UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

Refer to NMFS No:
2010/06104

March 18, 2011

Joyce E. Casey
Chief, Environmental Resources Branch
U.S. Army Corps of Engineers, Portland District
P.O. Box 2946
Portland, Oregon 97208-2946

Re: Endangered Species Act Biological Opinion and Conference Report and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Major Rehabilitation of the Jetty System at the Mouth of the Columbia River.

Dear Ms. Casey:

The enclosed document contains a biological opinion (Opinion) and conference report prepared by the National Marine Fisheries Service (NMFS) pursuant to section 7(a)(2) of the Endangered Species Act (ESA) on the effects of the U.S. Army Corps of Engineers' proposed major rehabilitation of the jetty system at the mouth of the Columbia River. The Corps' authority for this action comes from the original authority for construction of the project granted by Senate Executive Document 13, 47th Congress, 2nd Session (5 July 1884), and subsequently renewed with authorizations related to construction, operation and maintenance of the Columbia River navigation channel. In this Opinion, NMFS concludes that the proposed action is not likely to jeopardize the continued existence of eulachon (*Thaleichthys pacificus*), Steller sea lions (*Eumetopias jubatus*), and humpback whales (*Megaptera novaeangliae*).

Furthermore, NMFS concluded that the proposed action may affect, but is not likely to adversely affect the following species:

- Fin whale (*Balaenoptera physalus*)
- Southern Resident killer whale (*Orcinus orca*)
- Sperm whale (*Physeter macrocephalus*)
- Sei whale (*B. borealis*)
- Blue whale (*B. musculus*)
- Leatherback sea turtle (*Dermochelys coriacea*)#
- Lower Columbia River (LCR) Chinook salmon (*O. tshawytscha*)*
- Upper Willamette River (UWR) Chinook salmon (*O. tshawytscha*)*
- Upper Columbia River (UCR) spring-run Chinook salmon (*O. tshawytscha*)*
- Snake River (SR) spring/summer-run Chinook salmon (*O. tshawytscha*)*
- SR fall-run Chinook salmon (*O. tshawytscha*)*
- Columbia River (CR) chum salmon (*O. keta*)*

- LCR coho salmon (*O. kisutch*)#
- Oregon Coast coho salmon (*O. kisutch*)
- Southern Oregon/Northern California Coasts coho salmon (*O. kisutch*)
- SR sockeye salmon (*O. nerka*)*
- LCR steelhead (*O. mykiss*)*
- UWR steelhead (*O. mykiss*)*
- Middle Columbia River steelhead (*O. mykiss*)*
- UCR steelhead (*O. mykiss*)*
- SR basin steelhead (*O. mykiss*)*
- Southern distinct population segment (DPS) green sturgeon (*Acipenser medirostris*)*

Additionally, NMFS concluded that the proposed action is not likely to adversely affect designated critical habitat for the above species or proposed critical habitat for eulachon, leatherback turtles, and LCR coho salmon.

The Corps also requested a conference report for critical habitat that NMFS proposed for leatherback turtles, LCR coho salmon, and eulachon. An action agency is not required to consult on proposed critical habitat unless its action is likely to destroy or adversely modify the proposed critical habitat. Nonetheless, NMFS encourages action agencies to complete a conference process to identify and resolve any conflicts that may arise between a proposed action and proposed critical habitat. Here, the effects of the proposed action on proposed critical habitat are likely to be similar to the effects on critical habitats that are already designated in the action area. Please note, however, that the Corps has a duty to reinitiate this consultation if NMFS designates these critical habitats before the action is completed and may comply with that duty by requesting that NMFS adopt the conference report as a final report or biological opinion.

The NMFS is not including an incidental take statement for eulachon as NMFS has not issued protective regulations for eulachon under section 4(d) of the ESA. Additionally, NMFS is not including an incidental take authorization for marine mammals at this time because the incidental take of marine mammals has not been authorized under section 101(a)(5) of the Marine Mammal Protection Act and/or its 1994 Amendments. Following issuance of such regulations or authorizations for marine mammals, NMFS may amend this biological opinion to include an incidental take statement for marine mammals, as appropriate.

This document also includes the results of our analysis of the action's likely effects on essential fish habitat (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), and includes no conservation recommendations to avoid, minimize, or otherwise offset potential adverse effects on EFH, as NMFS determined that there are no conservation recommendations, in addition to those proposed by the Corps, that can be implemented that would avoid, minimize, or offset potential adverse effects. Therefore, no response is required.

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we request that in your statutory reply to the

EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted, if applicable.

If you have questions regarding this consultation, please contact Robert Anderson, Fishery Biologist with the Oregon State Habitat Office, at 503.231.2226, or Zachary Radmer, Fishery Biologist with the Oregon State Habitat Office, at 503.872.2738. For questions about the marine mammal determinations contact Alison Agness of the Northwest Region, Protected Resources Division at 206.526.6152.

Sincerely,

for

William W. Stelle, Jr.
Regional Administrator

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.

Lead Action Agency:	Army Corps of Engineers
Consultation Conducted By:	National Marine Fisheries Service Northwest Region
Date Issued:	March 18, 2011
Issued by:	William W. Stelle, Jr. Regional Administrator
NMFS No.:	**2010/06104**

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INTRODUCTION

This document contains a biological opinion (Opinion) prepared by the National Marine Fisheries Service (NMFS) in accordance with section 7(b) of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531, *et seq*.), and implementing regulations at 50 CFR 402.[1] It also contains essential fish habitat (EFH) conservation recommendations prepared by NMFS in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801, *et seq*.) and implementing regulations at 50 CFR 600. The Opinion and EFH conservation recommendations are both in compliance with section 515 of the Treasury and General Government Appropriations Act of 2001 (Data Quality Act) (44 U.S.C. 3504 (d)(1) and 3516), and underwent pre-dissemination review. The administrative record for this consultation is on file at the Oregon State Habitat Office in Portland, Oregon.

The Corps maintains the jetty system and navigational channels at the mouth of the Columbia River (MCR) as appropriate based on necessity and appropriations.

Background and Consultation History

Project Authority

The present navigation channel and inlet configuration at the MCR is the result of continuous improvement and maintenance efforts that have been undertaken by the Corps, Portland District since 1885. Congress has authorized the improvement (actual construction) of the MCR for navigation through the following legislation. Senate Executive Document 13, 47th Congress, 2nd Session (5 July 1884) authorized the Corps to construct the South Jetty (first 4.5 miles) for the purpose of attaining a 30-foot channel across the bar at the MCR. House Document 94, 56th Congress, 1st Session (3 March 1905) authorized the Corps to extend the South Jetty (to 6.62 miles in length) and construct the North Jetty (2.35 miles long) for the purpose of attaining a 40-foot channel (0.5 mile wide) across the bar at the MCR. House Document 249, 83rd Congress, 2nd Session (3 September 1954) authorized a bar channel of 48 feet in depth and a spur jetty ("B") on the north shore of the inlet. Funds for Jetty "B" construction were not appropriated. Jetty A was constructed in 1939 under the authority of the Rivers and Harbors Act. Public Law 98-63 (30 July 1983) authorized the deepening of the northern most 2,000 feet of the MCR channel to a depth of 55 feet below mean lower low water (MLLW). The MCR Federal navigation project was originally authorized in 1884 before formulation of local sponsor cost sharing agreements; therefore, all costs of navigation maintenance and improvements at MCR are borne by the Federal government.

The authority for maintenance of the MCR jetties comes from the original authority for construction of the project and then with Corps' policies for the operations, maintenance, and management of a Corps' project (Chapter 11 of EP 1165-2-1).

[1] With respect to designated critical habitat, the following analysis relied only on the statutory provisions of the ESA, and not on the regulatory definition of "destruction or adverse modification" at 50 CFR 402.02.

Corps projects are maintained by regular operations and maintenance, major maintenance, and major rehabilitation. Major rehabilitation consists of either one or both of two mutually exclusive categories: reliability or efficiency improvements, as described below.

- Reliability. Rehabilitation of a major project feature that consists of structural work on a Corps-operated and maintained facility to improve reliability of an existing structure, the result of which will be a deferral of capital expenditures to replace the structure. Rehabilitation will be considered as an alternative when it can significantly extend the physical life of the feature (such as a jetty) and can be economically justified by a benefit/cost relationship. Each year the budget EC delineates the dollar limits and construction seasons (usually two construction seasons).
- Efficiency Improvements. This category will enhance operational efficiency of major project components. Operational efficiency will increase outputs beyond the original project design.

Thus, the authority for maintenance of the MCR jetties comes from the authorization documents for the project and/or the authority to operate and maintain the structures.

Consultation History

On April 2, 2004, NMFS issued a letter of concurrence on marine mammals and sea turtles to the Corps on the minor rehabilitation of the Columbia River North and South Jetties.

On July 29, 2004, NMFS issued an Opinion to the Corps on the minor rehabilitation of the Columbia River North and South Jetties for salmon and steelhead. In our 2004 Opinion, NMFS concluded that the proposed action was LAA Columbia River Basin salmon and steelhead. We also concluded that this action was NLAA Steller sea lions (this determination was amended on September 27, 2006). Our 2011 Opinion does not reach the same conclusion for Columbia River Basin salmon and steelhead because of new information, particularly information about species behavior at the MCR.

On November 30, 2005, the Corps reinitiated consultation on the rehabilitation of the Columbia River North and South Jetties project.

On June 2, 2005, NMFS issued an amendment to the July 29, 2004, Opinion, for salmon and steelhead.

On September 27, 2006, NMFS issued an amendment to the April 2, 2004, letter of concurrence, and issued the Corps an Opinion for Steller sea lions.

On April 18, 2007, NMFS issued an incidental harassment authorization (IHA) to the Corps for the Columbia River South Jetty.

On November 5, 2007, the Corps submitted a biological assessment (BA) to NMFS for the Columbia River Jetty System project. In February 2008, the Corps withdrew their request for consultation due to significant changes in the proposed action.

The Corps published a revised draft environmental assessment in April 2010 in which the Corps determined that a new proposed action with a smaller project footprint was the preferred alternative. The NMFS and the Corps resumed pre-consultation in June 2010. In August 2010, a site visit to view construction activities on the Tillamook North Jetty was conducted with NMFS and Corps representatives to observe and to compare construction activities and design elements associated with a similar, smaller-scale jetty rehabilitation project. From July 2010 to December 2010, NMFS and the Corps met regularly to discuss and describe the proposed action, related studies, jetty design model runs, and what information would be required for the BA and the Opinion. NMFS received the BA for the current proposed action on December 17, 2010.

On February 16, 2011, the Corps modified the proposed action such that no pile driving associated with this action will occur until on or after May 1 of each year. This change was made to prevent acoustic effects on Southern Resident killer whales that have been known to forage in the project vicinity in March or April.

The Corps determined in the December 17, 2010, BA that the proposed action is not likely to adversely affect (NLAA) the following species and/or designated (*) or proposed (#) critical habitats where applicable:

- Blue whale (*Balaenoptera musculus*)
- Fin whale (*B. physalus*)
- Southern Resident killer whale (*Orcinus orca*)
- Sperm whale (*Physeter macrocephalus*)
- Sei whale (*B. borealis*)
- Leatherback sea turtle (*Dermochelys coriacea*)(#)

NMFS concurs with the Corps' NLAA determination for the aforementioned whales and leatherback sea turtle, and proposed critical habitat for leatherback sea turtle as they are either very unpredictable in their occurrence in the action area or transitory when they do occur in the area, such that co-occurrence of the effects of the intermittent pile driving and the species is extremely unlikely.

The Corps determined in the December 17, 2010, BA that the proposed action is likely to adversely affect (LAA) the following species and/or designated (*) or proposed (#) critical habitats where applicable:

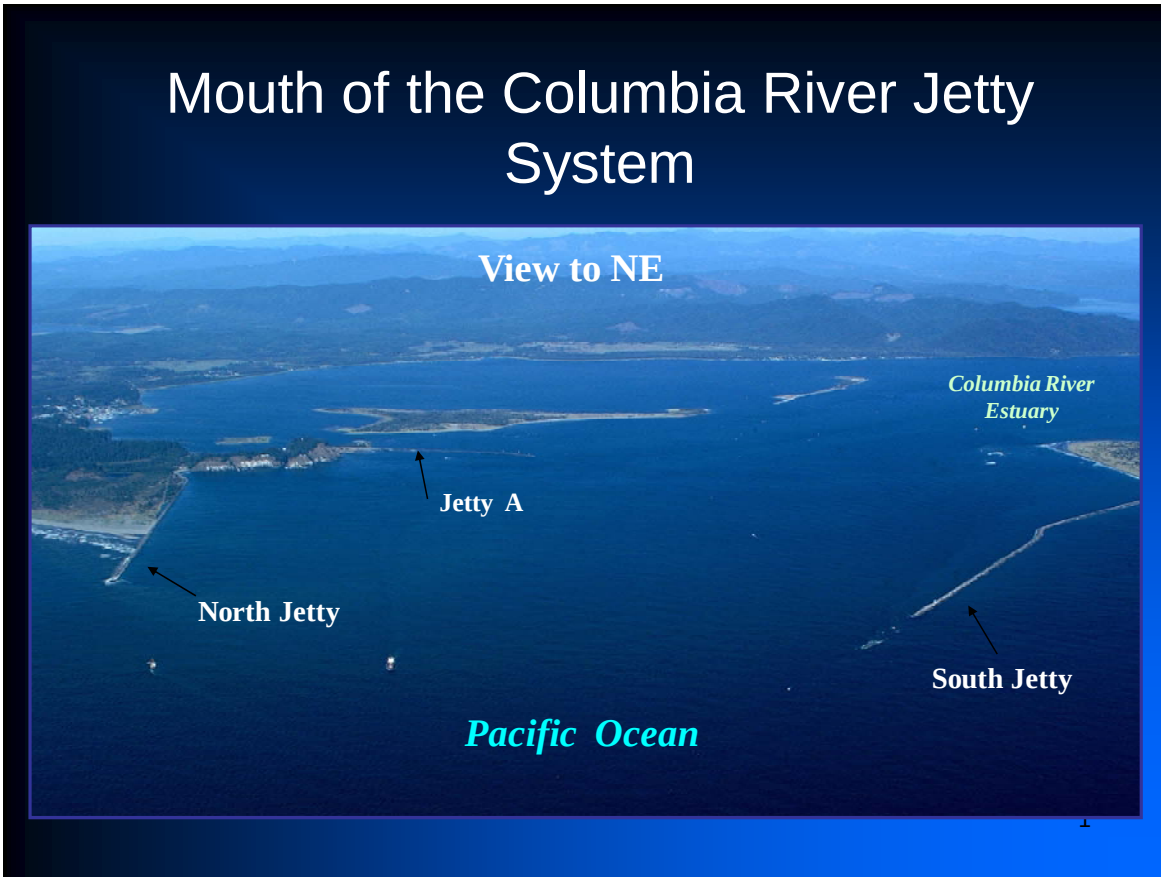
- Lower Columbia River (LCR) Chinook salmon (*O. tshawytscha*)*
- Upper Willamette River (UWR) Chinook salmon (*O. tshawytscha*)*
- Upper Columbia River (UCR) spring-run Chinook salmon (*O. tshawytscha*)*
- Snake River (SR) spring/summer-run Chinook salmon (*O. tshawytscha*)*
- SR fall-run Chinook salmon (*O. tshawytscha*)*
- Columbia River (CR) chum salmon (*O. keta*)*
- LCR coho salmon (*O. kisutch*)#
- Oregon Coast coho salmon (*O. kisutch*)
- Southern Oregon/Northern California Coasts coho salmon (*O. kisutch*)

