhaleReport app. The alerts inform shipmasters and pilots of cetacean occurrence in their vicinity. This awareness better enables vessels to undertake adaptive mitigation measures, such as slowing down or altering course in the presence of cetaceans, to reduce the risk of collision and disturbance." (The WhaleReport Alert System).

Funding provided by the Port of Seattle and other Quiet Sound members supports Quiet Sound's priority initiatives. This funding has been used to support the WRAS and provides ongoing training for mariners on use of the app to report and download whale sighting information. Future efforts will focus on improving use of the WhaleReport app for commercial mariners so that it may become a universal tool accepted by commercial mariners in Puget Sound. The Port will continue to support efforts to enhance mariner reporting, and to incorporate WRAS data into vessel AIS systems so that all mariners see real-time marine mammal location data on their chart-plotter. Through the Working Group, the Port will also help facilitate communication to tug operators, as they currently do not have access to cellular phones and their apps when on the bridge. Incorporation into the AIS system would alleviate this issue.

Finally, to bring awareness to the issue of underwater noise, the Port will consider a recommendation that the Working Group add "underwater noise" to the purpose statement of the WRAS. This description suggests that vessels "slow down or alter course" to "reduce the risk of collision and disturbance." Amending the text to read "slowing down and/or altering course in the presence of cetaceans, to reduce the risk of collision and disturbance, including acoustic disturbance from increased underwater noise," would expand the conservation goals of the program to include mitigation of acoustic impacts, and would increase awareness of underwater noise as a threat to cetaceans.

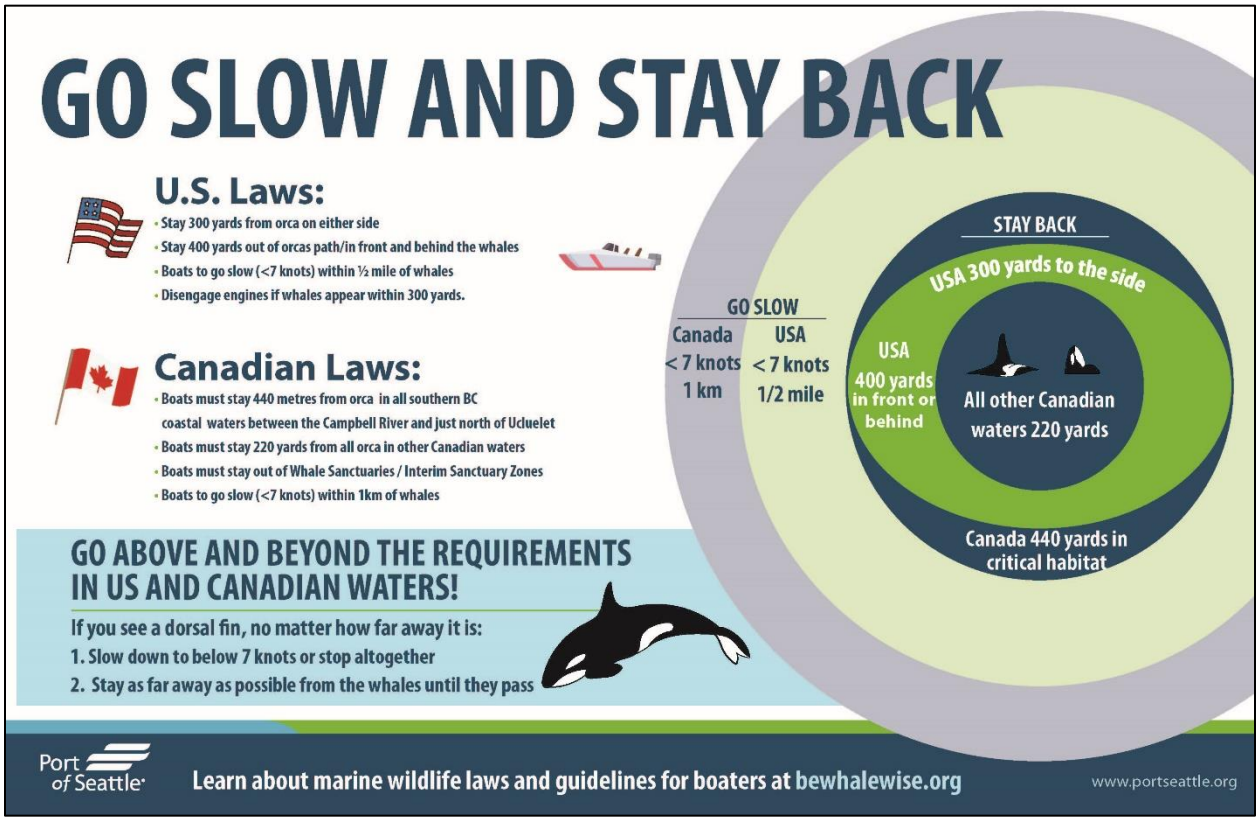
Figure 18. How the WRAS works. Credit: Ocean Wise



