BIOLOGICAL EVALUATION
Produced for Port of Ilwaco
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moffatt & nichol

PORT OF ILWACO

Port of Ilwaco East Bulkhead Resilience Project

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Glossary

AMMs	Avoidance and Minimization Measures
BE	Biological Evaluation
BMP	Best Management Practice
BO	Biological Opinion
cy	Cubic yard
dB	Decibel
dBA	A-Weighted Decibels
dBrms	Decibel Root Mean Square
DNR	Washington Department of Natural Resources
DPS	Distinct Population Segment
Ecology	Washington State Department of Ecology
EFH	Essential Fish Habitat
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
ft	feet
hr	hour
HTL	High Tide Line
IPaC	Information For Planning and Consultation
l	liter
LCR	Lower Columbia River
LCFRB	Lower Columbia Fish Recovery Board
lf	Linear feet
MCR	Middle Columbia River
mg	milligram
MHHW	Mean Higher High Water
MLLW	Mean Lower Low Water
mph	Miles per hour
MSA	Magnuson Stevens Fishery Conservation and Management Act
NLAA	Not Likely to Adversely Affect
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
PCE	primary constituent element
Project	Port of Ilwaco East Bulkhead Resilience Project
RM	River Mile
sf	Square feet
SEL	Sound exposure level
SR F	Snake River fall-run
SRKW	Southern Resident Killer Whale
SR-SS	Snake River spring/summer-run
UCR	Upper Columbia River
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
UWR	Upper Willamette River
WDFW	Washington Department of Fish and Wildlife
WSDOT	Washington State Department of Transportation

1. Purpose of the Biological Evaluation

The purpose of this Biological Evaluation (BE) is to address potential effects of the Port of Ilwaco East Bulkhead Resilience Project (herein referred to as 'Project') and address the proposed action in compliance with Section 7 of the Endangered Species Act (ESA). Section 7 requires consultation with the Services (U.S Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA) Fisheries or National Marine Fisheries Service (NMFS) to evaluate whether proposed Project activities could potentially jeopardize the continued existence of any threatened, endangered, or proposed species, or result in the destruction or adverse modification of critical habitat.

The Project would consist of three primary elements;

1. Replacement of the failing bulkhead
2. Replacement of slope protection to the north and south of the bulkhead
3. Paving and grading the upland wharf area behind the bulkhead to mitigate the effects of sea level rise.

Creosote-treated structures would be removed as part of the proposed Project elements. The Port is also proposing to remove adjacent derelict creosote-treated piles as additional mitigation.

The Project has the potential to impact the following ESA-listed species and/or their critical habitat: Chinook salmon (*Oncorhynchus tshawytcha)*, chum salmon (*Oncorhynchus keta*), Coho salmon (*Oncorhynchus kisutch)*, sockeye salmon (*Oncorhynchus nerka)*, steelhead *(Onocorhynchus myskiss)*, bull trout (*Salvelinus confluentus)*, green sturgeon (*Acipenser medirostris)*, eulachon (*Thaleichthys pacificus)*, leatherback sea turtle (*Dermochelys coriacea*), southern resident killer whales (*Orcincus orca)*, humpback whale (*Megaptera novaeangliae)*, western snowy plover (*Charadrius nivosus nivosus*), marbled murrelet (*Brachyramphus marmoratus)*, and streaked horned lark (*Eremophila alpestris strigata)*.

Appendix B of this BE also includes an assessment of essential fish habitat (EFH) protected under the Magnuson–Stevens Fishery Conservation and Management Act (MSA).

1.1. Project Location

The Project is located at the Port of Ilwaco on the southwest coast of Washington State near the mouth of the Columbia River (Figure 1). The Port area generally consists of a marina used for year-round moorage of recreational and commercial fishing vessels, upland commercial buildings, and a boatyard

(Figure 2). The Project site at the Port of Ilwaco is the bulkhead along the east side of the commercial fishing wharf (herein referred to as 'wharf'). The approximate coordinates of the Project site are latitude 46.30498 and longitude -124.0408. The wharf is an earth filled structure on the east side and pile supported on the west side. The wharf is protected by a failing creosote-treated timber bulkhead along the eastern limits of the wharf (Figure 2). The shoreline to the north of the bulkhead is protected by a low creosote-treated timber retaining wall and large log (Figure 2). The shoreline protection on the south side of the bulkhead consists of riprap and concrete rubble (Figure 2). The Safe Coast Seafoods buildings are located on the wharf (Figure 2). The Port and marina area is protected by a rubble breakwater (Figure 2).

Figure 1. Vicinity Map

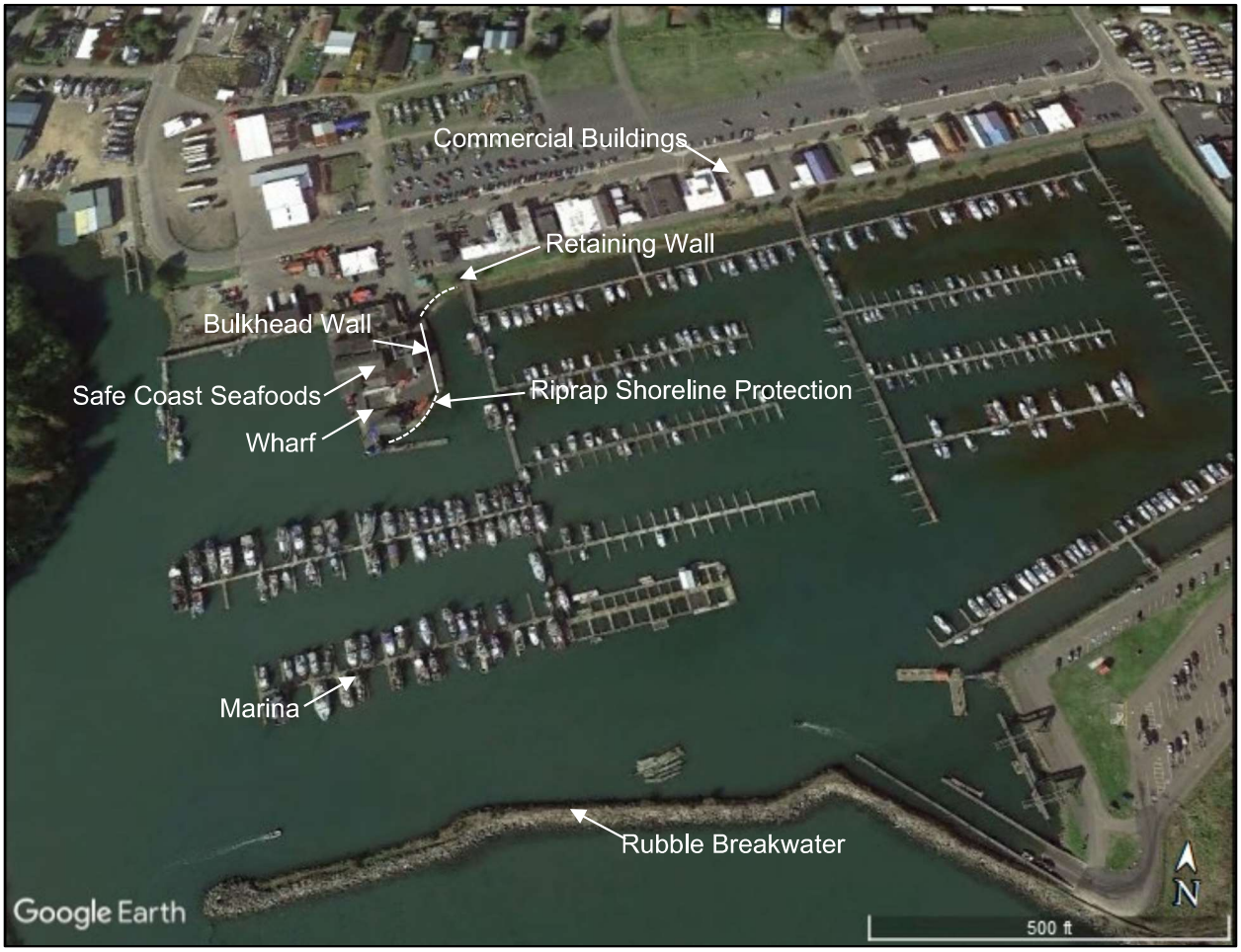

Figure 2. Project Location Aerial

1.2. Purpose and Need

The proposed Project is required for improved the safety, efficiency, and reliable use of the wharf. The Port is a key hub for commercial fishing, seafood and aquaculture processing, and recreation activities that greatly benefit the regional economy. The commercial fishing wharf, operated by Safe Coast Seafoods, is one of the most active in the state, landing roughly $14 million in commercial seafood each year. Repair of the bulkhead wall is critical to ongoing operations at Safe Coast Seafoods. In its current condition, the bulkhead is in serious structural condition and at risk of failing. Frequent flooding due to high water levels from "king tides" and severe winter storm surges further threaten the structural capacity of the bulkhead. Pavement settlement has been observed on the adjacent landward driveway and access is now restricted based on those conditions and the condition of the deteriorating bulkhead. The 2022 geotechnical investigations (GeoEngineers, 2022) indicated that the project site is underlain by liquefiable soil.

Bulkhead failure would shut down cargo operations at the Port and negatively impact a wide variety of businesses in maritime and non-maritime sectors including Safe Coast Seafoods. The shutdown of the Safe Coast site due to failure of the bulkhead would lead to a series of economic impacts for many more workers and businesses and the region. The facility is capacity-limited and at risk until the bulkhead is replaced and the Project is completed. Without the Project, the eventual closure of the Wharf would result in cascading negative transportation and economic impacts for the region.

The Project would serve the following purposes and provide the following benefits:

- The replacement bulkhead will serve as the initial phase to increase the facility's climate change/sea level rise resiliency and will help protect Wharf facilities from flooding. The bulkhead will be designed to accommodate the planned increase to Safe Coast Seafoods facility ground floor elevations in the future.
- The top of the embankment elevation to the north of the bulkhead will be raised to approximately +14 feet (ft) mean lower low water (MLLW) and the existing creosote-treated timber retaining wall will be replaced with riprap to improve shoreline protection. The increase to top of bank elevation will mitigate sea level rise impacts between the bulkhead and the marina access pier to the east.
- Re-grading and re-paving of the upland area behind the bulkhead wall will facilitate positive drainage away from the Safe Coast Seafoods buildings and help protect the facilities during flood events.
- The bulkhead replacement would prevent the shoreline from failing into a portion of the active Port of Ilwaco Marina, which would impact operations in the marina.
- The new bulkhead will be designed to accommodate the temporary mooring of fishing vessels which will allow vessels to unload/load equipment and product and improve efficiencies at the Safe Coast Seafoods facility. The timber bulkhead is used for temporary mooring under existing conditions, but cannot be used for loading/unloading of vessels due to its poor, unstable condition.
- The Project will allow trucks to drive safely on the bulkhead again, which will improve the efficiency of cargo transfer operations and improve the port's competitiveness. The adjacent roadway has been closed to vehicle access due to the poor condition of the existing bulkhead.
- The removal of creosote-treated wood from the marine environment will provide water quality benefits.

1.3. Project Description

The proposed East Bulkhead Resilience Project at the Port would consist of three primary elements:

- Replacing the failing east bulkhead (Figure 3, shown in red) and the installation of fiberglass fender piles external to the bulkhead to support temporary berthing (Figure 3, shown in blue);
- Repairing/replacing slope protection north and south of the bulkhead (Figure 3, shown in green); and,
- Paving and re-grading the upland wharf area directly landward of the bulkhead to mitigate the effects of sea level rise. (Figure 3, shown in yellow).

Figure 3. Location of Proposed Project Activities

As part of the above elements, creosote-treated timber that configures the external wall of the existing bulkhead and retaining wall will be removed along with select derelict creosote-treated piles next to the bulkhead.

Project details are described below.

1.3.1. Bulkhead Wall

Bulkhead replacement will include installing a new 225 linear feet (lf) steel sheet pile wall waterward of the existing creosote-treated timber wall. Select creosote-treated timber piles that configure the exterior portion of the existing wall will be removed to accommodate installation of the new bulkhead. Drainage rock will be placed between the existing and new bulkhead walls and a fender system will be installed on the outer face of the new sheet pile wall.

Removal of the entire existing east bulkhead wall is not feasible without undermining the stability of the soil behind the bulkhead and the adjacent building foundations. The majority of the existing timber bulkhead will be abandoned in place behind the replacement bulkhead in order to protect the existing buildings at the Safe Coast Seafoods facility. Localized bulkhead demolition will likely consist of removal of the rotted top several feet of the existing creosote-treated timber piles above the timber wale location. This targeted demolition will take place above mean higher high water (MHHW). In addition, there may be localized notching of the bulkhead wall to accommodate the installation of the new tie-back ground anchors. Approximately twelve (12) 12-inch diameter existing creosote-treated timber piles and three (3) 12-inch diameter steel pipe piles that are located directly waterward of the existing timber bulkhead will be removed. These piles will be removed by either pulling them out directly using a chain or with a vibratory hammer depending on the eventual contractors preferred means and methods. The piles will be cut at the mudline if complete removal is not possible or the piles break. Upland demolition will consist of removal of the existing pavement and surface features.

The replacement bulkhead will be positioned to the waterside of the existing east bulkhead and will consist of a 225 lf steel sheet pile bulkhead wall with grouted ground anchors extending from a cast-in-place concrete pile cap down to a bedrock layer. The bulkhead wall will not increase in length. The top elevation of the new bulkhead wall will be approximately three (ft) higher than the existing bulkhead to accommodate for high tides and sea level rise. It is anticipated that the steel sheet piles will be driven using a vibratory hammer. The option for impact proofing will also be included in the event difficult driving conditions are encountered. The ground anchors will consist of high strength steel strands or steel bars and will be installed using either land-based equipment or from a barge depending on the contractors preferred means and methods. The anchor holes will be drilled with a full-length casing. All drill spoils will be contained and prevented from entering marine waters. The anchor holes will be filled with grout using a tremie tube and then then pressure grouted after the anchor tendons are installed. The anchors will be tensioned after all anchors have been installed and have reached the required grout

and concrete strengths. The cast-in-place concrete pile cap will then be constructed. The pile cap will be cast-in place in the dry and uncured concrete will not be allowed to come in contact with waters of Baker Bay (Figure 1).

The sheet pile placement in front of the existing bulkhead will result in an approximately 2- to 5-foot space between the existing bulkhead and the new bulkhead sheet piles. The area between the existing structure and the new bulkhead will be backfilled with drainage rock to allow for water to flow in and out of the soil supporting the Safe Coast Seafood facility. Approximately 400 cubic yards (cy) of free draining drainage rock backfill will be placed between the existing timber bulkhead and the replacement bulkhead (Table 1). The drainage rock will likely be placed using a clamshell operating from a barge. The clean drainage rock will be obtained from a commercial supplier. This placement will minimize the risk of slope failure that removing the existing structure would exacerbate. The drainage rock placement in the space between the existing and replacement bulkhead structures will minimize additional pressure from trapped groundwater behind the new bulkhead.

The southern portion of the replaced east bulkhead wall will be designed to accommodate the temporary mooring of fishing vessels by incorporating fiberglass fender piles for temporary berthing (Figure 3, shown in blue). This will allow vessels to unload/load equipment and product to the Safe Coast Seafoods facility. Vessels have temporarily moored adjacent to the existing bulkhead but, as its condition deteriorated and has become unstable, it can no longer be used for loading/unloading of vessels. It is anticipated that the fiberglass fender piles will be driven using vibratory hammers and proofed with an impact hammer as necessary.

The new bulkhead, pile cap, and fender system will have a footprint of approximately 1,500 square feet (sf) in marine waters (measured waterward of the high tide line [HTL]). Of the overall footprint in marine waters, approximately 1,150 sf of the replacement structure will result in benthic habitat impacts. The completed project will result in an increase of overwater coverage of 200 sf.

1.3.2. Slope Protection

Proposed slope protection repairs/replacement include:

- Removing and replacing armoring along the southern shoreline to accommodate bulkhead wall replacement
- Removing the creosote-treated tibmer retaining wall along the northern shoreline and replacing it with riprap.

Approximately 400 sf (16 cy) of riprap and concrete debris from the shoreline to the south of the bulkhead wall will be removed to accommodate replacement bulkhead installation (Table 1). Approximately sixteen (16) 12-inch diameter creosote-treated timber piles associated with the existing timber retaining wall will be removed from the shoreline along the north end of the bulkhead wall. The existing creosote-treated timber retaining wall to the north of the bulkhead will be completely removed. The associated piles will be removed by either pulling them out using a chain or with a vibratory hammer depending on the contractor's preferred means and methods. The piles will be cut at the mudline if complete removal is not possible or the piles break during removal.

The 400 sf (16 cy) of riprap removed from the south portion of the project to accommodate installation of the new bulkhead will be replaced with approximately 35 cy of riprap in the same 400 sf area to maintain slope stability (Table 1). Approximately 30 cy of replacement riprap (total 35 cy) will be placed waterward of the HTL (Table 1).

Approximately 165 cy (2,200 sf) of riprap, 140 cy (1,850 sf) of which occurs below the HTL, will be placed on the embankment to the north of the new bulkhead to replace the existing creosote treated timber retaining wall and provide shore protection (Table 1). The riprap slope protection will serve as grade transition from the vertical bulkhead structure to the adjacent sloped shorelines to the north and south. The top of the embankment will be raised to approximately +14 ft MLLW between the bulkhead and the marina access pier to the east to mitigate the effects of sea level rise.

1.3.3. Upland Paving and Grading

Upland paving and grading will be completed landward of the bulkhead wall along the wharf to mitigate sea level rise following construction of the new bulkhead. Approximately 8,000 sf of driveway along the wharf will be regraded and repaved with structural fill base course and asphalt pavement. The upland area will be re-graded and re-paved to maintain positive drainage away from the Safe Coast Seafoods buildings. The bulkhead will be outfitted with scuppers to allow rainwater to flow into the marina rather than pooling along the driveway or draining toward the Safe Coast facilities.

1.3.4. Benthic Habitat Impacts and Creosote Removal

Approximately twenty-eight (28) creosote-treated timber piles (12-inch diameter) and three (3) steel piles (12-inch diameter) will be removed from adjacent to the existing bulkhead and as part of the north shoreline rehabilitation. The Port also proposes to remove approximately thirty-six (36) 12-inch diameter derelict creosote-treated timber piles and 3 creosote-treated timber pile caps as mitigation for the fill

and benthic habitat impacts created by the placement of the new bulkhead wall in front of the existing structure. This will result in approximately 64 total creosote-treated timber piles and 3 steel piles being removed along with approximately 70 lf of creosote- treated timber retaining wall, and 40 lf of creosote-treated timber pile caps.

Approximately 1,500 sf of drainage rock backfill (Table 1) will be placed below the HTL to encourage groundwater drainage between the existing bulkhead and the new bulkhead. The construction of the bulkhead will result in approximately 1,150 sf of benthic habitat impacts. The new fender system will result in in approximately 200 sf of new overwater coverage.

The riprap to be placed on the north shoreline to replace the existing shoreline protection (creosote-treated timber retaining wall) will be placed over a 2,200 sf area, 1,850 sf of which occurs below the HTL and would result in benthic habitat impacts (Table 1). Approximately 750 sf of the riprap shore protection will be placed waterward of the existing retaining wall. The riprap to be replaced on the shoreline to the south of the bulkhead will not result in any additional benthic habitat impacts (Table 1).

The removal of approximately sixty-four (64) 12-inch creosote-treated timber piles, three (3) 12-inch steel piles, 70 lf of creosote-treated timber retaining wall, and 40 lf of derelict creosote-treated timber pile caps will restore approximately 165 sf of benthic habitat (Table 1) and remove approximately 20 tons of creosote from the marine environment.

Table 1. Approximate Fill Impacts

Activity	Fill below HTL (sf)	Fill below HTL (cy)	Fill above HTL (sf)	Fill above HTL (cy)
Bulkhead wall and shoreline protection installation				
Sheetpile and fender pile installation	500 sf	40 cy	0 sf	0 cy
Bulkhead drainage rock placement	1,000 sf	400 cy	0 sf	0 cy
Rip-rap placement (north shoreline)	1,850 sf	140 cy	350 sf	25 cy
Rubble/ rip-rap removal (south shoreline)	-350 sf	-14 cy	-50 sf	-2 cy
Rip-rap replacement (south shoreline)	350 sf	30 cy	50 sf	5 cy
Structure removal				
Pile removal adjacent to existing bulkhead	-12 sf	-6 cy	0 sf	0 cy
North shoreline- creosote-treated timber retaining wall removal	-85 sf	-12 cy	0 sf	0 cy
Derelict pile/timber removal	-68 sf	-12 cy	0 sf	0 cy

1.3.5. Construction Sequencing

Construction sequencing for the bulkhead replacement will likely be as follows:

- Localized demolition of the existing east bulkhead wall

- Installation of the new steel sheet pile wall
- Placement of drainage rock between the existing east bulkhead wall and new bulkhead wall
- Installation of new fender system along bulkhead

1.4. Avoidance and Minimization Measures (AMMs)

The Project will take place in the water and along the shoreline in the west portion of the Port of Ilwaco Marina which is located along the northeast shore of Baker Bay in Ilwaco, Washington. The paving and regrading portions of the Project will all occur at the top of the shoreline in the dry. The bulkhead sheetpile wall cap will be cast in place and uncured concrete will not be allowed to come into contact with surface waters. The shoreline riprap replacement will be placed in the dry to the extent practicable. The bulkhead demolition, placement of the new bulkhead, fenders and appurtenances will be accomplished using equipment operated from a barge(s).

The following AMMs will be used for this Project:

1.4.1. General AMMs

- Containment booms will be used to surround in-water work areas or separate embankment work from surface water. The booms will serve to contain and collect any oily material and/or floating debris potentially released during construction. Oil-absorbent materials will be employed immediately if visible sheen is observed. Accumulated debris will be collected daily and disposed of at a permitted upland site approved by the owner.
- Hydraulic water jets will not be used to install piles.
- Water quality standards and procedures that limit the impact of pollutants will be observed.
- Land-based staging areas for activities, such as storage of machinery, equipment, materials, and stockpiled soils will be established landward of the top of bank. A silt fence will be installed around the perimeter of the upland work areas and locations where machinery, materials, and stockpiled soils are situated. Any temporary stockpiles will be covered and bermed when not in use.
- All federal, state, and/or local construction permit requirements will be followed during demolition and construction activities.

1.4.2. In, Over, and Near Water AMMs

- In-water construction activities will comply with the in-water construction window (anticipated to be November 1 through February 28 within state and federal permits).
- Typical construction best management practices (BMPs) for working in, over, and near water will be applied, including activities such as the following:
    - Checking equipment for leaks and other problems that could result in the discharge of petroleum-based products or other material into waters of Baker Bay.
    - Corrective actions will be taken in the event of any discharge of oil, fuel, or chemicals into the water, including:
        - Containment and cleanup efforts will begin immediately upon discovery of a spill and will be completed in an expeditious manner in accordance with all local, state, and federal regulations. Cleanup will include proper disposal of any spilled material and used cleanup material.
        - The cause of any spill will be ascertained, and appropriate actions taken to prevent further incidents or environmental damage.
        - Spills will be reported to the Washington State Department of Ecology (Ecology) Southwest Regional Spill Response Office pursuant to WAC 173-303-145 and WAC 173-182-260.
    - Work barges will not be allowed to ground out.
    - Excess or waste materials will not be disposed of or abandoned waterward of ordinary high water or allowed to enter waters of the state. Waste materials will be disposed of in an appropriate manner consistent with applicable local, state, and federal regulations.
    - Demolition and construction materials will not be stored where wave action or upland runoff can cause materials to enter surface waters.
    - Oil-absorbent materials will be present on site for use in the event of a spill or if any oil product is observed in the water.

1.4.3. Pile Removal and Installation AMMs

Pile removal BMPs will be applied, including activities such as the following:

- Removal of creosote-treated piles will be conducted consistent with the BMPs established in U.S. Environmental Protection Agency (EPA) Region 10, Best Management Practices for Piling Removal and Placement in Washington State, dated February 18, 2016 (EPA 2016).
- While creosote-treated piles are being removed, a containment boom will surround the work area to contain and collect any floating debris and sheen. Debris will be retrieved and disposed of properly.
- The piles will be dislodged with a vibratory hammer when possible and will not be intentionally broken by twisting or bending.
- The piles will be removed in a single, slow, and continuous motion in order to minimize sediment disturbance and turbidity in the water column.
- If a pile breaks above or below the mudline, it will be cut or pushed in the sediment consistent with agency-approved BMPs (U.S. Army Corps of Engineers [USACE], Department of Natural Resources [DNR], Ecology, and EPA).
- Removed piles, stubs, and associated sediments (if any) will be contained on a barge. If piles are placed directly on the barge and not in a container, the storage area will consist of a row of hay or straw bales, filter fabric, or similar material placed around the perimeter of the barge.
- All creosote-treated material, pile stubs, and associated sediments (if any) will be disposed of by the contractor in a landfill approved to accept those types of materials.
- Steel piling will be installed with a vibratory hammer when possible. Impact hammering will start with light tapping, then increase to full force gradually.
- A bubble curtain and one or more other noise attenuation methods such as a wood cushion block will be used during impact installation or proofing of all steel piling.
- Pile-driving will commence with a soft start procedure (ramping up) in order to alert nearby wildlife, allowing them to move out of the area prior to construction activities. For impact pile driving, contractors will be required to provide an initial set of strikes from the hammer at reduced percent energy, each strike followed by no less than a 30-second waiting period. This procedure will be conducted a total of two times before impact pile driving begins.
- To avoid impacts to marine mammals, an exclusion zone will be monitored during and immediately before pile driving activities. The exclusion zone will include the entire marina area shoreward of the breakwaters. Although ESA-listed species, including Southern Resident killer whales and humpback whales are not anticipated to occur within the marina where noise

impacts could occur, this avoidance measure would provide further protections against potential noise impacts to these species.

- During pile driving activities a qualified observer will monitor the exclusion zone, if any marine mammals are observed within the exclusion zone, all in-water Project activities shall cease. Project activities shall not commence or continue until the marine mammal has either been observed having left the exclusion zone, or at least 15 minutes have passed since the last sighting whereby it is assumed the marine mammal has voluntarily left the exclusion zone.

1.4.4. Overwater Concrete Placement Minimization and Concrete Placement AMMs

The Project has been designed to minimize the placement of concrete over water. Where possible, pre-cast concrete elements will be used. On-site (wet) concrete placement, where needed, will follow appropriate AMMs, including:

- Wet concrete will not contact surface waters.
- Forms for any concrete structure will be constructed to prevent leaching of wet concrete.
- Concrete process water will not be allowed to enter surface waters. Any process water/contact water will be routed to a contained area for treatment and will be disposed of at an upland location.

2. Action Area

This section describes the defined geographic area that could be affected by the direct and indirect effects of the proposed action (the "Action Area"). The Action Area includes all areas that may be directly or indirectly affected by the proposed activities and expands beyond the immediate location of these activities. The Action Area includes the footprint, extent of potential water quality impacts, and all areas in which related noise will exceed background noise levels. The calculated Action Area was defined by the activity with the greatest potential for adverse impact. For the proposed Project, the greatest potential extent of an adverse impact is Project related noise. Therefore, noise was used to define the total extent of the Action Area (see Section 2.3 and Figure 4)

2.1. Proposed Project Footprint

The Project footprint consists of the physical location of the proposed work. This includes the installation of the bulkhead and fender piles, installation of riprap on the northern shoreline, replacement of armoring on the southern shorelines, removal of the creosote-treated retaining wall, and removal of the derelict creosote-treated piles. The Project footprint is depicted above in Section 1, Figure 3.

2.2. Water Quality

In-water construction activities have the potential to elevate turbidity levels due to sediment resuspension. The proposed activities including structure removal, pile installation, drainage rock placement, and riprap placement could result in small scale turbidity plumes however these would be anticipated to be minor, temporary, and localized to the immediate vicinity of the Project activities.

2.3. Underwater and Terrestrial Noise

The proposed repairs have the potential to result in temporary elevated underwater and terrestrial noise levels, with the most substantial construction activity-related noise being the installation of the sheet pile wall and fender piles. The total extent of Project related noise is defined as the distance in which Project related noise will attenuate to background noise levels. Background in-water and in-air noise levels are discussed in Section 2.3.1. Noise levels associated with the proposed pile installation activities are described in Section 2.3.2.

2.3.1. Background Noise Levels

2.3.1.1. In-water

Site specific underwater noise levels are not available but are anticipated to be elevated due to anthropogenic activities associated with the commercial fishing operations and the use of the marina. Underwater noise levels in deep slow-moving rivers are typically about 120 decibel (dB) root mean square (rms) (Washington Department of Transportation [WSDOT] 2020). Given the occurrence of the Project in the Columbia River, a deep slow-moving river, 120 dBrms has been used to represent the anticipated in-water background noise level for the Project area. However, it should be noted that background noise may be higher than 120 dBrms depending on the levels of activity occurring at the wharf and marina.

2.3.1.2. In-air

Site specific in-air noise levels are not available but are anticipated to be elevated due to anthropogenic activities including port and marina traffic within the area. Waterfront Way is a one-lane street immediately adjacent to the Project site and would be anticipated to contribute background traffic noise. In addition, Howerton Avenue, a two-lane road, is approximately 150 ft from the Project site. The speed limit for Howerton Avenue is 25 miles per hour (mph). The WSDOT Biological Assessment Manual (2020) reports typical traffic noise levels for various speed limits (ranging from 35 mph to 75 mph) and traffic counts, ranging from 125 per hour (hr) to 6,000/hr). Traffic noise levels for traffic counts of approximately 125 vehicles per hour traveling at speeds of 35 miles per hour (mph), is 57 A-weighted decibels (dBA) at 50 ft from the source (WSDOT 2020). The Project is located within an area zoned as light industrial and adjacent to areas zoned as low density commercial (City of Ilwaco 2022). Commercial and industrial activities within the vicinity would be anticipated to contribute to background noise levels. Measured in-air background noise levels at the Port of Bellingham, a larger Port facility, ranged from 69 dBA to 73 dBA during peak traffic hours (Landau 2007). In the absence of site specific in-air noise data, 60 dBA is assumed to be representative of the in-air background noise level given the commercial and industrial activities in the area and proximity to roads.

2.3.2. Project-related Noise Levels

2.3.2.1. In-water Noise Levels

The Project proposes to install a 225 lf steel sheet pile wall and approximately ten (10) 12-inch diameter fiberglass piles. The fiberglass piles consist of concrete piles with fiberglass casings and anticipated in-water noise levels are based on documented noise levels for concrete pile installation. Noise levels for

the installation of 12-inch diameter concrete piles are not available and therefore noise levels for the installation of 14-inch diameter concrete piles were used to conservatively approximate potential noise levels. It is anticipated that the steel sheet pile wall and fiberglass fender piles will be driven using a vibratory hammer. The option for impact proofing has been included in the event that difficult driving conditions are encountered. A bubble curtain would be used during the impact pile driving of steel sheet piles and a 5dB noise reduction has been assumed. Anticipated noise levels for the proposed pile installation activities are shown in Table 2.

Vibratory pile driving noise levels for the installation of fiberglass piles are not available. Therefore, vibratory noise levels are based on the impact installation of fiberglass piles. Vibratory pile driving generally results in noise levels that are 10 to 20 dB lower than impact pile driving (WSDOT 2020). The noise levels from vibratory installation have been conservatively assumed to be 10 dB lower than the noise levels emitted during impact installation (Table 2).

Table 2. Anticipated In-water Pile Driving Noise Levels

Pile Type	Installation Method	Anticipated Noise Level		
		dB peak	SEL	dBrms
Sheet Pile*[1]	Impact (attenuated)	204	161	170
Sheet Pile[1]	Vibratory	177	163	163
Concrete (14-inch diameter)[1]	Impact	183	146	157
Concrete (12-inch diameter)[1,2]	Vibratory	173	136	147

* Assumes 5dB reduction for use of bubble curtain
[1] California Department of Transportation (Caltrans) 2020
[2] WSDOT 2020
[3] Sound exposure level (SEL)

The impact installation of steel sheet pile walls has the greatest potential to result in noise impacts and was therefore used to determine the total extent of in-water noise. In-water noise would dissipate to the 120 dBrms background noise levels within 13.5 miles of the proposed pile driving activities if not confined by adjacent land masses (Figure 4). The rubble breakwaters around the marina would be anticipated to limit the extent of in-water noise to the marina/port area (Figure 4). Noise calculations were completed in accordance with the WSDOT 2020 Biological Assessment Manual, using the practical spreading loss model and assuming a 4.5 dBA attenuation rate for each doubling distance.

2.3.2.2. In-air Noise Levels.

Airborne noise levels for the installation of steel sheet piles and/or fiberglass piles is not available. In general, vibratory pile drivers can result in airborne noise levels of up to 105 dBA at 50 ft from the source (WSDOT 2020). Similarly, impact pile drivers can result in noise levels of up to 105 dBA at 50 ft from the

source (WSDOT 2020). The piles proposed for installation are small in size and would likely result in noise levels of less than 105 dBA. However, for the purpose of this noise analysis, 105 dBA was used as a conservative estimate to assess potential airborne noise impacts. In-air pile driving noise would dissipate to 60 dBA background noise levels within 1.7 miles of the proposed pile driving activities (Figure 4). Noise calculations were completed in accordance with the WSDOT 2020 Biological Assessment manual, using the spherical spreading loss model and assuming a 6 BA attenuation rate for each doubling distance.