- SR sockeye salmon (*O. nerka*)*
- LCR steelhead (*O. mykiss*)*
- UWR steelhead (*O. mykiss*)*
- Middle Columbia River steelhead (*O. mykiss*)*
- UCR steelhead (*O. mykiss*)*
- SR basin steelhead (*O. mykiss*)*
- Southern distinct population segment (DPS) green sturgeon (*Acipenser medirostris*)*
- Eulachon (*Thaleichthys pacificus*)#
- Steller sea lions (*Eumetopias jubatus*)
- Humpback whales (*Megaptera novaeangliae*)

The Corps stated in the BA that they will obtain an IHA permit from NMFS for incidental harassment of Steller sea lions, humpback whales, and non-federally listed California sea lions and harbor seals during the proposed action.

The Corps is proposing major repair and rehabilitation of the North Jetty, South Jetty, and Jetty A, all located at the MCR (Figure 1).

Figure 1. Mouth of the Columbia River Jetty System (Corps).



Project Background

The construction and repair history of the MCR jetties is summarized in Table 1.

Table 1. Construction and repair history for the MCR jetties.

1881: A pile dike was proposed to be built on the south side of the MCR to build up Clatsop spit and deepen the navigation channel.

1883: The Corps of Engineers stated that any structures placed in-river should not harm the river and should keep the channel open using the tide; therefore, the jetty should not obstruct the entry of the flood tide. Estimated depths of various jetty sections from the landward end were: 5,000 feet - less than +6 feet; 7,500 feet – +6 to +11 feet; 4,000 feet – +11 to +16 feet; and 7,500 feet – +16 to +21 feet. Jetty crest elevation was designed to be at a low water level because of wave violence that could harm a higher jetty. The logic was that a higher jetty could be built, if needed later, by placing more stone on the existing jetty.

1884: The improvement plan for MCR was approved by the Rivers and Harbors Act of July 5, 1884 to maintain a channel 30 feet deep at mean low tide by constructing a low-tide jetty, approximately 4.5 miles long, from near Fort Stevens on the South Cape to a point approximately 3 miles south of Cape Disappointment.

1886-1896: On-going construction on the South Jetty. A 115 feet long spur was also built landward of the jetty for shore protection. A 510 feet long sand-catch, consisting of heavy beach drift and loose brush, was built on the south side of landward end of the jetty to continue filling the old outlet of a lagoon at extreme end of Point Adams.

1903-1913: The South Jetty was extended. The crest elevation of the jetty was raised to 10 feet MLLW from stations 210+35 to 250+20, and rock placed from stations 250+20 to 375+52, elevation increasing in steps to 24 feet MLLW. Crest width is 25 feet. Seaward bend in the jetty is added and called the "knuckle."

1913-1917: The North Jetty was constructed from stations 0+00 to 122+00. Side slopes are 1 vertical by 1.5 horizontal (1:1.5) and crest width is 25 feet. Crest elevation varied from 15 to 32 feet.

1931-1936: The South Jetty was repaired from stations 175+00 to 257+68.7 (shoreline to knuckle), from stations 257+68.7 to 305+05 (knuckle to middle of outer segment), and from stations 305+05 to 353+05 (middle of outer segment to existing end) with 2.2 million tons of stone. The crest elevation was between 17 and 26 feet MLLW and the crest width was 24 feet. The jetty had been flattened to approximately low water level. A solid concrete terminal was constructed above low water level 3,900 feet shoreward of the original jetty end that was completed in 1913.

1936: A stone/asphalt cone-shaped terminal was constructed on the South Jetty from stations 340+30 to 344+30. The crest width was approximately 50 feet and the elevation varied from 23 to 26 feet.

1937-1939: The North Jetty was repaired from stations 68+35 to 110+35. The crest elevation was 26 feet and the crest width was 30 feet.

1939: Jetty A was constructed. Crest width was 10 feet from the root to station 53+00, and 20 feet thereafter. Jetty A was 30 feet wide. Four pile dikes were also constructed at Sand Island.

1940-1942: South Jetty was repaired from stations 332+00 to 343+30. A concrete terminal/stone foundation added. Crest elevation was 8-20 feet and crest width was between 50 and 75 feet.
1945-1952: Jetty A was repaired from stations 78+00 to 96+00, stations 92+35 to 95+35, stations 91+50 to 93+00, and stations 90+00 to 94+00. Crest elevation was 20 feet with a crest width between 20 and 40 feet.

1958: Jetty A was repaired from stations 41+00 to 79+00 to a crest elevation of 20 feet and crest width between 20 and 30 feet.

1961-1962: Jetty A was repaired from stations 50+00 to 90+50, with no repairs from Stations 68+00 to 76+50. Crest elevation was built with a 10% grade from 20 feet to 24 feet from stations 50+00 to 68+00. The crest elevation was raised to 24 feet from stations 76+50 to 90+50.

1961: South Jetty was repaired from stations 194+00 to 249+00 (current stationing). Crest elevation varied from 24 to 28 feet and crest width was 30 feet. Channel side slope 1:1.25 and ocean side slope 1:1.5. It was also repaired from stations 38+00 to 93+00 (old stationing). Elevation at station 38+00 is +24 feet was increased with a 0.5% grade up to +28 feet for the remainder of repair section. The repair centerline was located 13 feet north of the centerline of the original jetty design. The design crest width was 30 feet. The north slope was 1:1.25 and south slope was 1:1.5.

1962-1965: South Jetty was repaired from stations 249+00 to 314+05 (beyond knuckle). Crest elevation began at 28 feet and transitioned to 25 feet for most of section. Side slopes varied from 1:1.5 to 1:2 and crest width was 40 feet (this appears to be the furthest seaward intact portion of current jetty). Repairs were made from stations 93+00 to 157+50 (old stationing). The crest elevation was +28 feet at station 93+00, decreased to +25 feet at station 95+00, and then continued with this elevation to end of the repairs. The crest width was 40 feet and had a slope of 1:1.5 from stations 93+00 to 152+00. The slope transitioned to 1:2 from stations 152+00 to 154+00. The centerline of the repair was 15 feet south of the trestle centerline.

1965: The North Jetty was repaired from stations 89+47 to 109+67 with a crest elevation of 24 feet and crest width of 30 feet. Side slopes varied from 1:1.5 to 1:2.

1982: The South Jetty was repaired from stations 194+00 to 249+00 (segment before knuckle) so that the crest elevation varied from 22 to 25 feet MLLW. The crest width varied from 25-30 feet and the side slopes were 1:1.5. The crest elevation varied from +22 feet at station 38+00 to +25 feet at station 80+35 (old stationing). From stations 44+50 to 80+35, crest width is 30 feet and slope is 1:1.5. Crest elevation was +25 feet, width varied from 25-30 feet, and the side slope was 1:1.5.

2005: The North Jetty was repaired from stations 55+00 to 86+00. The crest elevation was built to +25 feet with a side slope of 1:1.5.

2006: The South Jetty was repaired from stations 223+00 to 245+00. The crest elevation was built +25 feet with a side slope of 1:2.

2007: The South Jetty was repaired from stations 255+00 to 285+00. The crest elevation was built to +25 feet with a side slope of 1:2.

Figure 1 shows the navigation channel and the three primary navigation structures, the North Jetty, South Jetty, and Jetty A. Those structures are shown in more detail in Figure 2. The North Jetty and Jetty A are located in Pacific County, Washington, near Ilwaco and Long Beach on the Long Beach Peninsula. The South Jetty is located in Clatsop County, Oregon near Warrenton/Hammond and Astoria.

Figure 2. Pictures of the MCR Jetties. Top left photo shows the South Jetty looking east. The remnant feature shown disconnected from the primary structure is the concrete monolith that was constructed in 1941. The top right photo shows Jetty A. The bottom photo illustrates the North Jetty and the shoreline north of the MCR.

South Jetty

Jetty A

North Jetty

Description of the Proposed Action

NMFS relied on the description of the proposed action (below), including all features identified to reduce adverse effects, to complete this consultation. To ensure that this biological opinion remains valid, NMFS requests that the action agency keep NMFS informed of any changes to the proposed action. For a complete description of the proposed action refer to the BA.

Along certain sections of each jetty, wave cast and erosional forces have flattened the jetty prism and left a bedding of relic stone with only some of the original jetty prism remaining. The Corps is proposing to perform modifications and repairs to the North and South Jetties and Jetty A at the MCR that would strengthen the jetty structures, extend their functional life, and maintain deep-draft navigation.

The proposed action is comprised of four categories that are applicable to each jetty:

1. Engineered designs elements and features of the physical structures.
2. Construction measures and implementation activities.
3. Proposed 7(a)(1) habitat improvement measures to improve habitat for the benefit of listed species.
4. Wetland mitigation actions to offset adverse effects of filling wetlands.
5. The proposed establishment of and coordination with an adaptive management team (AMT) comprised of staff and representatives from appropriate Federal and state agencies (including NMFS and the Corps).

Construction is proposed to continue for 20 years, with a 50-year operational lifetime for the MCR jetty system. An inherent level of uncertainty exists regarding dynamic environmental conditions around each of the Jetties. Because of this uncertainty, in all cases where areas, weights, and volumes (tons, acres, cubic yards, *etc.*) or other metrics are indicated, these are best professional estimates and may vary by greater or lesser amounts within a 20% range when final designs are completed. The estimated amounts represent the best professional judgment of the Corps as to what the range of variability will be in the design as on-the-ground conditions evolve over the 20-year construction schedule. The Corps currently maintains a jetty monitoring and surveying program that will further inform the timing and design of the proposed action. The information gathered at the Jetties will facilitate efficient completion of the project and whenever possible will avoid emergency repair scenarios.

1. Design elements and structural features specific to each jetty include the following:

- North Jetty – The North jetty will be repaired where cross-section has been lost, and engineering features designed to minimize future cross-section instability will be constructed. The cross-section repairs will be primarily above MLLW, with a majority of stone placement not likely to extend deeper than -5 feet MLLW. Four spur groins will be added and the jetty head (western-most section) will be capped with large stone to correct structural instability. Spur groins will be constructed primarily on existing relic stone. Head capping stone will be placed on relic stone as well as on jetty stone that is above MLLW. Shore-side improvements at the North jetty will include culvert replacements and the filling of lagoons. These improvement actions are designed to stop ongoing erosion of the jetty root.

- South Jetty – The South jetty will be repaired where cross-section has been lost, and engineering features designed to minimize future cross-section instability will be constructed. The cross-section repairs will be primarily above MLLW, with a majority of stone placement not likely to extend more than -5 feet MLLW. Five spur groins will be added and the jetty head (western-most section) capped with large stone to correct structural instability. Spur groins will be constructed primarily on existing relic stone. Head capping stone will be placed on relic stone as well as on jetty stone that is above MLLW. The dune at the western shoreline extending south from the jetty root will be augmented. The augmentation action is intended to prevent the degradation of the jetty root and prevent a potential breaching of the fore dune.

- Jetty A – Jetty A will be repaired where cross-section has been lost, and engineering features designed to minimize future cross-section instability will be constructed. The cross-section repairs will be primarily above MLLW, with a majority of stone placement not likely to extend more than -5 feet MLLW. Two spur groins will be added and the jetty head (southern most section) and will be capped with large stone to correct structural instability. The groins will be constructed primarily on existing relic stone. Head capping stone will be placed on relic stone as well as on jetty stone that is above MLLW. The repair is proposed to have a small cross-section, two spur groins, and a capped jetty head.

2. Construction for all three jetties is proposed to include the following:

- Storage and staging areas for rock stockpiles and all associated construction and placement activities such as roadways, parking areas, turn-outs, haul roads, weigh stations, and a yard area for sorting and staging actions.
- Stone delivery from identified quarries either by barge or by truck. Possible transit routes are identified below. Permanent barge offloading facilities and causeways will be constructed and operated as such. This part of the proposed action will include the installation and removal of piles and dolphins necessary for the offloading facilities.
- Stone placement either from land or water will require the construction, repair, and maintenance of a haul road on the jetty itself, crane set-up pads, and turnouts on the jetty road.
- Dredging and disposal of infill at offloading facilities, with a frequency dependent on a combination of the evolving conditions at the site and expected construction scheduling and stone delivery. Disposal will occur at existing approved in-water sites.