Public Outreach

The Port prioritizes underwater noise in public outreach through marina signage (as discussed above), blog posts, and webpages (e.g., Protect the Orcas). The Port also supports the Be Whale Wise program, which educates boaters about safe vessel operation when whales are nearby. Future outreach opportunities include blog posts and e-mailings specifically discussing underwater noise and its impacts to marine life, and other potential educational tools for the public and marina tenants. The Port will also weigh in on public outreach efforts made by the Quiet Sound program as a member of its Leadership Committee.

Figure 19. Be Whale Wise guidance brochure. Credit: Port of Seattle



The Port will consider offering a one-day public outreach event during which recreational boaters can motor their vessels past a hydrophone at a known speed and distance and the Port can report recorded noise levels to the operators. This would provide skippers with the information needed to operate their vessels at optimal speed to minimize underwater noise.

4.5 Improvements in Vessel Operation/Design

The Port can recognize vessel owners and operators for their efforts to reduce underwater noise. Efforts undertaken by vessel owners and operators can include operational changes, such as operating at the optimal speed for quiet performance, maintenance activities, such as hull or propeller polishing and repair, and design details, such as hull quieting technology, low cavitation propellers, quieter engines, or alternate propulsion (e.g., jets). Additionally, the Port can promote participation in the Green Marine Environmental Program by ship owners.

Financial Incentives

Some ports, for example Canada's Port of Vancouver, give financial incentives to vessel owners that take measures to reduce underwater noise via design features or operating practices. Financial incentives may be in the form of cash back or reduced moorage rates. The Port will explore the possibility of financial incentives, including potential grant funding opportunities and legislative measures that may provide funding for such programs, while also considering its legal limitations and economic constraints.

Sustainable Century Awards

The Port recognizes outstanding environmental accomplishments of Maritime customers, tenants, non-profits, and partners with the Sustainable Century Awards. Award recipients demonstrate environmental leadership in the maritime industry, consistent with the goals of the Port's Century Agenda. Recipients receive a commemorative plaque, recognition through Port press and website announcements, and additional publicity through Port media channels.

The Port has recently revisited the scope of this award program and has included new categories and examples including programs that reduce underwater noise. Award criteria include technologies or practices that demonstrate new, effective and scalable innovative techniques to reduce underwater noise. Vessel owners or operators could be recognized, for example, for membership in Green Marine, voluntary speed reduction, ship concept and power requirements, reduction of propeller noise, reduction of machinery noise, and ship operator mitigation measures.

Other Non-Financial Incentives/Initiatives

The Port will explore opportunities to provide other non-financial incentives to vessels with noise-attenuating design or operations, such as priority berthing times. The Port will also evaluate whether other approaches, such as use of "Just in Time" arrival technology, can reduce underwater noise levels in the Port operations area. "Just in Time" provides vessels with scheduled arrival time slots so they can optimize travel speed to arrive at that specific time. This allows vessels to slow their speed, which results in both more efficient use of fuel and reduced vessel noise. "Just in Time" approaches may be more applicable to cargo ships than other types of vessels calling at Port terminals and marinas. Additionally, technology and data-sharing requirements are potential challenges to implementation of "Just in Time" approaches.

Vessel Operations & Incentives – Quiet Sound Working Group #3

The Port is a member of this Quiet Sound working group which will consider voluntary adjustments to vessel operations to reduce underwater noise impacts and related incentives. The group is planning a 2022-2023 pilot study to test a seasonal vessel slowdown area to benefit southern resident killer whales. The study will incorporate underwater noise measurement while vessels reduce their speed. Once complete, the study will inform plans to pursue seasonal or year-round voluntary vessel slowdown in the future.

Green Corridors for Cruise Lines

In May 2022, the Port announced a commitment to explore the feasibility of the world's first cruise-led "green corridor" along with its partners City and Borough of Juneau, Vancouver Fraser Port Authority, Carnival Corporation and its cruise brands, Cruise Lines International Association, Global Maritime Forum, Blue Sky Maritime Coalition, and Washington Maritime Blue. Since the launch, the cruise port communities of Skagway and Sitka in Alaska and Port of Victoria in British Columbia have also joined the effort. While the primary focus of a "green corridor" is to accelerate the transition to zero-emission fuels and technologies, reductions in underwater noise could be a co-benefit.

The Port will explore possibilities to expand the notion of "green corridor" to include noise reduction explicitly.