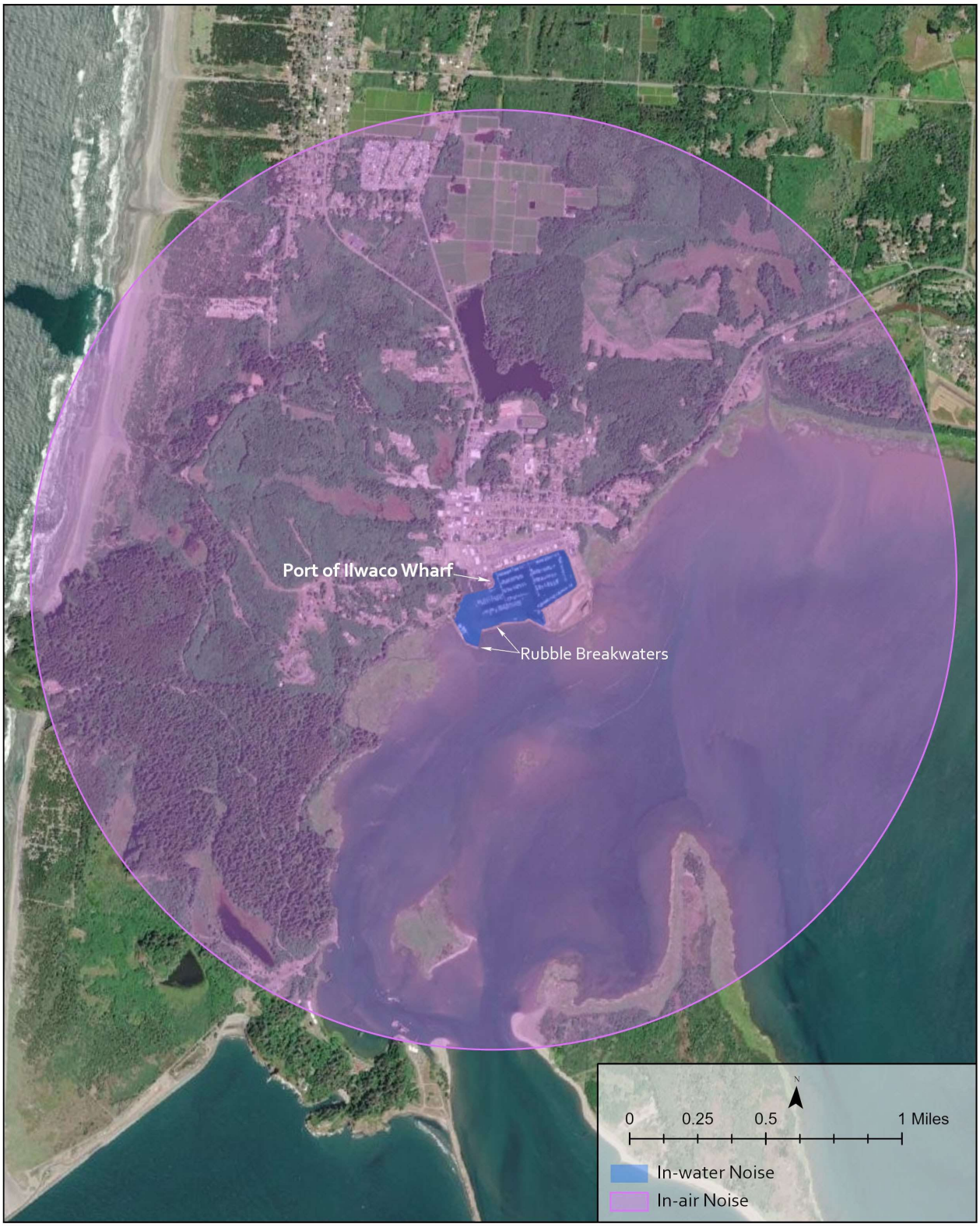

Figure 4. Action Area as Defined by In-water and In-air Noise

3. Status of Species and Critical Habitat

This Section discusses the ESA-listed species and critical habitat known to occur, or with the potential to occur, within the Action Area. Chinook salmon (*Oncorhynchus tshawytcha)* chum salmon (*Oncorhynchus keta*), Coho salmon (*Oncorhynchus kisutch)*, sockeye salmon (*Oncorhynchus nerka)*, steelhead *(Onocorhynchus myskiss)*, bull trout (*Salvelinus confluentus)*, green sturgeon (*Acipenser medirostris)*, eulachon (*Thaleichthys pacificus)*, leatherback sea turtle (*Dermochelys coriacea*), southern resident killer whales (*Orcincus orca)*, humpback whale (*Megaptera novaeangliae)*, western snowy plover (*Charadrius nivosus nivosus*), marbled murrelet (*Brachyramphus marmoratus)*, and streaked horned lark (*Eremophila alpestris strigata)* could occur in the Project Area (Table 3). It was determined that the Project may affect, but is not likely to adversely affect (NLAA) the ESA-listed species listed in Table 3. Yellow billed cuckoo (*Coccyzus americanus)* and monarch butterfly (*Danaus plexippus)* were evaluated for their potential to occur in the Project Area. However, it was determined that these species will either not occur in the Project Area based on the location of the Project and available habitat or would not be impacted by the Project given the nature of the proposed activities (Table 4). The Project would have no effect on the species listed in Table 4.

Information for this BE regarding listed species was obtained from the USFWS Information for Planning and Consultation (IPaC) website (USFWS 2022a) and the NMFS West Coast Region protected species website and Protected Resources App database (NMFS 2022a and NMFS 2022b) on 20 June 2022. Additional information came from the Washington Department of Fish and Wildlife's (WDFW's) database, SalmonScape (WDFW 2022a).

Table 3. ESA-Listed Species with Potential to Occur Within the Project Action Area

Species	ESU/DPS	Scientific Name	Agency	Federal Status	Critical Habitat
Chinook Salmon	Lower Columbia River evolutionarily significant unit (ESU)	*Oncorhynchus tshawytcha*	NMFS	Threatened	Occurs in Action Area
	Snake River fall-run ESU			Threatened	
	Snake River spring/summer-run ESU			Threatened	
	Upper Columbia River spring-run ESU			Endangered	
	Upper Willamette River ESU			Threatened	
Chum Salmon	Columbia River ESU	*O. keta*	NMFS	Threatened	Occurs in Action Area
Coho Salmon	Lower Columbia River ESU	*O. kisutch*	NMFS	Threatened	Occurs in Action Area

Species	ESU/DPS	Scientific Name	Agency	Federal Status	Critical Habitat
Sockeye Salmon	Snake River ESU	*O. nerka*	NMFS	Endangered	Occurs in Action Area
Steelhead	Lower Columbia River Distinct Population Segment (DPS)	*Onocorhynchus myskiss*	NMFS	Threatened	Occurs in Action Area
	Middle Columbia River DPS			Threatened	
	Snake River Basin DPS			Threatened	
	Upper Columbia River DPS			Threatened	
	Upper Willamette River DPS			Threatened	
Green sturgeon	Southern DPS	*Acipenser medirostris*	NMFS	Threatened	Occurs in Action Area
Eulachon	Southern DPS	*Thaleichthys pacificus*	NMFS	Threatened	Occurs in Action Area
Sea turtles	Leatherback	*Dermochelys coriacea*	NMFS	Endangered	None in Action Area
Killer Whale	Southern Resident	*Orcincus orca*	NMFS	Endangered	None in Action Area
Humpback Whale	Central America DPS	*Megaptera novaeangliae*	NMFS	Endangered	None in Action Area
	Mexico DPS			Threatened	None in Action Area
Bull Trout	N/A	*Salvelinus confluentus*	USFWS	Threatened	None in Action Area
Western Snowy Plover	N/A	*Charadrius nivosus*	USFWS	Threatened	None in Action Area
Marbled Murrelet	N/A	*Brachyramphus marmoratus*	USFWS	Threatened	None in Action Area
Streaked Horned Lark	N/A	*Eremophila alpestris strigata*	USFWS	Threatened	None in Action Area

Source: USFWS Information for Planning and Consultation (IPaC) database (USFWS 2022) and the NOAA Fisheries Protected Resources App (NOAA 2022).

Table 4. ESA-Listed Species Determined to not Occur in Project Area or be Impacted by Project

Species	Scientific Name	Agency	Status	Additional Information
Yellow-billed Cuckoo	*Coccyzus americanus*	USFWS	Threatened	Yellow-billed cuckoo believed to be extirpated from all its historical range in Washington (85 Federal Register [FR] 11465). Associated with cottonwood and willow riparian habitat, a habitat that does not occur in the Action Area.
Monarch Butterfly	*Danaus plexippus*	USFWS	Candidate	Proposed activities would not destroy vegetation that could provide habitat. Impacts would not occur.

Source: USFWS (IPaC) database (USFWS 2022)

4. Listed Species and Critical Habitat

4.1. Chinook Salmon (*Oncorhynchus tshawytscha*)

The Action Area is potential habitat for five ESU of Chinook salmon (*Oncorhynchus tshawytscha*): the Lower Columbia River (LCR), Upper Willamette River (UWR), Upper Columbia River (UCR), Snake River spring/summer-run (SR-SS), and Snake River fall-run (SR-F).

The LCR ESU of Chinook salmon includes all natural spawning populations in river reaches accessible to Chinook salmon in Columbia River tributaries between the Grays and White Salmon Rivers in Washington and the Willamette and Hood Rivers in Oregon (70 FR 37160). The other ESUs with the potential to occur within the Action Area use the Columbia River as a migratory corridor to spawning and rearing habitats higher in the watershed.

The most recent 5-year status reviews for these ESUs indicate that there has been some modest increase in abundance for some ESU populations, but most are not currently meeting recovery goals (NMFS 2016a). Native stocks are scarce or nonexistent (Myers et al. 1998; Lower Columbia Fish Recovery Board [LCFRB] 2010a). Habitat degradation due to stream blockages, forest practices, urbanization, and agriculture are listed as primary causes of decline.

4.1.1. Distribution and Habitat Requirements

Chinook salmon have the most complex life history with a large variety of patterns compared to other Pacific salmon. The length of freshwater and saltwater residency varies greatly (Myers et al. 2006). Channel size and morphology, substrate size and quality, water quality, and cover type and abundance may influence distribution and abundance of Chinook salmon (Lower Columbia Fish Recovery Board [LCFRB] 2010a). Columbia River stocks return to spawn in the fall and spring after three to five years in the ocean. Spawning occurs in the mainstems of larger tributaries in coarse gravel and cobble (Myers et al. 1998).

4.1.2. Presence in Action Area

Habitat use within the Action Area is variable, depending on the stock. Adult fish migrate through the Action Area almost year-round. Depending on the ESU, adults enter the LCR between February and November and spawn in tributaries from August through September (Myers et al. 2006, LCFRB 2010b). The portion of the LCR that is within the Action Area does not provide any suitable spawning or rearing habitat for Chinook salmon, as suitable spawning substrate is virtually non-existent. If they are present, migrating adults are expected to be moving quickly through the Action Area.

Juvenile movement through the Action Area is also variable depending on the stock. Juveniles often move into the LCR and estuary to over-winter (LCFRB 2010c). Spring Chinook tend to rear in tributary streams for a year, and yearlings out-migrate rapidly during the spring freshet (LCFRB 2010b). Fall Chinook tend to out-migrate as sub-yearlings in the late summer and fall of their first year (LCFRB 2010b). These fish are more likely to spend days to weeks residing in tidal freshwater habitats with peak abundances occurring March through May (Hering et al. 2010; McNatt et al. 2016). Smaller sub-yearling salmonids will likely congregate along the nearshore areas in shallow water and extend into the channel margins (Bottom et al. 2011), but some research indicates there is higher use of the channel margins than previously thought (Carlson et al. 2001) and relative juvenile position in the water column suggests higher potential sub-yearling use in areas of 20- to 30-ft-deep.

4.1.3. Critical Habitat

The proposed action occurs within designated critical habitat for all five ESU Chinook salmon. Table 5 provides a brief summary of the critical habitat designations.

Table 5. Chinook Salmon Critical Habitat Designations and Descriptions

Species and ESU/DPS	Date of Designation	Description of Critical Habitat
Chinook Salmon		
Lower Columbia River ESU	2 September 2005	Columbia River to confluence with Hood River and tributaries.
Upper Willamette River ESU	2 September 2005	Columbia River to confluence with Willamette River. Willamette River, including Willamette Channel, and tributaries.
Upper Columbia River Spring–Run ESU	2 September 2005	Columbia River to Island Dam and tributaries.
Snake River Spring/ Summer-Run ESU	25 October 1999	Columbia River to confluence with Snake River. Snake River and tributaries.
Snake River Fall-Run ESU	28 December 1993	Columbia River to confluence with Snake River. Snake River and tributaries.

Critical habitat is a specific geographic area that contains features essential to the conservation of the species. The primary constituent elements (PCEs) determined essential for to the conservation of salmon and steelhead and the presence or absence of these PCEs are discussed below. These PCEs are consistent for all ESU/DPS salmon and steelhead addressed in this BE and this Section will be referenced in discussion for those ESU/DPS below.

- ***Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development.***

The Action Area is situated at the mouth of the Columbia River where saline ocean water mixes with and is diluted by freshwater from the river system and does not provide suitable freshwater spawning habitat for salmon and steelhead.

- ***Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.***

The Action Area does not provide suitable freshwater habitat necessary to support juvenile growth and mobility, or juvenile development because is situated within an estuarine environment where saline ocean water mixes with freshwater from the river system.

- ***Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.***

The Action Area does not provide suitable freshwater migration habitat because it is situated within an estuarine environment where saline ocean water mixes with freshwater from the river system. It is possible that adult and juvenile salmon and steelhead migrate through the Action Area between their off-shore marine habitats and freshwater natal streams, however the nature of the estuarine environment within the Action Area is not a freshwater system.

- ***Estuarine areas free of obstruction with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh-and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.***

The Action Area provides only marginal estuarine rearing habitat for juvenile salmonids. The marina is enclosed by rock jetties with only limited natural cover or aquatic vegetation. Most of the shoreline consists of developed and/or armored areas with only short statured vegetation when present. West of the marina there is approximately 1,000 ft of more natural vegetated shoreline that provides cover, overhanging vegetation, and woody debris. The marina does not provide any side channel or off-channel habitat. The portion of the LCR that is within the Action Area does provide suitable habitat for juvenile growth, mobility, or forage, but offers very limited, suboptimal habitat for juvenile rearing, growth and maturation, and/or juvenile or adult forage.

- ***Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.***

The Action Area provides only marginal nearshore habitat for salmonids. The enclosed marina does not provide natural cover, submerged or overhanging large wood, aquatic vegetation, rocks, boulders, or

side channels. Most of the shoreline consists of developed and/or armored areas with only short statured vegetation when present. West of the marina there is some naturally vegetated shoreline that provides cover, overhanging vegetation, and woody debris. The in-water Action Area likely provides suitable water quality and quantity conditions to support foraging behavior (aquatic invertebrates and fish) for adult and juvenile salmonids. The portion of the LCR that is within the Action Area does provide suitable habitat for juvenile growth, maturation, and forage, but available habitat is limited and suboptimal compared to better quality habitat immediately outside of the Action Area within Baker Bay.

- ***Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.***

The Action Area does not provide offshore marine habitat for salmon and steelhead. As mentioned previously, the Action Area consists of the estuarian and nearshore habitat of Baker Bay at the mouth of the LCR where ocean water mixes with freshwater from the river system.

4.2. Chum Salmon (*Oncorhynchus keta*)

The proposed Project area is located within the Columbia River ESU of chum salmon (*Oncorhynchus keta*). The Columbia River ESU of chum salmon includes all naturally spawning populations in all river reaches accessible to chum salmon in the Columbia River downstream from Bonneville Dam (70 FR 37160).

The majority of the populations in this ESU are at high to very high risk, with very low abundances (NWFSC 2015). Columbia River ESU chum salmon are essentially extirpated upstream of Bonneville Dam. Only three populations (Grays River, Hardy Creek, and Hamilton Creek) are at low to moderate risk. The ESU as a whole remains at moderate to high risk. Habitat loss and degradation due to dam placement, forest practices, and urbanization are the most significant causes of decline in this ESU (Johnson et al. 1991; LCFRB 2010a).

4.2.1. Distribution and Habitat Requirements

Historically, chum salmon were very abundant in the Columbia River. They have the broadest spawning distribution of Pacific salmon species. Chum salmon have a very short freshwater residency time, and require cool, clean water, and substrate for spawning. Migration to saltwater occurs immediately after emerging from the gravel. After three to five years in saltwater, Columbia River chum salmon return to spawn in the fall. Spawning typically takes place in the lower mainstems of rivers, including the Columbia River, frequently in locations within the tidal zone where there is an abundance of clean gravel.

4.2.2. Presence in Action Area

Adults likely use the Action Area only as a migration corridor. Adult fish enter freshwater and likely migrate through the Action Area from mid-October through November and spawn from early November to late December. Spawning occurs in low-gradient, low-elevation reaches of the LCR and major tributaries (LCFRB 2010b). Spawning habitat requirements include clean gravel and spawning sites are typically associated with areas of upwelling water (LCFRB 2010a). No suitable spawning habitat exists within the Action Area.

Juvenile out-migration to the Columbia River estuary for rearing occurs soon after emergence from spawning gravels, from mid-February to mid-June. Chum salmon usually spend more time in estuaries than do other anadromous salmonids (Dorcey et al. 1978 and Healey et al. 1982, as cited in NMFS 2013)—(up to weeks or months) (NMFS 2011). Shallow, protected habitats such as salt marshes, tidal creeks, and intertidal flats serve as rearing areas for juvenile chum salmon during estuarine residency (LCFRB 2010a). Juvenile chum salmon rear in the Columbia River estuary from February through June before beginning long-distance ocean migrations (LCFRB 2010a).

No backwater channels habitat suitable for rearing chum salmon occur within the Action Area and nearshore habitat that does occur within the Action Area is not optimal for rearing. Chum salmon may rear within the Action Area.

4.2.3. Critical Habitat

The proposed action occurs within designated critical habitat for all Columbia River ESU chum salmon Table 6 provides a brief summary of the critical habitat designations.

Table 6. Chum Salmon Critical Habitat Designations and Descriptions

Species and ESU/DPS	Date of Designation	Description of Critical Habitat
Chum Salmon		
Columbia River ESU	2 September 2005	Columbia River to confluence with Hood River and tributaries.

Critical habitat is a specific geographic area that contain features essential to the conservation of the species. The PCEs determined essential to the conservation of salmon and steelhead that could be present within the Action Area are consistent for all ESU/DPS salmon and steelhead addressed in this BE. See Section 4.1.3 above for discussion of PCE presence within the Action Area.

4.3. Coho Salmon (*Oncorhynchus kisutch*)

The Action Area is located within the LCR ESU of Coho salmon (*Oncorhynchus kisutch*). This ESU includes all natural spawning populations in Columbia River tributaries below the Klickitat River in Washington and the Deschutes River in Oregon (including the Willamette River up to Willamette Falls) (70 FR 37160).

Of the 24 populations that make up this ESU, 21 populations are at very high risk, one population is at high risk, and two populations are at moderate risk. While recovery efforts have likely improved the status of a number of Coho salmon populations, abundance is still at low levels and the majority of the populations remain at moderate or high risk. Limiting factors for this ESU include degraded habitat and restricted access (e.g., altered flow regime in the Columbia River, sediment and nutrient changes in the estuary, fish passage barriers, reduced access to off-channel rearing habitat, and presence of contaminants), and over harvesting (LCFRB 2010b).

4.3.1. Distribution and Habitat Requirements

Historically, Coho salmon spawned in almost every accessible stream system in the LCR and typically occupy intermediate positions in tributaries relative to chum and fall-run Chinook (downstream) and steelhead and spring-run Chinook (upstream) (LCFRB 2010a). Coho salmon usually spawn in small to medium, low-to-moderate elevation streams and favor small, rain-driven, lower elevation streams characterized by late summer and early fall low flows, and increased river flows with cooler water temperatures in winter (LCFRB 2010a). Redds are constructed in gravel and small cobble substrate in pool tailouts, riffles, and glides and sufficient flow depth is required for spawning activity (NMFS 2013). Eggs incubate over late fall and winter for about 45 to 140 days, depending on water temperature, Fry typically emerge from early spring to early summer. Hatching success depends on clean gravel that is not choked with sediment or subject to extensive scouring by floods (LCFRB 2010a).

Juveniles rear in freshwater for more than a year. Fry move to shallow low-velocity environments (stream edges and side channels) after emergence. Juveniles favor pools and will congregate in backwaters and side channels (LCFRB 2010a). Most juvenile Coho salmon migrate seaward as smolts in April to June, (typically during their second year). Coho generally do not linger for extended periods in the LCR estuary, but it is a critical habitat used for feeding during the physiological adjustment to salt water. Juvenile Coho salmon are present in the LCR estuary from March to August (LCFRB 2010a). Adult Coho salmon return from the ocean to spawn during fall freshets in September and October.

The distribution and abundance of Coho salmon are most likely influenced by water temperature, stream size and flow, channel morphology, vegetation type and abundance, and channel substrate.

4.3.2. Presence in Action Area

There are two types of run timing associated with Coho, Type S, which are early run, and Type N, which are late run (Myers et al. 2006). Type S fish generally return to the Columbia River from August to October and spawn in October and November. Type N fish return to the Columbia River from October to November/ December and spawn in November through January. Some Type N Coho can spawn as late as mid-February (Myers et al. 2006).

Spawning in the tributaries of the LCR occurs roughly November through January (Weitkamp 1994). No suitable spawning habitat is present within the Action Area.

Juveniles rear in smaller tributaries and are not anticipated to rear in significant numbers within the Action Area. Juvenile out-migration occurs in the spring and summer of the second year, with the peak occurring in May (LCFRB 2010b). Depending on the degree of maturation, some juveniles may forage in the Action Area during out-migration.

4.3.3. Critical Habitat

The proposed action occurs within designated critical habitat for LCR ESU Coho salmon. Table 7 provides a brief summary of the critical habitat designations.

Table 7. Coho Salmon Critical Habitat Designations and Descriptions

Species and ESU/DPS	Date of Designation	Description of Critical Habitat
Coho Salmon		
Lower Columbia River ESU	24 February 2016	Columbia River to confluence with Hood River and tributaries.

Critical habitat is a specific geographic area that contain features essential to the conservation of the species. The PCEs determined essential for to the conservation of salmon and steelhead that could be present within the Action Area are consistent for all ESU/DPS salmon and steelhead addressed in this BE. See Section 4.1.3 above for discussion of PCE presence within the Action Area.

4.4. Sockeye Salmon (*Oncorhynchus nerka*)

The Action Area is located within the Snake River ESU of sockeye salmon (*Oncorhynchus nerka*). The Snake River ESU of sockeye salmon includes all river reaches and estuary areas presently or historically accessible to sockeye salmon in the Columbia River. This is defined as all river reaches east of a straight line connecting the west end of the Clatsop Jetty (Oregon side) and the west end of the Peacock Jetty (Washington side), and extending upstream to the confluence of the Snake River, upstream on the Snake River to the confluence of the Salmon River, and upstream on the Salmon River to the confluence of the

Alturas Lake Creek and Stanley, Redfish, Yellow Belly, Pettit, and Alturas Lakes (including their inlet and outlet tributaries) (70 FR 37160).

The Snake River ESU of sockeye salmon is extremely close to extinction. There has been substantial progress on developing hatchery program(s) to amply stock and facilitate reintroductions and captive brood programs have been successful in providing substantial numbers of hatchery produced fish for use in supplementation efforts, but this single population ESU is at very high risk due to small population size (NMFS 2016b). Limiting factors for this ESU include effects related to the hydropower system on the Columbia River, reduced water quality and elevated temperatures, water quality, and predation. The only extant sockeye salmon in the Snake River ESU spawn in lakes in the Stanley basin of Idaho.

4.4.1. Distribution and Habitat Requirements

Historically, adult sockeye salmon in the Snake River ESU enter the LCR in June and July and migrate upstream through the Snake and Salmon Rivers, arriving at their natal lakes in August and September. Spawning peaks in October and occurs in lakeshore gravels. Fry emerge in late April and May and move immediately to the open waters of the lakes where they feed on plankton for one to three years before migrating to the ocean (NMFS 2015). Juvenile sockeye generally leave Redfish Lake from late April through May and migrate to the Pacific Ocean. Snake River ESU sockeye salmon spend two to three years in the Pacific Ocean before returning to their natal lakes to spawn (NMFS 2015).

4.4.2. Presence in Action Area

Adult and juvenile sockeye salmon are expected to migrate through the Project vicinity. In the Columbia River basin, sockeye salmon spawn and rear in lakes in the upper Snake River watershed. Adults likely migrate through the Action Area in June and July. Juvenile out-migration begins in early spring after ice breakup on the lakes (LCFRB 2010c), and out-migrating juveniles are likely present within the Action Area between April and June.

4.4.3. Critical Habitat

The proposed action occurs within designated critical habitat for Snake River ESU sockeye salmon. Table 8 provides a brief summary of the critical habitat designations.

Table 8. Sockeye Salmon Critical Habitat Designations and Descriptions

Species and ESU/DPS	Date of Designation	Description of Critical Habitat
Sockeye Salmon		
Snake River ESU	28 December 1993	Columbia River to confluence with Snake River. Snake River and tributaries.

Critical habitat is a specific geographic area that contain features essential to the conservation of the species. The PCEs determined essential for to the conservation of salmon and steelhead that could be present within the Action Area are consistent for all ESU/DPS salmon and steelhead addressed in this BE. See Section 4.1.3 above for discussion of PCE presence within the Action Area.

4.5. Steelhead (*Oncorhynchus mykiss*)

The Action Area represents potential habitat for five ESUs of steelhead (*Oncorhynchus mykiss*): the LCR, UWR, Middle Columbia River (MCR), UCR, and Snake River Basin ESU. The LCR within the Action Area represents a migration corridor for these five ESUs.

Factors contributing to the decline of the steelhead ESU in the Columbia River include predation and competition, blocked access to historical habitat, habitat degradation, hatchery practices, and urbanization. Despite the ability of steelhead to use a diversity of habitats, very few healthy stocks remain within the Columbia River basin (LCFRB 2010c).

4.5.1. Distribution and Habitat Requirements

Steelhead is the most widely distributed anadromous salmonid. The life history pattern of steelhead can be very complex, involving repeated spawnings, and continuous reversals of freshwater to ocean phases (LCFRB 2010c). The distribution and abundance of steelhead are thought to be influenced by water temperature, stream size, flow, channel morphology, vegetation type and abundance, and channel substrate size and quality (LCFRB 2010c). Steelhead use a wide range of habitat types from low-order tributaries to river mainstems depending upon the specific requirements of a particular life stage (61 FR 41541). Steelhead ESU that migrate within the LCR return in the spring and fall to spawn. Spawning occurs in small to large gravel of tributaries and smaller rivers (LCFRB 2010b). Fry emergence typically occurs from March into July, with peak emergence time generally in April and May (NMFS 2015). Fry usually move to the shallow margins of streams following emergence and begin inhabiting deeper, higher velocity environments as they grow. Juvenile steelhead rear in freshwater streams for 1 to 4 years before migrating to the ocean. Outmigration generally occurs from March to June. Catch data suggest that juvenile steelhead migrate directly offshore during their first summer.

4.5.2. Presence in Action Area

Adult and juvenile steelhead most likely use the Action Area as a migration corridor. Adults likely migrate through the Action Area year-round, depending on the run type. Summer steelhead migrate upstream within the Columbia River between roughly May and October, with spawning occurring in tributaries

between late February and early April. Winter-run adults enter the LCR between December and May, spawning in tributaries in late April and early May.

Peak adult spawning for both summer and winter runs occurs in the spring. Spawning occurs in the tributaries throughout the Columbia River basin (LCFRB 2010b). In streams that support both summer and winter steelhead runs, summer steelhead tend to spawn higher in the watershed. No suitable steelhead spawning habitat occurs within the Action Area.

The peak juvenile out-migration through the LCR occurs in the spring. Over-wintering and out-migrating juvenile steelhead occupy the nearshore habitat within the Project area. Juvenile steelhead may be present in high numbers during migration periods.

4.5.3. Critical Habitat

The proposed action occurs within designated critical habitat for all five ESU of listed steelhead. Table 9 provides a brief summary of the critical habitat designations.

Table 9. Steelhead Critical Habitat Designations and Descriptions

Species and ESU/DPS	Date of Designation	Description of Critical Habitat
Steelhead		
Lower Columbia River DPS	2 September 2005	Columbia River to confluence with Hood River and tributaries.
Upper Willamette River DPS	2 September 2005	Columbia River to confluence with Willamette River. Willamette River, including Willamette Channel, and tributaries.
Middle Columbia River DPS	2 September 2005	Columbia River to confluence with Yakima River and tributaries.
Upper Columbia River DPS	2 September 2005	Columbia River to Chief Joseph Dam and tributaries.
Snake River Basin DPS	2 September 2005	Columbia River to confluence with Snake River. Snake River and tributaries.

Critical habitat is a specific geographic area that contain features essential to the conservation of the species. The PCEs determined essential for to the conservation of salmon and steelhead that could be present within the Action Area are consistent for all ESU/DPS salmon and steelhead addressed in this BE. See Section 4.1.3 above for discussion of PCE presence within the Action Area.

4.6. Bull Trout (*Salvelinus confluentus*)

The Project area is located within the Columbia River DPS of bull trout (*Salvelinus confluentus*). Excluding one Nevada population, the Columbia River DPS includes all natural spawning populations in the Columbia River basin within the U.S. and its tributaries (FR 63 31647). Bull trout in the Columbia River DPS are listed as threatened under the ESA. Bull trout are piscivorous and are the only native char.

Key factors in the decline of bull trout populations include harvest by anglers, impacts to watershed biological integrity, and the isolation and fragmentation of populations. Changes in sediment delivery (particularly to spawning areas), degradation and scouring, shading (high water temperature), water quality, and low hydrologic cycles adversely affect bull trout. Therefore, impacted watersheds are negatively associated with current populations. Bull trout also appear to be affected negatively by non-native trout species through competition and hybridization.

4.6.1. Distribution and Habitat Requirements

Bull trout were once widely distributed throughout the Pacific Northwest but have been reduced to approximately 44 percent of their historical range (LCFRB 2010c). Bull trout are thought to have more specific habitat requirements in comparison to other salmonids and are most often associated with undisturbed habitat with diverse cover and structure. Spawning and rearing are thought to be primarily restricted to relatively pristine cold streams, often within headwater reaches (Rieman and McIntyre 1993). Adults can reside in lakes, reservoirs, and coastal areas or they can migrate to saltwater (63 FR 31647). Juveniles are typically associated with shallow backwater or side-channel areas, while older individuals are often found in deeper pools sheltered by large organic debris, vegetation, or undercut banks (63 FR 31467). Water temperature is also a critical factor for bull trout and areas where water temperature exceeds 59°F (15°C) are thought to limit distribution (Rieman and McIntyre 1993).

4.6.2. Presence in Action Area

In southwest Washington, bull trout have been reported in the North Fork Lewis, White Salmon, and Klickitat River systems (USFWS 1998). Historically, bull trout were found in the Cowlitz and Kalama basins but are not believed to be present there today. Bull trout populations occur in two drainages downstream of Bonneville Dam: the Willamette River and the Lewis River (USFWS 1998). Because bull trout in the LCR basin are not usually anadromous, they are primarily regulated by local habitat conditions, and not directly affected by conditions in the mainstem Columbia River and estuary (LCFRB 2010c).

The only core areas presently supporting anadromous populations of bull trout are located within the Puget Sound and Olympic Peninsula regions. Although bull trout in the LCR region share a genetic past with the Puget Sound and Olympic Peninsula regions, it is unclear to what extent the LCR core areas supported the anadromous life history in the past or could in the future (Ardren et al. 2011 in USFWS 2015a).

Bull trout prefer the upper reaches of cold, clear running streams with clean gravel and cobble substrate for spawning. Adult bull trout in the Columbia River basin spawn in headwater tributaries and forage in mainstem freshwater reaches of larger rivers. It is unlikely that bull trout would occur in the Action Area because it is located within the marine/mixing zone of the Columbia River estuary.

4.6.3. Critical Habitat

The critical habitat designation and description for Columbia River DPS bull trout are summarized in Table 10.

Table 10. Bull Trout Critical Habitat Designation and Descriptions

Species and ESU/DPS	Date of Designation	Description of Critical Habitat
Bull Trout		
Columbia River DPS	17 November 2010	Mainstem Columbia River and major tributaries from mouth to Chief Joseph Dam.

The PCEs determined essential to the conservation of Columbia River DPS bull trout are as follows:

- ***Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.***

The Action Area does not provide these habitat characteristics and will not impact these PCEs of bull trout critical habitat.

- ***Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.***

The Action Area may serve as a migratory corridor for bull trout. However, habitat conditions within the Action Area severely limit its suitability. No natural cover, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, or large rocks and boulders exist within the active marina. As previously discussed there is more natural shoreline on the west side of the Action Area that may provide limited marginal resources for bull trout mobility and survival.

- ***An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.***

The Action Area does provide habitat for native and non-native juvenile fishes and aquatic macroinvertebrates that serve as prey for bull trout.

- ***Complex river, stream, lake, reservoir, and marine shoreline aquatic environments, and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.***

The Action Area includes a developed marina that is dredged to maintain vessel access and shorelines that are engineered. As previously discussed, the west side of the marina does provide some more natural shoreline characteristics. The Action Area does not provide these habitat characteristics and the will not impact these PCEs of bull trout critical habitat.

- ***Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence.***

The LCR downstream of Bonneville Dam does not typically achieve water temperatures that would be suitable for bull trout (USACE 2011a). Summer water temperatures frequently exceed thresholds considered necessary for salmonid growth and survival (Tanner et al. 2012). The Action Area may provide suitable conditions for bull trout survival throughout the year but in general this PCE is not present within the Action Area and the Project will not impact this PCE of bull trout critical habitat.

- ***In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in larger substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to bull trout will likely vary from system to system.***

The Action Area does not provide these habitat characteristics and the Project will not impact these PCEs of bull trout critical habitat.

- ***A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departure from a natural hydrograph.***

Freshwater flows of the Columbia River are controlled for hydroelectric operations of the Bonneville Dam. Hydrologic control of the Columbia River at Bonneville Dam has altered the natural hydrograph of the river system, however, operations at the dam implement "target flows" to ensure adequate instream flows to support salmon and steelhead life stages including smolt outmigration. At the mouth of the Columbia River (including the Action Area) hydrologic forces are primarily dominated by tidal forces. This PCE is functioning within the river system, thought as previously stated, the Action Area is primarily dominated by tidal forces. The Project would not impact this PCE of bull trout critical habitat.

- ***Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.***

Water quality within the Action Area is moderately impaired, but likely suitable for survival of migrating adults and out-migrating juveniles. Portions of the LCR within the Action Area are listed on the Ecology's

303(d) list for bacteria (fecal coliform) (Ecology 2022). Water quantity, while artificially maintained by upstream control structures, is assumed to be sufficient for survival of migrating adults and out-migrating juveniles. Minor, localized, and temporary effects from increased suspended sediment due to construction activities are likely, however, BMPs will be implemented to reduce turbidity and/or any incidental impacts to water quality as the result of leaks or spills.

- ***Sufficiently low levels of occurrence of nonnnative predatory (e.g., lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.***

Northern pike, small mouth bass, and brown trout have been documented in the Columbia River, however these freshwater species are not likely to occur in the saline mixing zone that defines the Action Area. Catch reports indicate that these areas are primarily inhabited by saltwater species such as Pacific halibut and black seabass, and anadromous salmon species. The Project will not alter the presence or absence of non-native predatory, interbreeding, or competing species.

4.7. North American Green Sturgeon (*Acipenser medirostris*)

The Southern DPS of North American green sturgeon (*Acipenser medirostris*) are listed as threatened under the ESA. The LCR estuary below RM 46 has been designated as critical habitat (74 FR 52299).

The most recent 5-year Status Review for this species was conducted in 2021 (NMFS 2021). The review indicates that there has not been significant change in the status of Southern DPS green sturgeon. Threats include commercial and sport fisheries, modification of spawning habitats (e.g., as a result of logging, agriculture, mining, road construction, and urban development in coastal watersheds), entrainment in water Project diversions, and pollution. All known spawning rivers have flow regimes affected by water Projects (NMFS 2018).

4.7.1. Distribution and Habitat Requirements

The green sturgeon is distributed throughout Alaska, Washington, California, and Oregon (McCabe and Tracy 1994). The Southern DPS of North American green sturgeon includes individuals from coastal and Central Valley populations south of the Eel River in California. At the time of listing there was only one known spawning population in the Sacramento River (71 FR 17757). Spawning has since been documented in the Feather and Yuba rivers, which are tributaries to the Sacramento River (Seesholtz et al. 2015; Beccio 2018, 2019). The Columbia River does not support spawning populations of green sturgeon (71 FR 17757). Adults and subadults from this DPS migrate up the coast and use coastal estuaries, including the LCR, for resting and feeding during the summer. In the mid-1930s, before

Bonneville Dam was constructed, green sturgeon were found in the Columbia River up to the Cascades Rapids; today, they occur upriver to Bonneville Dam but are predominantly found in the lower reach of the river. The estuaries of Willapa Bay, the Columbia River, and Grays Harbor are late summer concentration areas (NMFS 2018).

4.7.2. Presence in Action Area

Adult and subadult green sturgeon are typically present in the LCR from June through August, with August the peak month (McCabe and Tracy 1994). It is possible that during the months of June through August green sturgeon could be present in the Action Area.