3. 7(a)(1) Habitat improvement projects. Proposed habitat improvement projects are likely to include one or more projects intended to benefit listed species, such as:

- Excavation and creation of intertidal wetlands to restore and improve wetland functions.
- Culvert and tide gate replacements or retrofits to restore or improve fish passage and access to significant spawning, rearing, and resting habitat.
- Dike breaches to restore brackish intertidal shallow-water habitat for fish benefits.
- Beneficial uses of dredged material from the MCR hopper dredge to replenish the Columbia River littoral cells.
- Invasive species removal and control and revegetation of native plants to restore ecological and food web functions that benefit fisheries.

These habitat improvement projects will require additional consultations, and the proposed AMT likely will be of assistance in this process. Furthermore, NMFS did not consider the beneficial effects of the habitat improvement projects in making our jeopardy/adverse modification determinations.

4. Clean Water Act Section 404 wetland mitigation projects.

The wetlands to be affected by the proposed action are isolated, non-fish bearing wetlands. The Corps will mitigate for all impacts to wetlands regulated under section 404 of the Clean Water Act. Estimates for wetland impacts are preliminary and may be reduced or increased when final delineations are completed.

5. Due to the long duration of the MCR jetty rehabilitation schedule, the Corps has proposed the formation of an AMT.

The Corps suggested annual meetings to discuss relevant design and construction challenges and modifications, technical data, and adaptive management practices as needed. The primary purpose of the proposed AMT and its implementation will be to

ensure that construction, operation, and maintenance actions do not have impacts greater than those described in the BA and the Opinion. This process will also provide confirmation that any necessary construction or design refinements remain within the range and scope of effects described in the Opinion. The AMT will facilitate continued coordination and updating and allow the Corps to inform agency partners when unforeseen changes arise. Results regarding marine mammal and fish monitoring, wetland mitigation and habitat improvement monitoring, as well as water quality monitoring will also be made available to the AMT to fulfill reporting requirements and address any unexpected field observations. Results of jetty monitoring surveys will also inform the AMT of the changing repair schedule and design refinements that occur as the system evolves over time. This venue will provide greater transparency and allow opportunities for additional agency input. Final selection and design of the habitat improvement and wetland mitigation proposal will be vetted through the AMT to facilitate obtaining final environmental clearance documents for this component of the proposed action. Potential principal partners include federal (NMFS, U.S. Fish and Wildlife Service) and state (Washington, Oregon) resource management agencies.

Project Specifications

Repair and *rehabilitation* are two proposed approaches that specifically describe construction and stone placement actions for the cross-sections and engineered features along the trunks and roots of the Jetties. An economics and design model will be used to select the repair and rehabilitation schedule at the North and South Jetties. This model predicts a certain number of repair actions that will be needed to avoid a breaching scenario during the 20-year construction schedule and 50-year operational lifetime of the Jetties. This model and repair system is referred to as the scheduled repair approach. The scheduled repair approach prioritizes work on specific portions of the jetty so that sections in a greater degree of deterioration will be repaired with rock according to a programmed sequence developed as a result of regular jetty monitoring and inspections.

Repair is defined as adding limited amounts of stone to the trunk, head, and root features in order to restore the damaged cross-sections back to a standard repair template. The standard repair template will be described in more detail in the paragraphs below for each jetty. A repair action is generally triggered when the upper cross-sectional area falls below 30%-40% of its standard jetty template profile (*i.e.*, only 30% or 40% of the current jetty structure remains; 60%-70% of the previously existing prism is gone). For each repair action, the majority of stone placement will occur above MLLW. However, depending on conditions at specific jetty cross-sections, stone could extend more than -5 feet MLLW in order to restore that jetty section back to the standard repair template. Therefore, repair actions could be slightly greater or smaller, depending on the condition of the cross-section being repaired.

Rehabilitation is defined as adding new structures and/or placing rock along the cross-section of the entire root and trunk. For instance, the construction and placement sequence for immediate rehabilitation at Jetty A means stone placement activities are initiated at one end of the jetty and are completed continuously in succession without prioritization based on conditions at any particular jetty section. The proposed rehabilitation action on Jetty A is more robust than a repair

action and includes a re-built cross-section along the entire length of the jetty. Sections in a greater state of deterioration may receive a relatively larger amount of rock compared to sections with less deterioration. The rehabilitation cross-section template is expanded slightly beyond the existing prism template. This involves stone placement that primarily fits within the existing footprint of the jetty structure or relic stone, but may extend slightly beyond the existing prism.

The following paragraphs use station numbers on each jetty to describe locations. These stations indicate lineal distance along the jetty relative to a fixed reference point (0+00) located at the landward-most point on the jetty root. Numbering begins at the reference point (0+00) and increases seaward such that each station number represents that distance in feet, multiplied by 100, plus the additional number of feet indicated after the station number. For instance, station 100+17 would be 10,017 feet seaward from the reference point. A summary of design parameters for the preferred plan at each jetty is shown in Table 2.

Table 2. Design parameters for the preferred plan at each jetty volumes, lengths and areas may vary by ± 20% upon final design.

North Jetty Scheduled Repair with Engineering Features

Jetty Crest Elevation	Estimated Stone Density	Total Repair Length	Jetty Crest Width	Jetty Sideslope		Jetty Head Station	Head Length	Spur Groin Sta.	Spur Groin Tons
				Channel	Ocean				
25' above MLLW	167 #/ft3	8,100'	30'	1v:1.5h	1v:1.5h	99+00 to 101+00	200'	Sta 50-C Sta 70-C Sta 80-O Sta 90-C	3,895 12,870 2,340 33,960

South Jetty Scheduled Repair with Engineering Features

Jetty Crest Elevation	Estimated Stone Density	Total Repair Length	Jetty Crest Width	Jetty Sideslope		Jetty Head Station	Head Length	Spur Groin Sta.	Spur Groin Tons
				Channel	Ocean				
25' above MLLW	167 #/ft3	15,800'	30'	1v:1.5h	1v:2h	311+00 to 313+00	200'	Sta 165-O Sta 210-C Sta 230-C Sta 265-C Sta 305-O	1,496 2,095 2,095 2,841 16,747

Jetty A Rehab with Engineering Features

Jetty Crest Elevation	Estimated Stone Density	Total Repair Length	Jetty Crest Width	Jetty Sideslope		Jetty Head Station	Head Length	Spur Groin Sta.	Spur Groin Tons
				Estuary	Ocean				
20' above MLLW	167 #/ft3	5,300'	40'	1v:2h	1v:2h	91+00 to 93+00	200'	Sta 84 O Sta 90-E	12,272 12,272

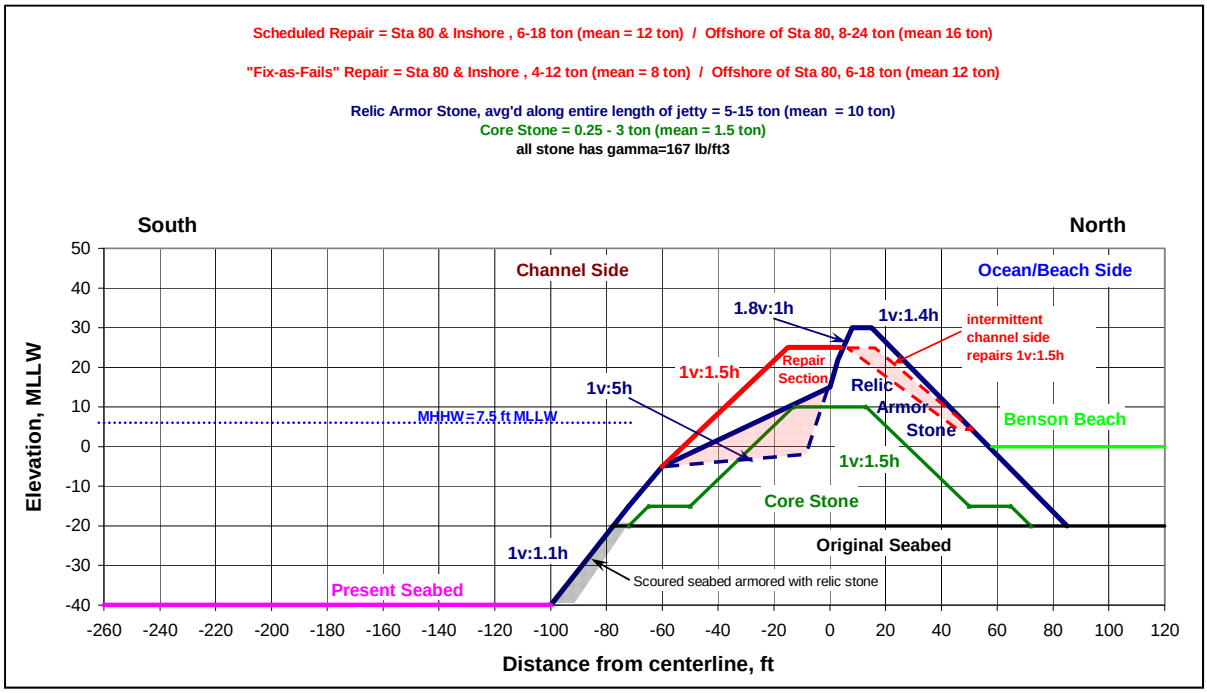
MCR North Jetty

The proposed action for the North Jetty is scheduled repair and construction of engineered features (rehabilitation) including four spur groins and head capping, culvert replacement, and lagoon fill to stop erosion of the jetty root (Figures 3, 4, 5, and 6). The jetty head and foundation at the most exposed portion of jetty will be stabilized. Details are described below.

North Jetty Trunk and Root. The cross-section design from stations 20+00 to 99+00 will have a crest width of approximately 30 feet and will lie essentially within the existing jetty footprint based on the configuration of the original cross-section, previous repair cross-sections, and redistribution of jetty rock by wave action. Approximately 460,000 tons (~287,500 cubic

yards [cy]) of new rock will be placed on relic armor stone, with the majority of stone placement occurring above MLLW. Approximately four repair events are predicted over the next 20 years. Each repair action is expected to cover a length range of up to 1,700 feet and include stone volumes in the range of 45,000 to 100,000 tons (~28,125 to 62,500 cy) per season.

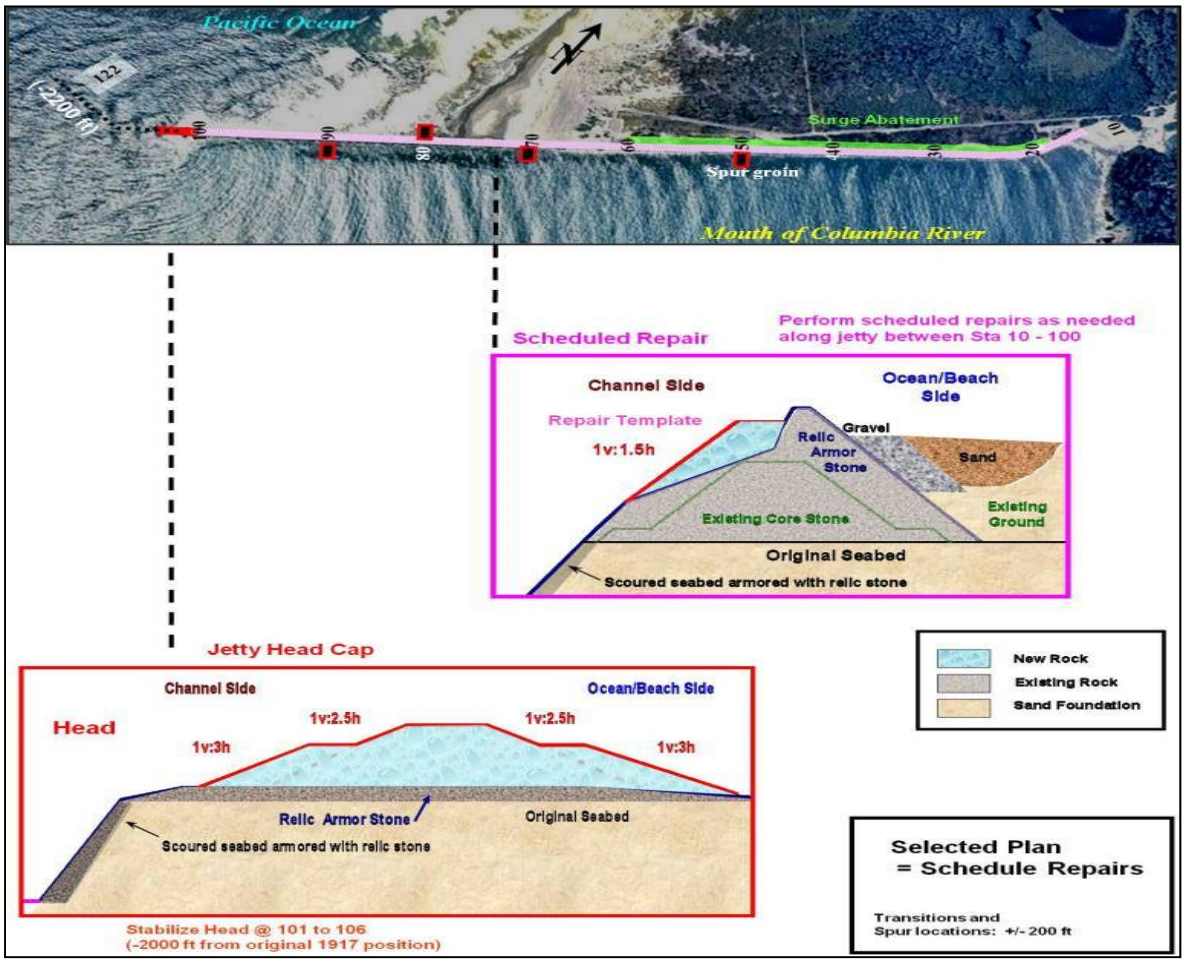
Figure 3. North Jetty cross-section for existing condition and scheduled repair template.



At the time of repair, it is likely that 60 to 70% of the standard jetty template cross-section will have been displaced. Therefore, each repair event will increase the degraded cross-section from 30 to 40% back to 100% of the desired standard cross-section template. This means the overall added rock will essentially triple what exists immediately prior to the time of repair. Jetty repairs will not increase the jetty prism or footprint beyond the scope and size of the historic structure, and would not include any modification that changes the character, scope, or size of the original structure design.