Shore Power for Cruise Vessels

The Port currently provides shore power for both vessel berths at its Terminal 91 cruise terminal. This enables cruise ships to shut down their generators while at berth, thereby quieting the underwater acoustic environment. The Port plans to install shore power at its Pier 66 Bell Harbor cruise terminal by 2024, so that 100% of its cruise berths will provide shore power.

4.6 Collaboration & Amplification

The Port has a record of successful collaboration with industry, government, and community partners with the common goal of protecting marine species. Collaboration is important to leverage Port resources in addressing underwater noise, especially since the Port has limited influence over the many noise-producing sources in its operations area.

Quiet Sound – Investment and Participation

Quiet Sound is a collaborative program officially launched in 2021, aimed at reducing underwater noise impacts to southern resident killer whales from large commercial vessels. The Port is a founding member of Quiet Sound and helped lead the planning team that defined the program's mission and overall structure. Now that the program is under the operational leadership of Maritime Blue, the Port has committed financial support for Quiet Sound for the next three years. Port staff will serve on the Leadership Committee to help guide operational decisions. Staff will also participate in three of the five Quiet Sound working groups established to undertake specific technical studies and work on targeted underwater noise reduction efforts. These groups include the Monitoring Whales and Vessel Noise work group, Vessel Operations and Incentives work group, and the Whale Notification System work group.

Seattle Aquarium Partnership

The Port has partnered with the Seattle Aquarium to fund the development of the Aquarium's Ocean Pavilion project. Under the plan, the Port will commit $5,000,000 over five years with the possibility for the Port and Aquarium to expand current and future collaboration. The Ocean Pavilion will educate and inspire international visitors and local communities about the environmental stewardship of the marine ecosystem of the Salish Sea and broader Pacific Ocean. The Port will encourage the Aquarium to highlight the need for, and status of, and maritime innovations pertaining to underwater noise in its education and engagement activities in the Ocean Pavilion.

Industry Association Memberships

The Port is an active member of various industry groups such as the American Public Ports Association, the Washington Public Ports Association (WPPA), and other port-related associations that promote environmental sustainability along with economic development. In 2020, the Port received an Environmental Stewardship Award from WPPA for the planning and organization of Quiet Sound. As a member of WPPA, the Port

can continue to promote collaboration among coastal ports in Washington on understanding and reducing underwater noise.

The Port is also a member of Green Marine, an organization promoting environmental excellence in North America's maritime industry. The Port is represented on Green Marine's new Aquatic Ecosystems technical advisory group which will update guidance for ports, ship owners, shipyards, and terminals to reduce underwater noise.

Engage Small Vessel Manufacturers

Currently there are no known efforts to reduce the acoustic footprint of small recreational vessels, and only a handful of companies manufacture mechanical components for most recreational vessels. The Port will assess opportunities to collaborate with manufacturers of small vessels and small vessel engines to use quieting mechanical components in recreational vessel design, potentially through its membership in Maritime Blue. If quieter mechanical components were developed, this could scale very quickly, given the small pool of manufacturers.

4.7 Legislative Advocacy

The Port advocates for environmentally sound policy, laws, and regulations that advance Century Agenda goals at the international, national, state, and local levels. The Port will continue to include protection of marine mammals and underwater noise reduction in its legislative agenda.

International Maritime Organization

In 2021 the Port urged the U.S. delegation to the International Maritime Organization (IMO) to push strongly for improved international standards to reduce underwater noise from vessels, including new technologies and ship designs. The Port also supported the proposal to review the IMO's Maritime Environmental Policy Committee's "Guidelines for the reduction of underwater noise from commercial shipping to address adverse impacts on marine life," and supported the findings of "Belgium desk studies on underwater noise impacts that address the beneficial underwater noise impacts from energy efficiency improvements."

HR 6987 – Protecting Our Marine Mammals Act

In 2022, the Port went on record as supporting HR 6987, the Protecting Our Marine Mammals Act, a federal bill that would establish programs to reduce the impacts of vessel traffic and underwater noise to marine mammals. Key provisions of the bill include grants for seaports to establish underwater noise program such as Quiet Sound; funding to expand the Ocean Noise Reference Station Network, which monitors and maps underwater sound; new monitoring and mitigation programs for large whales; grants to support new technology that reduces underwater noise from vessels; and a technology assessment for quieting United States government vessels.

Governor's Southern Resident Orca Task Force Recommendation #27

The Washington State Department of Ecology has announced that it will be developing additional State Environmental Policy Act (SEPA) guidance and an Orca supplemental

environmental checklist. The Orca supplemental environmental checklist is intended to help lead agencies better understand the impacts of proposals on the Southern Resident Killer Whale population. This action is in response to the 2019 recommendation of the Governor's Southern Resident Task Force to *"Determine how permit applications in Washington state that could increase traffic and vessel impacts could be required to explicitly address potential impacts to orcas".* The Port of Seattle has been asked to participate in a work group to provide input on the proposed changes through 2022, and will continue to engage in the potential rulemaking process in 2023.