4.7.3. Critical Habitat

The proposed action occurs within designated critical habitat for the Southern DPS of North American green sturgeon. Table 11 shows the date of the designation and gives a general description of the area designated (NMFS 2009a).

Table 11. North American Green Sturgeon Critical Habitat Descriptions

Species and ESU/DPS	Date of Designation	Description of Critical Habitat
North American Green Sturgeon		
Southern DPS	9 October 2009	Columbia River mouth to RM 74.

The specific PCEs determined essential to the conservation of Southern DPS of North American green sturgeon in estuarine and coastal marine areas include:

- ***Abundant prey items within estuarine habitats and substrates for juvenile, subadult, and adult life stages.***

The Action Area represents habitat providing suitable prey items for adult green sturgeon. Juvenile green sturgeon are not likely to be present within the Action Area. Migrating adults and subadults typically feed on benthic species such as shrimp, clams, and benthic fishes (NMFS 2018). The Action Area likely provides an adequate source of prey items for migrating adult and subadult green sturgeon.

- ***Within bays and estuaries adjacent to the Sacramento River (i.e., the Sacramento-San Joaquin Delta and the Suisun, San Pablo, and San Francisco bays), sufficient flow into the bay and estuary to allow adults to successfully orient to the incoming flow and migrate upstream to spawning grounds.***

The Action Area is not located within the specified estuarine areas identified for the PCE. Green sturgeon are not known to spawn in the Columbia River or its tributaries and the Action Area does not represent

habitat between marine/estuarine habitat and spawning grounds. This PCE of green sturgeon habitat is not present within the Action Area and the Project will not impact this PCE.

- ***Water quality, including temperature, salinity, oxygen content, and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages.***

Water quality conditions are adequate to support migrating adult and subadult green sturgeon that may be present within the Action Area.

- ***A migratory pathway necessary for the safe and timely passage of Southern DPS fish within estuarine habitats and between estuarine and riverine or marine habitats.***

Green sturgeon are not known to spawn in the Columbia River or its tributaries and the Action Area does not represent habitat between marine/estuarine habitat and spawning grounds. As the Columbia River does not represent suitable spawning habitat, the Action Area is most likely used as foraging habitat for migrating adult green sturgeon. The deep-water habitat is largely unobstructed, and likely is adequate to allow the safe and timely passage of migrating green sturgeon. High levels of shipping traffic on the Columbia River likely influence the usability of the shipping channel as a migratory corridor.

- ***Diversity of depths necessary for shelter, foraging, and migration of juvenile, subadult, and adult life stages.***

The Action Area has limited complexity regarding diversity of depths because the marina is dredged to maintain vessel access. The Action Area likely represents marginally suitable nearshore estuarine habitat for shelter, foraging, and migration of adult life stages of green sturgeon.

- ***Sediment quality (i.e., chemical characteristics) necessary for normal behavior, growth, and viability of all life stages.***

Sediments within the Action Area are expected to meet this criterion. At minimum, the Action Area does likely provide sediment quality conditions that are suitable for the normal behavior, growth, and viability of migrating adult green sturgeon, which is the only life stage that is expected to occur within the Action Area.

- ***A migratory pathway necessary for the safe and timely passage of Southern DPS fish within marine and between estuarine and marine habitats.***

The Columbia River does not represent suitable spawning habitat, but the Action Area is most likely used as foraging habitat for migrating adult green sturgeon. The deep-water habitat is largely unobstructed, and likely is adequate to allow the safe and timely passage of migrating green sturgeon.

- ***Coastal marine waters with adequate dissolved oxygen levels and acceptably low levels of contaminants (e.g., pesticides, PAHs, heavy metals that may disrupt the normal behavior, growth, and viability of subadult and adult green sturgeon).***

Water quality conditions are adequate to support migrating adult and subadult green sturgeon that may be present within the Action Area. Portions of the Columbia River within the Action Area are listed on the Ecology's 303(d) list for bacteria (fecal coliform) (Ecology 2022). Water quantity, while artificially maintained by upstream control structures, is assumed to be sufficient for survival

- ***Abundant prey items for subadults and adults, which may include benthic invertebrates and fish.***

The Action Area represents habitat providing suitable prey items for adult green sturgeon. Migrating adults and subadults typically feed on benthic species such as shrimp, clams, and benthic fishes (NMFS 2018). The Action Area likely provides an adequate source of prey items for migrating adult and subadult green sturgeon.

4.8. Pacific Eulachon (*Thaleichthys pacificus*)

Pacific eulachon (*Thaleichthys pacificus*) are small anadromous fish that occur offshore in marine waters and return to tidal areas of rivers to spawn in late winter and early spring (WDFW and Oregon Department of Fish and Wildlife [ODFW] 2001). Pacific eulachon (commonly called smelt) in the LCR are considered part of the southern DPS and is a threatened species under the ESA (NMFS 2010).

Eulachon abundance in monitored rivers has generally improved (particularly in the 2013-2015 return years), but recent poor ocean conditions and the likelihood that these conditions will persist into the near future suggest that population declines may be widespread in the upcoming return years (Gustafson et. al. 2016). Key threats to eulachon are overfishing in subsistence and commercial fisheries, continued/increased by catch in commercial groundfish and shrimp fisheries, industry pollution of freshwater and marine habitats, human impact on spawning habitat through logging, dredging, and diversions, and climate change (Hay and McCarter 2000).

4.8.1. Distribution and Habitat Requirements

Pacific eulachon are endemic to the eastern Pacific Ocean and range from northern California to southwest Alaska and into the southeastern Bering Sea. Eulachon typically spend three to five years in saltwater before returning to freshwater to spawn from late winter through early summer. Spawning runs in the Columbia River typically occur in January, February, and March. Spawning grounds are typically in the lower reaches of larger rivers fed by snowmelt and spawning typically occurs at night. Spawning occurs at temperatures from 39°F to 50°F (4°C to 10°C) in the Columbia River over sand, coarse gravel, or detrital substrates. Eulachon eggs hatch in 20 to 40 days, and then are carried downstream and dispersed by estuarine and ocean currents. Therefore, it is unlikely that eulachon life stages would occur

in the Action Area during proposed construction. In addition, the Project area lacks nearshore habitat in which eulachon would spawn.

4.8.2. Presence in Action Area

Most Pacific eulachon production for the southern DPS occurs in the Columbia River basin according to NMFS (2010). Spawning runs return to the mainstem of the Columbia River from RM 25 (near the estuary) to immediately downstream of Bonneville Dam (river miles [RM] 146). The Washougal River, which empties into the Columbia River at RM 122, is known to support smelt (NMFS 2010). The Sandy River, also located at RM 122 in Oregon, also supports a smelt run (NMFS 2010). In the Columbia River and its tributaries, spawning usually begins in January or February (Beacham et al. 2005). It is unlikely that Pacific eulachon spawning occurs within the Action Area because of the saline water conditions. Larvae are carried downstream and are dispersed by estuarine and ocean currents shortly after hatching. Larval forms outmigrate through the estuary and juvenile forms rear in marine waters extending out along the continental shelf (NMFS 2008a). While information on juvenile distribution is limited, it is likely that juveniles rear in near-shore marine areas at moderate or shallow depth (Barraclough 1964) feeding on pelagic species and krill. Pacific eulachon tend to use waters of greater depths as they grow in the marine environment and have been found as deep as 2,051 ft (Allen and Smith 1988).

It is likely that adult eulachon will be migrating through the Action Area during the in-water work period. It is not likely that spawning could occur in the Action Area and it is not likely that any spawning adults or incubating eggs would be present within the Action Area. Larval stage eulachon could be present within the Action Area.

4.8.3. Critical Habitat

The proposed action occurs within the designated critical habitat for southern DPS of Pacific eulachon. Table 12 shows the date of the designation and gives a general description of the area designated.

Table 12. Pacific Eulachon Critical Habitat Descriptions

Species and ESU/DPS	Date of Designation	Description of Critical Habitat
Pacific Eulachon		
Southern DPS	5 January 2011	Lower Columbia River and tributaries

The PCEs determined essential to the conservation of Southern DPS Pacific eulachon that could be present within the Action Area are:

- ***Freshwater spawning and incubation sites with water flow, quality and temperature conditions and substrate supporting spawning and incubation, and with migratory access for adults and juveniles.***

The Action Area does not represent suitable freshwater spawning and/or incubation habitat for eulachon. This PCE is not present within the Action Area and the Project will not impact this PCE of Pacific eulachon.

- ***Freshwater and estuarine migration corridors associated with spawning and incubation sites that are free of obstruction and with water flow, quality and temperature conditions supporting larval and adult mobility, and with abundant prey items supporting larval feeding after the yolk sac is depleted.***

The Action Area does not represent a suitable freshwater migration corridor but does represent estuarine migration habitat for Pacific eulachon. The Action Area likely provides suitable water and conditions and prey availability to support larval and adult mobility and larval survival.

- ***Nearshore and offshore marine foraging habitat with water quality and available prey, supporting juveniles and adult survival.***

The Action Area represents suitable nearshore habitat with suitable water quality and prey availability for Pacific eulachon.

4.9. Leatherback Sea Turtle (*Dermochelys coriacea*)

The leatherback turtle (*Dermochelys coriacea*) is listed as Endangered throughout its range. In the Pacific, leatherback populations are in severe decline and recovery actions must be given the highest priority. Primary threats to the species are incidental take in coastal and high seas fisheries, and the killing of nesting females and collecting of eggs at the nesting beaches (WDFW 2022b). The U. S. does not have any nesting of leatherbacks in its jurisdiction in the Pacific but has important foraging areas on the continental U.S. west coast and near the Hawaiian Islands.

4.9.1. The Distribution and Habitat Requirements

Leatherback sea turtles are most widely distributed in tropical and sub-tropical waters in the Pacific. Leatherback sea turtles spend nearly their entire lifespan at sea. Five consistent conditions characterize nesting beaches: coarse-grained sand; steep, sloping littoral zone; an obstacle-free approach; proximity to deep water; and oceanic currents affecting the coast (Hendrickson and Balasingam 1966). Foraging habitat for leatherback sea turtles has been known to extend in subpolar oceans (Sato 2017). Western Pacific leatherbacks often forage in the coastal and shelf waters adjacent to the Columbia River Plume and satellite telemetry data indicates that the state's outer coast (especially the area near the Columbia River plume) is an important foraging area for the species (Benson et al. 2011)

4.9.2. The Presence in Action Area

Other species of sea turtles have occasionally been documented in marine waters at the mouth of the LCR or found washed ashore on coastal beaches in Oregon and Washington. These are typically juvenile individuals that have been driven off course by storms or are sick and found stranded. Off the West Coast of North America, western Pacific leatherback sea turtles are distributed most commonly off central California (Benson et al. 2007). Within Washington waters, western Pacific leatherbacks occur along the entire outer coast outward to pelagic waters but are most commonly found in continental shelf and slope habitat (200–2000 m) (Benson et. al. 2011). While it is possible that this species could occur in the vicinity of the project area it is unlikely.

4.9.3. Critical Habitat

The proposed Action Area does not occur within designated critical habitat for the leatherback sea turtles. Table 13 shows the date of the designation and gives a general description of the area designated.

Table 13. Leatherback Sea TurtleCritical Habitat Descriptions

Species and ESU/DPS	Date of Designation	Description of Critical Habitat
Leatherback Sea Turtle		
NA	27 February 2012	Oregon/Washington. The area bounded by Cape Blanco, Oregon (42°50'4" N./124°33'44" W.) north along the shoreline following the line of extreme low water to Cape Flattery, Washington (48°23'10" N./124°43'32" W.) then north to the U.S./Canada boundary at 48°29'38" N./124°43'32" W. then west and south along the line of the U.S. Exclusive Economic Zone to 47° 57'38" N./126° 22'54" W. then south along a line approximating the 2,000 meter isobath that passes through points at 47° 39'55" N./126°13'28" W., 45°20'16" N./125°21' W. to 42°49'59" N./125°8'10" W. then east to the point of origin at Cape Blanco.

4.10. Killer Whale (*Orcincus orca*)

The Southern Resident killer whale (SRKW, *Orcincus orca*) DPS was ESA-listed as endangered in 2005 (NMFS 2016). The SRKW population is made up of the J, K, and L pods.

4.10.1. Distribution and Habitat Requirements

Southern resident killer whales are found in the Salish Sea during fall, spring, and summer. Less is known about their winter habitat; however, they are known to travel along the Oregon and Washington coast. Southern Resident killer whales consume fish, particularly salmon. Their preferred prey is Chinook salmon, particularly in the summer (NMFS 2014)

4.10.2. The Presence in Action Area

Southern Resident killer whales have been repeatedly observed feeding off the Columbia River plume in the vicinity of the LCR jetties in March and April during peak spring Chinook salmon runs (USACE 2011b). Salmon returning to the Columbia River mouth may have been an important part of SRKW diet previously; however with declines in prey availability (salmon) in Columbia River stocks it is possible that the current movement patterns of the SRKW are somewhat different from those of several centuries ago (NMFS 2008b).

Southern Resident Killer whale presence in the Columbia River mouth is rare and it is unlikely that this species would be present in the Action Area.

4.10.3. Critical Habitat

The proposed Action Area does not occur within designated critical habitat for SRKWs. Table 14 shows the date of the designation and gives a general description of the area designated.

Table 14. Southern Resident Killer Whale Critical Habitat Descriptions

Species and ESU/DPS	Date of Designation	Description of Critical Habitat
Killer Whale		
Southern Resident DPS	9 October 2009	*Coastal Washington/Northern Oregon Inshore Area.* U.S. marine waters west of a line connecting Cape Flattery, Washington (48°23'10" N/124°43'32" W), Tatoosh Island, Washington (48°23" N/124°44'12" W), and Bonilla Point, British Columbia (48°35'30" N/124°43'00" W), from the U.S. international border with Canada south to Cape Meares, Oregon (45°29'12" N), between the 6.1-m and 50-m isobath contours. This includes waters off Clallam, Jefferson, Grays Harbor, and Pacific counties in Washington and Clatsop and Tillamook counties in Oregon.

4.11. Humpback Whale (*Megatera novaeangliae*)

Humpback whales (*Megaptera novaeangliae*) were listed under the ESA as endangered in 1970. In 2016 NMFS revised the listing status and divided the globally endangered species into 14 distinct population segments, removed the species-level listing, and revised the listing status of the individual DPSs (81 FR 62259).

4.11.1. Distribution and Habitat Requirements

Humpback whales in the California/Oregon/Washington "stock" include multiple DPSs. These populations are recognized based on their low-latitude breeding areas. The California/Oregon/ Washington stock primarily includes whales from the endangered Central America DPS and the threatened Mexico DPS, in addition to a small number of whales from the Hawaii DPS (which is not

currently listed under the ESA). The Marine Mammal Protect Act considers the California/Oregon/ Washington stock endangered and depleted for management purposes.

The Mexico DPS breeds along the Pacific coast of Mexico during winter months and then migrates to feeding areas that range from California to the Aleutian Islands. The Central American DPS breeds along the Pacific coast of Central America and has feeding grounds of the west coast of the U.S. extending to British Columbia (86 FR 21082). Feeding areas in the North Pacific are broadly distributed, but are usually over the continental shelf or near the shelf edge at shallow (approximately 10m) to moderate water depths (approximately 50-200m). Feeding areas are also typically associated with oceanographic, bathymetric, and/or biological features that concentrate or aggregate prey species.

The Central America DPS breed in waters off Central America (Panama north to Guatemala, and possibly into southern Mexico (Bettridge *et al.* 2015, Calambokidis *et al.* 2017 as cited in 86 FR 21082) and feed off the West Coast of the U.S. and British Columbia. Foraging occurs most commonly off the coast of California with decreased numbers north to Washington and British Columbia.

The Mexico DPS breed in the area of mainland Mexico, transit off the coast of Baja California, and feed off coasts of California and Oregon, northern Washington and British Columbia, and Western Gulf of Alaska and Berring Sea 86 FR 21082.

For the remainder of this BE, the discussion of the "humpback whale" refers to either DPS.

4.11.2. The Presence in Action Area

Humpback whales are known to forage in the Columbia River plume system which supports foraging by many predators. This area is known to support an abundance of krill and seasonal/annual assemblages of forage fish. Habitat use by humpback whales is primarily continental shelf and shelf edge environments (Mate et. al. 2018). Humpback whales have occasionally been documented within the mouth of the Columbia River. It is thought that very near-shore habitat use may be driven by prey availability especially when targeting nearshore concentrations of fish like anchovies, has sometimes brought whales closer to shore and into new areas.

Humpback whale presence in the Columbia River mouth is rare and it is unlikely that this species would be present in the Action Area

4.11.3. Critical Habitat

The proposed action does not occur within designated critical habitat for the either the Mexico or Central America DPS of Humpback whales. Table 15shows the date of the designation of critical habitat. Critical

habitat along the west coast is variable based on known use in coastal waters. Table 15 gives a general description of the area designated nearest to the Action Area.

Table 15. Humpback Whale Critical Habitat Descriptions

Species and ESU/DPS	Date of Designation	Description of Critical Habitat
Humpback Whale		
Mexico/Central America DPS	21 May 2021	extends southward from 46°50' N to 45°10' N and extends out to a seaward boundary corresponding to the 1,200-m isobath. The 50-m isobath forms the shoreward boundary. This area includes waters off of Pacific County, WA and Clatsop County, OR. This unit covers about 3,636 nmi^2 of marine habitat..

4.12. Streaked Horned Lark (*Eremophila alpestris strigata*)

The streaked horned lark (*Eremophila alpestris strigata*) is endemic to the Pacific Northwest (British Columbia, Oregon, and Washington). It was listed as a threatened species under the ESA on 3 October 2013 (78 FR 61505).

The USFWS Periodic Status Review for Streaked Horned Lark (Stinson 2016) states:

> "*the factors currently influencing the streaked horned lark and anticipated to continue influencing larks in the future include ongoing loss and conversion of suitable habitats, land management activities at occupied sites and the related effects, and recreation. Survey data from some regularly monitored sites indicates that the subspecies appears to have increased in abundance from 198 breeding pairs in 2013 to 383 breeding pairs in 2019… Despite increases in abundance, a range-wide population estimate has not been reanalyzed since 2011. Therefore, we are unable to state conclusively that the range-wide population has increased based on survey data of local populations since larks were listed in 2013. In the foreseeable future, however, there is potential for a decline in resiliency of local populations across the range.*"

The loss of preferred habitat will continue from plant succession and encroachment of woody vegetation, invasion of beach grasses, changes in land use, and changes in beneficial agricultural practices. The regular large-scale, human-caused disturbance (burning, mowing, cropping, chemical treatments, or placement of dredged materials) that now provides and maintains replacement habitat for the streaked horned lark will continue, as will the related effects of these activities that can negatively affect individual larks (nest destruction, mortality, disturbance, and aircraft strikes). Recreation will also continue. The cumulative negative effect from these factors will likely be amplified in some local populations due to the synergistic effects related to small population size and climate change over the next 30 years.

4.12.1. Distribution and Habitat Requirements

Nesting habitat for the streaked horned lark along the Willamette and Columbia Rivers was historically found on sandy beaches and spits (Stinson 2016). Streaked horned larks currently nest in a broad range of habitats, including native prairies, coastal dunes, fallow and active agricultural fields, wetland mudflats, sparsely vegetated edges of grass fields, recently planted Christmas tree farms with extensive bare ground, moderately to heavily grazed pastures, gravel roads or gravel shoulders of lightly traveled roads, airports, and dredge deposition sites, particularly islands in the LCR (USFWS 2012). Wintering streaked horned larks use habitats that are very similar to breeding habitats. Habitats on the Columbia River used by larks are typically adjacent to and in view of open water, which provides the open landscape context this species needs.

Streaked horned larks need expansive areas of flat, open ground to establish breeding territories. Horned larks forage on the ground in low vegetation or on bare ground (USFWS 2012). Adults feed mainly on grass and weed seeds but feed insects to their young. Introduced weedy grasses and forb seeds comprise the winter diet. Horned larks form pairs in spring and create nests in shallow depressions on the ground. The larks show strong natal fidelity to nesting sites and may return each year to the place they were born (USFWS 2012). The nesting season begins in mid-April and ends in the early part of August. Some streaked horned larks may re-nest in late June or early July. Wintering streaked horned larks use habitats that are very similar to breeding habitats.

4.12.2. Presence in Action Area

The Action Area does not represent optimal habitat for streaked horned lark. There are some shoreline areas within the Action Area that include wetland mudflats and dredge deposit sites and visual access to open water, however vegetation conditions are generally not optimal for streaked horned lark nesting habitat. Additionally, more suitable habitat for streaked horned lark breeding and nesting occurs outside of the Action Area but within the general vicinity of the mouth of the Columbia River. Any potential streaked horned lark present within the Action Area would likely be foraging and would not spend extended periods of time in the vicinity.

Streaked horned larks could potentially be present in the Action Area during all months of the year, though they are most likely to be present during the mid-April to early August nesting season.

4.12.3. Critical Habitat

The proposed action does not occur within the immediate vicinity of designated critical habitat for the southern DPS of streaked horned lark. Table 16 shows the date of the designation and gives a general description of the area designated (USFWS 2013).

Table 16. Streaked Horned Lark Critical Habitat Descriptions

Species and ESU/DPS	Date of Designation	Description of Critical Habitat
Streaked Horned Lark		
NA	3 October 2013	Critical habitat designation includes 2 units and 16 subunits located in both Oregon and Washington. The designation includes several sites in and adjacent to the LCR.

4.13. Western Snowy Plover (*Charadrius nivosus nivosus*)

The western snowy plover (*Charadrius alexandrinus nivosus*) was listed as a threatened species by the USFWS in 1993. The western snowy plover is a small shorebird found in coastal habitats. Several factors have been identified for population declines including human disturbance, predation, poor reproductive success, encroachment of non-native vegetative species into breeding areas, and urban development, among others (USFWS 2007).

4.13.1. The Distribution and Habitat Requirements

This species breeds in environments that include coastal beaches, sand spits, sparsely vegetated dunes, salt pans at lagoons and estuaries, and beaches at the mouths of creeks and rivers. Less frequent documented nesting habitats include dredged material disposal sites, bluff-backed beaches, dry salt ponds, and river bars (USFWS 2007). The historic range of this species included numerous nesting sites across the coasts of California, Oregon, and Washington, but current nesting inventories show a significant decline in the population.

The breeding season for this species (March through September) also coincides with high levels of human beach use, which is thought to result in nest abandonment and a reduction in nest density and success.

4.13.2. The Presence in Action Area

The Action Area does not represent optimal habitat for western snowy plover nesting or breeding habitat. The Pacific Coast western snowy plover breeds primarily above the high tide line on coastal beaches, sand spits, dune-backed beaches, sparsely vegetated dunes, beaches at creek and river mouths, and salt pans at lagoons and estuaries (77 FR 36727). In winter this species is found on many of the beaches used for nesting as well as on beaches where they do not nest (e.g., manmade salt ponds, on estuarine

sand and mud flats). Despite the variation in the types of habitat these habitats all share the same general characteristics of typically being flat, open areas with sandy or saline substrates, with usually sparse or absent vegetation or driftwood (Stenzel *et al.* 1981, p. 18; Service 2007 as cited in 77 FR 36727).

Any western snowy plover present in the Action Area would likely be foraging and are not expected to remain for a significant duration of time.

4.13.3. Critical Habitat

The proposed action does not occur within designated critical habitat for the Pacific Coast DPS of western snowy plover. The nearest designated critical habitat occurs more than 17 miles north of the Action Area along the outer coast and mouth of Willapa Bay. Table 17 shows the date of the designation and gives a general description of the area designated.

Table 17. Western Snowy Plover Critical Habitat Descriptions

Species and ESU/DPS	Date of Designation	Description of Critical Habitat
Western Snowy Plover		
Pacific Coast DPS	19 July 2012	Four units in Washington, totaling 6,077 acres (2,460 hectares)

4.14. Marbled Murrelet (*Brachyramphus marmoratus*)

The marbled murrelet *(Brachyramphus marmoratus marmoratus)* was listed as threatened under the ESA in 1992 in Washington, Oregon, and California as the result of nesting habitat loss from commercial timber harvest and mortality cause by net fisheries and oil spills. (57 FR 45328).

4.14.1. The Distribution and Habitat Requirements

This species is a small seabird that nests in mature and old growth coniferous forests and forages in marine environments (WDFW 2016). During the nesting season (approximately 1 April to 15 September), marbled murrelets forage in the marine environment and return to the nest at least once daily, carrying prey to their young. Both marine and terrestrial factors influence the survivorship of the species. A reduction in availability of successful nesting sites in proximity to foraging habitat (resulting from timber harvest) in combination with declines in forage fish species have impacted nest success and nestling survival (WDFW 2016).

Marbled murrelets nest in inland coastal forests dominated by western hemlock (*Tsuga heterophylla*), Sitka spruce (*Picea sitchensis*), Douglas fir (*Pseudotsuga menziesii*), and western red cedar (*Thuja plicata*). Nesting habitat requirements include a forest structure that is of sufficient height and depth to provide cover. Structure requirements are thought to provide enhanced microclimate conditions and reduce

predation (WDFW 2016). Foraging habitat has been documented as generally occurring within 2 to 8 km from shore. Marbled murrelets primarily feed on forage fish species (herring, anchovy, eulachon, sand lance, etc.) The largest concentrations of this species are found along the northern and outer coast of Puget Sound, where large areas of mature forest in close proximity to foraging habitat is still intact.

4.14.2. The Presence in Action Area

According to USFWS distribution of marbled murrelet habitat in Washington is currently disjunct with a major gap in distribution of habitat and occupied sites occurring along the southwest Washington coast from Grays Harbor south the Columbia River (USFWS 2019). The closest designated critical habitat to the Action Area is located approximately 8 miles to the east of the Project site, and the Action Area represents potential foraging habitat for this species, however murrelet occurrence at the mouth of the Columbia River is limited (ODFW 2017). Marbled murrelet have the potential to occur within the Action Area, however species presence at the mouth of the Columbia River is extremely limited and any individuals present within the Action Area are likely to be foraging and are not expected to be present for a sustained duration of time.

4.14.3. Critical Habitat

The proposed action does not occur within designated critical habitat for marbled murrelet. Table 18 shows the date of the designation and gives a general description of the area designated. The Action Area does not contain designated critical habitat for this species and the Project will not impact designated critical habitat or the PCEs necessary for the conservation of this species.

Table 18. Marbled Murrelet Critical Habitat Descriptions

Species and ESU/DPS	Date of Designation	Description of Critical Habitat
Marbled Murrelet		
N/A	4 November 2011	Approximately 3,698,100 acres (1,497,000 hectares) of critical habitat in the States of Washington, Oregon, and California.

5. Environmental Baseline

This Section outlines the presence and condition of aquatic and terrestrial habitat features within the Action Area as they pertain to the species addressed in this BE. The Section summarizes the baseline habitat conditions and then analyzes the likely effects that the proposed action will have on the baseline.

5.1. General Setting

The Project occurs at the Port of Ilwaco on the southwest coast of Washington State, located just inside the Columbia River bar at the Pacific Ocean.

5.2. Terrestrial and Riparian Habitat

Vegetation and terrestrial habitat conditions are limited within the in-water Action Area. The site is in an industrial area and is largely devoid of terrestrial vegetation. The Project would occur within the Port's marina at the existing wharf and associated bulkhead wall, retaining wall, and riprap shoreline. Little to no terrestrial and riparian habitat occurs here. The mudline at the base of the existing bulkhead is largely unvegetated and consists of a silty sand, sandy silt slope with riprap extending on the shore slope to the north and south of the bulkhead. The upland adjacent to the bulkhead is a paved driveway servicing the Safe Coast Seafood facility, which is located on the wharf. Existing vegetation consists of short-statured ruderal species behind the existing bulkhead wall (Figure 5) and in viable spaces along the riprap shoreline (Figure 6). Upland vegetation observed along the shoreline during a 2022 site survey included clover species (*Trifolium species*), Japanese knotweed (*Polygonum cuspidatum*), various grasses, dandelion (*tatxasum officinale*), and creeping buttercup (*Ranunculus repens*) (Geoengineers 2022).

Figure 5. Riprap Shoreline to the South of the Bulkhead Wall

Figure 6. Retaining Wall to the North of the Bulkhead

5.3. Aquatic Habitat

An eelgrass and macroalgae survey and wetland and stream delineation was conducted within the marina for a separate dredging project (GeoEngineers 2022). The survey included the entire Project area. The survey results identified one main bed of eelgrass within the marina with smaller adjacent patches

(Figure 7). The eelgrass bed is not anticipated to be impacted by the proposed Project. No wetlands or streams were identified within the marina.

Source: GeoEngineers 2022

Figure 7. Eelgrass IdentifiedDduring 2022 Eelgrass Survey (GeoEngineers 2022)

6. Effects of the Action

This Section outlines the potential effects of the proposed action as they pertain to the species identified as having potential to occur in the Action Area.

6.1. Direct Impacts

Direct impacts are generally defined as impacts that physically contact the species and have the potential to cause physical damage. Direct impacts are caused by the activity and occur at the same time and place. The Project has the potential to create the following discussed short-term direct adverse impacts.

6.1.1. Noise

In-water and in-air noise disturbances could occur as defined by the Action Area. The greatest potential for in-water noise impacts will occur during pile installation. Potential in-water noise impacts will be species specific and are further discussed in Sections 6.3 through 6.4 of this BE.

6.1.2. Water Quality

General localized and temporary water quality/turbidity impacts could occur. In general, water quality and turbidity impacts from sediment resuspension are anticipated to be minor, localized, and temporary. Removal of existing creosote-treated timber (associated with derelict creosote-treated structures and piles; up to 30 cy/20 tons) will result in water quality improvements by reducing toxicity potential. Potential water quality impacts are species specific and are further defined below in Sections 6.3 and 6.4 below.

6.1.3. Vessel Collision

Vessels will be used during construction to support Project activities and would travel to and from the site. Species that surface to breathe are susceptible to propeller strikes and vessel collisions. Potential vessel collision impacts are discussed in detail in Sections 6.3 and 6.4 below.

6.1.4. Habitat Disturbance

Temporary and permanent habitat disturbances could occur. Installation of the replacement bulkhead wall, drainage rock, and riprap will result in approximately 3,350 sf of fill in marine waters (measured below the HTL). Approximately 3,000 sf of the fill would come into contact with the bottom substrate and result in permanent impacts to the existing aquatic soft bottom habitat. Temporarily disturbed benthic habitat would be anticipated to be quickly recolonized by benthic species and in-benthic invertebrates (Thrush and Dayton 2002). The installation of a fender system along the new bulkhead will

result in approximately 200 sf of new overwater coverage. This increase in overwater coverage is anticipated to be negligible and would not result in substantial impacts to ESA-listed species. Fill and benthic habitat impacts are anticipated to be offset by the removal of creosote-treated timber from the marine environment. Potential benthic habitat disturbance impacts are discussed in further detail in Sections 6.3 and 6.4 below.

6.2. Indirect Effects

Indirect impacts are generally defined as ecosystem changes that could affect food web dynamics. Indirect impacts are caused by the activity and are later in time or farther removed in distance but are still reasonably foreseeable. The Project has the potential to cause the following indirect adverse impacts.

6.2.1. Prey Species

Adverse impacts to prey species are unlikely due to the minor, short-term, localized nature of the proposed activities. The Project will be anticipated to provide an overall long-term benefit to prey species by removing creosote treated wood and reducing toxicity potential. Potential impacts to prey species for the identified species are further discussed below in Section 6.3 and 6.4 below.

6.3. NMFS Listed Species

6.3.1. Salmonids (Chinook, Coho, Sockeye, Steelhead)

Direct and indirect adverse impacts could occur to salmonids but are unlikely given the extent of the proposed activities and proposed AMMs. As discussed in Sections 4.1 through 4.5, adult salmonids may occur in the Columbia River and Action Area during migrations, however these is no suitable spawning habitat within the Action Area. Juvenile salmonids may rear within the Action Area.

Direct impacts could occur due to noise, water quality, and benthic habitat disturbances. Indirect impacts could occur due to impacts to prey species. Potential impacts to salmonids from the proposed activities are discussed below in Sections 6.3.1.1 through 6.3.1.4.

6.3.1.1. Noise

The main hearing organ in fish is the lateral line system that is sensitive to particle motion. Pressure waves can cause changes in the swim bladder which may cause damage or reduced hearing sensitivity. Impulsive noise sources such as impact pile driving are known to result in adverse impacts to fish when noise thresholds are exceeded (NMFS 2008c). Noise produced during pile installation activities has the greatest potential to exceed noise thresholds. These thresholds, as well as the distances to these

thresholds for the proposed pile driving activities, are shown in Table 19. Continuous noise sources such as vibratory pile driving are not held to the thresholds presented in Table 19.

The Project proposes to install a 225 lf steel sheet pile wall and approximately 10, 12-inch diameter fiberglass fender piles external to the wall. It is anticipated that the steel sheet pile wall and fiberglass fender piles will be driven using vibratory hammers. The option for impact proofing has been included in the event that difficult driving conditions are encountered.

To install the sheet pile wall, up to 8 hours of vibratory pile driving and up to 600 blows per day could be required. Sheet pile wall installation could occur for up to 12 total days. To install the 12-inch fiberglass fender piles, up to 2.5 hours of vibratory pile driving and up to 30 blows per pile could be required with up to 4 piles being installed in a day. Fiberglass pile installation could take a total of 3 days.

Anticipated in-water noise levels for the proposed pile installations are reported in Section 2, Table 2 of this report. Anticipated noise levels were compared to established noise thresholds using the NMFS Interim Injury Criteria Threshold Spreadsheet (NMFS 2009). The sound levels from the impact installation of steel sheet piles could exceeded thresholds in which physical injury may occur within a small area no larger than 24 meters around each pile (Table 19). Impact pile driving of 12-inch diameter fiberglass fender piles could exceed thresholds in which physical injury may occur within a small area no larger than 1 meter around each pile (Table 19).

It is unlikely that fish will occur within close proximity to the active construction area and within the small Interim Injury Criteria threshold areas. Additionally, the analysis presented in this section conservatively assumes the maximum number of blows per day that could occur. In actuality far less are likely. Pile installation activities will be short-term and would occur during the approved in-water work window when salmonid presence is anticipated to be low. Steel sheet pile installation would only occur for 12 total days and fiberglass pile installation would only occur for 3 total days. Impacts from noise exceedances over the Interim Injury Criteria thresholds are unlikely.

The behavioral threshold, although not a formal regulatory standard, is 150 dBrms (NMFS 2008c). The behavioral threshold guideline could be exceeded within 215 meters of steel sheet pile installation and 29 meters of fiberglass pile installation. Behavioral impacts could include fleeing of the area, and or ceasing of feeding or spawning in the area. Whether or not substantial impacts occur at noise levels exceeding this threshold relies heavily on project timing, project duration, species life history and other site-specific factors (WSDOT 2020). Pile installation activities would be short-term. Any potential

impacts associated with exceedances over the behavioral threshold are anticipated to be minor and temporary.

Table 19. Noise Criteria Thresholds for Fish

	Onset of Physical Injury			Behavioral Threshold
	Peak dB	Cumulative SEL dB		
		Fish > 2 Grams	Fish < 2 Grams	
Threshold Value	***206 dB***	***187 dB***	***183 dB***	***150 dBrms***
Fiberglass Pile Installation Threshold Distance	0 meters	0 meters	1 meter	29 meters
Steel Sheet Pile Installation Threshold Distance	7 meters	13 meters	24 meters	215 meters

Source: NMFS 2008c and NMFS 2009b

6.3.1.2. Water Quality

Decreased water quality including turbidity has the potential to directly impact fish. There are several mechanisms by which suspended sediment could potentially impact fish. These mechanisms include increased potential for gill tissue damage, physiological stress, direct mortality, and behavioral changes (NMFS 2002). The proposed action may create focused areas of minor temporary water quality impacts due to sediments becoming suspended in the water column during in-water construction activities. Activities with the potential to cause turbidity include, structure removal, pile installation, drainage rock placement, and riprap placement. Potential turbidity plumes would be small in scale, temporary, and localized to the immediate vicinity of the Project activities.