Described below is the quantity of rock that will be placed into each elevation zone per representative repair event. Approximately 21,550 cy of rock will be placed above mean higher high water (MHHW). This represents 58% of the overall stone placement on these portions of the jetty. Approximately 9,230 cy of rock will be placed between MHHW and MLLW. This represents 25% of the overall stone placement on these portions of the jetty. Approximately 6,675 cy of rock will be placed below MLLW. The footprint of the trunk and root of the North Jetty will remain on relic stone and within its current jetty dimensions.

Figure 4. Typical cross-sections of the trunk repair and cap rehabilitation. The approximate placement of spur groins is also indicated.



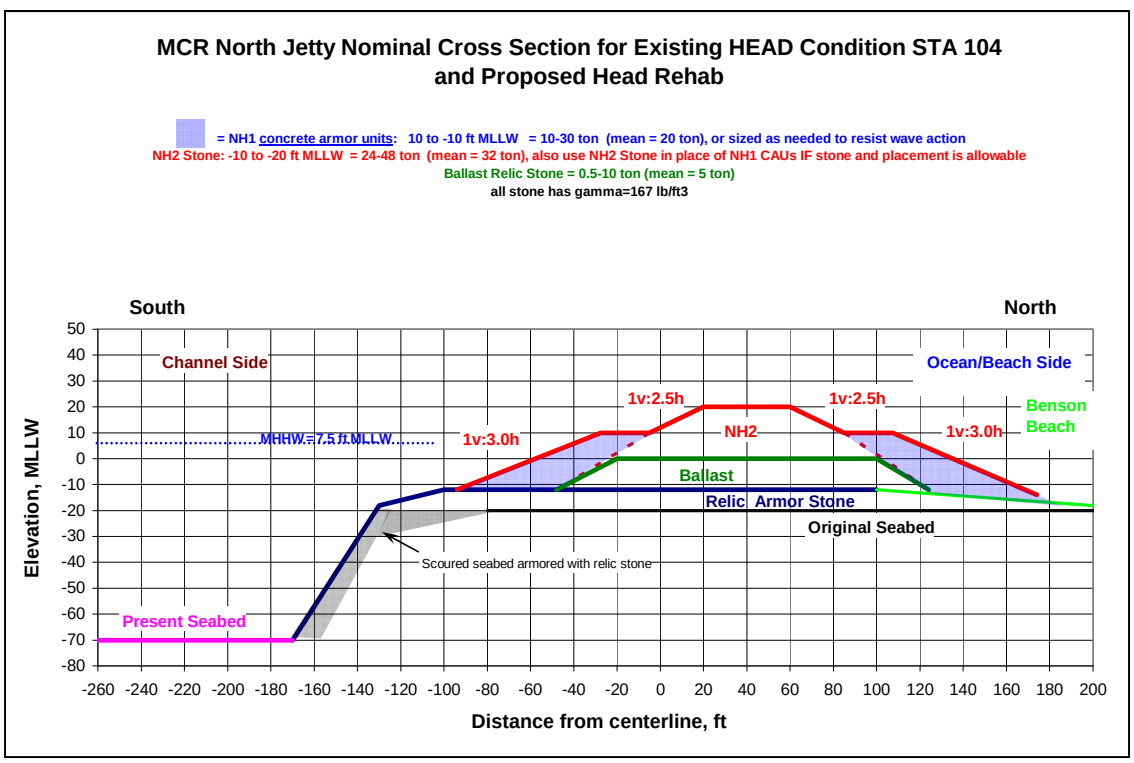
North Jetty Head Capping. An armor stone cap or concrete armor units (CAUs) will be placed on the head of the North Jetty to stop its deterioration (Figure 4, above, and Figure 5 and Table 3, below). Approximately 38,000 tons (~23,750 cy) of stone or functionally equivalent CAUs will be placed on the relic stone to cap the jetty head. Future physical modeling will refine head capping features.

Table 3. North Jetty head cap features.

Head Cap Features	North Jetty
Location of cap	stations 99 to 101
Timing of construction	2015
Approximate dimensions of cap: length x width x height (feet)	350 x 270 x 45 (2.17 acres)
Stone size	30 to 50 tons
Area affected (outside relic stone)	None
% of cap constructed on relic stone	100%
Construction method	Cranes set on the jetty

Stone placement for head capping has been divided into elevation zones. Approximately 13,425 cy of rock will be placed above MHHW. Approximately 6,490 cy of rock will be placed between MHHW and MLLW. This represents 24% of the overall stone placement on this portion of the North Jetty. Approximately 7,280 cy of rock will be placed below MLLW. This represents 27% of the overall stone placement on this portion of the North Jetty head. In all zones, all proposed stone placement will occur on existing base relic stone that formed the original jetty cross-section and was displaced and flattened by wave action, and does not include any modification that changes the character or increases the scope, or size of the original structure design. The footprint of the existing jetty mound on the flattened relic stone is approximately 1.37 acres, and the additional capping on the relic stone increases the width of the prism approximately 0.80 acres, for a total footprint of 2.17 acres, all of which will remain on the existing relic stone.

Figure 5. A more detailed representative cross-section of the North Jetty head cap.



MCR South Jetty

The proposed action for the South Jetty includes scheduled repairs addressing water structural instability mostly above MLLW, five spur groins, head capping, and the jetty shoreline near the root (Figures 6,7, and 8). Seven scheduled repair events over the next 20 years were predicted at the South Jetty.

South Jetty Trunk and Root. The cross-section design from stations 155+00 to 311+00 will have a crest width of approximately 30 feet and will lie essentially within the existing jetty footprint based on the configuration of the original cross-section, previous repair cross-sections, and redistribution of jetty rock by wave action (Figures 6 and 7). The majority of the stone will be placed above MLLW. Each repair action is expected to cover a length up to 2,100 feet and include stone volumes in the range of 30,000 to 118,000 tons per season (18,750 to 73,750 cy).

As with the North Jetty repair action, it is expected that 60 to 70% of the South Jetty's overall standard jetty template cross-section will have been displaced. Therefore, each repair event will increase the existing degraded cross-section from 30 to 40% back to 100% of the desired standard cross-section template. Jetty repairs will not result in an increase to the jetty prism or footprint beyond the scope and size of the historical structure, and would not include any modification that changes the character, scope, or size of the original structure design.

Approximately 37,640 cy of rock will be placed above MHHW per repair event. Approximately 10,420 cy of rock will be placed between MHHW and MLLW. This represents 19% of the overall stone placement on these portions of the South Jetty. Approximately 6,940 cy of rock will be placed below MLLW. This represents 13% of the overall stone placement on these portions of the South Jetty. Jetty repairs in all zones will occur on existing base relic stone that formed the original jetty cross-section. The footprint of the trunk and root of the South Jetty will remain within its current jetty dimensions and on relic stone.

Figure 6. Representative cross-sections of the South Jetty head cap rehabilitation and trunk repair. The approximate placement of spur groins is also included.

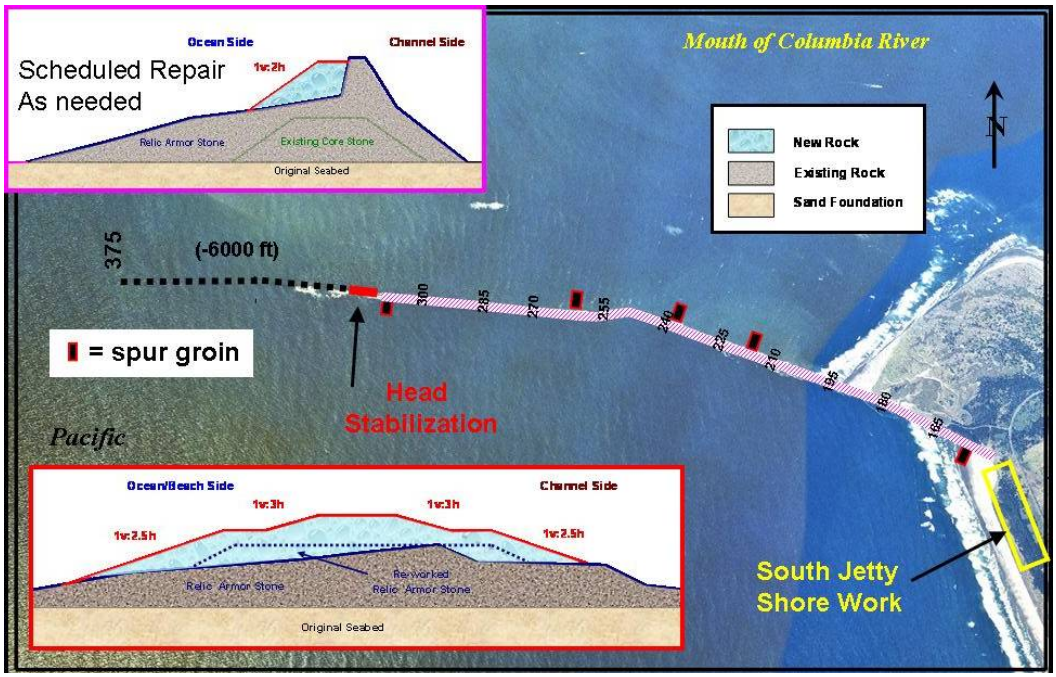
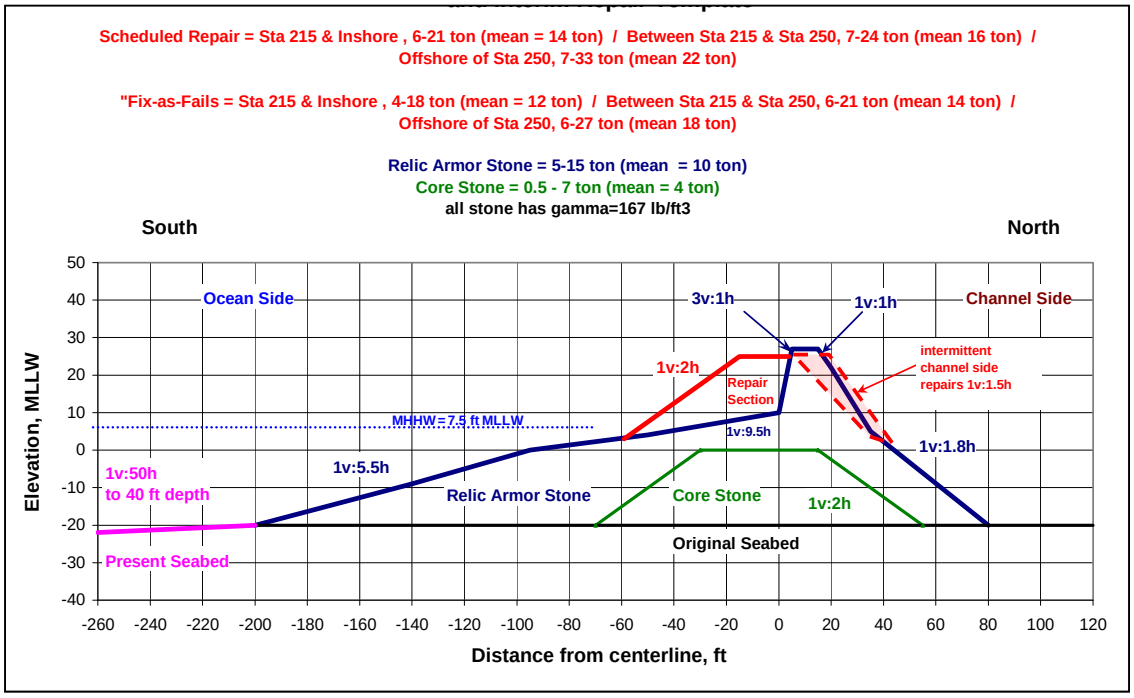
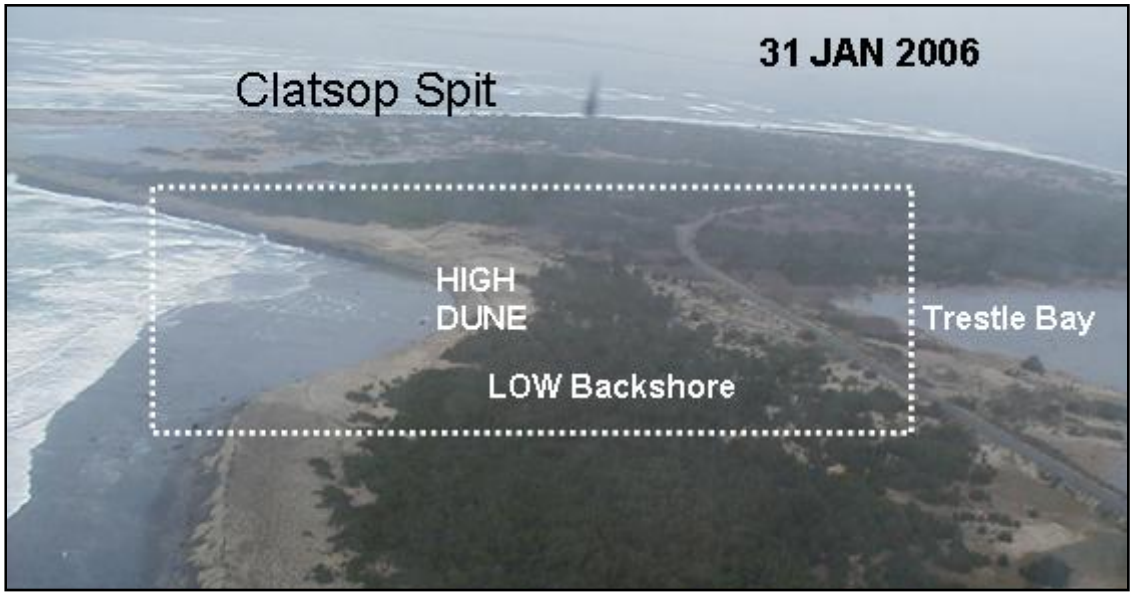


Figure 7. Detailed cross-section of the South Jetty trunk repair (representative).