Table 3. Summary of Port of Seattle Underwater Noise Mitigation and Management Plan strategies and recommended actions

UNDERWATER NOISE MANAGEMENT PROGRESS AND RECOMMENDED ACTIONS

	2022 PROGRESS TO DATE	2023-2024 RECOMMENDED ACTIONS
Best Management Practices (BMPs)	• Before starting pile-driving projects, exclusion zones are determined to ensure protected species are not harmed • During pile driving projects, monitors are onsite to observe for presence of target species; work is halted if target species are sighted • In-water construction coincides with published in-water work windows during which protected species are less likely to be present • Construction BMPs are maintained, communicated, and followed	• Continue to follow existing BMPs • Update BMPs as new technologies or methods (e.g., use of double-walled pile or custom bubble curtains) are developed
Research and Development	• Funding was provided for design and testing of innovative pile design—double-walled pile; the design aimed to reduce noise during in-water construction • An innovative, custom bubble curtain was designed and implemented to attenuate noise during pile driving of sheet pile	• Continue to develop and test new technologies and methodologies that may reduce underwater noise levels as opportunities arise

Leadership in environmentally responsible stewardship of marine facilities

Financial investments and studies to advance scientific knowledge

Advocacy for sound policy, regulations, and practices related to underwater noise

Partnerships with industry, government agencies, tribes, and non-profits

	2022 PROGRESS TO DATE	2023-2024 RECOMMENDED ACTIONS
Underwater Noise Studies	• Underwater noise levels were measured during dredging to assess noise levels compared to background levels • The Port funded a study by UW/ NOAA to conduct a gap analysis of the hydrophone network in the Salish Sea • The Port launched an Ambient Noise Assessment Program in 2022 to collect baseline underwater noise data in Elliott Bay • Port Environmental staff sit on the Monitoring Whales and Vessel Noise working group as part of the Quiet Sound program which oversees various underwater noise studies	• Purchase hydrophone equipment to improve the regional monitoring network with any remaining funds from the UW/ NOAA study • Continue to measure background noise levels in Elliott Bay through the Ambient Noise Assessment Program • Maintain a seat on the Monitoring Whales and Vessel Noise Quiet Sound working group • Establish plan-specific noise reduction target(s) will be set once background noise levels are established
Outreach & Education	• Signs are posted at recreational marinas to educate boaters about best practices and laws when operating around marine mammals • Through Quiet Sound, funding was provided for the WhaleReport Alert System (WRAS) which notifies mariners of the presence of whales in the area • The Port contracted with OceanWise to provide training and promote use of the WRAS • Port Environmental staff sit on the Quiet Sound program's Whale Notification to Vessels working group as part of the Quiet Sound program • The Port uses social media and other platforms to share information with the public about underwater noise	• Maintain and improve educational signage at marinas • Maintain a seat on the Quiet Sound Whale Notification to Vessels working group; the group will work to fund the WRAS and improve WRAS accessibility • Continue to communicate about impacts of underwater noise via this Plan, blogs, social media, and web posts • Consider hosting a one-day voluntary event offering measurement of underwater vessel noise levels to recreational boaters

Leadership in environmentally responsible stewardship of marine facilities

Financial investments and studies to advance scientific knowledge

Advocacy for sound policy, regulations, and practices related to underwater noise

Partnerships with industry, government agencies, tribes, and non-profits

	2022 PROGRESS TO DATE	2023-2024 RECOMMENDED ACTIONS
Improvements in Vessel Design/Operation	• The scope of the Port's Sustainable Century Awards was expanded to recognize efforts of customers, tenants, and partners to reduce underwater noise • Port Environmental staff sit on the Quiet Sound program's Vessel Operations and Incentives working group which is planning a pilot study to test seasonal vessel slowdowns	• Explore feasibility of financial and non-financial incentives for vessel owners to reduce underwater noise via vessel design or operations • Explore expansion of a proposed "Green Corridor" — a zero emissions cruise operation zone—to include noise reduction • Install shore power at the Pier 66 cruise terminal to enable cruise engines to shut down while at berth • Maintain a seat on the Quiet Sound Vessel Operations and Incentives working group
Collaboration & Amplification	• The Port was a founding member of the Quiet Sound program, launched in 2021 to reduce underwater noise from large commercial vessels • The Port provided funding for the Seattle Aquarium's new Ocean Pavilion • The Port is an active member with a variety of industry associations that can advance underwater noise programs	• Continue to provide annual funding to Quiet Sound • Encourage Seattle Aquarium to highlight underwater noise in its Ocean Pavilion exhibits • Consider partnering with Maritime Blue to engage small vessel manufacturers on developing quieter mechanical components • Seek opportunities to partner with University of Washington, Maritime Blue, and others on new BMP technologies
Legislative Advocacy	• The Port strongly supports underwater noise regulation by the International Maritime Organization • The Port advocates for adoption of federal regulations such as HR 6987 — Protecting Our Marine Mammals Act	• Continue to advocate for policy, laws, and regulations at the international, national, state, and local levels • Participate in potential Department of Ecology rulemaking in response to Governor's Southern Resident Orca Task Force Recommendation #27