Adverse turbidity impacts to fish do not typically occur until turbidity concentrations reach 1,000 milligrams (mg)/liter (l) or 580 mg/l for more sensitive species (Burton 1993 and Sherk et al. 1975). Suspended sediment concentrations during pile driving would be anticipated to range from 5 to 10 mg/l above background levels at approximately 300 ft from the pile driving activities (FHWA 2012). Although salmonids may alter their movements to avoid these turbid areas, changes in movement are anticipated to be too small to be meaningfully detected. The proposed Project activities would not be anticipated to result in turbidity concentrations that could cause adverse impacts. Any potential direct water quality adverse impacts are anticipated to be minor and temporary. The AMMs in Section 1.4 such as the implementation of spill prevention measures and compliance with the in-water work window will further reduce the potential for adverse water quality impacts.

The removal of approximately 30 cy/20 tons of creosote-treated timber is anticipated to result in long-term water quality benefits by reducing toxicity potential. AMMs such as the use of a containment boom to protect water quality during creosote-treated timber removal would be implemented.

6.3.1.3. Benthic Habitat Disturbance

The Project will result in temporary and permanent benthic habitat impacts. Temporarily disturbed benthic habitat would be anticipated to be quickly recolonized by benthic species and in-benthic invertebrates (Thrush and Dayton 2002). Permanent benthic habitat impacts include the conversion of approximately 3,000 sf of aquatic soft bottom habitat to hard shoreline armoring (bulkhead wall and riprap). The existing soft bottom habitat occurs within an active marina and adjacent to creosote-treated structures. Therefore, the existing habitat is not anticipated to be of high habitat value to salmonids.

Benthic habitat impacts to salmonids are anticipated to be minor and offset by the removal of the creosote-treated timber as part of the existing retaining wall, bulkhead, and derelict piles. The removal of approximately 64, 12-inch creosote-treated timber piles, 3, 12-inch steel piles, 70 lf of creosote-treated timber retaining wall, and 40 lf of derelict creosote-treated timber pile caps, will restore approximately 165 sf of benthic habitat and remove approximately 30 cy or 20 tons of creosote-treated timber.

6.3.1.4. Prey Species

Impacts to prey species have the potential to cause indirect impacts to their predators through reduced food supply. Salmonid prey that could occur in the Action Area includes crustaceans, invertebrates, and small fish. The active marina/port area in which the Project is located is not anticipated to provide optimal foraging habitat for salmonids.

As discussed in Section 6.3.1.3, the Project will result in temporary disturbance of and permanent impacts to benthic sediments. Benthic prey species would be anticipated to quickly recolonize temporarily disturbed benthic habitats (Thrush and Dayton 2002). However, the installation of the bulkhead wall and riprap shoreline may result in approximately 3,000 sf of reduced soft bottom foraging habitat. This area is anticipated to be of low habitat value to salmonids due to is presence within an active marina/port area and proximity to creosote-treated timber structures. Therefore, foraging impacts are anticipated to be minor. Fish prey species could be impacted by noise emitted during in-water construction activities. As discussed in Section 6.3.1.1, Project related noise would only exceed the Interim Injury Criteria Injury threshold for fish within a small area where salmonids would be unlikely to occur foraging (Table 19).

To reduce the potential for impacts to foraging, the Project would comply with the in-water work window for the area (anticipated to be November 1 through February 28) when salmonid foraging presence is anticipated to be low. Substantial impacts to salmonids due to a reduced food supply are not anticipated given the nature and location of the proposed Project and proposed AMMs. The removal of creosote-treated timber could improve foraging habitat.

6.3.1.5. Determination

Due to a lack of identified substantial direct and indirect impacts the Project may affect, but is ***not likely to adversely affect (NLAA)***, Chinook, Coho, sockeye, and steelhead salmon. Critical habitat for Chinook, Coho, sockeye, and steelhead salmon occurs in the Action Area. The Project is ***NLAA*** Chinook, Coho, sockeye, and steelhead salmon critical habitat within the Action Area for the reasons given above.

6.3.2. Eulachon

Direct and indirect adverse impacts could occur to eulachon but are considered unlikely given the extent of the proposed activities and proposed minimization measures. As discussed in Section 4.8 adult Pacific DPS eulachon could occur migrating through the Action Area. Larval state eulachon could also occur in the Action Area. Spawning is unlikely given the saline water conditions in the Action Area.

Direct impacts could occur due to noise, water quality, and benthic habitat disturbances. Indirect impacts could occur due to impacts to prey species. Potential impacts to salmonids from the proposed activities are discussed below in Sections 6.3.2.1 through 6.3.2.4.

6.3.2.1. Noise

As discussed in additional detail in Section 6.3.1.1, The sound levels from the impact installation of steel sheet piles could exceed thresholds in which physical injury may occur within a small area no larger than 24 meters around each pile installation activity (Table 19). Impact pile driving of 12-inch diameter fiberglass fender piles could exceed thresholds in which physical injury may occur within a small area no larger than 1 meter around each pile (Table 19). Impacts due to exceedances over the Interim Injury Criteria threshold are anticipated to be unlikely given the small threshold area, short-term nature of the pile driving activities, and compliance with the in-water work window.

The behavioral threshold guideline could be exceeded within 215 meters during steel sheet pile installation and 29 meters during fiberglass fender pile installation. Impacts due to exceedances over the behavioral threshold are anticipated to be minor given the short-term nature of the pile driving activities, and compliance with the in-water work window. Pile installation activities would be short-term.

6.3.2.2. Water Quality

As discussed in additional detail in Section 6.3.1.2, decreased water quality including turbidity has the potential to directly impact fish. Project activities with the potential to cause turbidity include, structure removal, pile installation, drainage rock placement, and riprap placement. However, potential turbidity plumes would be small in scale, temporary, and localized to the immediate vicinity of the Project

activities. Any potential direct water quality adverse impacts are anticipated to be minor and temporary. The AMMs in Section 1.4 such as the implementation of spill prevention measures and compliance with the in-water work window will further reduce the potential for adverse water quality impacts.

The removal of approximately 30 cy/20 tons, of creosote-treated timber is anticipated to result in long-term water quality benefits. AMMs such as the use of a containment boom to protect water quality during creosote-treated timber removal would be implemented.

6.3.2.3. Benthic Habitat Disturbance

As discussed in additional detail in Section 6.3.1.3, the Project will result in temporary and permanent benthic habitat impacts. Temporarily disturbed benthic habitat would be anticipated to be quickly recolonized by benthic species and in-benthic invertebrates. Permanent benthic habitat impacts include the conversion of approximately 3,000 sf of aquatic soft bottom habitat to hard shoreline armoring. Benthic habitat impacts to eulachon are anticipated to be minor and offset by the removal of the creosote-treated timber retaining wall, portions of the existing bulkhead, and derelict piles.

6.3.2.4. Prey Species

As discussed in additional detail in Section 6.3.1.4, direct impacts to prey species have the potential to cause indirect impacts to their predators through reduced food supply. Eulachon prey that could occur in the Action Area includes small crustaceans and krill. The Project may result in minor benthic habitat impacts that could result in impacts to benthic food supply for a short period of time. The active marina/port area in which the Project is located is not anticipated to provide optimal foraging habitat for eulachon and foraging impacts are anticipated to be minor. The removal of creosote-treated timber could also improve foraging habitat by removing toxins from the marine environment.

6.3.2.5. Determination

Due to a lack of identified substantial direct and indirect impacts, the Project may affect, but is ***NLAA*** eulachon. Critical habitat for eulachon occurs in the Action Area. The Project is ***NLAA*** eulachon critical habitat within the Action Area for the reasons given above.

6.3.3. Green Sturgeon

Direct and indirect adverse impacts could occur to green sturgeon but are considered unlikely given the extent of the proposed activities and proposed AMMs. As discussed in Section 4.7, adult and subadult green sturgeon could occur in the Action Area from June to August.

Direct impacts could occur due to noise, water quality, entrainment, and benthic habitat disturbances. Indirect impacts could occur due to impacts to prey species. Potential impacts to green sturgeon from the proposed activities are discussed below in Sections 6.3.3.1 through 6.3.3.4.

6.3.3.1. Noise

As discussed in additional detail in Section 6.3.1.1, The sound levels from the impact installation of steel sheet piles could exceed thresholds in which physical injury may occur within a small area no larger than 24 meters around each pile installation activity (Table 19). Impact pile driving of 12-inch diameter fiberglass fender piles could exceed thresholds in which physical injury may occur within a small area no larger than 1 meter around each pile (Table 19). Impacts due to exceedances over the Interim Injury Criteria threshold are unlikely given the small threshold area, short-term nature of the pile driving activities, and compliance with the in-water work window.

The behavioral threshold guideline could be exceeded within 215 meters during steel sheet pile installation and 29 meters during fiberglass fender pile installation. Impacts due to exceedances over the behavioral threshold are anticipated to be minor given the short-term nature of the pile driving activities and compliance with the in-water work window.

6.3.3.2. Water Quality

As discussed in additional detail in Section 6.3.1.2, decreased water quality including turbidity has the potential to directly impact fish. Project activities with the potential to cause turbidity include, structure removal, pile installation, drainage rock placement, and riprap placement. However, potential turbidity plumes would be small in scale, temporary, and localized to the immediate vicinity of the Project activities. Any potential direct water quality adverse impacts are anticipated to be minor and temporary. The AMMs in Section 1.4 such as the implementation of spill prevention measures and compliance with the in-water work window will further reduce the potential for adverse water quality impacts.

The removal of approximately 30 cy/20 tons of creosote-treated timber is anticipated to result in long-term water quality benefits by reducing toxicity potential. AMMs such as the use of a containment boom to protect water quality during creosote-treated timber removal would be implemented.

6.3.3.3. Benthic Habitat Disturbance

Green sturgeon are bottom dwelling fish that that may use subtidal soft bottom habitat within the Action Area. The existing soft bottom habitat occurs within an active marina/port area and adjacent to creosote-treated structures. Therefore, the existing habitat is not anticipated to be of high habitat value to green

sturgeon. As discussed in additional detail in Section 6.3.1.3, the Project will result in temporary and permanent benthic habitat impacts. Temporarily disturbed benthic habitat would be anticipated to be quickly recolonized by benthic species and in-benthic invertebrates. Permanent benthic habitat impacts include the conversion of approximately 3,000 sf of aquatic soft bottom habitat to hard shoreline armoring. Benthic habitat impacts to green sturgeon are anticipated to be minor and offset by the removal of the creosote-treated timber retaining wall, portions of the existing bulkhead, and derelict piles.

6.3.3.4. Prey Species

As discussed in additional detail in Section 6.3.1.4, impacts to prey species have the potential to cause indirect impacts to their predators through reduced food supply. Green sturgeon prey that could occur in the Action Area includes crustaceans, invertebrates. The Project may result in minor benthic habitat impacts that could result in impacts to benthic food supply. However, the active marina/port area in which the Project is located is not anticipated to provide optimal foraging habitat for green sturgeon. Therefore, foraging impacts are anticipated to be minor. The removal of creosote-treated timber could improve foraging habitat.

6.3.3.5. Determination

Due to a lack of identified substantial direct and indirect impacts the Project may affect, but is ***NLAA*** green sturgeon. Critical habitat for green sturgeon occurs in the Action Area. The Project is ***NLAA*** green sturgeon critical habitat within the Action Area for the reasons given above.

6.3.4. Sea Turtles (Leatherback)

Direct and indirect adverse impacts to leatherback sea turtles could occur, but are considered unlikely given the location and extent of the proposed activities and proposed minimization measures. As discussed in Section 4.9 although leatherback sea turtles could occur in the Columbia River and in the Action Area on rare occasions, their presence within the enclosed marina is not anticipated.

Noise, water quality, habitat, and foraging impacts are not anticipated given that sea turtles would not be anticipated to occur within the enclosed marina/port area where construction activities are proposed. The potential for direct impacts due to vessel collision during transportation of materials to the site is evaluated below in Section 6.3.4.1.

6.3.4.1. Vessel Collision

Because sea turtles surface to breathe, they are susceptible to propeller strikes and vessel collisions. Vessels will be used during construction to support Project activities and would travel to and from the site. Although sea turtles are not anticipated to occur within the enclosed marina, there is potential for them to occur along the routes that vessels may travel when accessing the site. Vessels proposed for use during construction could include barges and smaller support vessels. These types of vessels are typical throughout the Action Area and do not pose a substantial deviation from normal vessel activity. The increased risk of vessel collision due to construction related boating activity is considered negligible given the rare occurrence of leatherback sea turtles in the Columbia River and typical nature of the types of construction vessels proposed. There is no proposed long-term increase in vessel use in Action Area as a result of Project. Therefore, long-term operational vessel collision risks are not anticipated.

6.3.4.2. Determination

Due to a lack of identified direct and indirect impacts the Project is ***NLAA*** leatherback sea turtles. Critical habitat for leatherback sea turtles does not occur in the Action Area. The Project would have ***No Effect*** on leatherback sea turtle critical habitat.

6.3.5. Marine Mammals (Killer Whale, Humpback Whale)

Direct and indirect adverse impacts to SRKW and humpback whales could occur, but are considered unlikely given the location and extent of the proposed activities and proposed AMMs. As discussed in Section 4.10 and 4.11, SRKWs and humpback whales occur on rare occasions at the Columbia River mouth and it is considered unlikely that these species would be present in the Action Area.

Direct impacts could occur due to noise and/or decreased water quality. Indirect impacts could occur due to impacts to prey species. Potential impacts to SRKW and humpbacks from the proposed activities are discussed below in Sections 6.3.5.1 through 6.3.5.4.

6.3.5.1. Noise

Noise has the potential to directly impact marine mammals by causing physical injury or altering behaviour when noise threshold levels are exceeded. NMFS has identified Level A (potential injury) and Level B (potential disturbance) thresholds for marine mammals based on their hearing class. Potential noise impacts would be confined to the marina/port area by the rubble breakwaters. Noise impacts are not anticipated given that whales would not be anticipated to occur within the enclosed marina where construction activities are proposed. Although it is extremely unlikely that SRKW or humpback whales

would occur within the enclosed marina/ port area, a shutdown zone would be implemented to further protect whales from noise impacts. The shutdown zone would include the entire enclosed port/marina area. This shutdown zone would also be applied to all marine mammals. With the proposed shutdown zone, noise impacts to SRKW and humpbacks would be avoided.

Figure 8. Marine Mammal Shutdown Zone

6.3.5.2. Water Quality

Decreased water quality has the potential to directly impact SRKWs and humpback whales. The Project may create focused areas of minor temporary water quality impacts due to suspended sediments during in-water construction activities, however any potential water quality would be anticipated to be confined to the marina/port area. Water quality impacts are therefore not expected given that whales would not be anticipated to occur within the enclosed marina/port area where construction activities are proposed. The AMMs in Section 1.4 such as the implementation of spill prevention measures and the proposed shutdown zone will further reduce the potential for adverse water quality impacts.

The removal of approximately 30 cy/20 tons of creosote-treated timber is anticipated to result in long-term water quality benefits. AMMs such as the use of a containment boom to protect water quality during creosote-treated timber removal would be implemented.

6.3.5.3. Vessel Collision

Because whales surface to breathe, they are susceptible to propeller strikes and vessel collisions. Vessels will be used during construction to support Project activities and would travel to and from the site. Although whales are not anticipated to occur within the enclosed marina, there is the potential for them to occur along the routes that vessels may travel when accessing the site.Vessels proposed for use during construction could include barges and smaller support vessels. These types of vessels are typical throughout the Action Area and do not pose a substantial deviation from normal vessel activity. The increased risk of vessel collision due to construction related vessel activity is considered negligible given the rare occurrence of SRKW and humpback whales in the LCR and typical nature of the types of vessels proposed. There is no proposed long-term increase in vessel use in Action Area as a result of Project. Therefore, long-term operational vessel collision risks are not anticipated.

6.3.5.4. Prey Species

Direct impacts to prey species such as fish, for reasons outlined in section 6.3.1 are unlikely. Additionally, the marina is not anticipated to be used as foraging habitat for SRKW or humpback whales. Therefore, the Project is not anticipated to indirectly impact SRKW and humpback whales by impacting prey species.

6.3.5.5. Determination

Due to a lack of identified direct and indirect impacts the Project is ***NLAA*** SRKW and humpback whales. Critical habitat for humpback whales or SRKWs does not occur in the Action Area. The Project would have ***No Effect*** on SRKW or humpback whale critical habitat.

6.4. USFWS Listed Species

6.4.1. Fish Species (Bull Trout)

Direct and indirect adverse impacts could occur to bull trout but are considered unlikely given the extent of the proposed activities and proposed AMMs. As discussed in Section 4.6, it is unlikely that bull trout would occur in that Action Area because it is located within the marine/mixing zone of the LCR estuary and this species it typically associated with freshwater habitats.

Direct impacts could occur due to noise, water quality, and benthic habitat disturbances. Indirect impacts could occur due to impacts to prey species. Potential impacts to bull trout from the proposed activities are discussed below in Sections 6.4.1.1 through 6.4.1.4.

6.4.1.1. Noise

As discussed in additional detail in Section 6.3.1.1, The sound levels from the impact installation of steel sheet piles could exceed thresholds in which physical injury may occur within a small area no larger than 24 meters around each pile installation (Table 19). Impact pile driving of 12-inch diameter fiberglass fender piles could exceed thresholds in which physical injury may occur within a small area no larger than 1 meter around each pile (Table 19). Impacts due to exceedances over the Interim Injury Criteria threshold are anticipated to be unlikely given the small threshold area, short-term nature of the pile driving activities, and compliance with the in-water work window.

The behavioral threshold guideline could be exceeded within 215 meters during steel sheet pile installation and 29 meters during fiberglass fender pile installation. Impacts due to exceedances over the Level B threshold are anticipated to be minor given the short-term nature of the pile driving activities and compliance with the in-water work window.

6.4.1.2. Water Quality

As discussed in additional detail in Section 6.3.1.2, decreased water quality including turbidity has the potential to directly impact fish. Project activities with the potential to cause turbidity include, structure removal, pile installation, drainage rock placement, and riprap placement. However, potential turbidity plumes would be small in scale, temporary, and localized to the immediate vicinity of the Project

activities. Any potential direct water quality adverse impacts are anticipated to be minor and temporary. The AMMs in Section 1.4 such as the implementation of spill prevention measures and compliance with the in-water work window will further reduce the potential for adverse water quality impacts.

The removal of approximately 30 cy/20 tons of creosote-treated timber is anticipated to result in long-term water quality benefits by reducing toxicity potential. AMMs such as the use of a containment boom to protect water quality during creosote-treated timber removal would be implemented.

6.4.1.3. Benthic Habitat Disturbance

As discussed in additional detail in Section 6.3.1.3, the Project will result in temporary and permanent benthic habitat impacts. Temporarily disturbed benthic habitat would be anticipated to be quickly recolonized by benthic species and in-benthic invertebrates. Permanent benthic habitat impacts include the conversion of approximately 3,000 sf of aquatic soft bottom habitat to hard shoreline armoring (bulkhead wall and riprap shoreline). As discussed previously, it is unlikely that bull trout would occur in that Action Area because it is located within the marine/mixing zone of the LCR estuary and this species is typically associated with freshwater habitats. Benthic habitat Impacts to bull trout are anticipated to be minor and any potential impacts are anticipated to be offset by the removal of the creosote-treated timber retaining wall, existing bulkhead, and derelict piles which would restore approximately 165 sf of benthic habitat and remove approximately 30 cy or 20 tons of creosote.

6.4.1.4. Prey Species

As discussed in additional detail in Section 6.3.1.4, direct impacts to prey species have the potential to cause indirect impacts to their predators through reduced food supply. Bull trout prey that could occur in the Action Area includes crustaceans, invertebrates, and small fish. The Project may result in minor benthic habitat impacts that could result in impacts to benthic food supply. However, the active marina/port area in which the Project is located is not anticipated to provide optimal foraging habitat for bull trout. Fish prey species could be impacted by noise emitted during in-water construction activities. As discussed in Section 6.3.1.1, Project related noise would only exceed the Interim Injury Criteria Injury threshold for fish within a small area where salmonids would be unlikely to occur foraging (Table 19).

Substantial impacts to bull trout due to a reduced food supply are not anticipated given the nature and location of the proposed Project and proposed AMMs. The removal of creosote-treated timber could also improve foraging habitat.

6.4.1.5. Determination

Due to a lack of identified direct and indirect impacts the Project is ***NLAA*** bull trout. Critical habitat for bull trout does not occur in the Action Area. The Project would have ***No Effect*** on bull trout critical habitat.

6.4.2. Bird Species (Western Snowy Plover, Marbled Murrelet)

Direct and indirect adverse impacts could occur to western snowy plover and marbled murrelet could occur but are considered unlikely given the extent of the proposed activities and proposed AMMs. As discussed in Section 4.12, streaked horned lark are unlikely to occur in the Action Area and any potential streaked horned lark present within the Action Area would likely be foraging and would not spend extended periods of time in the vicinity of the project area. As discussed in Section 4.13, optimal western snowy plover habitat does not occur in the Action Area and any western snowy plover present in the Action Area would likely be foraging and are not expected to remain for a significant duration of time. As discussed in Section 4.14, marbled murrelet have the potential to occur foraging within the Action Area.

Direct impacts could occur due to noise, water quality, and benthic habitat disturbances. Indirect impacts could occur due to impacts to prey species. Potential impacts to bull trout from the proposed activities are discussed below in Sections 6.4.2.1 through 6.4.2.4.

6.4.2.1. Noise

Noise has the potential to directly impact marbled murrelets, western snowy plover, and streaked horned lark. The Project could create in-air noise levels of up to 105 dBA at 50 ft from the source (WSDOT 2020). In-water noise levels of up to 170 dBrms, 161 dBSEL, and 204 dBpeak during the impact installation of steel sheet piles (Table 2). In-water noise levels of up to 157 dBrms, 146 dBSEL, and 183 dBpeak during the impact installation of fiberglass fender piles (Table 2).

Noise thresholds have not been developed for western snowy plover or streaked horned lark, but have been developed for marbled murrelets. In the absence of noise thresholds for western snowy plover and streaked horned lark, noise thresholds developed for marbled murrelets were used to consider potential noise impacts to all three bird species.

<u>In-air</u>

The USFWS completed a biological opinion (BO) on potential in-air noise impacts to marbled murrelets from the use of heavy machinery (USFWS 2015b). The BO establishes threshold distances to certain activities to help determine potential impacts to marbled murrelets during construction activities.

According to this BO, pile driving at a distance greater than 0.25 miles from a known occupied nest tree or suitable nesting tree in an un-surveyed area would have no effect on marbled murrelets. Suitable nesting habitat does not occur within 0.25 miles of the proposed Project activities. The nearest suitable nesting habitat for marbled murrelets as defined by the critical habitat, is approximately 8 miles east of the Action Area (USFWS 2016). Therefore, noise impacts to nesting individuals are not anticipated.

In addition, the USFWS has developed thresholds for pile driving projects which when exceeded would result in masking impacts that could result in impaired essential communication between foraging murrelets. The USFWS determined that air-borne noise from 'typical' pile driving projects, results in insignificant masking impacts (USFWS 2013b). A 'typical' pile driving project involves the installation of up to 36-inch diameter steel piles and is defined as "a project which vibes in the piles as much as possible before impact driving to proof the piles". Piles proposed for installation under this Project are less than 36-inches in diameter and would be vibrated in as much as possible for impact proofing. Therefore, the Project is considered a 'typical' pile driving project that would have insignificant impacts on masking.

In-water

The USFWS has developed in-water auditory thresholds for marbled murrelets (Table 20). These auditory thresholds apply to repetitive impulsive noise sources such as impact pile driving (USWFS 2014a). There are currently no thresholds for continuous noise sources such as vibratory pile installation. The USFWS considers 150 dBrms a guideline, not a threshold. Marbled murrelets may respond to noise levels above this guideline, but the response may not constitute an adverse impact (USFWS 2014a). Potential impacts from noise exceedances above the behavioral guideline include masking, delayed or interrupted foraging, interference with mate identifications, courtship, and bonding. The USFWS Sound Exposure Level Calculator for Marbled Murrelet and Bull Trout was used to calculate the distance in which pile driving noise may exceed the established threshold (USFWS 2014b Table 20).

Noise levels would not exceed injury thresholds, but could exceed behavioral thresholds within 215 meters of the pile driving activities. It is unlikely that ESA-listed birds species will occur within close proximity to the active construction site and within the behavioral threshold area. Any potential behavioral impacts are anticipated to be minor and temporary.

Table 20. Marbled Murrelet In-water Noise Thresholds

	Injury		Behavioral
	Auditory	Non auditory	
Threshold Value	**202 dB SEL**	**208 dB SEL**	**150 dBrms**
Distance to Threshold (Steel Sheet)	Does not exceed	Does not exceed	215 meters
Distance to Threshold (12-inch fiberglass)	Does not exceed	Does not exceed	29 meters

Source: USFWS 2014a and USFWS 2014b

6.4.2.2. Water Quality

Marbled murrelets forage in subtidal areas and therefore decreased water quality has the potential to directly impact foraging marbled murrelets. Western snowy plover and streaked horned larks are not known to use subtidal areas and therefore water quality impacts are unlikely.

The Project may create focused areas of minor temporary water quality impacts due to suspended sediments during in-water construction activities. Project activities with the potential to cause turbidity include, structure removal, pile installation, drainage rock placement, and riprap placement. However, potential turbidity plumes would be small in scale, temporary, and localized to the immediate vicinity of the Project activities. Any potential direct water quality adverse impacts are anticipated to be minor and temporary. The AMMs in Section 1.4 such as the implementation of spill prevention measures will further reduce the potential for adverse water quality impacts.

The removal of approximately 30 cy/20 tons of creosote-treated timber is anticipated to result in long-term water quality benefits by reducing toxicity potential. AMMs such as the use of a containment boom to protect water quality during creosote-treated timber removal would be implemented.

6.4.2.3. Benthic Habitat Disturbance

Marbled murrelets, western snowy plover, and streaked horned lark could use soft bottom habitat within the Project area for foraging. However, the existing soft bottom habitat occurs within an active marina/port area and adjacent to creosote-treated structures. Therefore, the existing habitat is not anticipated to be of high habitat value to marbled murrelet, western snowy plover, or streaked horned lark.

The Project will result in temporary and permanent benthic habitat impacts. Temporarily disturbed benthic habitat would be anticipated to be quickly recolonized by benthic species and in-benthic invertebrates. Permanent benthic habitat impacts include the conversion of approximately 3,000 sf of aquatic soft bottom habitat and 350 sf of upland soft bottom habitat to hard shoreline armoring. Benthic habitat Impacts to marbled murrelets, western snowy plover, and streaked horned larks are anticipated

to be minor and any potential impacts are anticipated to be offset by the removal of the creosote-treated retaining wall, existing bulkhead, and derelict piles.

6.4.2.4. Prey Species

Impacts to prey species have the potential to cause indirect impacts to their predators through reduced food supply. Marbled murrelet prey that could occur in the Action Area includes invertebrates and forage fish. Western snowy plover prey that could occur in the Action Area includes invertebrates. Streaked horned lark prey that could occur in the Action Area includes insects and small areas of vegetation. The Project may result in minor benthic habitat impacts that could result in impacts to benthic food supply. However, the active marina/port area in which the Project is located is not anticipated to provide optimal foraging habitat for marbled murrelets, western snowy plover, or streaked horned lark. Fish prey species could be impacted by noise emitted during in-water construction activities. As discussed in Section 6.3.1.1, Project related noise would only exceed the Interim Injury Criteria Injury threshold for fish within a small area where salmonids would be unlikely to forage (Table 20).

Substantial impacts to marbled murrelets, western snowy plover, or streaked horned lark due to a reduced food supply are not anticipated given the nature and location of the proposed Project and proposed AMMs. The removal of creosote-treated timber could improve foraging habitat.

6.4.2.5. Determination

Due to a lack of identified direct and indirect impacts the Project is ***NLAA*** marbled murrelets and western snowy plover. Critical habitat for marbled murrelets and western snowy plover does not occur in the Action Area. The Project would have ***No Effect*** on marbled murrelet and western snowy plover critical habitat.

7. Conclusion

Direct and indirect adverse impacts could occur to protected species but are unlikely to occur given the extent of the proposed repairs and proposed AMMs. The Project could result in direct impacts from construction related noise, water quality, vessel collision, and benthic habitat disturbances. The Project could also result in indirect impacts due to impacts to prey species. Given the extent of the repairs proposed any potential direct or indirect impacts are anticipated to be minor and temporary. Additionally, the AMMs proposed in Section 1.4 of this BE will further reduce the potential for adverse

impacts to protected species and critical habitat. Potential ESA effects determinations are summarized in Table 21

Table 21. Effect Determination

Species	Scientific Name	Federal Status	Effect Determination	Critical Habitat Determination
NMFS ESA-listed Species				
Chinook Lower Columbia River ESU	*Oncorhynchus tshawytcha*	Threatened	NLAA	NLAA
Chinook Snake River fall-run ESU		Threatened	NLAA	NLAA
Chinook Snake River spring/summer-run ESU		Threatened	NLAA	NLAA
Chinook Upper Columbia River spring-run ESU		Endangered	NLAA	NLAA
Chinook Upper Willamette River ESU		Threatened	NLAA	NLAA
Chum Columbia River ESU	*O. keta*	Threatened	NLAA	NLAA
Coho Lower Columbia River ESU	*O. kisutch*	Threatened	NLAA	NLAA
Sockeye Snake River ESU	*O. nerka*	Endangered	NLAA	NLAA
Steelhead Lower Columbia River DPS	*O. myskiss*	Threatened	NLAA	NLAA
Steelhead Middle Columbia River DPS		Threatened	NLAA	NLAA
Steelhead Snake River Basin DPS		Threatened	NLAA	NLAA
Steelhead Upper Columbia River DPS		Threatened	NLAA	NLAA
Steelhead Upper Willamette River DPS		Threatened	NLAA	NLAA
Green Sturgeon Southern DPS	*Acipenser medirostris*	Threatened	NLAA	NLAA
Eulachon Southern DPS	*Thaleichthys pacificus*	Threatened	NLAA	NLAA
Leatherback Sea Turtle	*Dermochelys coriacea*	Endangered	NLAA	No Effect
Southern Resident Killer Whale	*Orcincus orca*	Endangered	NLAA	No Effect
Humpback Whale Central America DPS	*Megaptera novaeangliae*	Endangered	NLAA	No Effect
Humpback Whale Mexico DPS		Threatened	NLAA	No Effect
USFWS ESA-listed Species				
Bull Trout	*Salvelinus confluentus*	Threatened	NLAA	No Effect
Western Snowy Plover	*Charadrius alexandrinus nivosus*	Threatened	NLAA	No Effect
Marbled Murrelet	*Brachyramphus marmoratus*	Threatened	NLAA	No Effect
Streaked Horned Lark	*Eremophila alpestris strigata*	Threatened	NLAA	No Effect

8. References

Allen, M.J. and G.B. Smith. 1988. Atlas and zoogeography of common fishes in the Bering Sea and Northeastern Pacific. NOAA Tech. Rpt. NMFS-NWFSC-66.

Beacham, T.D, Hay, D.E., and Le, K.D. 2005. Population structure and stock identification of eulachon (*Thaleichthys pacificus*), an anadromous smelt, in the Pacific Northwest. Mar. Biotech. 7:363–372.

Barraclough, W. E. 1964. Contribution to the marine life history of the eulachon Thaleichthys pacificus. Journal of Fisheries Research Board of Canada 21:1333– 1337.

Beccio, M. 2019. 2019 Yuba River Sturgeon Spawning Study. California Department of Fish and Wildlife.

Beccio, M. 2018. 2018 Yuba River Sturgeon Spawning Study. California Department of Fish and Wildlife.

Burton, W.H. 1993. Effects of bucket dredging on water quality in the Delaware River and the potential for effects on fisheries resources. Versar, Inc., 9200 Rumsey Road, Columbia, Maryland 21045.

Carlson, T., G. Ploskey, R. L. Johnson, R. P. Mueller and M. A. Weiland. 2001. Observations of the behavior and distribution of fish in relation to the Columbia River navigation channel and channel maintenance activities. Review draft report to the Portland District COE of Engineers prepared by Pacific Northwest National Laboratory, Richland, Washington. 35 pages.

Craddock, D.R., T.H. Blahm, and W.D. Parente. 1976. Occurrence and utilization of zooplankton by juvenile Chinook salmon in the lower Columbia River. Trans. Amer. Fish. Soc. 105: 72–76.

California Department of Transportation (Caltrans). 2020. Technical Noise Supplement.

City of Ilwaco Zoning Map. 2017. Available at: https://cdn.townweb.com/ilwaco-wa.gov/wp-content/uploads/2018/07/Ilwaco_Zoning2_2017.pdf

Environmental Protection Agency (EPA). 2016. EPA Region 10 Best Management Practices for Piling Removal and Placement in Washington State.

FHWA (Federal Highway Administration). 2012. Tappan Zee Hudson River Crossing Project. Final Environmental Impact Statement. August.

GeoEngineers. 2022 Aquatic Critical Areas Assessment and Macrovegetation/Eelgrass Survey.

Gustafson, R. G., L. Weitkamp, YW. Lee, E. Ward, K. Somers. V. Tuttle, and J. Jannot. 2016. Status Review Update of Eulachon (*Thaleichthys pacificus*) Listed under the Endangered Species Act: Southern Distinct Population Segment. U.S. Department of Commerce, NOAA.

Hay, D.E. and P.B. McCarter. 2000. Status of the eulachon Thaleichthys pacificus in Canada. Department of Fisheries and Oceans Canada, Canadian Stock Assessment Secretariat, Research Document 2000-145.

Hendrickson, J. T. and E. Balasingam. 1966. Nesting beach preferences of Malayan sea turtles. Bulletin of the National Museum Singapore 33(10):69-76.

Hering, D.K., D.L. Bottom, E.F. Prentice, K.K. Jones, and I.A. Fleming. 2010. Tidal movements and residency of subyearling Chinook salmon (*Oncorhynchus tshawytscha*) in an Oregon salt marsh channel. *Canadian Journal of Fisheries and Aquatic Sciences* 67:524-533.

Johnson, O.W., T.A. Flagg, D.J. Maynard, G.B. Milner, and F.W. Waknitz. 1991. Status Review for Lower Columbia River Coho Salmon. U.S. National Marine Fisheries Service, Seattle, Washington. 95 pp.

Landau Associates (Landau). 2007. Noise Technical Report New Whatcom Redevelopment Project Port of Bellingham, Bellingham Washington.

Lower Columbia Fish Recovery Board (LCFRB). 2010a. Lower Columbia Salmon Recovery and Fish and Wildlife Subbasin Plan, Volume I—Regional Plan.

———. 2010b. Lower Columbia Salmon Recovery and Fish and Wildlife Subbasin Plan, Volume II—Subbasin Plans.

———. 2010c. Lower Columbia Salmon Recovery and Fish and Wildlife Subbasin Plan, A—Focal Fish Species.