<u>South Jetty Root Erosion and Dune Augmentation.</u> Currently, the coastal shore interface along the South Jetty is in a condition of advanced deterioration (Figures 8 and 9). The foredune separating the ocean from the backshore is almost breached. The backshore is a narrow strip of a low-elevation, accretion area that separates Trestle Bay from the ocean by hundreds of yards. The offshore area along the South Jetty (and to the south) continues to erode, promoting larger wave action that affects the shoreline along the South Jetty root. The back dune of Trestle Bay has continued to advance westward due to increased circulation in the bay, seasonal wave chop, and hydraulic surcharging. Under existing conditions, the shoreline at the root of the South Jetty will continue to erode and recede, resulting in a possible shoreline breach into Trestle Bay in approximately 8 to 16 years. If this sand spit breach occurs, the result would be catastrophic. The MCR inlet would establish a secondary flow way from the estuary to the ocean along this area (south of South Jetty). This condition would profoundly disrupt navigation at the MCR and bring lasting changes to the physical nature of the inlet.

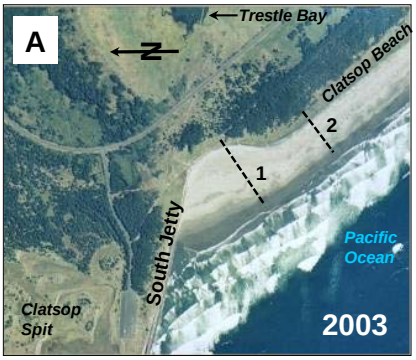
Figure 8. Aerial photograph showing Clatsop spit and South Jetty root erosion.



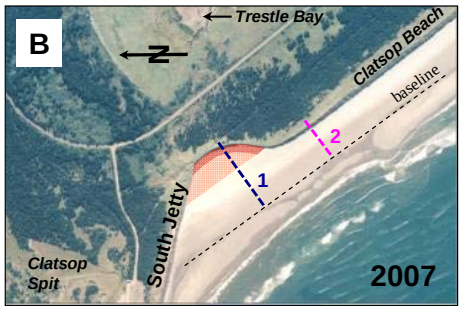
Approximately 40,000 to 70,000 cy of cobble in the shape of angular or rounded graded stone is proposed to be placed at the South Jetty root to fortify the toe of the foredune and to improve the foreshore fronting to resist wave-induced erosion/recession (Figure 9). Maximum crest width of the template is estimated to extend 70 feet seaward from the seaward base of the present foredune. Construction of the berm augmentation would take 2 to 6 weeks. To adequately protect the foredune during storm conditionsrequires that the top of the stone berm (crest) extend vertically to approximately 25 feet NAVD and have an alongshore application length of approximately 1,100 feet (3 acres), extending southward from the South Jetty root. The constructed template crest would be 10 to 15 feet above the current beach grade and have a 1 vertical:10 horizontal slope aspects from crest to existing grade. Cobble will not extend below MHHW. An additional layer of sand may be placed over this berm, or natural accretion may facilitate sand recruitment after construction of the adjacent spur groin.

Cobble material would be procured from upland sources and placed using trucks and bulldozers. The material would be transported on existing surface roads and through Fort Stevens State Park to a beach access point at the project site. There is an existing relic access road along the jetty root that will be refurbished and used to transport stone to the dune augmentation area.

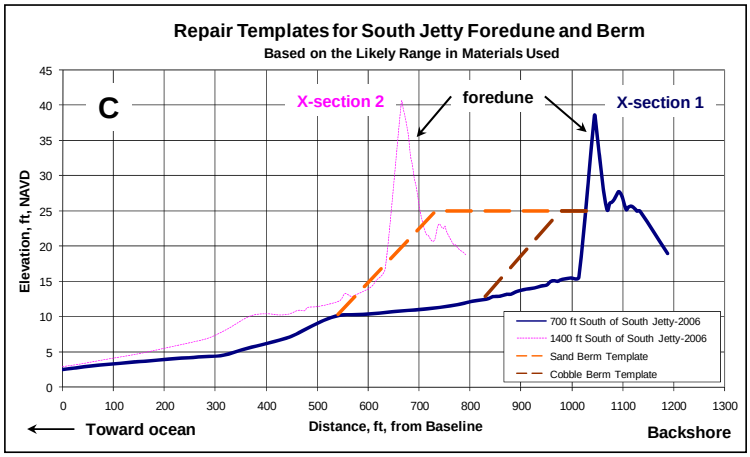
Figure 9. Aerial photographs of, and repair template for the South Jetty root shoreline area.



MCR South Jetty root, south side where Clatsop Spit joins with Clatsop Plains/Beach. Panels A and B show the erosion embayment along the south jetty root for 2003 (hIgh tide) and 2007 (low tide). The embayment & adjacent shore have receded 40 ft landward during 2003-2007, reducing the protective foredune along the embayment.



Panel C shows cross-sections 1 and 2 for 2007(shown in panels A & B). Severe erosion in this area had threatened the inlet stability during early 1930s, when jetty rehabilitation and sand augmentation measures were implemented. Erosion has again become chronic since the late 1970s. The foredune protects the backshore (elevation 15-18 ft NAVD) from wave surge action during storms. If the foredune is breached, the backshore will be rapidly eroded. Without erosion abatement, it is estimated that that the Pacific Ocean will establish hydraulic connectivity with Trestle Bay in 10-15 years from 2009, and again threaten inlet stability. Panel C shows two options for protecting the foredune within the erosion embayment: A SAND berm template requires ~225,000 cy of sand placement, and a COBBLE berm template requires ~60,000 cy of cobble placement.



The dune augmentation may require maintenance every 4 to 10 years (assuming 40% replacement volume). Consideration will be given to development of revegetation plans which incorporate native dune grasses to supplement foredune stabilization in the augmentation area. This bioengineering component could help restore habitat and take advantage of natural plant rooting functions that provide greater protection from erosive forces.

MCR Jetty A

The proposed action for Jetty A includes immediate rehabilitation with a small cross-section, two spur groins, and head capping (Figures 10, 11, 12, 13 and Table 4), as described below.

Jetty A Trunk and Root. The cross-section design from stations 40+00 to 91+00 will have a crest width of approximately 40 feet and will lie mostly within the existing jetty footprint based on the configuration of the original cross-section, previous repair cross-sections, and redistribution of jetty rock by wave action (Figures 10 and 11). Approximately 55,000 tons (~34,375 cy) of new rock will be placed on the existing jetty cross-section and relic armor stone on the estuary/channel side of the jetty and 75,000 tons (~46,875 cy) of new rock on the ocean side of the jetty. Although most of the work will occur above MLLW, there will also be some

stone placement below this elevation. The small cross-section also has a higher likelihood of expanding beyond the relic base compared to repair actions.

Approximately 63,700 cy of rock will be placed above MHHW. This represents 63% of the overall stone placement on these portions of Jetty A. Approximately 28,940 cy of rock will be placed between MHHW and MLLW. This represents 29% of the overall stone placement on these portions of Jetty A. Approximately 8,030 cy of rock will be placed below MLLW. This represents 8% of the overall rock on these portions of Jetty A. In all zones, most of the proposed stone placement will occur on existing base relic stone that formed the original jetty cross-section. However, the footprint of the proposed prism could increase in width compared to the existing prism by up to 10 feet along the length of the jetty (though it would still be on the relic stone). This equals approximately 1.2 acres, but it is not expected to result in additional habitat conversion because it will on top of an area that is already comprised of jetty stone, and does not include any modification that changes the character, scope, or size of the original structure design.

Figure 10. Typical cross-section and locations of the trunk, root, and cap on Jetty A. The approximate locations of the spur groins are also shown.

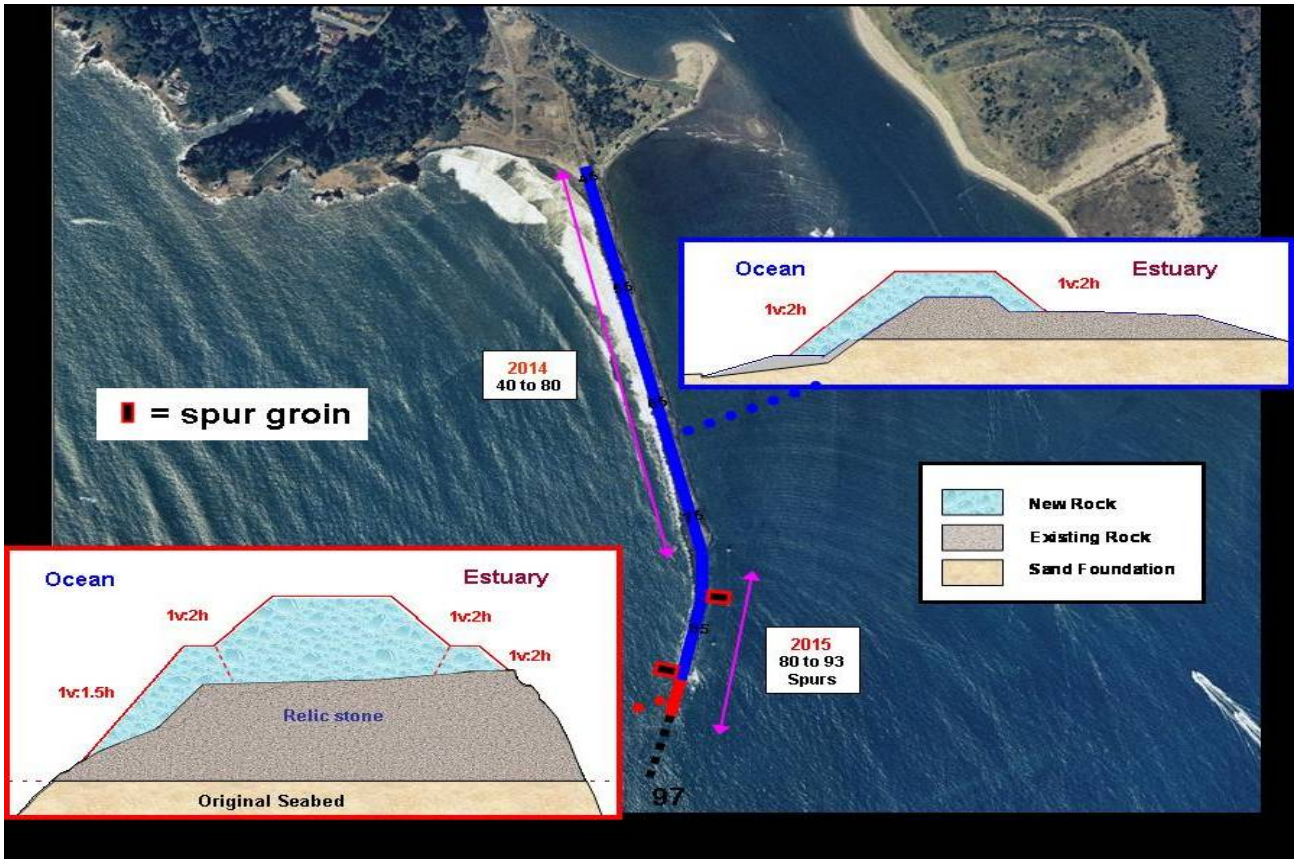
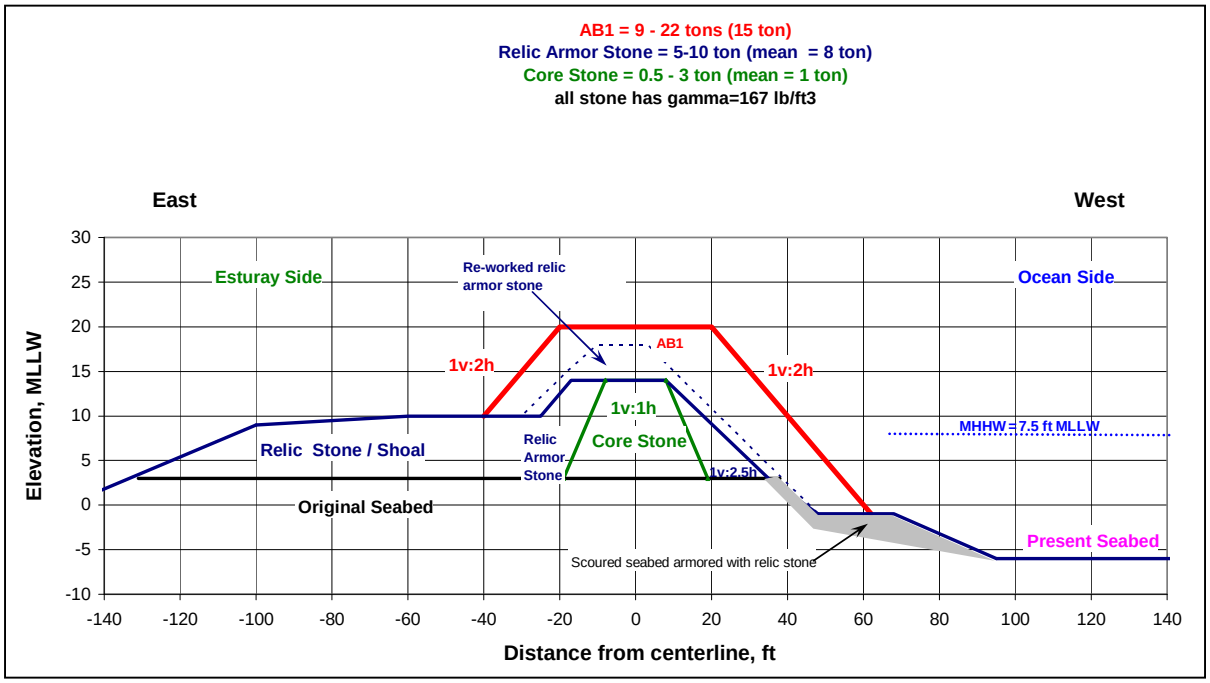


Figure 11. Detailed representative cross-section for Jetty A.