Leadership in environmentally responsible stewardship of marine facilities

Financial investments and studies to advance scientific knowledge

Advocacy for sound policy, regulations, and practices related to underwater noise

Partnerships with industry, government agencies, tribes, and non-profits

5 TARGETS

The Port intends to set numeric target(s) for underwater noise level reduction after the baseline condition has been defined. The key elements informing that definition are the Port's 2022 ambient noise data collection, the UW/NOAA Gap Analysis on the Puget Sound hydrophone network, and other studies overseen by the Quiet Sound Working Group #1 – Monitoring Whales & Vessel Noise.

Once targets have been set, the Port will reevaluate strategies and actions to enable successful attainment of the targets. Noise levels will be monitored to assess whether the targets are being met.

6 ADAPTIVE MANAGEMENT

This is a "living document" and as such the Port will take an adaptive management approach to monitoring and reviewing this Plan. As strategies are implemented and opportunities and recommendations are turned into actions, the Port will assess progress and revise goals and targets as they are met. When goals and targets are not met, the Port will reevaluate tactics to achieve success.

Biannual Review

Every two years, the Port will conduct a review of Plan implementation efforts to assess progress on each action, identify lessons learned, and update the actions and timeframes as needed. The bi-annual review will include evaluation of any new ambient noise data collected over the past two years to assess trends in noise levels and determine whether noise targets – once established – are being met.

Reporting

Results of the bi-annual review will be reported to Port management, Quiet Sound partners, and made available to the public as appropriate.

Budgeting

The Port will allocate staff resources and funding for Plan updates and strategy implementation as part of its annual budget process.