Mate, B.R., D.M. Palacios, C.S. Baker, B.A. Lagerquist, L.M. Irvine, T. Follett, D. Steel, C.E. Hayslip, and M.H. Winsor. 2018. Humpback Whale Tagging in Support of Marine Mammal Monitoring Across Multiple Navy Training Areas in the Pacific Ocean: Final Report for Feeding Areas off the US West Coast in Summer-Fall 2017, Including Historical Data from Previous Tagging Efforts. Prepared for Commander, US Pacific Fleet and Commander, Naval Sea Systems Command. Submitted to Naval Facilities Engineering Command Southwest, San Diego, California, under Cooperative Ecosystem Studies Unit, Department of the Navy Cooperative Agreement No. N62473-17-2-0001. 19 October. 135 pp.

McCabe, G.T., Jr., and C.A. Tracy. 1994. Spawning and early life history of white sturgeon, *Acipenser transmontanus*, in the lower Columbia River. Fishery Bulletin 92:760–772.

McNatt, R.A., D.L. Bottom, and S.A. Hinton. 2016. Residency and movement of Juvenile Chinook Salmon at Multiple Spatial Scale in a Tidal Marsh of the Columbia River Estuary. *Transactions of the American Fisheries Society* 145(4):774-785.

Myers, J., C. Busack, D. Rawding, A. Marshall, D. Teel, D.M. Van Doornik, and M.T. Maher. 2006. Historical Population Structure of Pacific Salmonids in the Willamette River and Lower Columbia River Basins. U.S. Dept. Commerce, NOAA Tech. Memo. NMFSNWFSC-73. 311 p.

Myers, J.M., R.G. Kope, G.J. Bryant, D. Teel, L.J. Lierheimer, T.C. Wainwright, W.S. Grant, F.W. Waknitz, K. Neely, S.T. Lindley, and R.S. Waples. 1998. Status Review of Chinook Salmon from Washington, Idaho, Oregon, and California. U.S. Department of Commerce, NOAA Tech. Memo. NMFS-NWFSC-35, 443 pp.

National Marine Fisheries Service (NMFS). 2022a. Fisheries West Coast Region website. Available at: https:// www.fisheries.noaa.gov/about/west-coast-region

———. 2022b. Protected Resources App. Available at: https://www.fisheries.noaa.gov/resource/map/protected-resources-app

———. 2021. 5-Year Status Review: Summary & Evaluation Southern Distinct Population Segment of North American Green Sturgeon (*Acipenser medirostris*).

———. 2016a. 5-Year Review: Summary & Evaluation of Lower Columbia River Chinook Salmon Columbia River Chum Salmon Lower Columbia River Coho Salmon Lower Columbia River Steelhead.

———. 2016b. 5-Year Review: Summary & Evaluation of Snake River Sockeye, Snake River spring-Summer Chinook Snake River Fall-Run Chinook Snake River Basin Steelhead.

———. 2015. ESA recovery plan for Snake River sockeye salmon (Oncorhynchus nerka). United States, National Marine Fisheries Service., West Coast Region.

———. 2013. ESA Recovery Plan for Lower Columbia River Coho Salmon, Lower Columbia River Chinook Salmon, Columbia River Chum Salmon, and Lower Columbia River Steelhead. National Marine Fisheries Service, Northwest Region.

_____. 2011. Columbia River Estuary ESA Recovery Plan Module for Salmon and Steelhead. NMFS Northwest Region. Portland, OR. Prepared for NMFS by the Lower Columbia River Estuary Partnership (contractor) and PC Trask & Associates, Inc. (subcontractor).

———. 2010. Endangered and Threatened Wildlife and Plants: Threatened Status for Southern Distinct Population Segment of Eulachon. Federal Register/Vol. 75, No. 52.

———. 2009a. Endangered and Threatened Wildlife and Plants: Final Rule Making to Designate Critical Habitat for the Threatened Southern Distinct Population Segment of North American Green Sturgeon; Final Rule. 9 October 2009. Federal Register/Vol. 74, No. 195/

_____. 2009b. NMFS Interim Injury Criteria Threshold Spreadsheet.

———. 2008a. Summary of Scientific Conclusions of the Review of the Status of Eulachon (*Thaleichthys pacificus*) in Washington, Oregon, and California.

———. 2008b. Recovery Plan for Southern Resident Killer Whales (*Orcinus orca*). National Marine Fisheries Service, Northwest Region, Seattle, Washington.

———. 2008c. Interim Criteria Agreement.

_____. 2002. Formal Section 7 Consultation and Magnuson-Stevens Act Essential Fish Habitat Consultation - Biological Opinion, Columbia River Federal Navigation Channel Improvements Project. National Marine Fisheries Service, Northwest Region. (Reference: OHB1999-0270-R).

NWFSC (Northwest Fisheries Science Center). 2015. Status Review Update for Pacific Salmon and Steelhead Listed under the Endangered Species Act: Pacific Northwest. 21 December 2015.

Oregon Department of Fish and Wildlife. 2017. Status Review of the Marbled Murrelet (*Brachyramphus marmoratus*) in Oregon and Evaluation of Criteria to Reclassify the Species from Threatened to Endangered under the Oregon Endangered Species Act – Draft for Public and Peer Review.

Rieman, B.E. and J.D. McIntyre. 1993. Demographic and habitat requirements for the conservation of bull trout Salvelinus confluentus. USDA Forest Service Intermountain Research Station, General Technical Report INT-302, Ogden, UT.

Sato, C. L. 2017. Periodic status review for the Leatherback Sea Turtle in Washington. Washington Department of Fish and Wildlife, Olympia, Washington. 20+iii pp.

Seesholtz, A. M., M. J. Manuel, and J. P. Van Eenennaam. 2015. First Documented Spawning and Associated Habitat Conditions for Green Sturgeon in the Feather River, California. Environmental Biology of Fishes 98(3):905-912.

Sherk, J.A., O'Connor, J.M., Neumann, D.A. 1975. Effects of Suspended and Deposited Sediments on Estuarine Environments.

Stinson, D. W. 2016. Periodic status review for the Streaked Horned Lark in Washington. Washington Department of Fish and Wildlife, Olympia, Washington. 21 + iii pp.

Tanner, D.Q., H. M. Bragg, and M. W. Johnston. 2012. Total dissolved gas and water temperature in the lower Columbia River, Oregon and Washington, water year 2011: Quality-assurance data and comparison to water-quality standards: U.S. Geological Survey Open-File Report 2011-1300, 28 pp.

Thrush, S., Dayton, P. 2002. Disturbance to Marine Benthic Habitats by Trawling and Dredging: Implications for Marine Biodiversity.

United States Army Corps of Engineers (USACE). 2011a. Endangered Species Act Biological Assessment for Marbled Murrelet, Western Snowy Plover, Northern Spotted Owl, Short-Tailed Albatross, Columbian White-Tailed Deer, Bull Trout, Oregon Silverspot Butterfly, Nelson's Checkermallow, and the Streaked Horned Lark for the Major Rehabilitation of the Jetty System at the Mouth of the Columbia River In Pacific County, Washington And Clatsop County, Oregon.

———.2011b. Endangered Species Act Biological Opinion and Conference Report and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation. Major Rehabilitation of the Jetty System at the Mouth of the Columbia River Sixth Field HUCs : Baker Bay-Columbia River – 1708000605; Necanicum River-Frontal Pacific Ocean – 1710020101; Youngs River-Frontal Columbia River – 1708000602; Long Beach-Frontal Pacific Ocean – 1710010607 and Wallacut River-Frontal Columbia River – 1708000604, Pacific and Clatsop Counties, Washington and Oregon. NMFS No.: 2010/06104

U.S. Fish and Wildlife Service (USFWS). 2022. Information for Planning and Consultation (IPaC) database. Available at https://ecos.fws.gov/ipac/location/index

_____. 2019. Endangered Species Act – Section 7 Consulation. Biological Opinion Washington State Deparement of Natural Resources Marbled Murrelet Long-term Conservation Strategy Amendment to the 1997 Habitat Conservation Plan. U.S. Fish and Wildlife Service Reference: 01EWFW00-2019-FW-594. 7 November.

———.2018. Recovery Plan for the Southern Distinct Population Segment of North American Green Sturgeon (Acipenser medirostris). National Marine Fisheries Service, Sacramento, CA.

_____. 2016. Endangered and Threatened Wildlife and Plants; Determination of Critical Habitat for the Marbled Murrelet.

———. 2015a. Coastal Recovery Unit Implementation Plan for Bull Trout (*Salvelinus confluentus*). Prepared by U.S. Fish and Wildlife Service Washington Fish and Wildlife Office Lacey, Washington and Oregon Fish and Wildlife Office Portland, Oregon.

_____. 2015b. Statewide Programmatic Consultation for Washington State Department of Transportation.

U.S Fish and Wildlife Service (USFWS). 2014a. Marbled Murrelet Effects Thresholds.

_____. 2014b. Sound Exposure Level Calculator for Marbled Murrelet and Bull Trout.

———. 2013a. Endangered and Threatened Wildlife and Plants: Designation of Critical Habitat for Taylor's Checkerspot Butterfly and Streaked Horned Lark. Final Rule. 3 October 2013. Fed. Reg. 2013-23552.

_____. 2013b. Conducting Masking Analysis for Marbled Murrelets & Pile Driving Projects.

———. 2012. Endangered and Threatened Wildlife and Plants; Listing Taylor's Checkerspot Butterfly and Streaked Horned Lark and Designation of Critical Habitat: Proposed Rule. Federal Register/Vol. 77, No. 197 (Thursday, 11 October 2012): 61938-62058.

———. 2007. Recovery Plan for the Pacific Coast Population of the Western Snowy Plover (*Charadrius alexandrinus nivosus*). In 2 volumes. Sacramento, California. xiv + 751 pages.

Washington Department of Ecology (Ecology). 2022. Water Quality Atlas Map online database. Available at: https://apps.ecology.wa.gov/waterqualityatlas/wqa/map?CustomMap=y&RT=0&Layers=23%2c27%2c29&Filters=y%2cn%2cn%2cn&F1.4=n%2cn%2cn%2cn%2cy&BBox=-12989889%2c6198435%2c-12981546%2c6205178

Washington Department of Fish and Wildlife (WDFW). 2022a. SalmonScape database. Available at: http://apps.wdfw.wa.gov/salmonscape/map.html

_____. 2022b. Species and Habitat webpage. Leatherback sea turtle. Accessed at: https://wdfw.wa.gov/specieshabitats/ species/dermochelys-coriacea#conservation

———. 2016. Desimone, S. M. 2016. Draft periodic status review for the Marbled Murrelet in Washington. Washington Department of Fish and Wildlife, Olympia, Washington. 21+iii pp.

Washington Department of Fish and Wildlife (WDFW) and Oregon Department of Fish and Wildlife (ODFW). 2001. Washington and Oregon Pacific Eulachon Management Plan. October 2001.

Washington State Department of Transportation (WSDOT). 2020. Chapter 7 Construction Noise Impact Assessment. Available at: https://wsdot.wa.gov/sites/default/files/2022-11/BA-Manual-Chapter7.pdf

Weitkamp, L.A. 1994. A review of the effects of dams on the Columbia River estuarine environment, with special reference to salmonids. Report to the U.S. Department of Energy, Bonneville Power Administration, Portland, Oregon and National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, Washington.

Appendix A: Design Drawings

PORT OF ILWACO

MARINA STRUCTURES REPLACEMENT

PORT COMMISSIONERS
ALAN BENNETT
BUTCH SMITH

PORT MANAGER

CIVIL/STRUCTURAL ENGINEER
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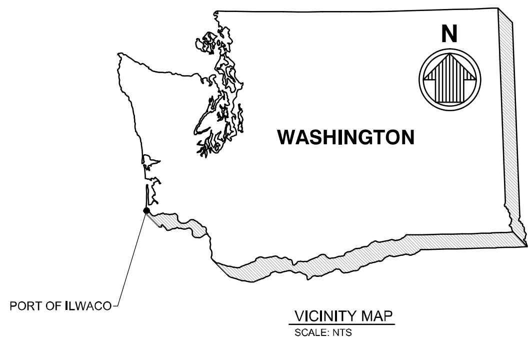

VICINITY MAP
SCALE: NTS

SHEET INDEX

LOCATION MAP
SCALE: NTS

50% DESIGN SUBMITTAL
ISSUED: 2022-10-07
NOT TO BE USED FOR CONSTRUCTION

DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

PORT OF ILWACO
MARINA STRUCTURES REPLACEMENT

COVER SHEET, VICINITY & LOCATION MAPS AND SHEET INDEX

Designed by: DES	Date: 2022-08-24	Rev. -
Drwn by: DRFT	Ckd by: CHK	M&N Project No. 211150
Reviewed by: REV	Drawing code:	
Submitted by: EMY CARPENTER ?? MOFFATT & NICHOL	Drawing Scale:	Plot scale: 1:1 (D SHEET)

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NOT FOR CONSTRUCTION
SEAL

Sheet
Reference No.
G-001
INDEX: 1 OF 25

GENERAL

1. THESE NOTES CONTAIN GENERAL INFORMATION AND ARE NOT COMPLETE FOR CONSTRUCTION PURPOSES. VERIFY INFORMATION GIVEN HERE WITH SPECIFICATIONS, REFERENCE DRAWINGS, AND OTHER DOCUMENTS AND BRING ANY CONFLICTS TO THE ATTENTION OF THE PORT BEFORE BEGINNING AFFECTED WORK INCLUDING FABRICATION, DEMOLITION, OR CONSTRUCTION. THE PORT WILL RESOLVE ANY SUCH CONFLICT.
2. VERIFY LOCATIONS OF EXISTING UTILITIES AND RELATED FEATURES IN A MANNER SIMILAR TO NOTE 1 ABOVE. USE A LOCATOR SERVICE AND EXCAVATE TO EXPOSE UTILITY LINES. BRING ANY CONFLICTS BETWEEN EXISTING UTILITIES OR RELATED FEATURES AND NEW CONSTRUCTION TO THE ATTENTION OF THE PORT.
3. IMMEDIATELY REPAIR ANY DAMAGE TO EXISTING UTILITIES OR RELATED FEATURES BY THE CONTRACTOR TO THE SATISFACTION OF THE PORT AND AT NO EXPENSE TO THE PORT. DRAWING G-003 CONTAIN THE PROJECT STRUCTURAL NOTES ASSOCIATED WITH THE FACILITY. NOTES ON ALL OTHER DRAWINGS ARE SUPPLEMENTAL.
4. AREAS OF THE FACILITY NOT UNDER CONSTRUCTION SHALL REMAIN IN OPERATION DURING THIS PROJECT. KEEP ALL CONSTRUCTION ACTIVITIES AND PERSONNEL CLEAR OF FACILITY OPERATIONS.
5. DRAWINGS INDICATE GENERAL AND TYPICAL DETAILS OF CONSTRUCTION. WHERE CONDITIONS ARE NOT SPECIFICALLY INDICATED BUT ARE OF SIMILAR CHARACTER TO DETAILS SHOWN, USE SIMILAR DETAILS OF CONSTRUCTION, SUBJECT TO REVIEW AND APPROVAL BY THE PORT.
6. VERIFY ALL SITE CONDITIONS, FEATURES, DIMENSIONS, AND ELEVATIONS PRIOR TO FABRICATION OF ASSEMBLIES OR CONSTRUCTION. COORDINATE THE SIZE AND LOCATION OPENINGS, AS WELL AS ALL OF ALL OPENINGS. VERIFY SIZE AND LOCATION OF ALL BY OTHER TRADES. THE CONDITIONS SHOWN ON THESE DRAWINGS ATTACHMENTS REQUIRED ARE BASED ON AVAILABLE EXISTING DATA. NOTIFY THE PORT IN WRITING OF ANY DISCREPANCIES BEFORE BEGINNING THE AFFECTED WORK. RESOLVE DISCREPANCIES AS APPROVED BY THE PORT BEGINNING THE AFFECTED WORK. RESOLVE DISCREPANCIES AS APPROVED BY THE PORT BEFORE BEGINNING THE AFFECTED WORK. LINES AND GRADES: ESTABLISH AND MAINTAIN THE DATUM AND CONSTRUCTION BASELINE.
7. SUBMIT SHOP DRAWINGS AND OTHER SUBMITTALS FOR REVIEW TO THE PORT PRIOR TO FABRICATION OF COMPONENTS. INCLUDE DEMOLITION PLANS, CONSTRUCTION JOINT LOCATIONS, AND CONSTRUCTION JOINT DETAILS. THE PORT WILL REVIEW THE SUBMITTALS.
8. SHOP DRAWING AND OTHER SUBMITTAL REVIEWS: REVIEW, VERIFY, AND STAMP BY BOTH THE CONTRACTOR AND THE CONTRACTORS QUALITY CONTROL MANAGER BEFORE SUBMITTING TO THE PORT. VERIFY CONFORMANCE WITH THE MEANS AND METHODS; TECHNIQUES, SEQUENCES, AND OPERATIONS OF CONSTRUCTION; AND ALL SAFETY PRECAUTIONS AND PROGRAMS INCIDENTAL THERETO. SUBMIT TO THE PORT FOR REVIEW WHEN COMPLETE.
9. BRING ALL OMISSIONS OR CONFLICTS BETWEEN THE VARIOUS ELEMENTS OF THE STRUCTURAL DRAWINGS OR BETWEEN THE STRUCTURAL DRAWINGS AND THE DRAWINGS OF OTHER TRADES (ELECTRICAL, MECHANICAL, PLUMBING, FIRE PROTECTION, ETC.) TO THE ATTENTION OF THE PORT BEFORE PROCEEDING WITH ANY WORK INVOLVED.
10. DO NOT SCALE WORKING DIMENSIONS FROM PLANS, SECTIONS OR DETAILS ON THE STRUCTURAL DRAWINGS.
11. SUBMIT CONTRACTOR-INITIATED CHANGES IN WRITING TO THE PORT FOR APPROVAL PRIOR TO SUBMITTAL OF SHOP DRAWINGS.
12. JOBSITE SAFETY; MEANS AND METHODS OF PERFORMING THE WORK; AND TECHNIQUES, SEQUENCES, AND PROCEDURES OF CONSTRUCTION ARE THE SOLE RESPONSIBILITY OF THE CONTRACTOR. THE PRESENCE OF THE PORT OR ITS REPRESENTATIVE DOES NOT NEGATE THE CONTRACTORS RESPONSIBILITY FOR JOBSITE SAFETY OR THE CONTRACTORS RESPONSIBILITY TO PERFORM ITS WORK IN COMPLIANCE WITH THE CONTRACT.
13. VERIFY THE STRUCTURAL CAPACITY OF EXISTING STRUCTURES FOR THE ANTICIPATED LOADS OF CONSTRUCTION EQUIPMENT AND OPERATIONS TO BE USED.
14. PROVIDE TEMPORARY BRACING TO UNFINISHED PORTIONS OF THE STRUCTURE. REMOVE TEMPORARY BRACING ONLY AFTER STABILITY OF THE FINISHED STRUCTURE IS ACHIEVED.
15. CONTRACTOR SHALL BE RESPONSIBLE TO PROTECT ALL EXISTING STRUCTURES THAT WILL REMAIN.

SURVEY NOTES:

1. EXISTING SITE INFORMATION SHOWN ON THESE DRAWINGS IS BASED ON SURVEY INFORMATION PROVIDED BY SOLMAR HYDRO, DATED 13 APRIL, 2022.
2. DATE OF SURVEY: TOPOGRAPHIC AND BATHYMETRIC SURVEYS CONDUCTED BETWEEN 15 FEB, 2022 AND 4 MARCH 2022
3. HORIZONTAL DATUM FOR THIS PROJECT IS NAD83/11 WITH PROJECTION STATE PLANE COORDINATE SYSTEM WASHINGTON SOUTH ZONE.
4. VERTICAL DATUM FOR THIS PROJECT IS MLLW BASED ON PUBLISHED NOAA TIDAL BENCHMARK 944 0581 C
5. UNITS: U.S FEET.
6. CONTOUR INTERVAL: 1 FOOT.
7. ALL UNDERGROUND UTILITY LOCATIONS ARE BASED ON OBSERVED EVIDENCE OF STRUCTURES. NO GUARANTEE IS MADE THAT THE UNDERGROUND UTILITIES SHOWN COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN SERVICE OR ABANDONED OR THAT THE UNDERGROUND UTILITIES ARE SHOWN IN THEIR EXACT LOCATION. FIELD VERIFY THE LOCATION,SIZE, MATERIAL, AND DEPTH OF UTILITIES.
8. CONTRACTOR IS RESPONSIBLE FOR REQUESTING AND MAINTAINING LOCATES ON ALL UNDERGROUND UTILITIES WITHIN THE PROJECT LIMITS.

CONTROL NOTES:

BASED STATION: SWLS ILWACO
NORTHING = 373487.13 FT
EASTING = 746918.05 FT
ELEVATION = 14.23 FT (NAVD88)

DATUM:

ELEVATION DATUM FOR THIS PROJECT IS 0.0' MEAN LOWER LOW WATER (MLLW).

TIDAL DATA:

TIDAL ELEVATIONS BASED ON NOAA TIDES AND CURRENTS DATUM FOR STATION 944 0581 CAPE DISAPPOINTMENT, WA EPOCH 1983 - 2001

ELEV(FT)	DATUM	DESCRIPTION
11.50	HOWL	HIGHEST OBSERVED WATER LEVEL
8.07	MHHW	MEAN HIGHER HIGH WATER
7.37	MHW	MEAN HIGH WATER
4.36	MTL	MEAN TIDAL LEVEL
1.35	MLW	MEAN LOW WATER
0.46	NAVD88	NORTH AMERICAN VERTICAL DATUM OF 1988
0.00	MLLW	MEAN LOWER LOW WATER
-2.95	LOWL	LOWEST OBSERVED WATER LEVEL

PERMIT REQUIREMENTS AND BMPS:

CONTRACTOR SHALL COMPLY WITH ALL PROJECT PERMIT CONDITIONS AND APPLICABLE BMPS LISTED BELOW AND IDENTIFIED IN THE SPECIFICATIONS, THE PROJECT STORM WATER POLLUTION PREVENTION PLAN, AND WATER QUALITY PROTECTION AND MONITORING PLAN.

1. DURING ANY IN-WATER AND EMBANKMENT WORK, CONTAINMENT BOOMS SHALL BE USED TO SURROUND THE WORK AREAS OR SEPARATE EMBANKMENT WORK FROM SURFACE WATER. THE BOOMS SHALL SERVE TO CONTAIN AND COLLECT ANY OILY MATERIAL RELEASED AS WELL AS FLOATING DEBRIS. OIL-ABSORBENT MATERIALS SHALL BE EMPLOYED IMMEDIATELY IF VISIBLE PRODUCT IS OBSERVED. ACCUMULATED DEBRIS SHALL BE COLLECTED DAILY AND DISPOSED OF AT A PERMITTED UPLAND SITE APPROVED BY THE PORT.
2. STEEL PILING SHALL BE INSTALLED WITH A VIBRATORY HAMMER WHEN POSSIBLE. IMPACT HAMMERING SHALL START WITH LIGHT TAPPING, THEN INCREASE TO FULL FORCE GRADUALLY.
3. A BUBBLE CURTAIN AND ONE OR MORE OTHER NOISE ATTENUATION METHODS SHALL BE USED DURING IMPACT INSTALLATION OR PROOFING OF ALL STEEL PILING.
4. HYDRAULIC WATER JETS SHALL NOT BE USED TO INSTALL PILES.
5. WORK BARGES, CONTAINMENT BOOMS, AND SILT CURTAINS SHALL NOT BE GROUNDED DURING CONSTRUCTION.
6. EXCESS AND/OR WASTE MATERIALS GENERATED DURING CONSTRUCTION SHALL NOT BE DISPOSED OF OR ALLOWED TO ENTER STATE WATERS. EXCESS OR WASTE MATERIALS SHALL BE COLLECTED AND RECYCLED OR DISPOSED OF AT A PERMITTED UPLAND FACILITY APPROVED BY THE PORT DEMOLITION AND CONSTRUCTION MATERIALS SHALL NOT BE STORED WHERE WAVE ACTION OR UPLAND RUNOFF CAN CAUSE MATERIALS TO ENTER SURFACE WATERS.
7. WATER QUALITY STANDARDS AND PROCEDURES THAT LIMIT THE IMPACT OF POLLUTANTS SHALL BE OBSERVED (WAC173-201A-210(1)(E)(I)).
8. LAND-BASED STAGING AREAS FOR ACTIVITIES, SUCH AS STORAGE OF MACHINERY, EQUIPMENT, MATERIALS, AND STOCKPILED SOILS SHALL BE ESTABLISHED LANDWARD OF THE TOP OF BANK IN ACCORDANCE WITH REQUIREMENTS IN THE SPECIFICATIONS. A SILT FENCE SHALL BE INSTALLED AROUND THE PERIMETER OF THE UPLAND WORK AREAS AND LOCATIONS WHERE MACHINERY, MATERIALS, AND STOCKPILED SOILS ARE SITUATED. ANY TEMPORARY STOCKPILES SHALL BE COVERED AND BERMED WHEN NOT IN USE.

CODES AND STANDARDS

ALL DESIGN AND CONSTRUCTION SHALL CONFORM TO THE REQUIREMENTS OF THE FOLLOWING CODES AND STANDARDS.

1. AMERICAN CONCRETE INSTITUTE (ACI) 318-14, BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE & COMMENTARY.
2. ACI 301-20, SPECIFICATIONS FOR CONCRETE CONSTRUCTION.
3. ACI DETAILING MANUAL MNL(66)-20.
4. AISC 360-16, SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS.
5. AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE) STANDARD 7-16, MINIMUM DESIGN LOADS AND ASSOCIATED CRITERIA FOR BUILDINGS AND OTHER STRUCTURES.
6. AMERICAN WELDING SOCIETY (AWS), AWS D1.1-2020, STRUCTURAL WELDING CODE - STEEL.
7. AWS D1.4-2018, STRUCTURAL WELDING CODE - REINFORCING STEEL.
8. AWS D1.6-2017, STRUCTURAL WELDING CODE - STAINLESS STEEL.
9. INTERNATIONAL CODE COUNCIL (ICC), INTERNATIONAL BUILDING CODE (IBC), 2018.
10. US ARMY CORPS OF ENGINEERS - DESIGN OF SHEET PILE WALLS, EM 1110-2-2504
11. UFC 4-152-07, DESIGN SMALL CRAFT BERTHING FACILITIES, 1 SEPTEMBER 2012.
12. UFC 4-159-03, DESIGN: MOORINGS, 12 MARCH 2020.
13. WASHINGTON DEPARTMENT OF TRANSPORTATION (WSDOT), STANDARD SPECIFICATIONS FOR ROAD, BRIDGE, AND MUNICIPAL CONSTRUCTION, 2021.
14. CRSI- MANUAL OF STANDARD PRACTICE 29TH EDITION, 2018

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PORT OF ILWACO

PORT OF ILWACO
MARINA STRUCTURES
REPLACEMENT

GENERAL NOTES

Designed by: DES | Date: 2022-08-24 | Rev.: -
Drwn by: DRFT | Ckd by: CHK | M&N Project No. 211150
Reviewed by: REV | Drawing code:
Submitted by: EMY CARPENTER ?? MOFFATT & NICHOL | Drawing Scale: | Plot scale: 1:1 (D SHEET)

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SEAL

Sheet
Reference No.
G-002
INDEX: 2 OF 25

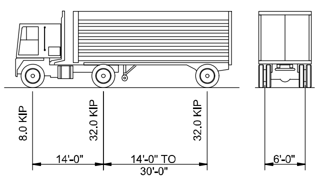
DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

File: Q:\SEA\213282\20 CADD_Active_Sheets\e213282_G-002 ; Plotted: 10/4/2022 3:43 PM by SEDIQI, KHALID ; Saved: 9/7/2022 3:34 PM by KSEDIQI

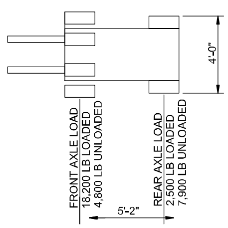
BULKHEAD DESIGN CRITERIA

1. THE BULKHEAD IS DESIGNED FOR STATIC, SEISMIC, AND LIQUEFACTION LATERAL LOADING CONDITIONS AS SPECIFIED IN THE GEOTECHNICAL ENGINEERING REPORT BY GEOENGINEERS INC, AUGUST 2022
2. BULKHEAD DESIGN IS IN ACCORDANCE WITH US ARMY CORPS OF ENGINEERS -DESIGN OF SHEET PILE WALLS (EM 1110-2-2504).
3. SUBMIT GROUTED TIE-BACK ANCHOR DESIGN CERTIFIED BY A PROFESSIONAL ENGINEER LICENSED IN THE STATE OF WASHINGTON TO THE PORT FOR REVIEW PRIOR TO THE START OF CONSTRUCTION. AT A MINIMUM PROVIDE: MATERIALS, DESIGN, STRESSING, LOAD TESTING, AND ACCEPTANCE CRITERIA IN ACCORDANCE WITH PTI RECOMMENDATIONS.
4. TIE-BACK ANCHOR ULTIMATE BOND STRENGTH FOR MINIMUM 6 INCH DIAMETER ANCHOR
   ASD DESIGN: FACTOR OF SAFETY FOR BOND STRENGTH = 2.0
   LRFD DESIGN: RESISTANCE FACTOR FOR BOND STRENGTH = 0.65
5. BULKHEAD SURCHARGE STATIC LOAD CASE = 300 PSF, SEISMIC LOAD CASE = 100 PSF, POST SEISMIC LOAD CASE = 100 PSF
6. VEHICLE LIVE LOADS, SEE DIAGRAMS BELOW.

HS20 DESIGN TRUCK



4 TON FORK LIFT



7. WIND

BASIC WIND ON STRUCTURE	95 MPH (3-SECOND GUST)
EXPOSURE	D

8. MOORING
   TYPE I MILD WEATHER (UFC 4-159-03)

WIND VELOCITY	35 KNOTS
CURRENT VELOCITY	1.0 KNOTS
WAVES	N/A FOR TYPE I MOORING

DESIGN VESSEL

DISPLACEMENT	40 LONG TON
LENGTH OVER ALL (LOA)	60 FEET
BEAM	22 FEET
DRAFT	12 FEET
APPROACH VELOCITY	1.0 FEET/SEC

9. SEISMIC
   RISK CATEGORY = II
   SHORT PERIOD SPECTRAL RESPONSE, Ss =1.427g
   ONE-SECOND PERIOD SPECTRAL RESPONSE, S1 =0.738 g
   SITE CLASS = F
   SPECTRAL RESPONSE COEFFICIENTS
   SHORT PERIOD, SDS = 1.142 g
   ONE-SECOND PERIOD, SD1 = 1.255 g

   MODIFIED PEAK GROUND ACCELERATION, PGAm = 0.798 g
   SEISMIC DESIGN CATEGORY = D

STEEL PILING

1. MATERIAL: SHEET PILES ASTM A572, GRADE 60, FY=60KSI
2. DRIVE ALL PILES TO THE REQUIRED TIP ELEVATIONS AS INDICATED.
3. ULTIMATE STEEL PILE CAPACITY IS SPECIFIED BY GEOENGINEERS,INC GEOTECHNICAL ENGINEERING REPORT.
4. COATING DAMAGED DURING HANDLING, DRIVING, OR DUE TO FILED WELDING MUST BE RESTORED AS REQUIRED BY THE SPECIFICATIONS AND AS DIRECTED BY THE PORT.

STRUCTURAL STEEL AND MISCELLANEOUS METAL

1. CONFORM TO THE FOLLOWING, UNO:

SHAPE	STANDARD, GRADE
PLATES	ASTM A572, GR 50
CHANNELS	ASTM A572, GR 50
W SECTIONS	ASTM A992, GR 50
ANGLES	ASTM A572, GR50
PIPE	ASTM A53, GR C
HSS RECTANGULAR	ASTM A500, GR C, FY=50 KSI
HSS ROUND	ASTM A500, GR C, FY=46 KSI

2. MACHINE BOLTS MUST CONFORM TO ASTM A307 GRADE A WITH COMPATIBLE ASTM A563 GRADE A NUTS AND ASTM F844 WASHERS.
3. HIGH STRENGTH BOLTS MUST CONFORM TO ASTM F3125, GRADE A325 WITH COMPATIBLE ASTM A563 NUTS AND ASTM F436 WASHERS.
4. ANCHOR BOLTS MUST CONFORM TO ASTM F 1554, GRADE 55, UNO
5. WELDING MUST CONFORM TO AWS D1.1
6. WHERE INDICATED, EXPOSED STRUCTURAL STEEL MUST BE HOT-DIP GALVANIZED CONFORMING TO ASTM A123/A123M GRADE 100 FOR SHAPES, PLATES, AND FABRICATIONS, ASTM A153/153M CLASS C FOR HARDWARE, AND ASTM F2329.
7. SET ALL EMBEDDED ANCHOR BOLTS AND ANCHOR RODS USING TEMPLATES THAT ARE VERIFIED WITH CERTIFIED DRAWINGS OF THE EQUIPMENT, FRAMING, OR MOORING HARDWARE PRIOR TO THE CONCRETE POUR. NOTIFY THE PORT OF ANY CHANGES TO ANCHOR BOLT SIZES, SPACING, OR QUANTITIES FROM WHAT IS SHOWN ON THE DRAWINGS. TEMPLATES MUST BE ADEQUATE TO HOLD THE BOLTS ACCURATELY IN PLACE AND IN ALIGNMENT DURING THE CONCRETE POUR.
8. PROVIDE BLEED HOLES IN EMBEDDED PLATES AND SHAPES AT 2'-0" ON CENTER MAXIMUM.
9. STAINLESS STEEL MUST BE OF TYPE 316L, BARS AND SHAPES, BOLTS, NUTS, AND WASHERS MUST CONFORM TO ASTM A276/A276M, F593, F594, AND F844, RESPECTIVELY.

STRUCTURAL CONCRETE REINFORCEMENT

1. MATERIALS:

REINFORCEMENT	STANDARD	GRADE	NOTES
REINFORCING STEEL	ASTM A615	60	DEFORMED, UNO
PREINFORCING STEEL TO BE WELDED	ASTM A706	60	DEFORMED
HEADED REINFORCEMENT	ASTM A970		CLASS HAS ROUND HEADS ONLY

2. PROVIDE MECHANICAL REINFORCING BAR CONNECTORS THAT DEVELOP A MINIMUM OF 1.25 TIMES THE YIELD STRENGTH OF REINFORCING BARS.
3. PLACEMENT:
   A LAP SPLICE REINFORCING STEEL MARKED CONT (CONTINUOUS) WITH A MINIMUM LAP SPLICE ACCORDING TO SHEET G-005 UNO.
   B CONFORM TO ACI 301, ACI MNL(66)-20, AND ACI 318 FOR CONCRETE DETAILS. DO NOT SPLICE ANY REINFORCEMENT LESS THAN 40 FEET IN LENGTH UNO.
   C STAGGER SPLICES OF ADJACENT BARS SO NO MORE THAN 50% OF THE BARS ARE SPLICED AT ANY ONE LOCATION. PROVIDE A MINIMUM STAGGER BETWEEN LAP SPLICES OF 180 BAR DIAMETERS UNO.
   E PROVIDE CORNER BARS AT ALL WALL, CURB, AND CURB WALL CORNERS MATCH THE QUANTITY, SPACING, AND DIAMETER OF ALL HORIZONTAL REINFORCEMENT AT THE CORNER. EXTEND TERMINATED STRAIGHT BARS THE FULL AVAILABLE LENGTH INTO ADJOINING MEMBERS. SPLICE EACH CORNER BAR TO A TERMINATED STRAIGHT BAR WITH A MINIMUM SPLICE LENGTH OF 60 BAR DIAMETERS. IF SPLICE LENGTH IS NOT AVAILABLE, USE MECHANICAL REINFORCING BAR CONNECTORS.
   F DO NOT WELD REINFORCING STEEL EXCEPT WHERE INDICATED OR BY APPROVAL OF THE PORT IN WRITING PRIOR TO CONSTRUCTION. IF AN ARC IS CREATED BETWEEN REINFORCING STEEL AND A WELDING ELECTRODE, REPLACE THE REINFORCING STEEL.