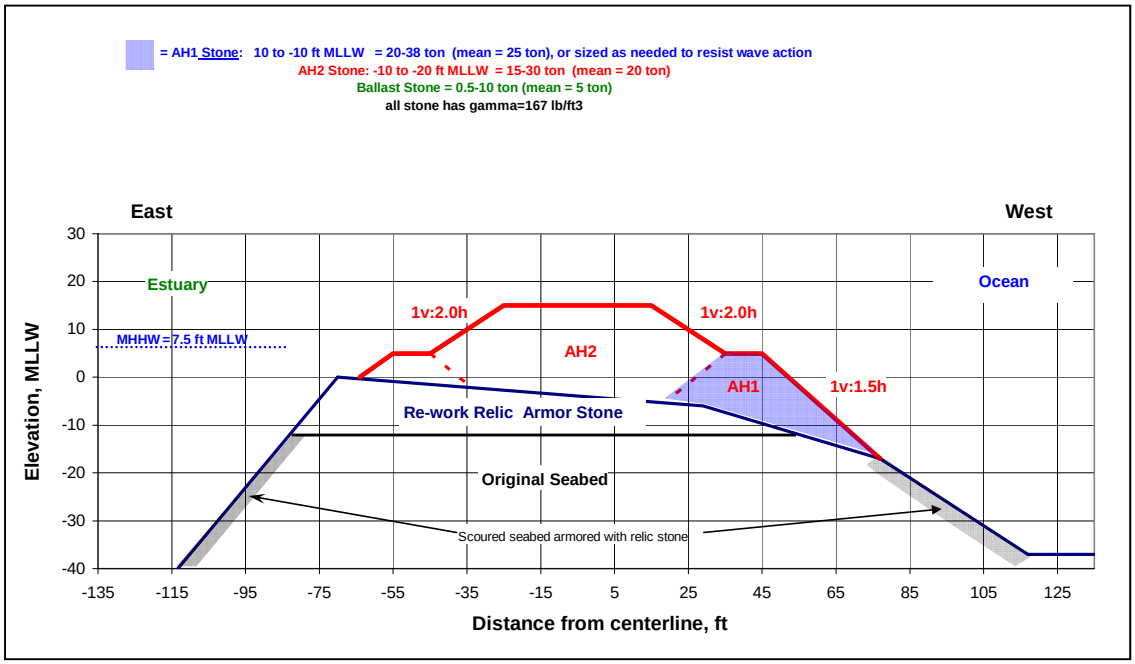
<u>Jetty A Head Capping</u>. An armor stone cap of approximately 24,000 tons (~ 15,000 cy) or equivalent concrete armor units will be placed on the head of the Jetty A to stop its deterioration (Table 4 and Figures 10, above, and Figure 12, below). As with the North and South Jetties, the stone to be placed on the head of Jetty A has been divided into elevation zones. Approximately 7,920 cy of rock will be placed above MHHW. This represents 44% of the overall stone placement on this portion of Jetty A. Approximately 4,740 cy of rock will be placed between MHHW and MLLW. This represents 26% of the overall stone placement on this portion of Jetty A. Approximately 5,420 cy of rock will be placed below MLLW. This represents 30% of the overall stone placement on this portion of Jetty A.

All proposed stone placement will occur on existing base relic stone that formed the original jetty cross-section and was displaced and flattened by wave action, and does not include any modification that changes the character or increases the scope or size of the original structure design. The footprint of the existing jetty mound on the flattened relic stone is approximately 0.64 acres, and the additional capping on the relic stone increases the width of the prism approximately 0.09 acres, for a total footprint of 0.73 acres on the existing relic stone.

Table 4. Jetty A head cap features.

Features	Jetty A
Location of cap	Stations 91 to 93
Timing of construction	2015
Dimensions of cap: length x width x height (feet)	200 x 160 x 40 (0.73 acres)
Stone size	30 to 40 tons
Area affected (outside relic stone)	None
% of cap constructed on relic stone	100%
Construction method	Land-based crane

Figure 12. Detailed representative cross-section for the Jetty A head capping.



Construction Measures and Implementation Activities

Construction Schedule and Timing. The preferred in-water work window for the Columbia River estuary at the mouth according to the Oregon Department of Fish and Wildlife is November 1 to February 28. However, seasonal inclement weather and sea conditions preclude safe, in-water working conditions during this timeframe. Therefore, it is likely that most of the in-water work for constructing spur groins, head capping, cross-section repairs, constructing off-loading facilities, *etc.* will occur outside this period, between April and October.

Most landward work on the Jetties will be occurring from April through October. Work on the more exposed sections of the Jetties is likely to occur from June through October. Placement

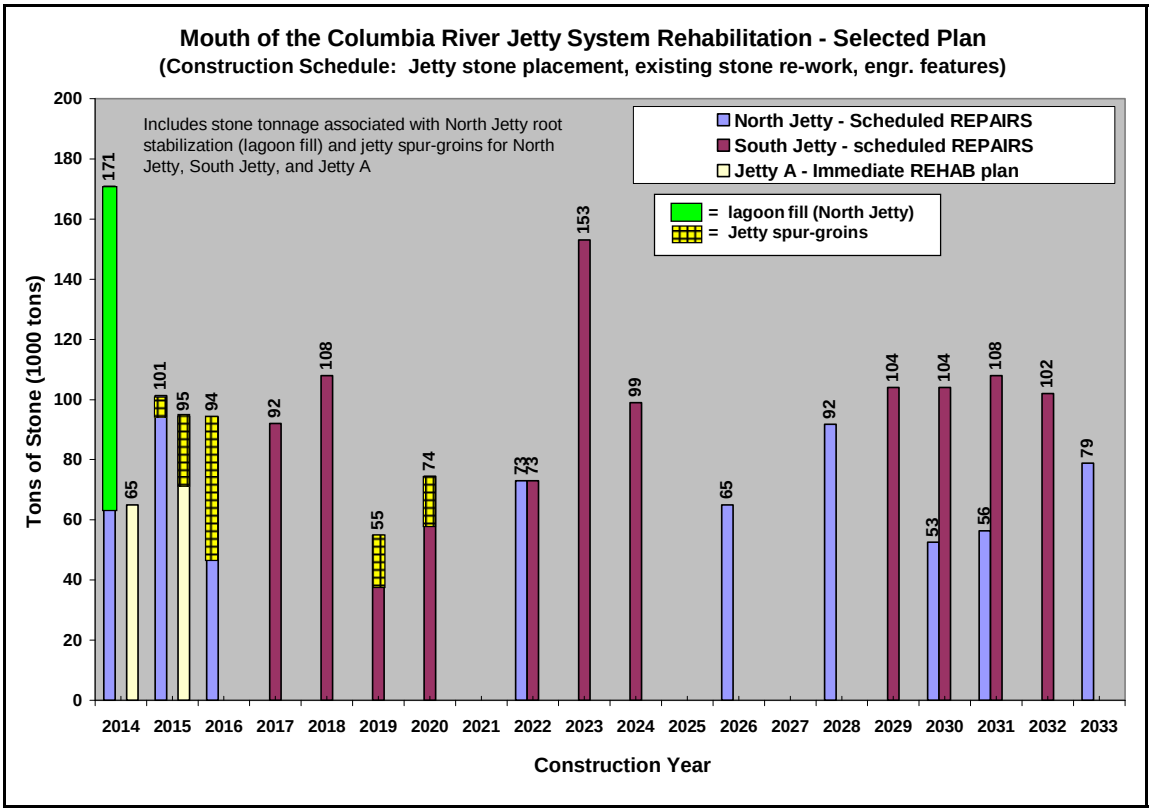
work may extend beyond these windows if weather and wave conditions are conducive to safe construction and rock delivery. Rock delivery by land or water could occur year-round, depending on delivery location and weather breaks. Barge delivery would most likely occur during the months of April through October or at other times of the year depending on breaks in the weather and which jetty is being used. Quarrying of the rock may be limited to the months of April through October depending on the regulations pertinent to each quarry.

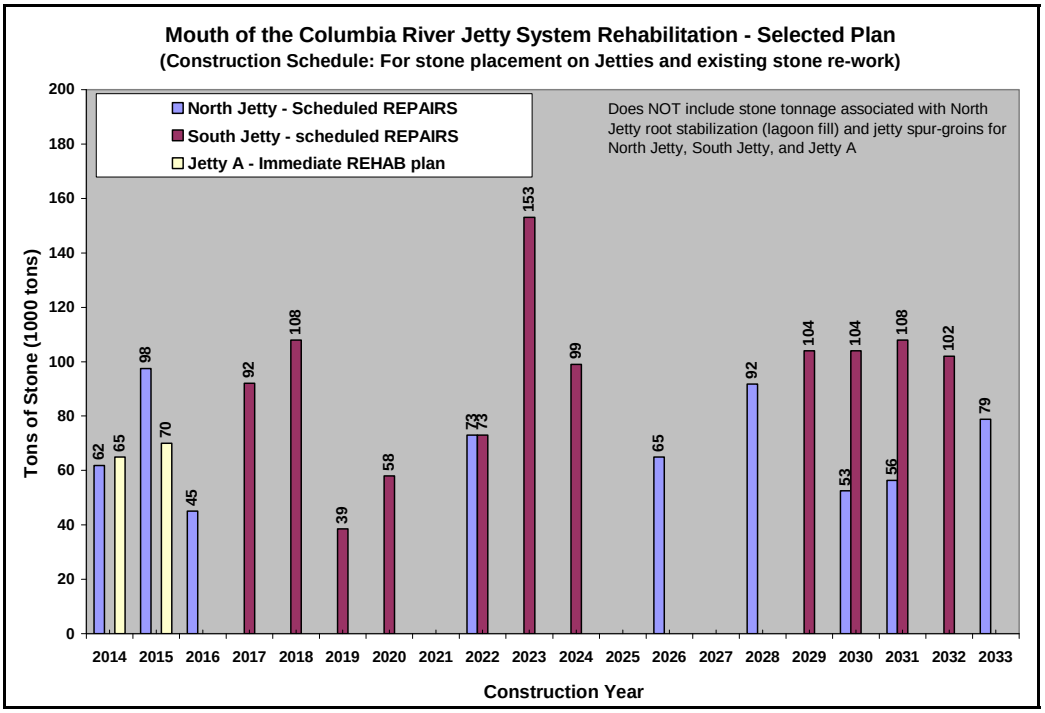
Work elements fall into four general categories for scheduling: (1) Rock procurement, quarrying, and delivery transport; (2) construction site preparation; (3) lagoon fill and dune augmentations; and (4) jetty repair and rehabilitation work with construction of the design features including head capping and spur groins. Site preparation would consist of the preparation of the rock stockpile storage and staging areas, as well as the construction of any barge-offloading facilities that may be required. The majority of the jetty rehabilitation work is expected to be conducted from the top of the jetty downward using an excavator or a crane.

For design and cost-benefit estimates, the project was modeled and designed for a 50-year operational lifespan. The schedule shown in Figures 13 and 14 illustrates construction actions at any one or some combination of all three of the Jetties for the duration of 20 years. Those figures also include a predicted schedule of repair actions that the Corps' model estimates will be necessary within that same time period. Additional repairs have also been predicted to occur after the initial 20-year construction schedule and within the 50-year lifespan of the project. Additional repairs beyond the 20-year schedule will be similar in scale and nature to those described above in the standard repair template. As previously explained, repair actions are generally triggered when a cross-section of the jetty falls below approximately 30 to 40% of the standard repair template profile. The schedule described further in the narrative is a combined reflection of constructing specific engineered features and forecasting needed repairs. Real-time implementation of repair actions will likely vary based on evolving conditions at the Jetties and could be shifted within and beyond this 20-year construction schedule.

In the construction schedule, rock production and stockpiling material is proposed to begin in 2013. The first jetty installation is scheduled for late spring 2014 and continues through 2033. The estimate assumes that the work will be accomplished with multi-year contracts.

Figures 13 and 14. Construction schedules for the rehabilitation of the MCR jetties.





Construction Sequence and General Schedule

Rock procurement will be initiated for the North Jetty repair in 2013. In 2014, the on-site work will begin with filling the lagoon area behind the North Jetty root (stations 20 to 60) and installing a culvert to divert overland flow to another area that will not impact the North Jetty root stability. The lagoon area will be filled with rock, gravel, and sand. Once the lagoon is filled, the filled portion will serve as a staging and stockpile area for the rock delivered to the North Jetty site. To control further head recession of the North Jetty, in 2014 construction will focus on reconstructing the jetty head (station 88 to 99). This work will require haul road construction on top of the jetty from station 70 out to the head requiring approximately 31,000 tons of rock. The North Jetty will require installing a barge offloading facility on the channel side of the jetty at approximately station 45+00. Dredging of 30,000 cy is anticipated to provide the minimum 25-ft working clearance. Concurrently, work will begin on Jetty A beginning with constructing the off-loading facility, 60,000 cy of dredging to accommodate the rock delivery by barge, and constructing the jetty crest haul road from station 40+00 to 80+00. Total new stone for 2013 would consist of approximately 50,000 tons of imported rock.

In 2015, construction will continue on the North Jetty head from station 99 to 101 and installation of one spur groin at station 50 on the channel side. The haul road will need to be reworked with approximately 26,000 tons of new topping material. Work will occur concurrently with Jetty A beginning with 60,000 cy of dredging, completion of the jetty crest haul road from station 80 to 93, and installation of two spur groins. Total new stone for 2015 would consist of approximately 160,000 tons of imported rock. Work on Jetty A is likely to be completed in the same year.

In 2016, work will continue on the North Jetty with the placement of 36,000 tons of large armor near the head at station 80 to 88. This will require refurbishing the haul road and building vehicle turnouts. In addition, three spur groins will be installed at station 70-C, 80-O, and 90-C with a total of 50,000 tons of new stone. Total new stone will consist of approximately 86,000 tons of imported rock, equivalent to 2,900 trucks or 13 barges. Site preparation work and stockpiling stone at the South Jetty will occur to prepare staging and stockpile areas for 2017 construction.