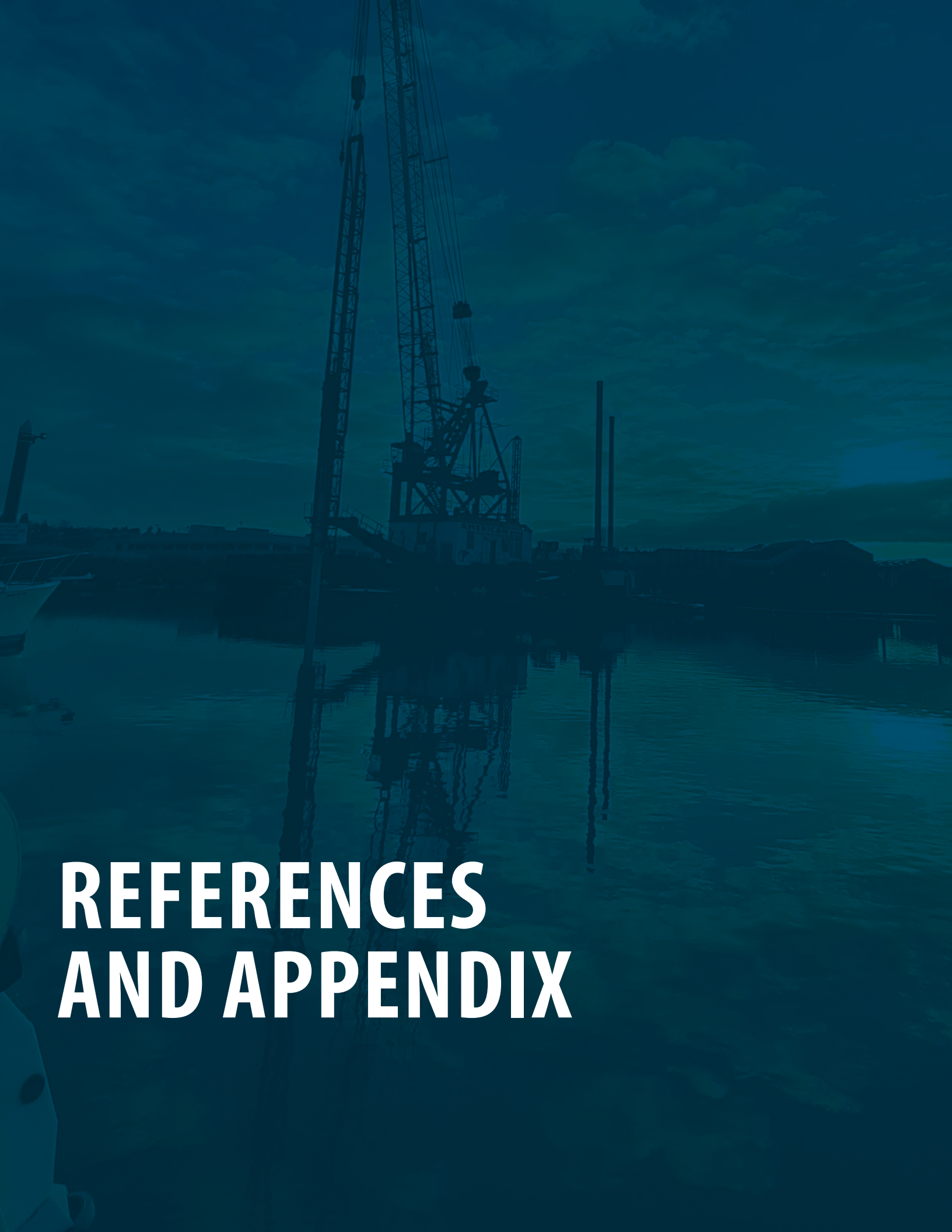
UNMMP Updates

This document is expected to continually evolve to:

- Incorporate findings from annual reporting regarding key metrics, including noise measurement data and trends as compared to target noise levels, as well as updated noise reduction targets
- Update actions and timeframes as needed as the Port identifies lessons learned
- Align with findings and recommendations of the Quiet Sound Evaluation & Adaptive Management Working Group, as applicable
- Adjust targets and strategies as the body of knowledge grows with regards to underwater noise and its impacts to marine species, technology advancements, policy updates, and funding opportunities

7 CONCLUSION

The Port is committed to reducing potential adverse effects of port-related underwater noise on endangered marine species inhabiting the Port operations area within Central Puget Sound. This Underwater Noise Mitigation and Management Plan builds upon the Port's past successes in reducing in-water construction noise and its role in establishing the Quiet Sound Program to address underwater noise from large commercial vessels. The Plan describes next steps to increase the Port's knowledge of underwater noise and its impact on marine species, as well as strategies to reduce those impacts. Strategies and actions focus on research and development on underwater noise studies, collaboration through Quiet Sound and other partnerships, outreach, advocacy, advancements in-water construction practices and methods, and recognition for improvements in vessel operations and design. As more data is gathered on underwater noise sources, levels, and impacts on marine species, the Port will develop numeric targets for underwater noise reduction and incorporate them into the Plan.



REFERENCES AND APPENDIX

8 REFERENCES

Abrahamsen, K.A. 2012. The ship as an underwater noise source. Proceedings of meetings on acoustics Acoustical Society of America. 17(1):070058.

Anchor QEA. 2019. Elliott Bay Seawall Project: 2018 post-construction monitoring report (Year 1). Prepared for City of Seattle Department of Transportation.

Dinnel, P.A., D.A. Armstrong, B.S. Miller, and R.F. Donnelly. 1986. Puget Sound Dredge Disposal Analysis disposal site investigations: Phase 1 trawl studies in Saratoga Passage, Port Gardner, Elliott Bay and Commencement Bay, Washington FRI-UW-8615. Goetz, F. A. 2016. Migration and residence patterns of salmonids in Puget Sound, Washington. Doctoral dissertation, University of Washington.

Goetz, F.A. 2016. Migration and residence patterns of salmonids in Puget Sound, Washington. Doctoral dissertation, University of Washington.

Grette Associates. 2022. T-5 dredge monitoring hydroacoustic monitoring report. Prepared for the Port of Seattle.

Kerwin, J. 2001. Salmon and steelhead limiting factors report for the Cedar-Sammamish basin (Water Resource Inventory Area 8). Washington Conservation Commission. Olympia, Washington.

Lake Washington/Cedar/Sammamish Watershed Recovery Council. 2017. Lake Washington/ Cedar/Sammamish Watershed (WRIA 8) Chinook salmon conservation plan 10-year update.

Miller, B.S. and S.F. Borton. 1980. Geographical Distribution of Puget Sound Fishes: Maps and data source sheets. University of Washington Fisheries Research Institute, 3 vols.

National Marine Fisheries Service (NMFS) Biological Review Team (BRT). 2008. Preliminary scientific conclusions of the review of the status of 5 species of rockfish: bocaccio (*Sebastes paucispinis*), canary rockfish (*Sebastes pinniger*), yelloweye rockfish (*Sebastes ruberrimus*), greenstriped rockfish (*Sebastes elongatus*), and redstripe rockfish (*Sebastes proriger*) in Puget Sound, Washington. NMFS Northwest Fisheries Science Center. Seattle, WA. December 2, 2008.