CAST-IN-PLACE CONCRETE

1. CAST-IN-PLACE CONCRETE MINIMUM 28 DAY COMPRESSIVE STRENGTH: 5000 PSI
2. COVER FOR REINFORCING STEEL: 3 INCH, UNO.
3. CHAMFER ALL EXPOSED CORNERS 3/4 INCH, UNO.
4. PROVIDE CONSTRUCTION JOINTS ONLY AS NOTED ON THE DRAWINGS OR AS SPECIFICALLY PERMITTED BY THE PORT.
5. ROUGHEN CONSTRUCTION JOINTS TO 1/4 IN AMPLITUDE, UNO. CLEAN AND REMOVE LAITANCE, THEN CONTINUOUSLY SOAK WITH WATER FOR 12 HOURS PRIOR TO POUR, UNO. REMOVE STANDING WATER JUST PRIOR TO PLACING NEW CONCRETE.

TIE BACK ANCHORS

1. TIE BACK ANCHORS INCLUDING STRAND, SHEATHING, AND ASSOCIATED HARDWARE MUST BE DYWIDAG MULTISTRAND, DOUBLE CORROSION PROTECTED OR APPROVED EQUAL MEETING ASTM A416.
2. GROUTED STRAND ANCHORS MUST CONFORM TO ASTM A416, GRADE 270, WITH COMPATIBLE HARDWARE AND ANCHORS. SYSTEM AS DESIGN IS PER DYWIDAG-SYSTEMS INTERNATIONAL. SUBMIT ALTERNATE SYSTEMS FOR APPROVAL PRIOR TO CONSTRUCTION.
3. TIE BACK ANCHOR SYSTEM AS SHOWN ON THE DRAWINGS IS FOR BID PURPOSES ONLY, FINAL DESIGN AND METHOD OF INSTALLTION IS TO BE DESIGNED BY THE CONTRACTOR. SEE G-004 FOR MINIMUM SPECIAL INSPECTION REQUIREMENTS.

SAWN TIMBER

1. SAWN TIMBER MUST CONFORM TO "GRADING AND DRESSING RULES", WEST COAST LUMBER INSPECTION BUREAU (WCLIB), LATEST EDITION. TIMBER MUST BE KILN DRIED AND BE THE SPECIES AND GRADE NOTED BELOW. DESIGN STRESSES ARE BASED ON THE NATIONAL DESIGN SPECIFICAITON (NDS).

USE	GRADE	FB (PSI)
WALES AND CHOCKS	DOUGLAS FIR-LARCH NO.1	1200

WOOD PRESERVATION TREATMENT

1. ALL LUMBER AND TIMBERS MUST BE PRESSURE TREATED IN ACCORDANCE WITH THE LATEST REVISION OF THE AMREICAN WOOD PRESERVES' ASSOCIATION (AWPA) STANDARDS M1, M2, M6, T1, AND U1.
2. PRESSURE TREATMENT MUST BE IN ACCORDANCE WITH THE "WESTERN WOOD PRESERVERS INSTITUTE BEST MANAGEMENT PRECTICES FOR USE OF TREATED WOOD IN AQUATIC ENVIRONMENTS".

PRODUCT	USE CATEGORY	PRESERVATIVE	NET RETENTION (PCF)
ALL LUMBER & TIMBER	5A	ACZA	0.6

3. ALL PRESERVATIVE TREATMENT PRODUCTS MUST BE BRANDED OR PERMANENTLY MARKED AFTER TREATMENT IN ACCORDANCE WITH AWPA STANDARD M6.
4. HANDLING, STORAGE, AND FIELD TREATMENT MUST BE IN ACCORDANCE WITH AWPA STANDARD M4.
5. CUTS AND DRILLED HOLES MADE IN THE FIELD MUST BE TREATED WITH COPPER NAPHTHENATE-BASED SOLUTION IN ACCORDANCE WITH AWPA STANDARD M4. THE PRESERVATIVE CONCENTRATION MUST CONTAIN NO LESS THAN 2 PERCENT COPPER METAL. FIELD TREATMENT MUST BE BY BRUSHING, DIPPING, OR SOAKING AND MUST BE DONE IN A MANNER THAT THE PRESERVATIVE DOES NOT DRIP OR SPILL ON THE GROUND OR IN THE WATER.

50% DESIGN SUBMITTAL
ISSUED: 2022-10-07
NOT TO BE USED FOR CONSTRUCTION

PORT OF ILWACO
MARINA STRUCTURES REPLACEMENT

STRUCTURAL NOTES & DESIGN CRITERIA

Designed by: DES	Date: 2022-08-24	Rev. -	
Drwn by: DRFT	Chk'd by: CHK	M&N Project No. 211150	
Reviewed by: REV		Drawing code:	
Submitted by: EMY CARPENTER ?? MOFFATT & NICHOL		Drawing Scale:	Plot scale: 1:1 (D SHEET)

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STUART J. STRINGER, STATE OF WASHINGTON, 52367, PROFESSIONAL ENGINEER, STRUCTURAL ENGINEER
NOT FOR CONSTRUCTION
SEAL

Sheet Reference No.
G-003
INDEX: 3 OF 25

DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

SPECIAL INSPECTION NOTES

1. THE ITEMS CHECKED WITH AN "X" MUST BE INSPECTED IN ACCORDANCE WITH IBC CHAPTER 17 BY AN INSPECTOR MEETING THE MINIMUM QUALIFICATIONS OUTLINED IN THE SPECIFICATIONS. FOR MATERIAL SAMPLING AND TESTING REQUIREMENTS, REFER TO THE PROJECT SPECIFICATIONS, THE SPECIFIC GENERAL NOTES SECTIONS, AND THE CODE SECTIONS REFERENCED. SEND COPIES OF ALL STRUCTURAL TESTING AND INSPECTION REPORTS DIRECTLY TO THE PORT. ANY MATERIALS WHICH FAIL TO MEET THE PROJECT SPECIFICATIONS MUST IMMEDIATELY BE BROUGHT TO THE ATTENTION OF THE PORT. SPECIAL INSPECTION TESTING REQUIREMENTS APPLY EQUALLY TO ALL BIDDER DESIGNED COMPONENTS.
2. CONTINUOUS SPECIAL INSPECTION MEANS THAT THE SPECIAL INSPECTOR IS ON THE SITE AT ALL TIMES OBSERVING THE WORK REQUIRING SPECIAL INSPECTION IBC SECTION 1702. PERIODIC SPECIAL INSPECTION MEANS THAT THE SPECIAL INSPECTOR IS ONSITE AT TIME INTERVALS NECESSARY TO CONFIRM THAT ALL WORK REQUIRING INSPECTION IS IN COMPLIANCE.
3. VISUALLY INSPECT ALL WELDS.
4. ALL COMPLETE PENETRATION WELDS MUST BE TESTED ULTRASONICALLY OR BY USE OF A COMPARABLE APPROVED METHOD.
5. CONTINUOUS SPECIAL INSPECTION BY A REGISTERED DEPUTY INSPECTOR IS REQUIRED FOR FIELD WELDING, CONCRETE STRENGTH, HIGH STRENGTH BOLTING, SPRAYED-ON FIREPROOFING, GROUTING.

TABLE 1705.3 REQUIRED SPECIAL INSPECTIONS AND TESTS OF CONCRETE CONSTRUCTION

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION	REFERENCED STANDARD	IBC REFERENCE
1. INSPECT REINFORCEMENT, VERIFY PLACEMENT.	-	X	ACI 318: 20, 25.2, 25.3, 26.6.1-26.6.3	1908.4
2. REINFORCING BAR WELDING A. INSPECT SINGLE-PASS FILLET WELDS, MAXIMUM 5/16";AND B. INSPECT ALL OTHER WELDS.	-	X X -	AWS D1.4 ACI 318: 26.6.4	-
3. REINFORCING BAR WELDING	-	X	ACI 318: 17.8.2	-
4. INSPECT ANCHORS POST-INSTALLED IN HARDENED CONCRETE MEMBERS. A. ADHESIVE ANCHORS INSTALLED IN HORIZONTALLY OR UPWARDLY INCLINED ORIENTATIONS TO RESIST SUSTAINED TENSION LOADS. B. MECHANICAL ANCHORS AND ADHESIVE ANCHORS NOT DEFINED IN 4.A.	X	X	ACI 318: 17.8.2.4 ACI 318: 17.8.2	-
5. VERIFY USE OF REQUIRED DESIGN MIX.	-	X	ACI 318: 19, 26.4.3, 26.4.4	1904.1 1904.2 1908.2 1908.3
6. PRIOR TO CONCRETE PLACEMENT, FABRICATE SPECIMENS FOR STRENGHT TESTS, PERFORM SLUMP AND AIR CONTENT TESTS, AND DETERMINE THE TEMPERATURE OF THE CONCRETE.	X	-	ASTM C172 ASTM C31 ACI 318: 26.4, 26.12	1908.10
7. INSPECT CONCRETE PLACEMENT FOR PROPER APPLICATION TECHINQUES.	X	-	ACI 318: 26.5	1908.6 1908.7 1908.8
8. VERIFY MAINTENANCE OF SPECIFIED CURING TEMPERATURE AND TECHNIQUES.	-	X	ACI 318: 26.5.3-26.5.5	1908.9
9. VERIFY IN-SITU CONCRETE STRENGTH, PRIOR TO REMOVAL OF SHORES AND FORMS FROM BEAMS.	-	X	ACI 318: 26.11.2	-
10. INSPECT FORMWORK FOR SHAPE, LOCATION, AND DIMENSIONS OF THE CONCRETE MEMBER BEING FORMED.	-	X	ACI 318: 26.11.1.2(b)	-

TABLE 1705.6 REQUIRED SPECIAL INSPECTIONS AND TESTS OF SOILS

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1. VERIFY MATERIALS BELOW SHALLOW FOUNDATIONS ARE ADEQUATE TO ACHIEVE THE DESIGN BEARING CAPACITY.	-	X
2. VERIFY EXCAVATIONS ARE EXTENDED TO PROPER DEPTH AND HAVE REACHED PROPER SUPPORTING MATERIAL.	-	X
3. PERFORM CLASSIFICATION AND TESTING OF COMPACTED FILL MATERIALS.	-	X
4. VERIFY USE OF PROPER MATERIALS, DENSITIES, AND LIFT THICKNESSES DURING PLACEMENT AND COMPACTION OF COMPACTED FILL.	X	-
5. PRIOR TO PLACEMENT OF COMPACTED FILL, INSPECT SUBGRADE AND VERIFY THAT SITE HAS BEEN PREPARED PROPERLY.	-	X

TABLE 1705.7 REQUIRED SPECIAL INSPECTIONS AND TESTS OF DRIVEN DEEP FOUNDATION ELEMENTS

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1. VERIFY ELEMENT MATERIALS, SIZES, AND LENGTHS COMPLY WITH REQUIREMENTS.	X	-
2. DETERMINE CAPACITIES OF TEST ELEMENTS AND CONDUCT ADDITIONAL LOAD TESTS, AS REQUIRED.	X	-
3. INSPECT DRIVING OPERATIONS AND MAINTAIN COMPLETE AND ACCURATE RECORDS FOR EACH ELEMENT.	X	-
4. VERIFY PLACEMENT LOCATIONS AND PLUMBNESS, CONFIRM TYPE AND SIZE OF HAMMER, RECORD NUMBER OF BLOWS PER FOOT OF PENETRATION, DETERMINE REQUIRED PENETRATIONS TO ACHIEVE DESIGN CAPACITY, RECORD TIP AND BUTT ELEVATIONS, AND DOCUMENT ANY DAMAGE TO FOUNDATION ELEMENT.	X	-
5. FOR STEEL ELEMENTS, PERFORM ADDITIONAL SPECIAL INSPECTIONS IN ACCORDANCE WITH SECTION 1705.2 SEE QUALITY ASSURANCE INSPECTION REQUIREMENTS OF AISC-360.	-	-
6. FOR CONCRETE ELEMENTS AND CONCRETE-FILLED ELEMENTS, PERFORM TESTS AND ADDITIONAL SPECIAL INSPECTIONS IN ACCORDANCE WITH SECTION 1705.3.	-	-
7. FOR SPECIALTY ELEMENTS, PERFORM ADDITIONAL INSPECTIONS AS DETERMINED BY THE REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE.	X	-

TIE-BACK ANCHORS TESTING AND INSPECTION

1. SUBMIT GROUTED TIE-BACK ANCHOR TESTING AND SPECIAL INSPECTION PROGRAM. CONTINUOUS SPECIAL INSPECTION IS REQUIRED FOR TIE-BACK ANCHOR INSTALLATION, GROUTING, AND TESTING.
2. AT A MINIMUM, PERFORMANCE TESTING OF GROUTED TIE-BACK ANCHORS MUST OCCUR ON THE FIRST THREE ANCHORS INSTALLED AND THEN ON A MINIMUM OF TWO OF THE REMAINING ANCHORS.
3. PERFORMANCE AND PROOF TESTS MUST BE ACCOMPLISHED IN ACCORDANCE WITH THE POST-TENSIONING INSTITUTE RECOMMENDATIONS (PTI, 2014).
4. A MINIMUM OF THREE PRE-PRODUCTION OR VERIFICATION TESTS SHALL BE PERFORMED TO 200% OF THE DESIGN BOND STRENGTH.

50% DESIGN SUBMITTAL
ISSUED: 2022-10-07
NOT TO BE USED FOR CONSTRUCTION

DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

PORT OF ILWACO

Mark	Description	Date	Appr.

PORT OF ILWACO
MARINA STRUCTURES
REPLACEMENT

STRUCTURAL SPECIAL
INSPECTION
REQUIREMENTS &
DETAILS

Designed by: DES | Date: 2022-08-24 | Rev. -
Dwn by: DRFT | Chk'd by: CHK | M&N Project No. 211150
Reviewed by: REV | Drawing code:
Submitted by: EMY CARPENTER ?? MOFFATT & NICHOL | Drawing Scale: | Plot scale: 1:1 (D SHEET)

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PROFESSIONAL ENGINEER
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Sheet
Reference No.
G-004
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ABBREVIATIONS

ACI	AMERICAN CONCRETE INSTITUTE
ACZA	AMMONICAL COPPER ZINC ARSENATE
ADDT'L	ADDITIONAL
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
AWPA	AMERICAN WOOD PROTECTION ASSOCIATION
AWS	AMERICAN WELDING SOCIETY
BLDG	BUILDING
C/C	CENTER ON CENTER
CL	CENTERLINE
CLR	CLEAR
CONC	CONCRETE
CONT	CONTINUOUS or CONTINUE
CSBC	CRUSHED SURFACING BASE COURSE
DACS	DRAWING AREA COORDINATE SYSTEM
E	EAST
EA	EACH
ELEV	ELEVATION
EM	ELECTROMAGNETIC
EQ	EQUAL
EQUIV	EQUIVALENT
EX	EXISTING
EXP	EXPANSION
FT	FOOT or FEET
FY	FORCE TO YIELD
GA	GAGE
GALV	GALVANIZED
GR	GRADE
HOWL	HIGHEST OBSERVED WATER LEVEL
HAS	HEADED ANCHOR STUD
HDPE	HIGH DENSITY POLYETHYLENE
HSS	HOLLOW STRUCTURAL SECTION
HORIZ	HORIZONTAL
IBC	INTERNATIONAL BUILDING CODE
ICC	INTERNATIONAL CODE COUNCIL
ID	INSIDE DIAMETER
IN.	INCHES
KSI	KIPS PER SQUARE INCH
L	LENGTH
LOWL	LOWEST OBSERVED WATER LEVEL
LB	POUND
LF	LINEAR or LINEAL FEET
LG	LONG
LLH	LONG LEG HORIZONTAL
MAX	MAXIMUM
MHW	MEAN HIGH WATER
MHHW	MEAN HIGHER HIGH WATER
MIN	MINIMUM
MLW	MEAN LOW WATER
MLLW	MEAN LOWER LOW WATER
MTL	MEAN TIDE LINE
N	NORTH
NAVD	NORTH AMERICAN VERTICAL DATUM
N/A	NOT APPLICABLE
NDS	NATIONAL DESIGN SPECIFICATION
NE	NORTH EAST
NO.	NUMBER
NOAA	NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION
NTS	NOT TO SCALE
OC	ON CENTER
OD	OUTSIDE DIAMETER
OGEE	DOUBLE CURVE
PCF	POUND PER CUBIC FOOT
PG	PRESSURE GAUGE
PL	PLATE or PROPERTY LINE
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PTDF	PRESSURE TREATED DOUGLAS FIR
PTI	POST - TENSIONING INSTITUTE
REQD	REQUIRED
SCH	SCHEDULE
SE	SOUTH EAST
SEC	SECONDARY
SECT	SECTION
SPEC	SPECIFICATION
SS	STAINLESS STEEL or SANITARY SEWER
SST	STAINLESS STEEL
STD	STANDARD
STL	STEEL
T&B	TOP AND BOTTOM
THRU	THROUGH
TYP	TYPICAL
T/	TOP OF
UFC	UNIFIED FACILITY CRITERIA
UNO	UNLESS NOTED OTHERWISE
UON	UNLESS OTHERWISE NOTED
WA	WASHINGTON
WP	WEATHER PROOF OR WATER PROOF
WSDOT	WASHINGTON DEPARTMENT OF TRANSPORTATION
W/	WITH

BAR SIZE	LAP SPLICE LENGTH IN INCHES	
	OTHER BARS	TOP BARS
#3	19	24
#4	25	32
#5	31	40
#6	37	48
#7	54	70
#8	62	80
#9	70	91
#10	79	102
#11	87	113

NOTES:

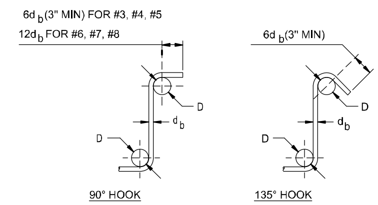
1. THE ABOVE SPLICE LENGTHS APPLY TO BARS WITH A MINIMUM SPACING OF 3db INCHES ON CENTER.

   db = BAR NOMINAL DIAMETER

2. DEVELOPMENT LENGTH OF BARS SHALL EQUAL A MINIMUM OF 77% OF LAP SPLICE LENGTH.
3. TOP BARS ARE HORIZONTAL BARS WITH MORE THAN 12 INCHES OF CONCRETE CAST BELOW THE BARS.
4. VALUES ARE BASED ON CLASS "B" SPLICES (MAX 50% OF BARS SPLICED AT ONE LOCATION).

TYPICAL REINFORCING BAR LAP SPLICE LENGTH

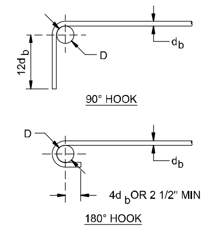
SCALE: NTS



BAR SIZE	#3	#4	#5	#6	#7	#8
D	1 1/2"	2"	2 1/2"	4 1/2"	5 1/4"	6"

TYPICAL STIRRUP & TIE HOOKS

SCALE: NTS

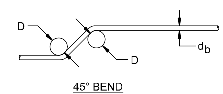


NOTES:

$D=6d_b$ FOR #3 THRU #8

$D=8d_b$ FOR #9 THRU #11

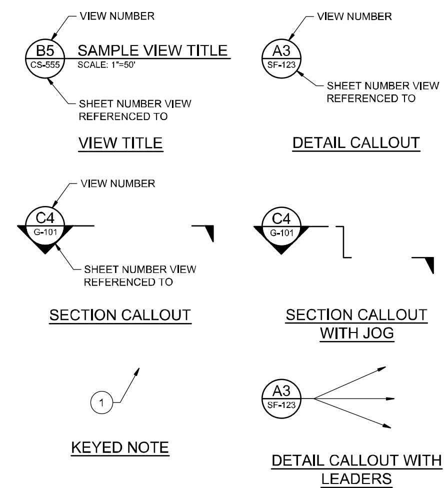
$D=10d_b$ FOR #14 AND #18



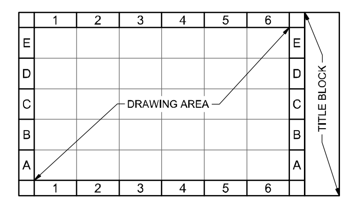
TYPICAL REINFORCING HOOKS

SCALE: NTS

CROSS-REFERENCE LEGEND



* VIEW NUMBER IS BASED ON THE (DACS) LOCATION OF THE LOWER-LEFT EXTENTS OF THE VIEW ON THE REFERENCED SHEET. WHEN REFERENCING DRAWING INFORMATION BETWEEN SHEETS, BOTH THE VIEW AND SHEET NUMBERS MUST BE QUOTED TOGETHER - EITHER IN A CALLOUT FORMAT AS SHOWN ABOVE OR IN THE FORM;
"VIEW NO./SHEET NO." (EG A1/CS-5001)



DRAWING AREA COORDINATE SYSTEM (DACS)

	SHEET TYPE DESIGNATORS
0	GENERAL (COVER SHEET, LEGEND, NOTES)
1	PLANS (HORIZONTAL VIEWS)
2	ELEVATIONS (NOT TYPICALLY USED)
3	SECTIONS (OVERALL VIEWS)
4	LARGE-SCALE VIEWS (PLANS, SECT. OR ELEV. - NOT DETAILS)
5	DETAILS (MAY BE PLAN, SECT. OR ELEV. VIEWS)
6	SCHEDULES
7	USER DEFINED
8	USER DEFINED
9	3D ISOMETRIC

DISCIPLINE DESIGNATORS

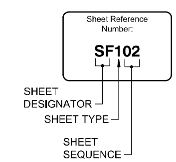
DISCIPLINE	DESIGNATOR
GENERAL	G
SURVEY/MAPPING	V
GEOTECHNICAL	B
CIVIL WORKS	W
CIVIL	C
STRUCTURAL	S
MECHANICAL	M
ELECTRICAL	E
OTHER DISCIPLINES	X

SECONDARY DESIGNATORS

DEMOLITION	D
GENERAL	G
SUBSTRUCTURE	B
FRAMING	F
COMPONENT	C
SITE	S

REVISION NUMBERING

A00, A01...	PRE-BID SUBMITTALS
B00, B01...	BID SUBMITTALS
000, 001...	CONSTRUCTION SUBMITTALS



SHEET NUMBERING

50% DESIGN SUBMITTAL
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PORT OF ILWACO
MARINA STRUCTURES REPLACEMENT

ABBREVIATIONS
LEGEND & DETAILS

Designed by: DES	Date: 2022-08-24	Rev. -	
Dwn by: DRFT	Ckd by: CHK	M&N Project No. 211150	
Reviewed by: REV		Drawing code:	
Submitted by: EMY CARPENTER ?? MOFFATT & NICHOL		Drawing Scale:	Plot scale: 1:1 (D SHEET)

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Sheet
Reference No.
G-005
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DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

EXISTING SITE PLAN
SCALE: 1"=20'

SURVEY LEGEND:

- STEEL PILE
- PILE
- SUBMERGED PILE
- UTILITY POLE
- HYDRANT
- WATER VALVE
- PATH LIGHT
- — MHHW — MEAN HIGHER HIGH WATER (MHHW) (ELEV= +8.07' MLLW)

NOTES:

1. BATHYMETRY AND TOPOGRAPHY BASED ON A SURVEY PERFORMED BT SOLMAR HYDRO ON APRIL 13, 2022.
2. CONTOURS SHON ARE IN FEET RELATIVE TO MLLW.

N

20' 0' 20' 40'
SCALE: 1"=20'

50% DESIGN SUBMITTAL
ISSUED: 2022-10-07
NOT TO BE USED FOR CONSTRUCTION

DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

PORT OF ILWACO

Mark	Description	Date	Appr.

PORT OF ILWACO
MARINA STRUCTURES
REPLACEMENT

EXISTING SITE PLAN

Designed by: DES	Date: 2022-08-24	Rev.: -
Drawn by: DRFT	Chk'd by: CHK	M&N Project No. 211150
Reviewed by: REV		Drawing code:
Submitted by: EMY CARPENTER ?? MOFFATT & NICHOL		Drawing Scale: / Plot scale: 1:1 (D SHEET)

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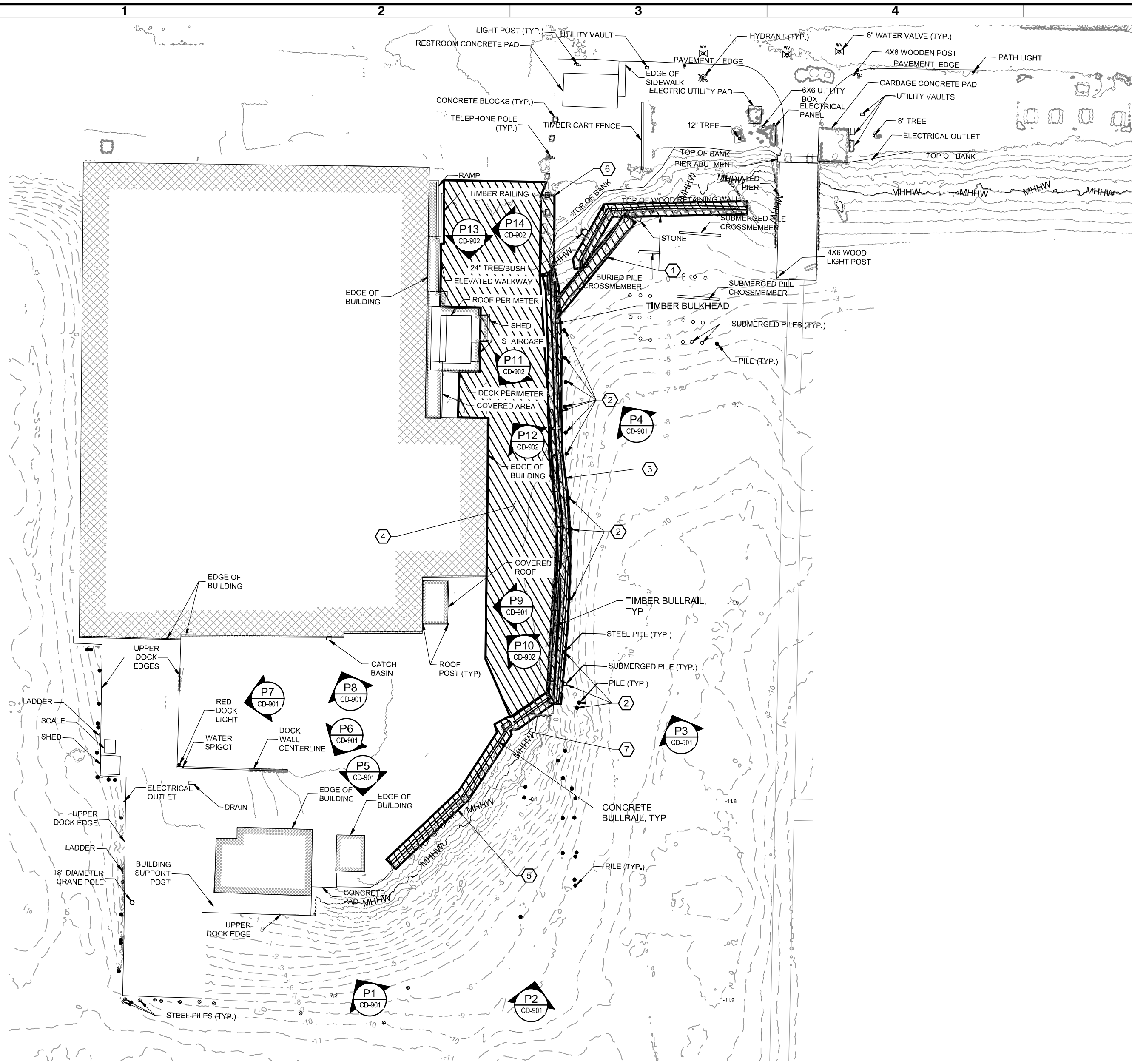

LIGHT POST (TYP.)
UTILITY VAULT
RESTROOM CONCRETE PAD
HYDRANT (TYP.)
6" WATER VALVE (TYP.)
4X6 WOODEN POST
PAVEMENT EDGE
PATH LIGHT
EDGE OF SIDEWALK
ELECTRIC UTILITY PAD
6X6 UTILITY BOX
ELECTRICAL PANEL
GARBAGE CONCRETE PAD
UTILITY VAULTS
CONCRETE BLOCKS (TYP.)
TELEPHONE POLE (TYP.)
TIMBER CART FENCE
12" TREE
8" TREE
ELECTRICAL OUTLET
TOP OF BANK
PIER ABUTMENT
ELEVATED PIER
RAMP
TIMBER RAILING
TOP OF WOOD RETAINING WALL
SUBMERGED PILE CROSSMEMBER
STONE
4X6 WOOD LIGHT POST
24" TREE/BUSH
ELEVATED WALKWAY
ROOF PERIMETER
BURIED PILE CROSSMEMBER
TIMBER BULKHEAD
EDGE OF BUILDING
SHED
STAIRCASE
SUBMERGED PILES (TYP.)
PILE (TYP.)
DECK PERIMETER
COVERED AREA
COVERED ROOF
TIMBER BULLRAIL, TYP
STEEL PILE (TYP.)
SUBMERGED PILE (TYP.)
UPPER DOCK EDGES
CATCH BASIN
ROOF POST (TYP)
LADDER
SCALE
SHED
RED DOCK LIGHT
WATER SPIGOT
DOCK WALL CENTERLINE
ELECTRICAL OUTLET
DRAIN
CONCRETE BULLRAIL, TYP
UPPER DOCK EDGE
18" DIAMETER CRANE POLE
BUILDING SUPPORT POST
CONCRETE PAD
STEEL PILES (TYP.)
MHHW
P1 CD-901
P2 CD-901
P3 CD-901
P4 CD-901
P5 CD-901
P6 CD-901
P7 CD-901
P8 CD-901
P9 CD-901
P10 CD-902
P11 CD-902
P12 CD-902
P13 CD-902
P14 CD-902

DEMOLITION SITE PLAN
SCALE: 1"=20'

DEMOLITION KEY NOTES

1. REMOVE TIMBER BULKHEAD AND LARGE LOG.
2. REMOVE TIMBER AND STEEL PILES ALONG TIMBER BULKHEAD
3. SELECTIVE DEMOLITION OF TIMBER BULKHEAD, SEE SHEET S-301.
4. REMOVE PAVEMENT.
5. REMOVE CONCRETE CURB.
6. REMOVE FENCE.
7. SELECTIVE REMOVAL OF LARGE RUBBLE ON SHORELINE SLOPE.

NOTES:

1. COORDINATE DEMOLITION PHASING AND SCHEDULE WITH THE PORT PRIOR TO MOBILIZATION.
2. PROVIDE A DEMOLITION PLAN AS REQUIRED BY THE SPECIFICATIONS.

LEGEND

DEMOLITION AREAS

PHOTOGRAPH NUMBER
P#
CD-###
SHEET NUMBER VIEW REFERENCED TO

PHOTOGRAPH CALLOUT

N

20' 0' 20' 40'
SCALE: 1"=20'

50% DESIGN SUBMITTAL
ISSUED: 2022-10-07
NOT TO BE USED FOR CONSTRUCTION

DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

PORT OF ILWACO

PORT OF ILWACO
MARINA STRUCTURES REPLACEMENT

DEMOLITION SITE PLAN

Designed by: DES	Date: 2022-08-24	Rev.: -
Dwn by: DRFT	Chk'd by: CHK	M&N Project No. 211150
Reviewed by: REV		Drawing code:
Submitted by: EMY CARPENTER ?? MOFFATT & NICHOL		Drawing Scale: Plot scale: 1:1 (D SHEET)

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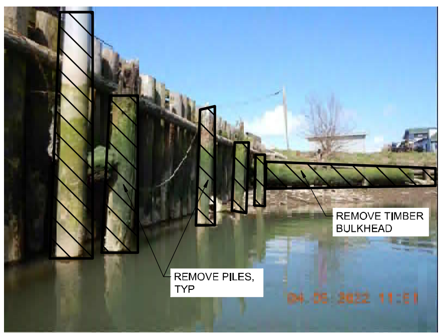
P1 CD-100 **SOUTH SHORLINE**
LOOKING NORTHWEST

P2 CD-100 **SOUTH SHORLINE**
LOOKING NORTH

P3 CD-100 **SOUTH END OF BULKHEAD**
LOOKING NORTHWEST



P4 CD-100 **NORTH END OF BULKHEAD**
LOOKING NORTHWEST

P5 CD-100 **SHED**
LOOKING SOUTH

P6 CD-100 **OFFICE BUILDING AND RAMP**
LOOKING SOUTH

P7 CD-100 **LOADING DOCK**
LOOKING SOUTHWEST

P8 CD-100 **CATCH BASIN**
LOOKING NORTHWEST

P9 CD-100 **RECESSED EQUIPMENT**
LOOKING SOUTHWEST

LEGEND

DEMOLITION AREAS

50% DESIGN SUBMITTAL
ISSUED: 2022-10-07
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DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

PORT OF ILWACO

Mark	Description	Date	Appr.

PORT OF ILWACO
MARINA STRUCTURES
REPLACEMENT

DEMOLITION PHOTOS
(1 OF 2)

Designed by: DES	Date: 2022-08-24	Rev.: -	
Drawn by: DRFT	Chk'd by: CHK	M&N Project No.: 211150	
Reviewed by: REV		Drawing code:	
Submitted by: EMY CARPENTER ?? MOFFATT & NICHOL		Drawing Scale:	Plot scale: 1:1 (D SHEET)

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P10 CD-100 SE CORNER OF BLDG
LOOKING NORTHWEST

P11 CD-100 NE CORNER OF BLDG
LOOKING SOUTHWEST

P12 CD-100 EQUIPMENT TOWER AND UTILITIES
LOOKING NORTHWEST

P13 CD-100 EQUIPMENT
LOOKING SOUTHEAST

P14 CD-100 BLDG FOUNDATION AND UTILITIES
LOOKING WEST

LEGEND

DEMOLITION AREAS

50% DESIGN SUBMITTAL
ISSUED: 2022-10-07
NOT TO BE USED FOR CONSTRUCTION

DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

PORT OF ILWACO

Mark	Description	Date	Appr.