In 2017, construction on the South Jetty is projected to begin, starting with construction work near the head from stations 173 to 176 and 180 to 195. South Jetty construction will require either a haul road be constructed on top of the jetty or constructed from a marine plant in order to get out to the head. Total work effort in 2017 is projected to consist of approximately 74,000 tons of rock; equivalent to 2,500 trucks or 12 barges.

Work will continue on the South Jetty for the next 3 years, working towards the head in 2018 with a total of 86,000 tons of new armor at station 290 to 311. Head construction will begin in 2019 with 30,000 tons of new head armor and installation of 4 spur groins at stations 165–O, 210-C, 230-C, and 265-C for a total of 9,000 tons of spur groin rock. The South Jetty head is anticipated to be completed in 2020 with 44,000 tons of new stone.

In 2022, construction is projected to occur concurrently on the North and South jetties: (1) North Jetty stone placement at station 40 to 45 and station 65 to 73; and (2) stone placement on the

South Jetty at station 160 to 163, station 170 to 173, station 176 to 180, and station 195 to 200. Total rock tonnage for 2022 was estimated to be 115,000 tons.

In 2023, construction will continue on the South Jetty with the placement of approximately 118,000 tons of rock between stations 205 to 250. The haul road will need to be reworked with approximately 62,000 tons of quarry stone road base and topping material.

In 2024, construction will continue on the South Jetty with the placement of approximately 76,000 tons of rock between stations 270 to 290.

In 2026, construction would resume on the North Jetty with the placement of approximately 52,000 tons of rock between stations 20 to 30. The long time frame from the previous construction on the North Jetty will also require rebuilding the jetty haul road from station 20 to 30.

In 2030, construction is projected to occur on the North and South jetties: (1) North Jetty stone placement at station 30 to 40; and (2) stone placement on the South Jetty at station 223 to 237, and station 250 to 253. Total rock tonnage proposed to be placed is estimated at 129,000 tons.

In 2031, construction is projected to occur on the North and South jetties: (1) North Jetty stone placement at station 88 to 99; and (2) stone placement on the South Jetty at station 253 to 270. The North Jetty haul road will need to be re-built from station 65 to 99 and will require 30,000 tons of quarry waste material. Total armor stone rock tonnage proposed to be placed is estimated at 135,000 tons.

In 2032, construction will continue on the South Jetty with the placement of approximately 85,000 tons of rock between stations 295 to 311. Total rock tonnage proposed to be placed would require 2,850 trucks or 13 barge loads. The offloading facility will be removed and scheduled construction will be complete for the South Jetty.

The final anticipated year of North Jetty rehabilitation is projected to be the year 2033, when construction is completed at stations 80 to 88. Total rock tonnage estimated to be 63,000 tons, equivalent to 2,100 trucks or 10 barge loads. When the offloading facility is removed scheduled construction will be complete for the North Jetty.

Because construction at the North and South jetties is spaced out from 2014 through 2033 with intermittent work, dredging at the barge offloading sites will only be required prior to a year of actual rock delivery in preparation for upcoming construction work. The Jetty A barge offloading site will only require dredging to make that site accessible for 2 years. Dredging will only be needed if the clearance depth at the barge offloading site is not found to be adequate prior to rock delivery activities.

Sources and Transportation of Rock

Rock Quarries and Transport. It is not yet known where jetty rock will come from and how it will be transported to the jetty sites. However, one or more of the options discussed below

would be employed (Figure 15 and Table 5). Stone sources located within 150 miles of a jetty are likely to be transported by truck directly to the jetty. Stone sources located at further distances, especially if they are located near waterways, are likely to be transported by truck to a barge on-loading facility, then transported by tug and barge to either a government-provided or commercial barge offloading site located nearby. Railway may also be an option for transporting stone, provided that an on-loading site is convenient to the quarry.

The Corps intends to use operating quarries rather than opening any new quarries. The contractor and quarry owner/operator will be responsible for ensuring that quarries selected for use are appropriately permitted and in environmental compliance with all State and Federal laws.

Canadian Quarries. Quarries in British Columbia are typically located adjacent to waterways and rock produced from these quarries will likely have a limited truck haul. Due to the long distance to the MCR, plus the immediate availability to deep water, rock would likely be loaded onto barges and shipped down the Washington Coast to barge offloading sites.

Washington Quarries. Quarries located in northern Washington are typically not on the water, but are generally located within 50 miles of a potential barge on-loading site. As a result, rock would need to be hauled, at least initially, by truck. Rock would be transported by trucks most likely to a barge on-loading facility or possibly all the way to the staging site at the jetty. Once the rock is loaded on barges, it would be transported down the coast to barge offloading sites.

It also is possible that railway systems may be used to transport rock much of the way to the Jetties. Burlington Northern Railroad operates a rail system that parallels Interstate 5 throughout Washington which would be the most likely route rock would be transported. Rock from the quarry would be taken by truck to a nearby railway station where they would be loaded onto railway cars and transported to an intermediate staging area. Trucks would then again take the rock the remainder of the way to the jetty staging areas.

Rock located within southern Washington would likely be trucked to the jetty staging areas. An exception to this would be a quarry that occurs within just a few miles of a port on the Washington Coast or a quarry that is near the Columbia River. In either of these two barge possibilities, rock would be delivered by truck to a barge on-loading facility, loaded on oceangoing or riverine barges, and delivered to one of the barge offloading facilities (see section on barge offloading facilities below). Truck hauling of rock from this area to the Jetties would be as described above.

Oregon Quarries. Rock located in northern Oregon within 50 miles of the North Jetty and Jetty A would likely utilize any of the main roads over to Highway 101 or Highway 30. From this point they would cross the Astoria-Megler Bridge and proceed west through Ilwaco to the jetty staging areas. Quarries exceeding 50 miles from the Jetties would likely utilize main roads at a farther distance from the jetty sites. This would involve longer haul distances on Highways 101, 30, 26, and others before crossing the Astoria-Megler Bridge and proceeding to the staging areas.

Truck hauling of rock from quarries within 50 miles of the South Jetty will most likely use any of the main roads over to Highway 101 or Highway 30. From this point they would proceed

through Astoria and Warrenton, or Seaside and Gearhart to local roads leading to Fort Stevens State Park and the jetty staging areas. Quarries exceeding 50 miles from the jetty would likely utilize main roads at a farther distance from the jetty site. This would involve longer haul distances on Highways 101, 30, 26, and others before going through Astoria and Warrenton, or Seaside and Gearhart to local roads leading into Fort Stevens State Park and the staging areas.

The likely mode of transportation from southern Oregon quarries is trucking, or a combination of trucking and barging. Many of the quarries may be near the Oregon Coast; however, they may not be near a port facility that has barge on-loading capability. Providing that barge facilities are available, rock located south of Waldport would be loaded at the quarry onto trucks and traverse main public roads to the barge on-loading site, loaded on ocean-going barges, and shipped up the Oregon Coast to one of the barge offloading facilities (see section on barge offloading facilities below). Quarries north of Waldport would most likely be hauled by truck the entire distance.

Southern Oregon rock sources requiring trucking would be loaded onto lowboy trucks one to three at a time and would traverse main roads to more main arterials such as Highway 101 or, to a lesser degree, Interstate 5. An effort would be made to use the least distance possible to transport the rock without sacrificing transport time.

California Quarries. For northern California quarries, there would be a very long haul distance required to get rock to the jetty repair areas. Barging of rock would be the only economically feasible option. Rock would be transferred by truck from the quarries along main roads leading to Highway 101 to a barge offloading facility.

Figure 15. Potential quarry locations (red dots) for repairs to MCR Jetties. See corresponding quarry information in Table 5.

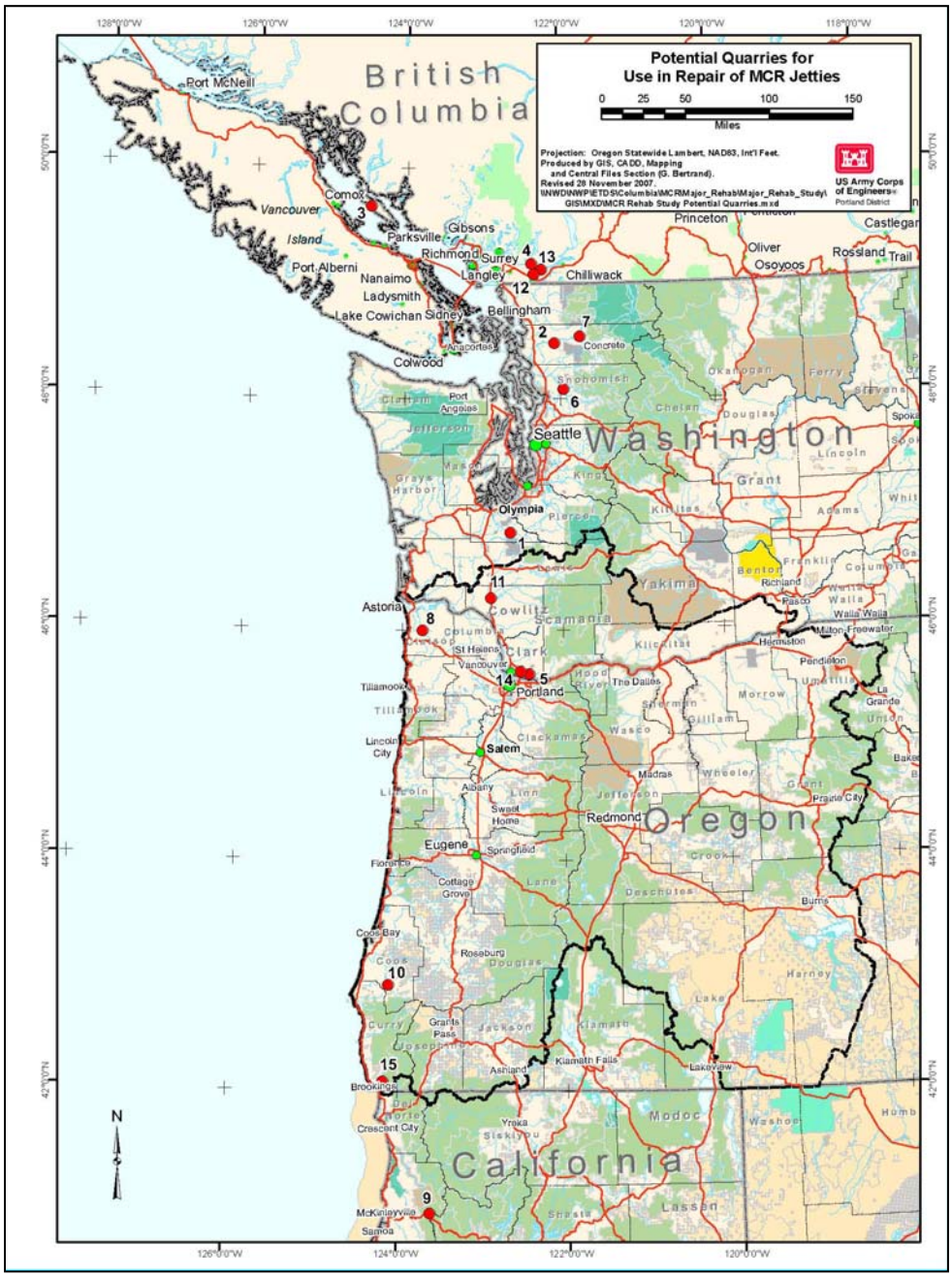


Table 5. Potential quarry and rock transport information. See Figure 27 for site map.

No.	Quarry	County and State	Nearest City	Road Miles from MCR	Unit Weight (pcf)	Reserves Available (tons)	Likely Transportation Method	Nearest Barge Facility
1	Columbia Granite Quarry	Thurston, WA	Vail, WA	129	168.5	28 M	Truck	N/A
2	Beaver Lake Quarry	Skagit, WA	Clear Lake, WA	251	181.1	1.86 M	Truck, then Barge	Anacortes, WA
3	Texada Quarry	BC, CANADA	Texada Island, BC	363	173.5+	275 M	Barge	Onsite
4	Stave Lake Quarry	BC, CANADA	Mission, BC	311	169.1	74 M	Truck, then Barge	Mission, BC, Canada
5	192nd Street Quarry	Clark, WA	Camas, WA	109	168.5	0.5 M	Truck/Barge	Camas, WA
6	Iron Mountain Quarry	Snohomish, WA	Granite Falls, WA	225	174	Unknown	Truck	N/A
7	Marble Mount Quarry	Skagit, WA	Concrete, WA	276	189.7	2 M	Truck, then Barge	Anacortes, WA
8	Youngs River Falls Quarry	Clatsop, OR	Astoria, OR	20	181.8	0.5 M+	Truck	N/A
9	Liscomb Hill Quarry	Humboldt, CA	Willow Creek, CA	515	179.1	0.5 M	Truck, then Barge	Eureka, CA
10	Baker Creek Quarry	Coos, OR	Powers, OR	275	200	Unknown	Truck, then Barge	Coos Bay, OR
11	Phipps Quarry	Cowlitz, WA	Castle Rock, WA	69	167.4	0.5 M	Truck	N/A
12	Cox Station Quarry	BC, CANADA	Abbotsford, BC	313	167.9	150 M	Barge	Onsite
13	Ekset Quarry	BC, CANADA	Mission, BC	309	172.2	10 M	Truck, then Barge	Mission, BC, Canada
14	Fisher Quarry	Clark, WA	Camas, WA	108	168.5	2 M	Barge	Camas, WA
15	Bankus Quarry	Curry, OR	Brookings, OR	347	183 & 195	0.7M	Truck, then Barge	Crescent City, CA

For water-based delivery of rock, a tow boat and barge would deliver the rock to the channel side of the Jetties where water depth, waves, and current conditions permit. During rock offloading, the barge may be secured to approximately 4 to 8 temporary dolphins/H-piles to be constructed within 200 feet of the jetty. Rock would be off-loaded from the barge by a land- or water-based crane and either placed directly within the jetty work area or stock piled on the jetty crest for subsequent placement at a later time.