Olson, J. 2014. Southern Resident Killer Whale Sighting Compilation 1948-2013. https://www.westcoast.fisheries.noaa.gov/publications/protected_species/marine_mammals/killer_whales/occurrencemap.pdf.

Putland, R.L., Merchant, N. D., Farcas, A., & Radford, C. A. 2017. Vessel noise cuts down communication space for vocalizing fish and marine mammals. *Global Change Biology*, *24*(4), 1708–1721. https://doi.org/10.1111/gcb.13996.

Ruggerone, G.T., T.S. Nelson, J. Hall, and E. Jeanes. 2006. Habitat utilization, migration timing, growth, and diet of juvenile Chinook salmon in the Duwamish River and Estuary. Prepared for: WRIA 9 Technical Committee and WRIA 9 Steering Committee.

Tyack, P. L. 2008. Implications for marine mammals of large-scale changes in the Marine Acoustic Environment. *Journal of Mammalogy*, *89*(3), 549–558. https://doi.org/10.1644/07-mamm-s-307r.1.

Waldron, K.D. 1972. Fish larvae collected from the northeastern Pacific Ocean and Puget Sound during April and May 1967. NOAA Technical Report NMS SSRF663.

Washington, P.M., R. Gowan, and D.H. Ito. 1978. A biological report on eight species of rockfish (Sebastes spp.) from Puget Sound, Washington. Northwest and Alaska Fisheries Center Processed Report, National Marine Fisheries Service, Seattle.

Washington Department of Fish and Wildlife (WDFW). 2022. *SalmonScape* online GIS salmonid distribution mapper. Available at http://apps.wdfw.wa.gov/salmonscape/. Queried May 23, 2022.

9 APPENDIX – SPECIES LIST

9.1 Fish

Puget Sound Chinook Salmon (Oncorhynchus tshawytscha)

Green/Duwamish River and Lake Washington stocks of Chinook salmon use these waters. Adult Green/Duwamish River Chinook could be present in Elliott Bay from mid-June through mid-October, sub-adults any month of the year, and juveniles May (peak numbers) through October (Anchor QEA 2019). Juvenile Chinook outmigrate from the Green/Duwamish River in two waves, February-March and March-July (Ruggerone et al. 2006).

Adult Lake Washington Chinook migrate from Salmon Bay through the Ballard Locks from June through September and spawn from September through November (Lake Washington/Cedar/ Sammamish Watershed Salmon Recovery Council 2017). Juveniles outmigrate and forage in the nearshore of Puget Sound from April-August but can be found in the nearshore year-round.

Puget Sound Steelhead Trout (Oncorhynchus mykiss)

Green/Duwamish River and Lake Washington basin stocks of "steelhead," a term which generally refers to the anadromous form of the trout species *Oncorhynchus mykiss*, use these waters. The Green/Duwamish River watershed contains winter and summer stocks and the Lake Washington watershed contains a winter stock (WDFW 2022). In the Green/Duwamish River, juvenile steelhead begin outmigration in early May, with migration peaking in May/June (Goetz 2016). Juvenile Lake Washington fish typically outmigrate through the Locks from mid-June through early July (Kerwin 2001). Juvenile steelhead use shoreline areas in Elliott Bay before moving offshore (Goetz 2016); sub-adult and adult steelhead may seasonally use the deeper waters of Elliott Bay for migration and foraging but are not known to be present in significant numbers at any time.

Bull Trout (Salvelinus confluentus)

Bull trout were once common in the Green/Duwamish River system; however, dramatic changes to the watershed have reduced the watershed size and flow by 98 percent (Goetz 2016). This has resulted in the degradation, loss and fragmentation of much of the bull trout habitat. Currently, bull trout use of the Green/Duwamish River basin is very low. Adult bull trout have been identified in the Green/Duwamish River basin and may use this area for foraging, migration, and overwintering; however, there is no indication that the system supports a spawning population (WDFW 2022). Lake Washington is documented rearing habitat for bull trout from the Cedar/Sammamish stock and the Lake Washington Ship Canal has documented presence (WDFW 2022). Sub-adult or adult bull trout found in Elliott Bay are likely from nearby core populations such as the Puyallup River, the Snohomish/Skykomish River, or the Stillaguamish River.