PORT OF ILWACO
MARINA STRUCTURES
REPLACEMENT

DEMOLITION PHOTOS
(2 OF 2)

Designed by: DES	Date: 2022-08-24	Rev. -
Dwn by: DRFT	Ckd by: CHK	M&N Project No. 211150
Reviewed by: REV	Drawing code:	
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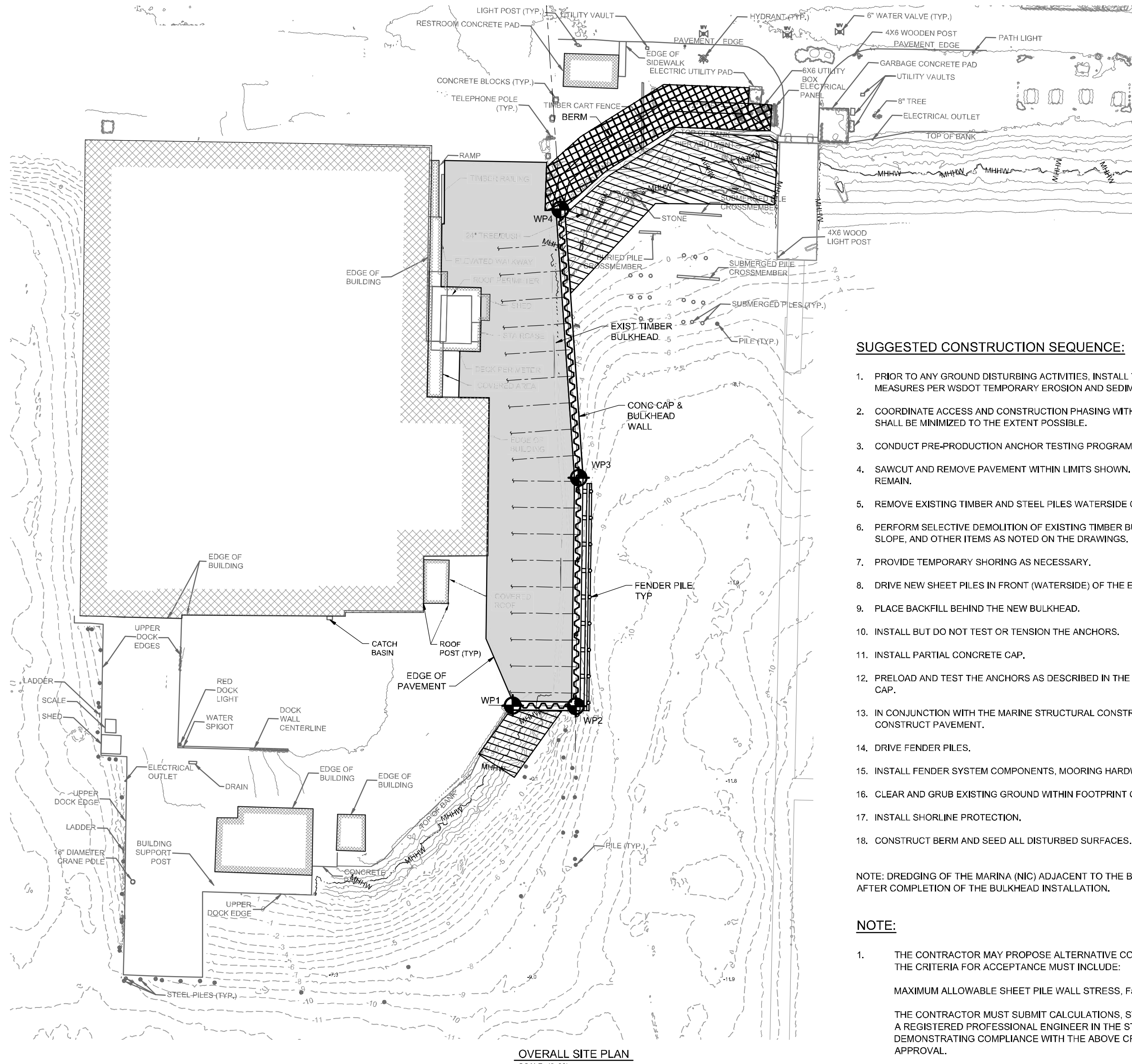

OVERALL SITE PLAN
SCALE: 1"=20'

WORKPOINT TABLE		
WORKPOINT	NORTHING	EASTING
1	374293.75	745889.35
2	374301.30	745912.08
3	374383.34	745884.80
4	374476.95	745845.02

LEGEND

- WORKPOINT, SEE TABLE ABOVE
- — MHHW — MEAN HIGHER HIGH WATER (MHHW) (ELEV= +8.07' MLLW)
- PAVING AREA LIMITS
- BERM CONSTRUCTION
- SLOPE PROTECTION

SUGGESTED CONSTRUCTION SEQUENCE:

1. PRIOR TO ANY GROUND DISTURBING ACTIVITIES, INSTALL TEMPORARY EROSION CONTROL MEASURES PER WSDOT TEMPORARY EROSION AND SEDIMENT CONTROL MANUAL, MAY 2019.
2. COORDINATE ACCESS AND CONSTRUCTION PHASING WITH TENANT OPERATIONS. INTERRUPTIONS SHALL BE MINIMIZED TO THE EXTENT POSSIBLE.
3. CONDUCT PRE-PRODUCTION ANCHOR TESTING PROGRAM, INSTALL AND TEST.
4. SAWCUT AND REMOVE PAVEMENT WITHIN LIMITS SHOWN. PROTECT ALL SURFACE FEATURES TO REMAIN.
5. REMOVE EXISTING TIMBER AND STEEL PILES WATERSIDE OF THE EXISTING TIMBER BULKHEAD.
6. PERFORM SELECTIVE DEMOLITION OF EXISTING TIMBER BULKHEAD, LARGE RUBBLE ON SHORELINE SLOPE, AND OTHER ITEMS AS NOTED ON THE DRAWINGS.
7. PROVIDE TEMPORARY SHORING AS NECESSARY.
8. DRIVE NEW SHEET PILES IN FRONT (WATERSIDE) OF THE EXISTING BULKHEAD.
9. PLACE BACKFILL BEHIND THE NEW BULKHEAD.
10. INSTALL BUT DO NOT TEST OR TENSION THE ANCHORS.
11. INSTALL PARTIAL CONCRETE CAP.
12. PRELOAD AND TEST THE ANCHORS AS DESCRIBED IN THE SPECIFICATIONS. COMPLETE THE PILE CAP.
13. IN CONJUNCTION WITH THE MARINE STRUCTURAL CONSTRUCTION, PLACE BACKFILL AND CONSTRUCT PAVEMENT.
14. DRIVE FENDER PILES.
15. INSTALL FENDER SYSTEM COMPONENTS, MOORING HARDWARE, DAVIT CRANES.
16. CLEAR AND GRUB EXISTING GROUND WITHIN FOOTPRINT OF PROPOSED BERM.
17. INSTALL SHORLINE PROTECTION.
18. CONSTRUCT BERM AND SEED ALL DISTURBED SURFACES.

NOTE: DREDGING OF THE MARINA (NIC) ADJACENT TO THE BULKHEAD MUST NOT OCCUR UNTIL AFTER COMPLETION OF THE BULKHEAD INSTALLATION.

NOTE:

1. THE CONTRACTOR MAY PROPOSE ALTERNATIVE CONSTRUCTION SEQUENCE. THE CRITERIA FOR ACCEPTANCE MUST INCLUDE:

   MAXIMUM ALLOWABLE SHEET PILE WALL STRESS, Fa=25ksi.

   THE CONTRACTOR MUST SUBMIT CALCULATIONS, STAMPED AND SEALED BY A REGISTERED PROFESSIONAL ENGINEER IN THE STATE OF WASHINGTON DEMONSTRATING COMPLIANCE WITH THE ABOVE CRITERIA FOR ENGINEERS APPROVAL.

N

SCALE: 1"=20'

50% DESIGN SUBMITTAL
ISSUED: 2022-10-07
NOT TO BE USED FOR CONSTRUCTION

PORT OF ILWACO

PORT OF ILWACO
MARINA STRUCTURES REPLACEMENT

OVERALL SITE PLAN

Designed by: DES | Drawn by: DRFT | Chk by: CHK | Reviewed by: REV | Submitted by: EMY CARPENTER ?? MOFFATT & NICHOL | Date: 2022-08-24 | M&N Project No. 211150 | Drawing code: | Drawing Scale: | Plot scale: 1:1 (D SHEET) | Rev.: -

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Sheet Reference No.
C-100
INDEX: 11 OF 25

DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

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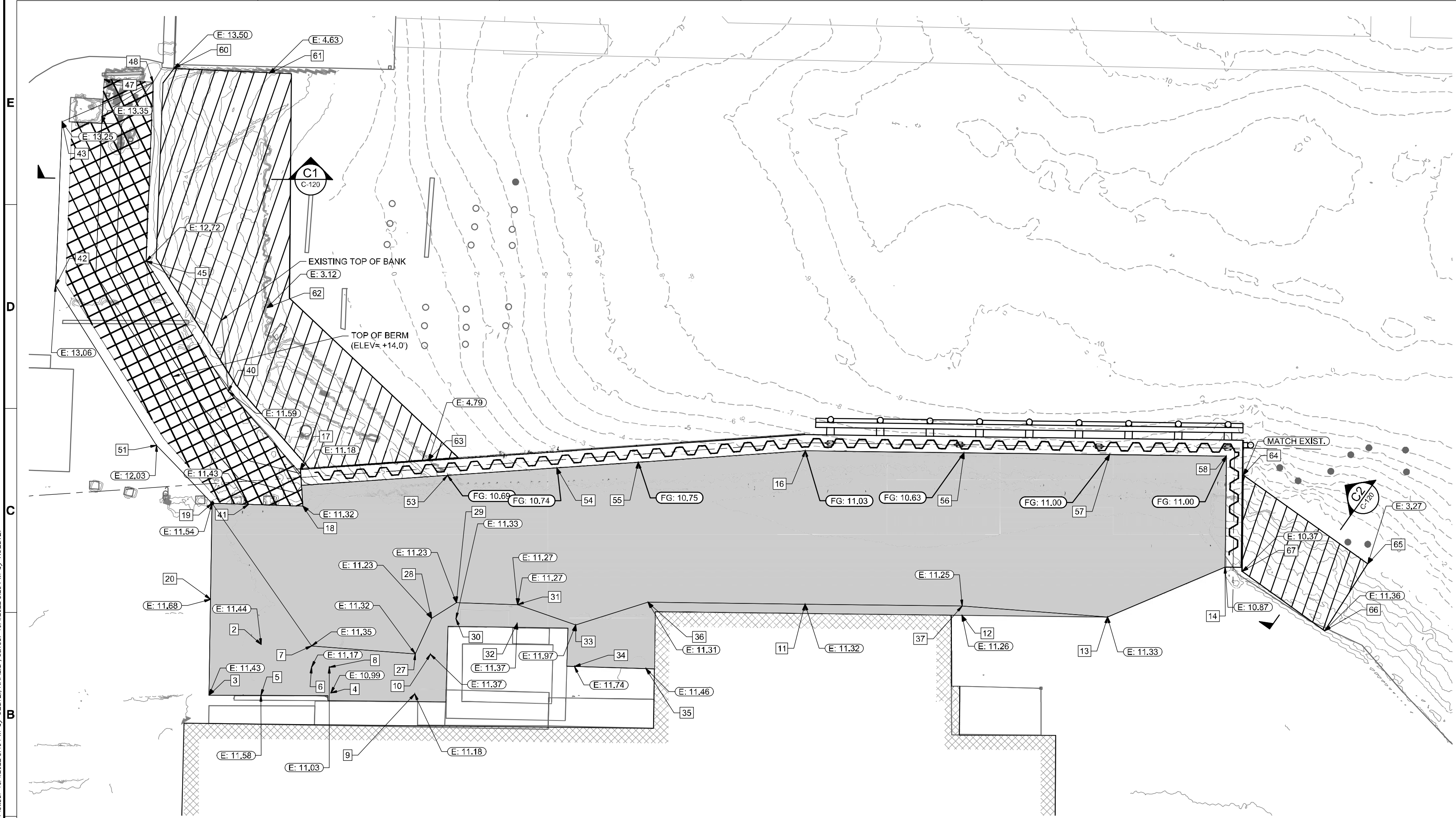
E: 13.50
60
E: 4.63
61
48
47
E: 13.35
E: 13.25
43
C1
C-120
E: 12.72
42
45
EXISTING TOP OF BANK
E: 3.12
62
TOP OF BERM
(ELEV= +14.0')
E: 13.06
40
E: 11.59
E: 4.79
63
17
E: 11.18
51
E: 12.03
E: 11.43
53
FG: 10.69
FG: 10.74
54
55
FG: 10.75
16
FG: 11.03
FG: 10.63
56
FG: 11.00
57
FG: 11.00
58
MATCH EXIST.
64
C2
C-120
E: 3.27
E: 10.37
67
65
19
41
E: 11.32
18
E: 11.54
29
E: 11.33
E: 11.23
E: 11.23
28
E: 11.27
E: 11.27
31
E: 11.25
20
E: 11.68
E: 11.44
E: 11.32
14
E: 10.87
E: 11.36
66
2
E: 11.35
30
36
E: 11.31
11
E: 11.32
37
12
E: 11.26
13
E: 11.33
7
E: 11.17
8
32
E: 11.97
33
E: 11.43
E: 10.99
E: 11.37
34
3
5
6
4
27
10
E: 11.37
E: 11.74
E: 11.46
35
E: 11.58
E: 11.03
9
E: 11.18

GRADING SITE PLAN

SCALE: 1"=10'

LEGEND

- FG: #.# — FINISHED GRADE ELEVATION
- E: #.# — EXISTING GRADE (MATCH NEW PAVEMENT)
- ## — CONSTRUCTION POINT
- PAVING AREA LIMITS
- BERM CONSTRUCTION
- SLOPE PROTECTION

N

10' 0' 10' 20'

SCALE: 1"=10'

50% DESIGN SUBMITTAL
ISSUED: 2022-10-07
NOT TO BE USED FOR CONSTRUCTION

DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

PORT OF ILWACO

Mark	Description	Date	Appv.

PORT OF ILWACO
MARINA STRUCTURES
REPLACEMENT

GRADING SITE PLAN

Designed by: DES	Date: 2022-08-24	Rev.: -	
Drwn by: DRFT	Ckd by: CHK	M&N Project No. 211150	
Reviewed by: REV		Drawing code:	
Submitted by: EMY CARPENTER ?? MOFFATT & NICHOL		Drawing Scale:	Plot scale: 1:1 (D SHEET)

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STUART J. STRINGER
STATE OF WASHINGTON
52367
STRUCTURAL ENGINEER
PROFESSIONAL ENGINEER
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Sheet
Reference No.
C-110
INDEX: 12 OF 25

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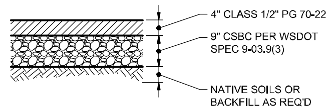
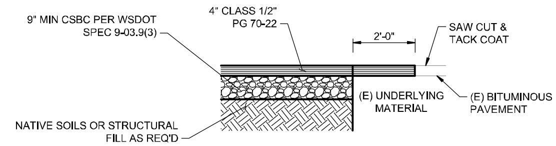
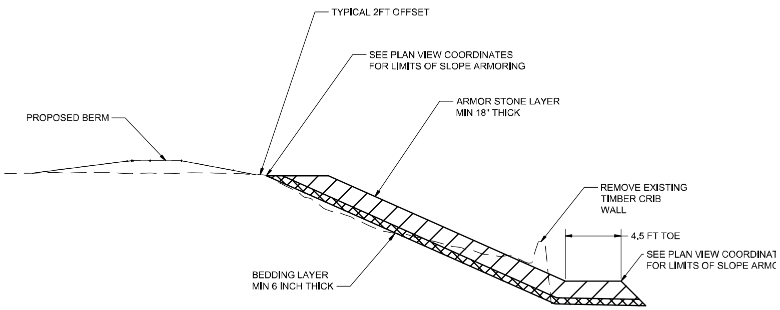


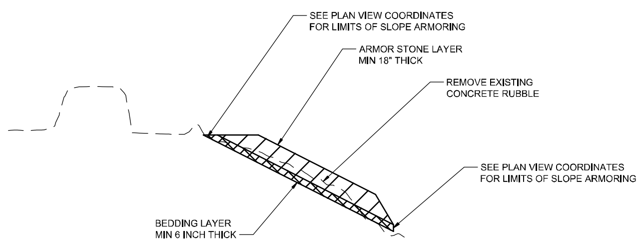
D1 - PAVING DETAIL
SCALE: 1/2"= 1'-0"



D4 - JUNCTURE OF NEW AND EXIST PAVEMENT
SCALE: 1/2"= 1'-0"



C1 C-110 SLOPE ARMOR SECTION 2
SCALE:



A1 C-110 SLOPE ARMOR SECTION 1
SCALE:

Point Table		
Point #	Northing	Easting
2	374473.51	745810.63
3	374480.10	745797.57
4	374457.07	745806.00
5	374470.20	745800.95
6	374462.44	745809.66
7	374463.82	745813.71
8	374459.04	745810.82
9	374441.06	745811.35
10	374440.68	745819.95
11	374372.75	745854.12
12	374342.14	745862.35
13	374314.36	745871.60
14	374295.29	745888.84
15	374302.33	745910.02
16	374382.76	745883.28
17	374477.58	745846.51
18	374474.68	745839.68
19	374492.13	745834.23
20	374486.12	745815.90
21	374324.67	745902.59
22	374352.46	745893.35
23	374382.76	745883.28
24	374413.79	745870.09
25	374437.87	745859.86

Point Table		
Point #	Northing	Easting
26	374449.19	745855.05
27	374443.63	745819.02
28	374442.85	745826.86
29	374439.15	745831.43
30	374438.13	745828.34
31	374427.36	745835.12
32	374426.23	745831.52
33	374414.98	745835.05
34	374412.49	745827.11
35	374398.77	745831.41
36	374402.76	745844.13
37	374342.73	745864.11
39	374428.88	745863.68
40	374496.38	745856.54
41	374485.16	745836.41
42	374536.22	745865.33
43	374545.77	745896.81
44	374487.73	745844.76
45	374520.62	745875.91
46	374529.29	745870.03
47	374540.55	745907.68
48	374531.05	745910.29
49	374525.82	745872.38
50	374501.99	745848.23

Point Table		
Point #	Northing	Easting
51	374506.49	745841.58
52	374499.75	745851.55
53	374449.19	745855.05
54	374428.88	745863.68
55	374413.79	745870.09
56	374352.46	745893.35
57	374324.67	745902.59
58	374302.33	745910.02
59	374299.28	745640.68
60	374528.00	745914.34
61	374509.56	745919.65
62	374494.53	745875.01
63	374453.81	745856.67
64	374297.86	745907.57
65	374268.35	745898.89
66	374272.16	745883.31
67	374291.74	745889.15

GRADING AND LAYOUT POINTS:

1. SEE SHEET C-110 FOR LOCATION OF POINTS AND FEATURES. ELEVATIONS ARE SHOWN IN PLAN VIEW.
2. WHERE POINTS FOR EXISTING GROUND DO NOT HAVE ELEVATION DATA THE POINTS ARE CONSIDERED DIRECTIVE TO MATCH EXISTING GRADE WHEN CONSTRUCTING PAVEMENT FINISH GRADE.

A4 - GRADING POINTS DATA

2'-0" 0'-0" 2'-0" 4'-0"
SCALE: 1/2"=1'-0"

50% DESIGN SUBMITTAL
ISSUED: 2022-10-07
NOT TO BE USED FOR CONSTRUCTION

DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

PORT OF ILWACO

Mark	Description	Date	Appr.

PORT OF ILWACO
MARINA STRUCTURES REPLACEMENT

GRADING & PAVING DETAILS

Designed by: DES	Date: 2022-08-24	Rev. -
Drwn by: DRFT	Chk'd by: CHK	M&N Project No. 211150
Reviewed by: REV	Drawing code:	
Submitted by: EMY CARPENTER ?? MOFFATT & NICHOL	Drawing Scale:	Plot scale: 1:1 (D SHEET)

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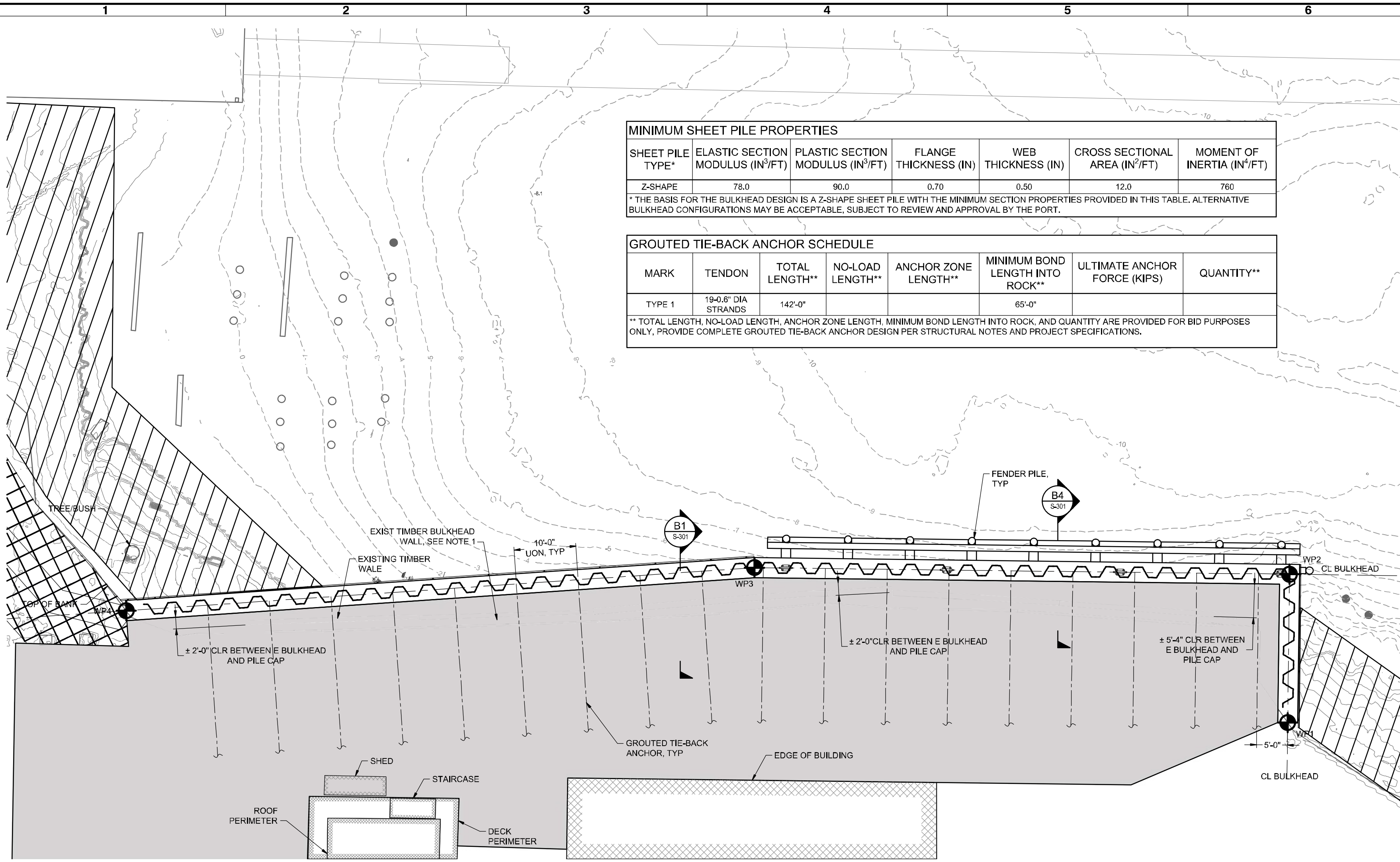
Sheet Reference No.
C-120
INDEX: 13 OF 25



MINIMUM SHEET PILE PROPERTIES

SHEET PILE TYPE*	ELASTIC SECTION MODULUS (IN^3/FT)	PLASTIC SECTION MODULUS (IN^3/FT)	FLANGE THICKNESS (IN)	WEB THICKNESS (IN)	CROSS SECTIONAL AREA (IN^2/FT)	MOMENT OF INERTIA (IN^4/FT)
Z-SHAPE	78.0	90.0	0.70	0.50	12.0	760

* THE BASIS FOR THE BULKHEAD DESIGN IS A Z-SHAPE SHEET PILE WITH THE MINIMUM SECTION PROPERTIES PROVIDED IN THIS TABLE. ALTERNATIVE BULKHEAD CONFIGURATIONS MAY BE ACCEPTABLE, SUBJECT TO REVIEW AND APPROVAL BY THE PORT.

GROUTED TIE-BACK ANCHOR SCHEDULE

MARK	TENDON	TOTAL LENGTH**	NO-LOAD LENGTH**	ANCHOR ZONE LENGTH**	MINIMUM BOND LENGTH INTO ROCK**	ULTIMATE ANCHOR FORCE (KIPS)	QUANTITY**
TYPE 1	19-0.6" DIA STRANDS	142'-0"			65'-0"		

** TOTAL LENGTH, NO-LOAD LENGTH, ANCHOR ZONE LENGTH, MINIMUM BOND LENGTH INTO ROCK, AND QUANTITY ARE PROVIDED FOR BID PURPOSES ONLY, PROVIDE COMPLETE GROUTED TIE-BACK ANCHOR DESIGN PER STRUCTURAL NOTES AND PROJECT SPECIFICATIONS.

BULKHEAD LAYOUT
SCALE: 1/8"=1'-0"

NOTES:

1. EXISTING TIMBER BULKHEAD WALL LOCATION IS APPROXIMATE. THE EXISTING STEEL CABLE TIE-BACK LOCATION VARY. THE EXISTING BULKHEAD ANCHOR SYSTEM IS UNKNOWN. PRIOR TO START OF CONSTRUCTION ACTIVITIES, LOCATIONS/ELEVATIONS OF EXISTING BULKHEAD COMPONENTS MUST BE FIELD VERIFIED.
2. PROVIDE FINAL GROUTED TIE-BACK ANCHOR AS-BUILT LOCATIONS, LENGTHS, AND GROUT VOLUMES TO THE PORT AND INDICATE ON THE RECORD DRAWINGS.
3. PROVIDE TIE-BACK INSTALLATION PROCEDURES TO THE PORT FOR APPROVAL PRIOR TO INSTALLATION.
4. COAT BOTH SIDES OF ALL SHEET PILE ELEMENTS PER THE SPECIFICATIONS. EXTEND THE COATING TO A FINAL ELEVATION OF EL -26' MLLW OR DEEPER.

LEGEND

- WORKPOINT, SEE SHEET C-100
- PAVING AREA LIMITS
- BERM CONSTRUCTION
- SLOPE PROTECTION

SCALE: 1/8"=1'-0"

50% DESIGN SUBMITTAL
ISSUED: 2022-10-07
NOT TO BE USED FOR CONSTRUCTION

DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

PORT OF ILWACO

PORT OF ILWACO
MARINA STRUCTURES REPLACEMENT

BULKHEAD LAYOUT

Designed by: DES | Date: 2022-08-24
Drwn by: DRFT | Chk by: CHK | M&N Project No. 211150
Reviewed by: REV | Drawing code:
Submitted by: EMY CARPENTER ?? MOFFATT & NICHOL | Drawing Scale: | Plot scale: 1:1 (D SHEET)

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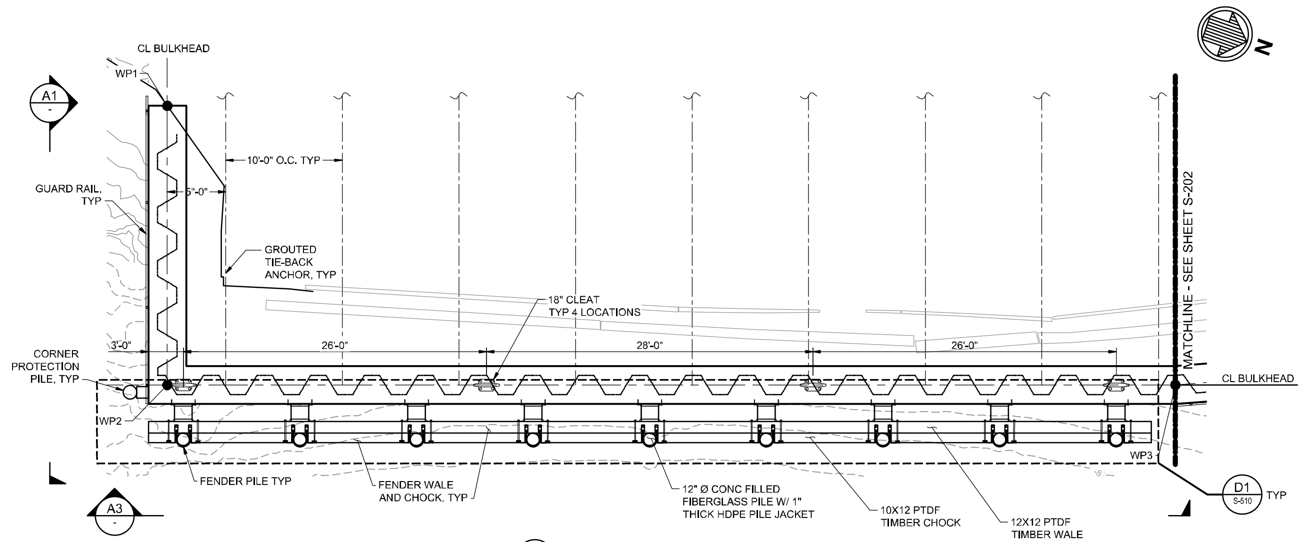
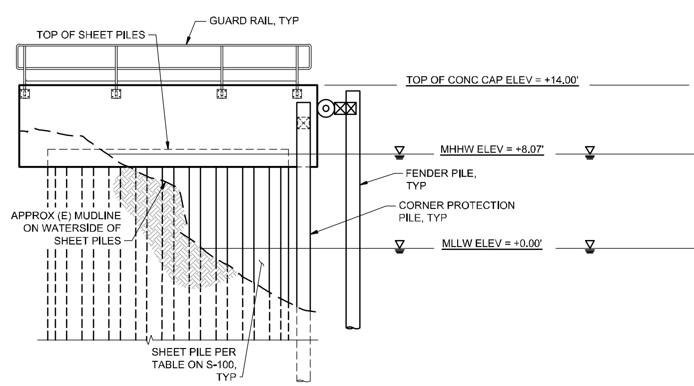
Sheet Reference No.
S-100
INDEX: 14 OF 25


CL BULKHEAD
WP1
A1
GUARD RAIL, TYP
10'-0" O.C. TYP
5'-0"
GROUTED TIE-BACK ANCHOR, TYP
18" CLEAT TYP 4 LOCATIONS
3'-0"
26'-0"
28'-0"
26'-0"
CORNER PROTECTION PILE, TYP
WP2
MATCHLINE - SEE SHEET S-202
CL BULKHEAD
WP3
FENDER PILE TYP
FENDER WALE AND CHOCK, TYP
12" Ø CONC FILLED FIBERGLASS PILE W/ 1" THICK HDPE PILE JACKET
10X12 PTDF TIMBER CHOCK
12X12 PTDF TIMBER WALE
A3
D1
S-510
TYP
N

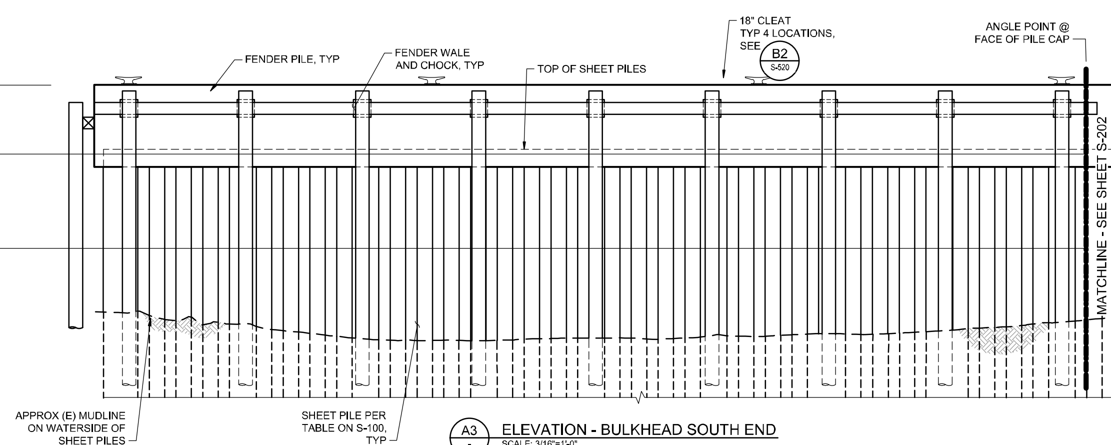
C1 - PLAN - BULKHEAD SOUTH END
SCALE: 3/16"=1'-0"

NOTES:

1. SEE SHEET S-530 FOR TYPICAL GUARDRAIL DETAILS AND POST SPACING.
2. BULKHEAD DEVELOPED ELEVATION AS VIEWED FROM THE WATERSIDE.
3. SEE SHEET C-100 FOR WORK POINT COORDINATES.



A1 - ELEVATION - BULKHEAD WINGWALL SOUTH END
SCALE: 3/16"=1'-0"



A3 - ELEVATION - BULKHEAD SOUTH END
SCALE: 3/16"=1'-0"

8' 0'-0" 4' 8'
SCALE: 3/16"=1'-0"

50% DESIGN SUBMITTAL
ISSUED: 2022-10-07
NOT TO BE USED FOR CONSTRUCTION

DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

PORT OF ILWACO

Mark	Description	Date	Appr.