Bocaccio Rockfish (Sebastes paucispinis)

Bocaccio have not been documented in Puget Sound since 2001, although it is assumed an extant population exists (NMFS 2008). Larval bocaccio in the pelagic stage may be

present throughout Puget Sound year-round, including in Elliott Bay where larval rockfish (not identified to species) have been documented (Waldron 1972). Juveniles may be found in the nearshore kelp and eelgrass habitats in spring and summer, and in the 1970s and 1980s, adult bocaccio were documented within the Bay (Washington et al. 1978; Dinnel et al. 1986). The aquatic habitat within the East and West Waterways is shallower than typical bocaccio habitat, and the habitat in the Elliott Bay portion of the Port operations area lacks the rocky, high relief substrate they prefer, and thus is not suitable habitat for this species.

Yelloweye Rockfish (Sebastes ruberrimus)

Yelloweye rockfish are considered rare in Puget Sound (NMFS 2008). Larval rockfish have been documented within Elliott Bay but were not documented to species. Juvenile yelloweye rockfish do not typically occupy shallow waters and are unlikely to be in Elliott Bay; adult yelloweye rockfish have been documented within Elliott Bay (Miller and Borton 1980; Dinnel et al. 1986). Snorkel and SCUBA surveys conducted in Elliott Bay in 2018 did not reveal any yelloweye rockfish (Anchor QEA 2019). As with bocaccio, the aquatic habitat within the East and West Waterways is shallower than typical yelloweye rockfish habitat, and the habitat within the Elliott Bay portion of the Port operations area lacks the rocky, high relief substrate they prefer. The habitat is not suitable for yelloweye rockfish.

9.2 Marine Mammals

Southern Resident Killer Whale (Orcinus orca)

The Southern Resident Distinct Population Segment of killer whales includes animals from the J, K, and L pods, except such whales placed in captivity prior to November 2005 and their captive progeny (NOAA 2014a). The southern resident killer whales has spring through fall ranges in Puget Sound and the Straits of Georgia and Juan de Fuca. J pod typically inhabits the Puget Sound/Straits area year-round, while the K and L pods often spend October through June on the outer coast. K and L pods are occasionally sighted in Puget Sound during the winter. In the 23-year period between 1990 and 2013, southern resident killer whales were sighted in Puget Sound between West Point and Alki Point on 286 total days and in Elliott Bay on 52 total days (Olson 2014). Per the Orca Network archived sightings map, in the seven year period from 2015 and 2021 (inclusive), southern resident killer whales were sighted in Puget Sound on 223 days. Most sightings occur in the late fall through the winter months (Orca Network, queried April 5, 2022).

Humpback Whale (Megaptera novaeangliae)

Humpback whales use their northern ranges for feeding on schools of small fish, such as herring, capelin, and sand lance. Historically, humpback whales' distribution in northern waters included the Salish Sea. From 1907-1910, several hundred were hunted from a whaling station on Vancouver Island, effectively removing them from the area (Calambokidis et al. 2018). Prior to 2003, only three individual humpback whales had been observed in Puget Sound. Since the late-2000s, numbers of humpbacks in the Salish Sea, including Puget Sound, have been steadily increasing (Calambokidis et al).

2018); sightings within Elliott Bay, however, remain infrequent. Based on a review of the Orca Network archived sightings maps, humpback whales were sighted in Puget Sound on 741 days over the seven year period from 2015-2021 (inclusive), though the number of individuals represented in those sightings is not known (Orca Network, queried April 5, 2022). Sighting numbers were highest in spring and fall months.

9.3 Birds and Reptiles

Marbled Murrelet (Brachyramphus marmoratus)

Marbled murrelet presence in Greater Elliott Bay/Central Puget Sound is not likely due to the high level of human activity and the distance from old growth forests. Marbled murrelets may use the area as they migrate from nesting areas to feeding grounds, but presence is transient in nature—birds do not linger in the area. Designated critical habitat for the marbled murrelet applies only to nesting habitat, and therefore does not occur within the Port operations area (USFWS 2011).

Leatherback Turtle (Dermochelys coriacea)

Occurrence of leatherback sea turtles in Washington has only been documented off the coast, not in Puget Sound. Sightings occurred during late spring, summer and early fall when sea surface temperatures are highest (Mager 1985). Critical habitat is associated with breeding areas and does not occur in Washington.

10 APPENDIX – PARTNERS AND COLLABORATORS

The Port expresses its gratitude to the following organizations and individuals who were interviewed for and contributed to this Underwater Noise Mitigation and Management Plan:

- Grette Associates and Cogent Environmental (Consultant Team)
- Green Marine Staff
- NWSA Environmental Staff
- Quiet Sound Staff and Leadership Committee
- Port of Seattle Sustainability Program, Maritime Operations, Property Management, Compliance, and Habitat Teams
- Natural Resources Defense Council (Quiet Sound Leadership Committee)
- Washington State Ferries (Whale Notification System to Vessels Working Group Lead)
- Marine Exchange (Vessel Operations and Incentives Working Group Lead)

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