PORT OF ILWACO
MARINA STRUCTURES
REPLACEMENT

BULKHEAD PLAN &
ELEVATION (1 OF 2)

Designed by: DES	Date: 2022-08-24	Rev.: -
Dwn by: DRFT	Ckd by: CHK	M&N Project No. 211150
Reviewed by: REV	Drawing code:	
Submitted by: EMY CARPENTER ?? MOFFATT & NICHOL	Drawing Scale:	Plot scale: 1:1 (D SHEET)

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Sheet
Reference No.
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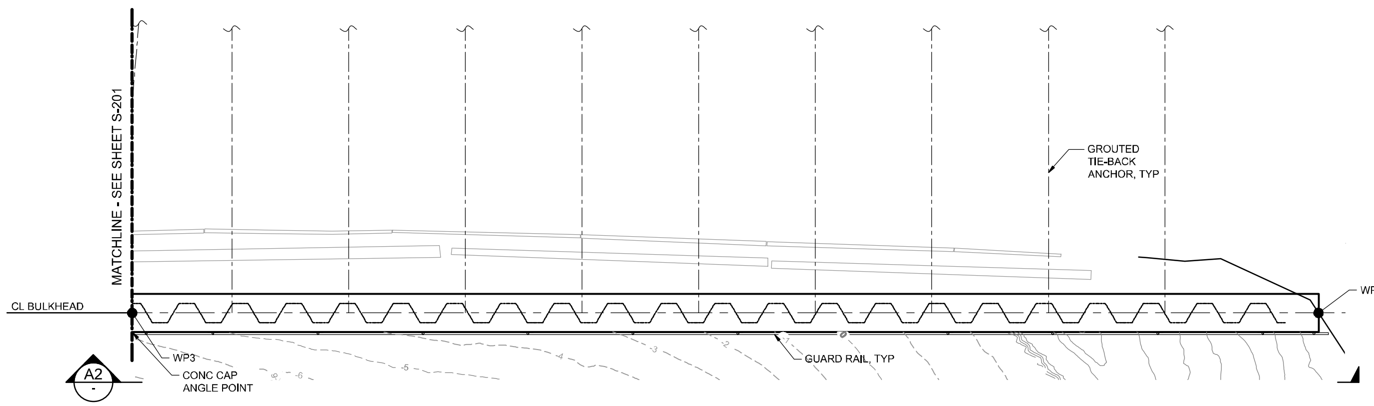
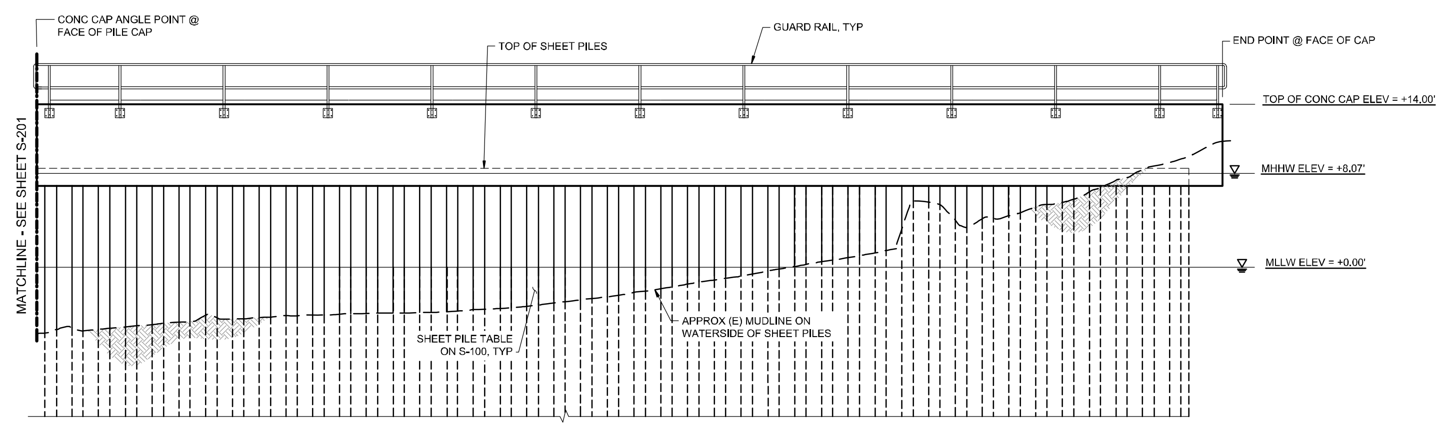
NOTE:

1. SEE SHEET S-201 FOR NOTES



C2 PLAN - BULKHEAD NORTH END
SCALE: 3/16"=1'-0"



A2 ELEVATION - BULKHEAD NORTH END
SCALE: 3/16"=1'-0"

SCALE: 3/16"=1'-0"

50% DESIGN SUBMITTAL
ISSUED: 2022-10-07
NOT TO BE USED FOR CONSTRUCTION

DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

PORT OF ILWACO

PORT OF ILWACO
MARINA STRUCTURES
REPLACEMENT

BULKHEAD PLAN &
ELEVATION (2 OF 2)

Designed by:	Date:	Rev.
DES	2022-08-24	-
Drwn by: DRFT	Chk'd by: CHK	M&N Project No. 211150
Reviewed by: REV		Drawing code:
Submitted by: EMY CARPENTER ?? MOFFATT & NICHOL		Drawing Scale: Plot scale: 1:1 (D SHEET)

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Sheet Reference No.
S-202
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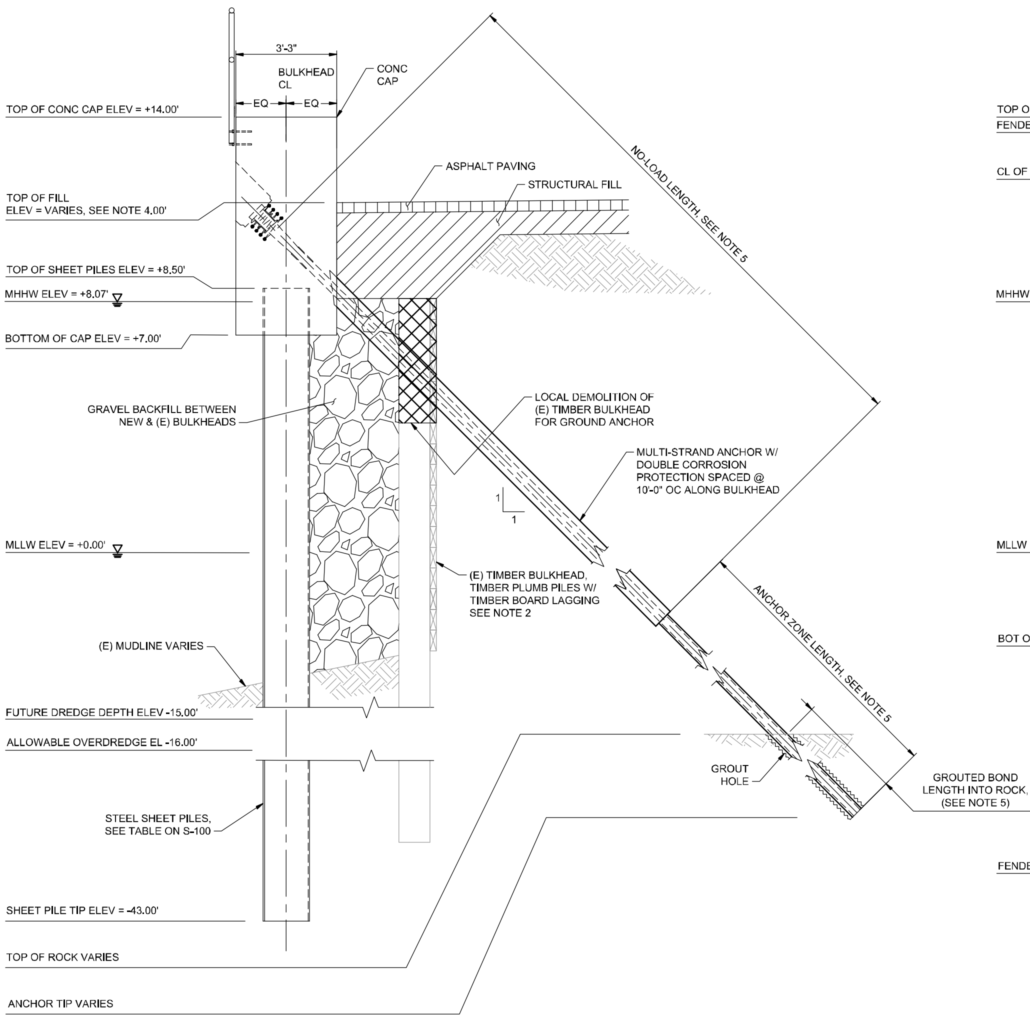
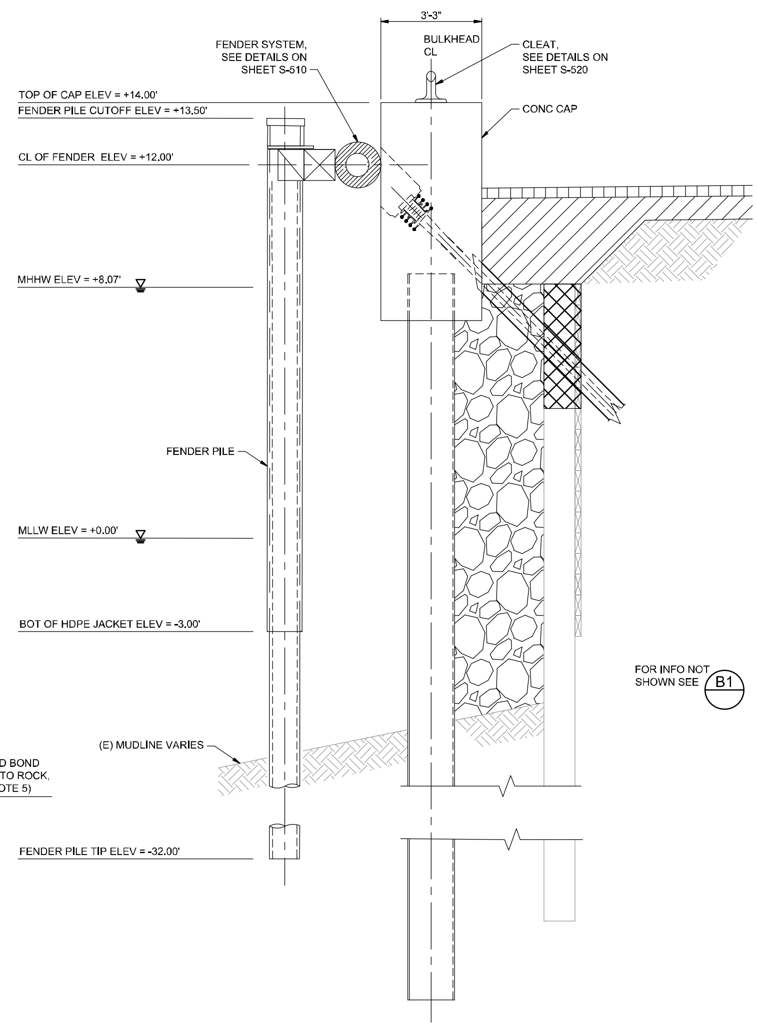

3'-3"
BULKHEAD CL
EQ
EQ
CONC CAP
TOP OF CONC CAP ELEV = +14.00'
ASPHALT PAVING
STRUCTURAL FILL
NO-LOAD LENGTH, SEE NOTE 5
TOP OF FILL ELEV = VARIES, SEE NOTE 4.00'
TOP OF SHEET PILES ELEV = +8.50'
MHHW ELEV = +8.07'
BOTTOM OF CAP ELEV = +7.00'
GRAVEL BACKFILL BETWEEN NEW & (E) BULKHEADS
LOCAL DEMOLITION OF (E) TIMBER BULKHEAD FOR GROUND ANCHOR
MULTI-STRAND ANCHOR W/ DOUBLE CORROSION PROTECTION SPACED @ 10'-0" OC ALONG BULKHEAD
MLLW ELEV = +0.00'
(E) TIMBER BULKHEAD, TIMBER PLUMB PILES W/ TIMBER BOARD LAGGING SEE NOTE 2
ANCHOR ZONE LENGTH, SEE NOTE 5
(E) MUDLINE VARIES
FUTURE DREDGE DEPTH ELEV -15.00'
ALLOWABLE OVERDREDGE EL -16.00'
GROUT HOLE
GROUTED BOND LENGTH INTO ROCK, (SEE NOTE 5)
STEEL SHEET PILES, SEE TABLE ON S-100
SHEET PILE TIP ELEV = -43.00'
TOP OF ROCK VARIES
ANCHOR TIP VARIES

B1 S-100 SECTION - TYPICAL BULKHEAD
SCALE: 1/2" = 1'-0"


3'-3"
BULKHEAD CL
FENDER SYSTEM, SEE DETAILS ON SHEET S-510
CLEAT, SEE DETAILS ON SHEET S-520
TOP OF CAP ELEV = +14.00'
FENDER PILE CUTOFF ELEV = +13.50'
CONC CAP
CL OF FENDER ELEV = +12.00'
MHHW ELEV = +8.07'
FENDER PILE
MLLW ELEV = +0.00'
BOT OF HDPE JACKET ELEV = -3.00'
(E) MUDLINE VARIES
FENDER PILE TIP ELEV = -32.00'

FOR INFO NOT SHOWN SEE B1

A4 S-100 SECTION - BULKHEAD WITH FENDER SYSTEM
SCALE: 1/2" = 1'-0"

NOTES:

1. GROUTED TIE-BACK ANCHOR TIP ELEVATION IS SUBJECT TO CHANGE BASED ON TEST ANCHOR RESULTS.
2. REFER TO THE SPECIFICATIONS FOR ANCHOR TESTING PROCEDURES.
3. TIP ELEVATION OF EXIST TIMBER PILES ARE UNKNOWN.
4. SEE GRADING PLAN ON C-110.
5. SEE S-100 FOR GROUTED TIE-BACK ANCHOR SCHEDULE, NO LOAD ZONE, ANCHOR ZONE LENGTH, BOND LENGTH INTO ROCK, AND ULTIMATE ANCHOR TENSION FORCE.

2'-0" 0'-0" 2'-0" 4'-0"
SCALE: 1/2"=1'-0"

50% DESIGN SUBMITTAL
ISSUED: 2022-10-07
NOT TO BE USED FOR CONSTRUCTION

PORT OF ILWACO

Mark	Description	Date	Apvd.

PORT OF ILWACO
MARINA STRUCTURES REPLACEMENT

BULKHEAD TYPICAL SECTIONS

Designed by: DES		Date: 2022-08-24	Rev. -
Drwn by: DRFT	Chk'd by: CHK	M&N Project No. 211150	
Reviewed by: REV		Drawing code:	
Submitted by: EMY CARPENTER ?? MOFFATT & NICHOL		Drawing Scale: Plot scale: 1:1 (D SHEET)	

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NOT FOR CONSTRUCTION
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Sheet Reference No.
S-301
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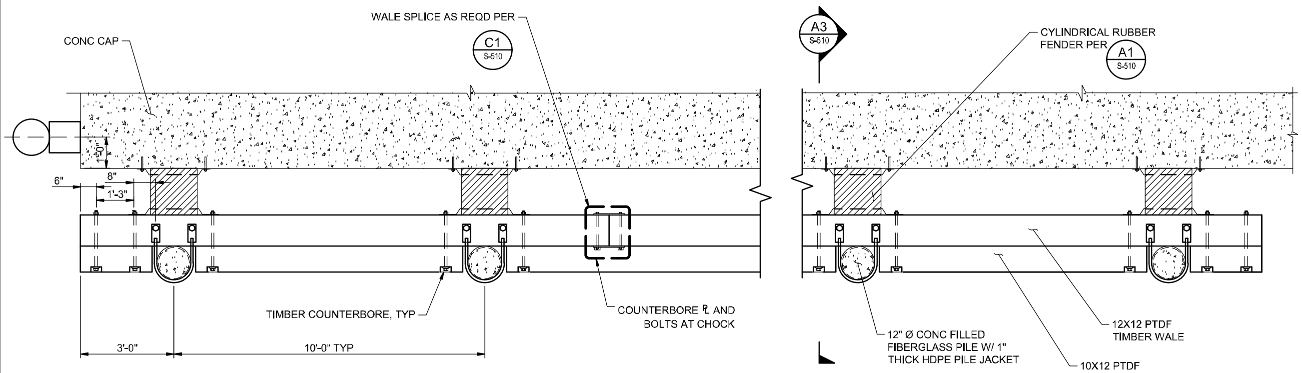
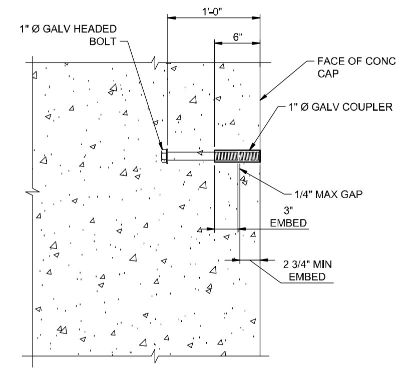
DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING


CONC CAP
WALE SPLICE AS REQD PER
C1
S-510
A3
S-510
CYLINDRICAL RUBBER FENDER PER
A1
S-510
6"
8"
1'-3"
TIMBER COUNTERBORE, TYP
COUNTERBORE ℄ AND BOLTS AT CHOCK
3'-0"
10'-0" TYP
12" Ø CONC FILLED FIBERGLASS PILE W/ 1" THICK HDPE PILE JACKET
12X12 PTDF TIMBER WALE
10X12 PTDF TIMBER CHOCK

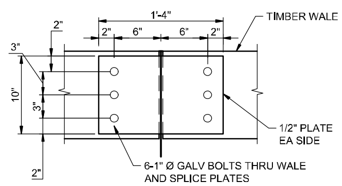
D1 S-510 **FENDER SYSTEM LAYOUT - PARTIAL PLAN**
SCALE: 1/2" = 1'-0"



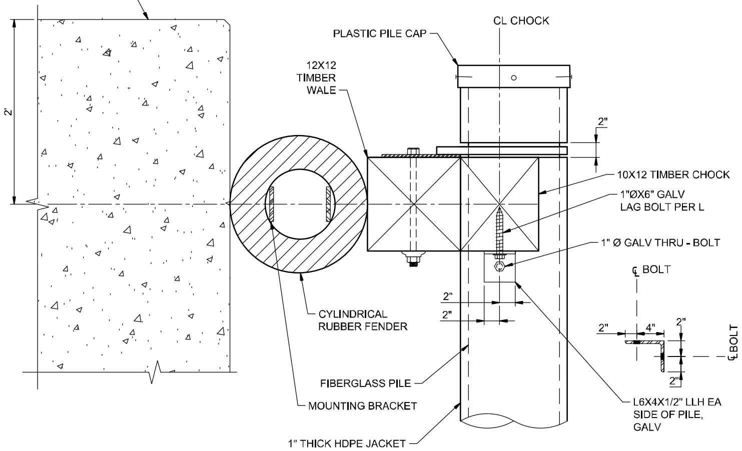
C5 S-510 **DETAIL - THREADED INSERT**
SCALE: 1 1/2" = 1'-0"

NOTE:

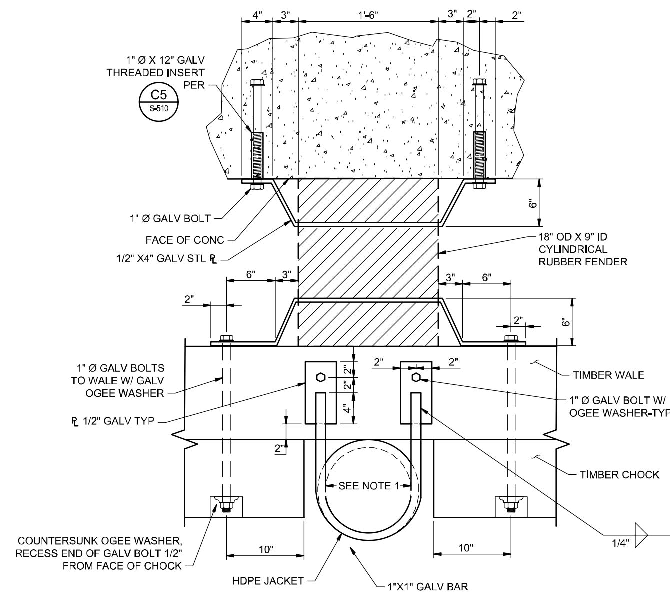
1. SIZE THE ID OF THE BAR TO BE 1/2" LARGER THAN OD OF THE PILE.



C1 S-510 **ELEVATION - WALE AND SPLICE PLATES**
SCALE: 1 1/2" = 1'-0"


CONC CAP
2'
CL CHOCK
PLASTIC PILE CAP
12X12 TIMBER WALE
2"
10X12 TIMBER CHOCK
1"ØX6" GALV LAG BOLT PER L
1" Ø GALV THRU - BOLT
℄ BOLT
2"
2"
2"
4"
2"
2"
℄ BOLT
CYLINDRICAL RUBBER FENDER
FIBERGLASS PILE
MOUNTING BRACKET
L6X4X1/2" LLH EA SIDE OF PILE, GALV
1" THICK HDPE JACKET

A1 S-510 **DETAIL - TYPICAL WALE SPLICE**
SCALE: 1 1/2" = 1'-0"


4"
3"
1'-6"
3"
2"
2"
1" Ø X 12" GALV THREADED INSERT PER
C5
S-510
6"
1" Ø GALV BOLT
FACE OF CONC
1/2" X4" GALV STL ℄
18" OD X 9" ID CYLINDRICAL RUBBER FENDER
6"
3"
3"
6"
2"
2"
6"
1" Ø GALV BOLTS TO WALE W/ GALV OGEE WASHER
℄ 1/2" GALV TYP
TIMBER WALE
1" Ø GALV BOLT W/ OGEE WASHER-TYP
SEE NOTE 1
TIMBER CHOCK
1/4"
TYP
COUNTERSUNK OGEE WASHER, RECESS END OF GALV BOLT 1/2" FROM FACE OF CHOCK
10"
10"
HDPE JACKET
1"X1" GALV BAR

A3 S-510 **DETAILS - FENDER MOUNTING BRACKET**
SCALE: 1 1/2" = 1'-0"

1'-0" 0'-0" 6" 1'-0"
SCALE: 1 1/2"=1'-0"

2'-0" 0'-0" 2'-0" 4'-0"
SCALE: 1/2"=1'-0"

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DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

PORT OF ILWACO

Mark	Description	Date	Appr.

PORT OF ILWACO
MARINA STRUCTURES REPLACEMENT

FENDER DETAILS (1 OF 2)

Designed by: DES	Date: 2022-08-24	Rev.:	
Drwn by: DRFT	Ckd by: CHK	M&N Project No.: 211150	
Reviewed by: REV		Drawing code:	
Submitted by: EMY CARPENTER ?? MOFFATT & NICHOL		Drawing Scale:	Plot scale: 1:1 (D SHEET)

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Sheet Reference No.
S-510
INDEX: 21 OF 25

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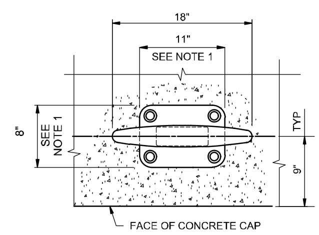
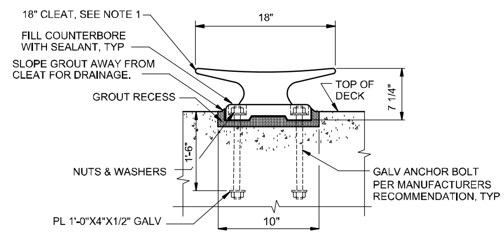
NOTES:

1. CLEAT MUST HAVE A MINIMUM OF 4 ANCHOR BOLTS. ALTERNATE CLEAT CONFIGURATIONS MAY BE ACCEPTABLE, SUBJECT TO REVIEW AND APPROVAL BY THE PORT.

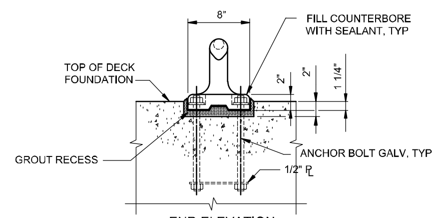
2. 18" CLEAT SHALL HAVE A WORKING LINE LOAD CAPACITY OF 10 TONS.



PLAN



FRONT ELEVATION



END ELEVATION

B2 / S-520 DETAILS - 18" CLEAT
SCALE: N.T.S

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PORT OF ILWACO

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PORT OF ILWACO
MARINA STRUCTURES REPLACEMENT

MOORING HARDWARE DETAILS

Designed by: DES	Date: 2022-08-24	Rev.: -
Dwn by: DRFT	Ckd by: CHK	M&N Project No. 211150
Reviewed by: REV		Drawing code:
Submitted by: EMY CARPENTER ?? MOFFATT & NICHOL		Drawing Scale: Plot scale: 1:1 (D SHEET)

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S-520
INDEX: 23 OF 25

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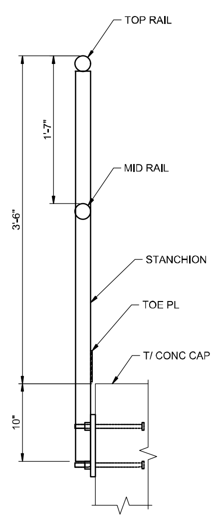
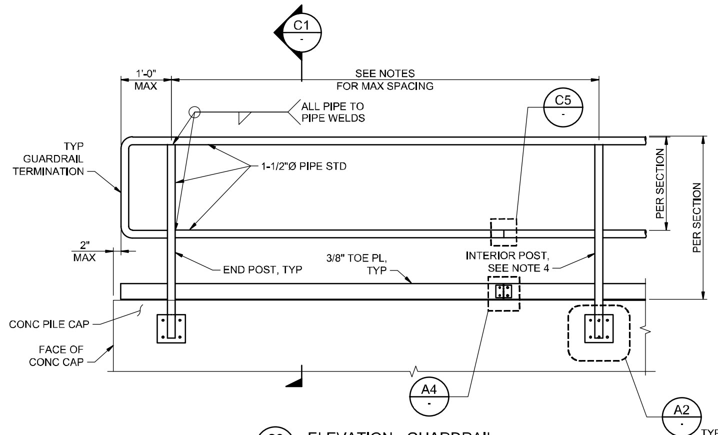


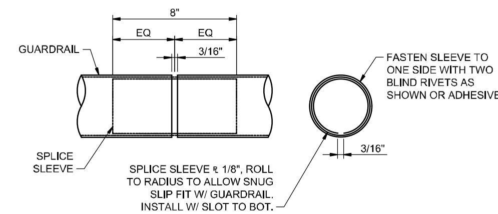
C1 SECTION - GUARDRAIL
SCALE: 1 1/2" = 1'-0"



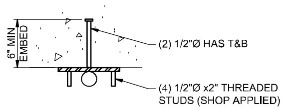
C2 ELEVATION - GUARDRAIL
SCALE: 3/4" = 1'-0"

NOTES:

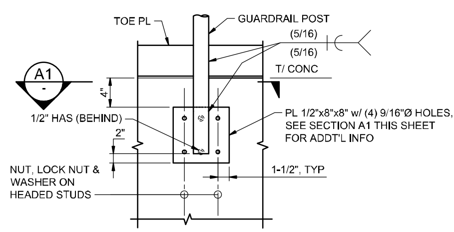
1. MAX POST SPACING SHALL BE 5 FT OC, ALONG LENGTH OF GUARDRAIL. GUARDRAIL POSTS SHALL BE LOCATED AT EVEN SPACING BETWEEN TIE BACK LOCATIONS. GUARDRAIL POST SUPPORTS SHALL BE LOCATED NO CLOSER THAN TWO FEET FROM TIE BACK LOCATIONS.
2. ALL GUARDRAIL FABRICATION SHALL BE WELDED.
3. GRIND SMOOTH ALL SHARP CORNERS & ROUGH EDGES AFTER FABRICATION.
4. USE AT LEAST TWO POSTS PER GUARDRAIL SEGMENT.
5. PAINT ACCORDING TO SPECIFICATIONS.
6. EXPANSION JOINTS IN RAILS AND TOE BOARDS SHALL BE LOCATED AT MAXIMUM 25 FEET SPACING. EXPANSION JOINTS ARE NOT REQUIRED FOR GUARDRAIL SEGMENTS LESS THAN 25 FEET LONG.



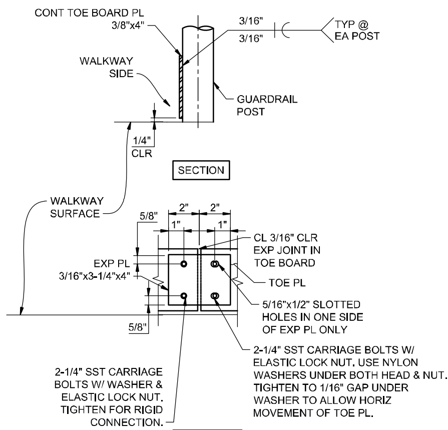
C5 DETAIL - EXPANSION JOINT
SCALE: 6" = 1'-0"



A1 SECTION
SCALE: 1-1/2" = 1'-0"



A2 DETAIL
SCALE: 1-1/2" = 1'-0"


CONT TOE BOARD PL 3/8"x4"
3/16"
3/16"
TYP @ EA POST
WALKWAY SIDE
GUARDRAIL POST
1/4" CLR
SECTION
WALKWAY SURFACE
5/8"
2"
2"
1"
1"
CL 3/16" CLR EXP JOINT IN TOE BOARD
EXP PL 3/16"x3-1/4"x4"
TOE PL
5/16"x1/2" SLOTTED HOLES IN ONE SIDE OF EXP PL ONLY
5/8"
2-1/4" SST CARRIAGE BOLTS W/ ELASTIC LOCK NUT. USE NYLON WASHERS UNDER BOTH HEAD & NUT. TIGHTEN TO 1/16" GAP UNDER WASHER TO ALLOW HORIZ MOVEMENT OF TOE PL.
2-1/4" SST CARRIAGE BOLTS W/ WASHER & ELASTIC LOCK NUT. TIGHTEN FOR RIGID CONNECTION.
ELEVATION

A4 DETAILS - GUARDRAIL TOE BOARD & EXPANSION JOINT
SCALE: 3" = 1'-0"

1'-0"	0'-0"	6"	1'-0"

SCALE: 1 1/2"=1'-0"

2"	0'-0"	2"	4"

SCALE: 6"=1'-0"

6"	0'-0"	3"	6"

SCALE: 3"=1'-0"

2'-0"	0'-0"	1'-0"	2'-0"

SCALE: 3/4"=1'-0"

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PORT OF ILWACO

Mark	Description	Date	Appr.

PORT OF ILWACO
MARINA STRUCTURES REPLACEMENT

MISCELLANEOUS DETAILS (1 OF 2)

Designed by: DES	Dwn by: DRFT	Ckd by: CHK	Date: 2022.05.05
Reviewed by: REV		M&N Project No.: 211150	Rev.: -
Submitted by: EMY CARPENTER ?? MOFFATT & NICHOL		Drawing code:	
		Drawing Scale:	Plot scale: 1:1 (D SHEET)

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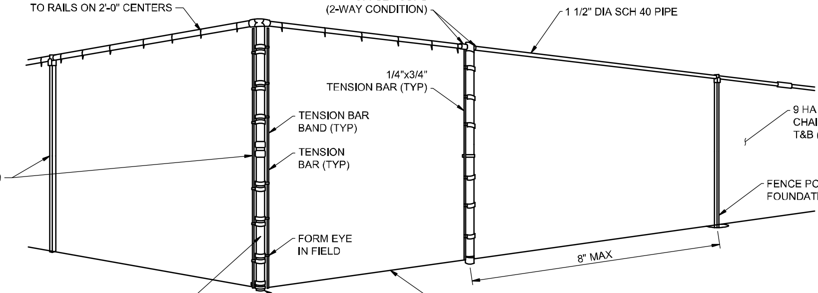
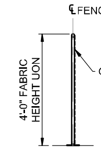
S-530
INDEX: 24 OF 24

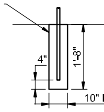


NOTE: ALL FENCE COMPONENT MATERIALNOT SPECIFIED ELSEWHERE SHALL MEET WSDOT STD SPECIFIATIONS.

D1 - ELEVATION: TYPICAL FENCE CONFIGURATION
NTS



D4 - SECTION - TYPICAL FENCE
NTS



D5 - POST FOUNDATION
NTS

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PORT OF ILWACO

PORT OF ILWACO
MARINA STRUCTURES
REPLACEMENT

MISCELLANEOUS
DETAILS (2 OF 2)

Designed by: DES		Date: 2022-08-24	Rev. -
Dwn by: DRFT	Ckd by: CHK	M&N Project No. 211150	
Reviewed by: REV		Drawing code:	
Submitted by: EMY CARPENTER ?? MOFFATT & NICHOL		Drawing Scale: Plot scale: 1:1 (D SHEET)	

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Reference No.
S-531
INDEX: 25 OF 25

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Appendix B: Essential Fish Habitat Assessment

9. Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) includes a mandate that NOAA Fisheries must identify essential fish habitat (EFH) for federally managed marine fish, and federal agencies must consult on all activities, or proposed activities, authorized, funded, or undertaken by the agency that may adversely affect EFH. The Pacific Fishery Management Council (PFMC) has designated EFH for the Pacific salmon fishery, federally managed ground fishes, and coastal pelagic fisheries (PFMC 1999). This assessment has been prepared to provide documentation that this project has been analyzed for its potential to affect EFH.

A. Description of the Proposed Action *(may refer to BE/BA project description)*

Please refer to Sections 1 of the BE.

B. Addresses EFH for Appropriate Fisheries Management Plans (FMP)

Three Fisheries Management Plans (FMPs) have been identified for the Action Area covering groundfish, coastal pelagic species and Pacific salmon. General impacts are anticipated to be similar to those described in the BE (minor, localized and short-term).

C. Effects of the Proposed Action

i. Effects on EFH (groundfish, coastal pelagic, and salmon EFH should be discussed separately)

Pacific Groundfish: The Pacific Groundfish FMP protects a variety of bottom dwelling fish and is composed of 90 different fish species, including flatfish, round fish, sharks and skates, and other species such as ratfish, finescale codling, and Pacific rattail grenadier. Groundfish species could occur within the Action Area. Temporary and permanent benthic habitat disturbance could occur. Temporarily disturbed benthic habitat would be anticipated to be quickly recolonized by benthic species and in-benthic invertebrates (Thrush and Dayton 2002). The proposed bulkhead installation and riprap installation will result in the permanent conversion of approximately 3,000 sf of aquatic soft bottom habitat to hard shoreline armoring. Impacts to benthic habitat are anticipated to be offset by the removal of creosote-treated timber from the marine environment. Any potential impacts to Pacific groundfish EFH are anticipated to be minor and localized and will not be anticipated to substantially impact Pacific groundfish.

Coastal Pelagic Species: The Coastal Pelagic Fisheries Management Plan (FMP) protects a variety of fish associated with open water coastal habitats. The Coastal Pelagic FMP is composed of six species including northern anchovy, market squid, pacific sardine, Pacific (chub) mackerel, jack mackerel and

krill. Construction of the bulkhead wall could cause minor impacts to coastal pelagic EFH. The removal of creosote-treated structures and piles would be anticipated to improve coastal pelagic Species EFH.

Salmon EFH: The Pacific Salmon FMP protects a variety of salmonid species. The main species managed by the council include chinook and Coho salmon. Salmon could occur within the Action Area. Construction of the replacement bulkhead wall could cause minor impacts to salmon EFH. The removal of creosote-treated structures and piles would be anticipated to improve salmon EFH. Any potential impacts to salmonid EFH are anticipated to be minor, temporary, and localized.

ii. Effects on Managed Species (unless effects to an individual species are unique, it is not necessary to discuss adverse effects on a species-by species basis)

The project has the potential to create the following short-term direct adverse impacts:

Noise

In-water and in-air noise disturbances to managed species could occur. The greatest potential for in-water noise impacts will be during pile installations. Potential in-water noise impacts to fish species are discussed in Section 6.3.1.1 of this BE. In general, potential noise impacts are anticipated to be minor and temporary.

Water Quality

General localized water quality/turbidity impacts could occur to managed species. Potential water quality impacts from the proposed project are discussed in detail in Section 6.3.1.2. In general, water quality and turbidity impacts from sediment resuspension are anticipated to be minor, localized, and temporary. The AMMs discussed in Section 1.4 of this BE will minimize the potential for this impact to be significant on aquatic species or habitat. Removal of creosote treated timber will result in water quality improvements by reducing toxicity potential.

Benthic Habitat Disturbance

Temporary and permanent benthic habitat disturbance could occur. Temporarily disturbed benthic habitat would be anticipated to be quickly recolonized by benthic species and in-benthic invertebrates (Thrush and Dayton 2002). The proposed bulkhead installation and riprap installation will result in the permanent conversion of approximately 3,000 sf of aquatic soft bottom habitat to hard shoreline armoring. Impacts to benthic habitat are anticipated to be offset by the removal of creosote-treated timber from the marine environment.

iii. Effects on Associated Species, Including Prey Species

Due to the proposed construction activities and methods, temporary nature of the project, and the implementation of the proposed AMMs (Section 1.4 of this BA) to reduce the risk of impacts to aquatic resources, the project is not anticipated to have substantial adverse impacts on prey species over the short or long term.

iv. Cumulative Effects

Cumulative effects are those effects of future state or private activities, not involving federal activities, that are reasonably certain to occur within the Action Area. Maintenance dredging may occur within the Action Area as a separate, independent project. This maintenance dredging could result in localized temporary effects to water quality, but would not be anticipated to result in substantial cumulative impacts. All dredged material will be characterized and placed either upland or at a permitted open water placement site if the material is suitable for open water placement.

D. Proposed Conservation Measures

See Section 1.4 of this BE.

E. Conclusions by EFH *(taking into account proposed conservation measures)*

Due to the temporary nature of the project and the implementation of AMMs (Section 1.4 of this BE) to reduce the risk of impacts to marine resources, the project ***may affect*** EFH for groundfish, coastal pelagic species, or salmonids.