For land-based delivery of rock, jetty access for rock hauling trucks would be via an existing paved road to the Benson Beach parking lot at Cape Disappointment State Park (North Jetty) and via an existing paved road to the parking lots C and D at the South Jetty. An existing overland route between Jetty A and North Jetty may also be used for land-based hauling. Work areas for delivery of rock, maneuvering of equipment, and stockpiling of rock near the Jetties have been identified and are shown in Figures 16, 17, and 18.

Barge Offloading Facilities

Stone delivery by water could require up to four barge offloading facilities that allow ships to unload cargo onto the jetty so that it can then be placed or stockpiled for later sorting and placement. The range of locations for these facilities is shown in Figures 16, 17, and 18. Depending on site-specific circumstances, offloading facilities may be converted to spur groins, may be partially removed and rebuilt, may be permanently removed, or may remain as permanent facilities upon project completion. Facility removal will depend on access needs and evolving hydraulic, wave, and jetty cross-section conditions at each offloading locations.

Facilities will range from approximately 200- to 5000-ft long (parallel to the jetty) and 20- to 50-ft wide (perpendicular to jetty), which ranges from about 0.48 to 2.41 acres in total area. For initial construction of all four facilities combined, approximately up to 96 Z- or H-piles could be installed as dolphins, and up to 373 sections of Z- or H-piles to retain rock fill. All piles will be between 12 and 16 inches in diameter. Facilities will have a 15 feet NGVD crest elevation and will be installed at channel depths between -20 and -30 NGVD. A vibratory hammer will be used for pile installation, and only untreated wood or steel piles will be used. Removal and replacement of the facilities could occur within the duration of the construction schedule. Volume and acreage of fill for these facilities are shown in Table 6.

Table 6. Approximate rock volume and area of barge offloading facilities and causeways.

Location	Approximate Length (ft)	Approximate Rock Volume (cy) Below 0 MLLW	Total Approximate Rock Volume (cy)	Approximate Square Feet	Acres
North Jetty	200	7,778	29,640 cy	21,000	0.48
Jetty A – near head	200	7,778	29,640 cy	21,000	0.48
Jetty A – mid-section causeway	5000	38,888	38,888	105,000	2.41
South Jetty – Parking Area D	450	17,417	33,688 cy	47,250	1.08
South Jetty – Along Jetty Turn-out	200		18,640 cy	21,000	0.48

Figure 16. North Jetty offloading, staging, storage and causeway facilities.

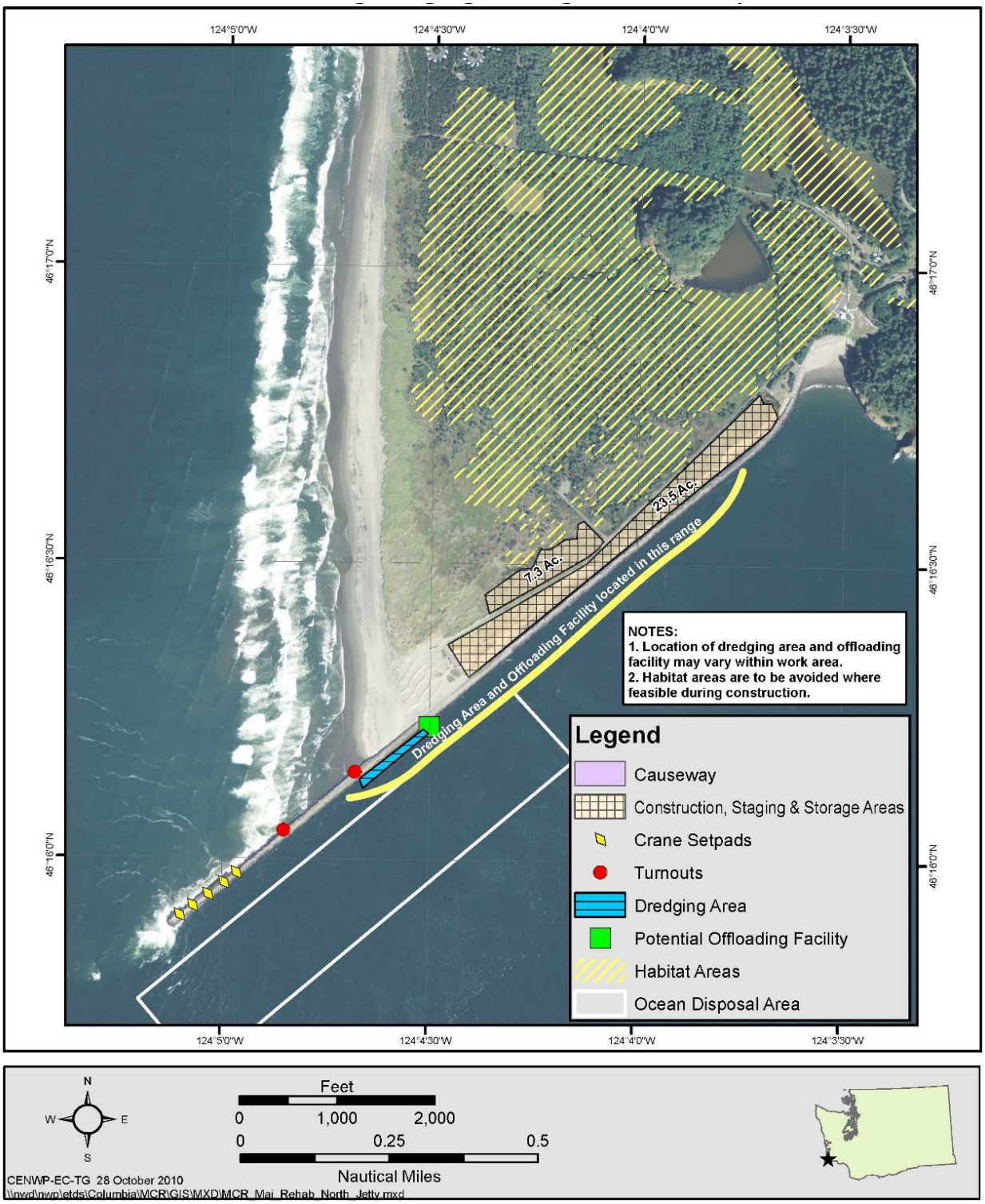


Figure 17. South Jetty offloading, staging, storage and causeway facilities.

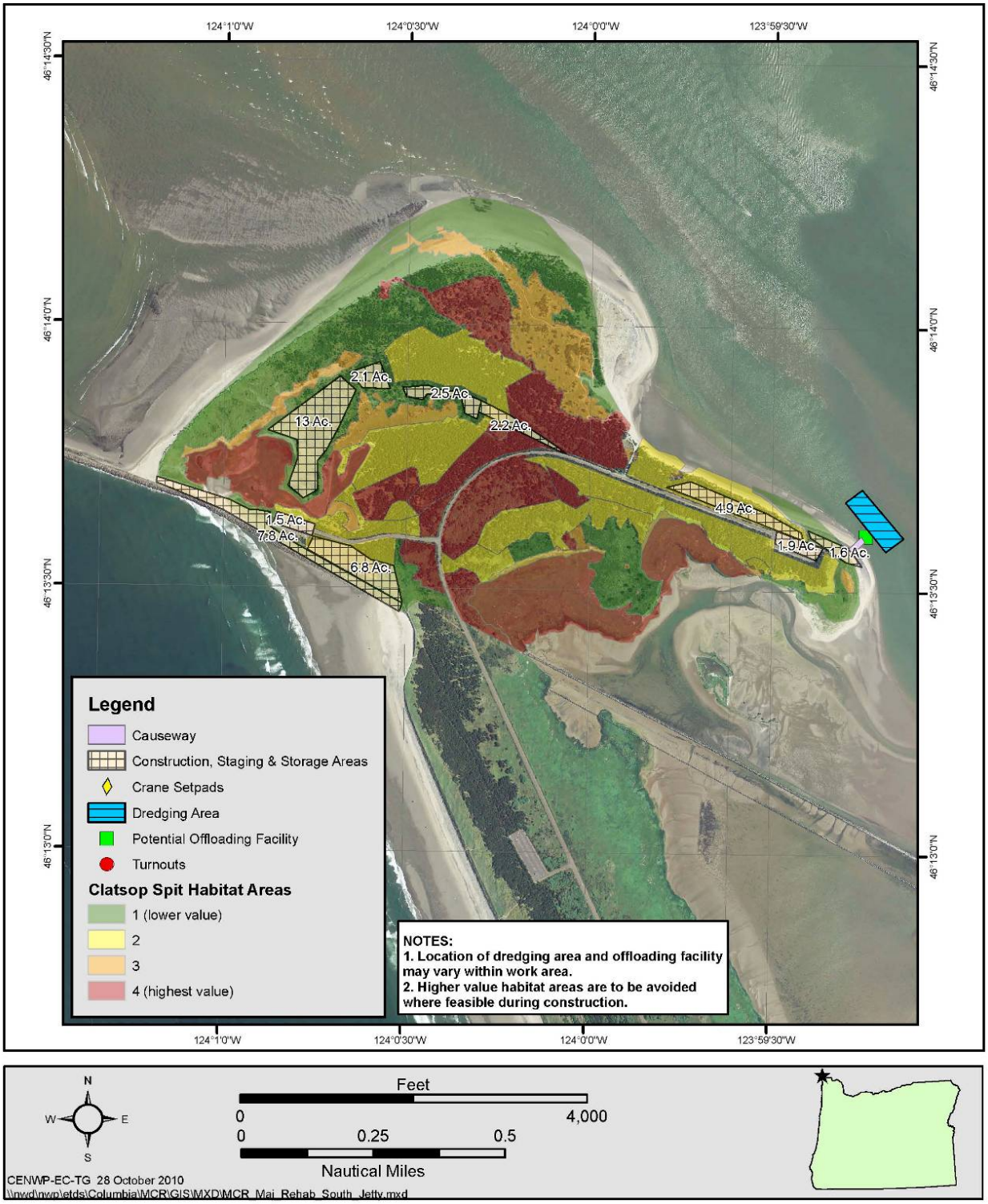


Figure 17 (continued). South Jetty offloading, staging, storage and causeway facilities.

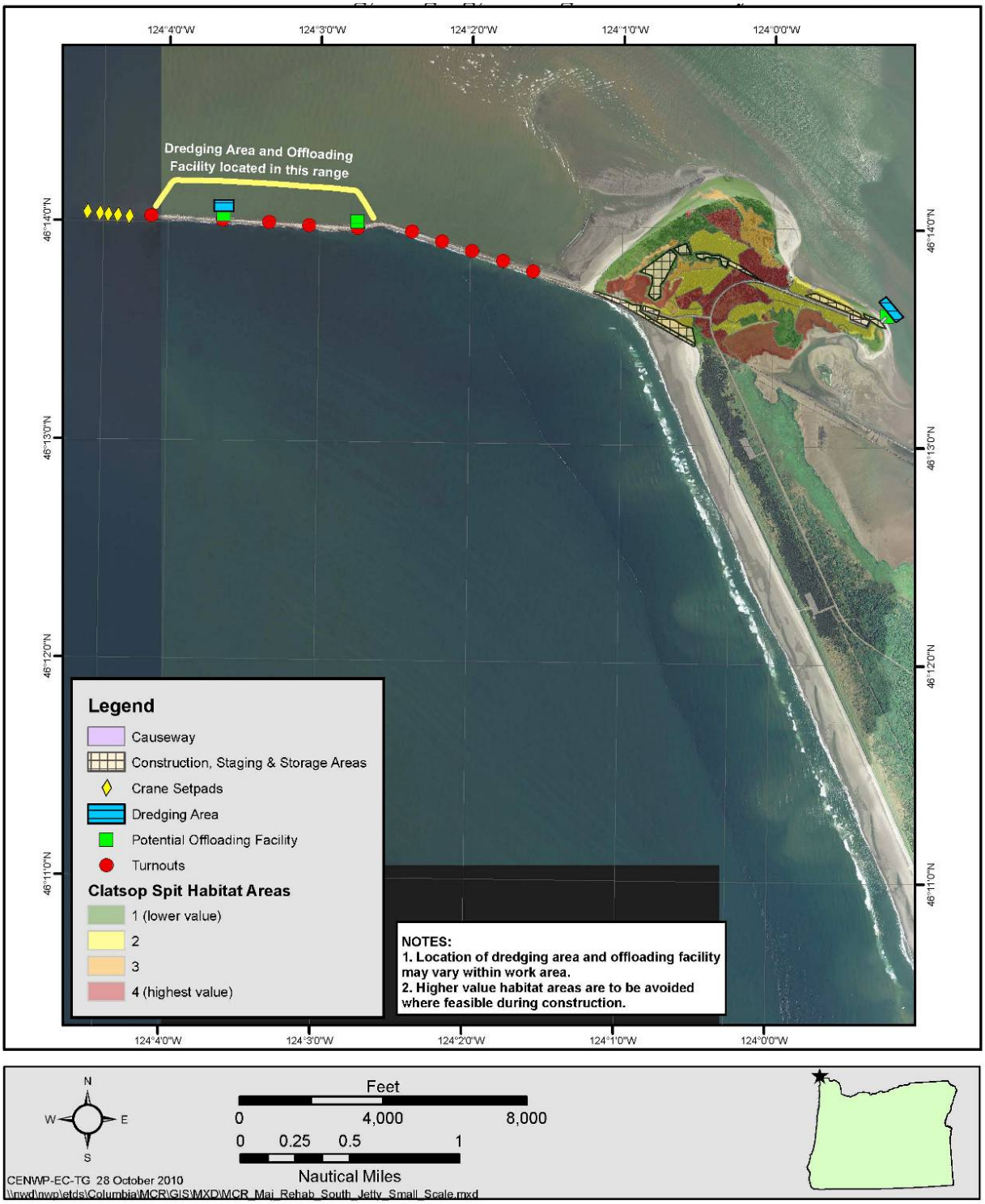
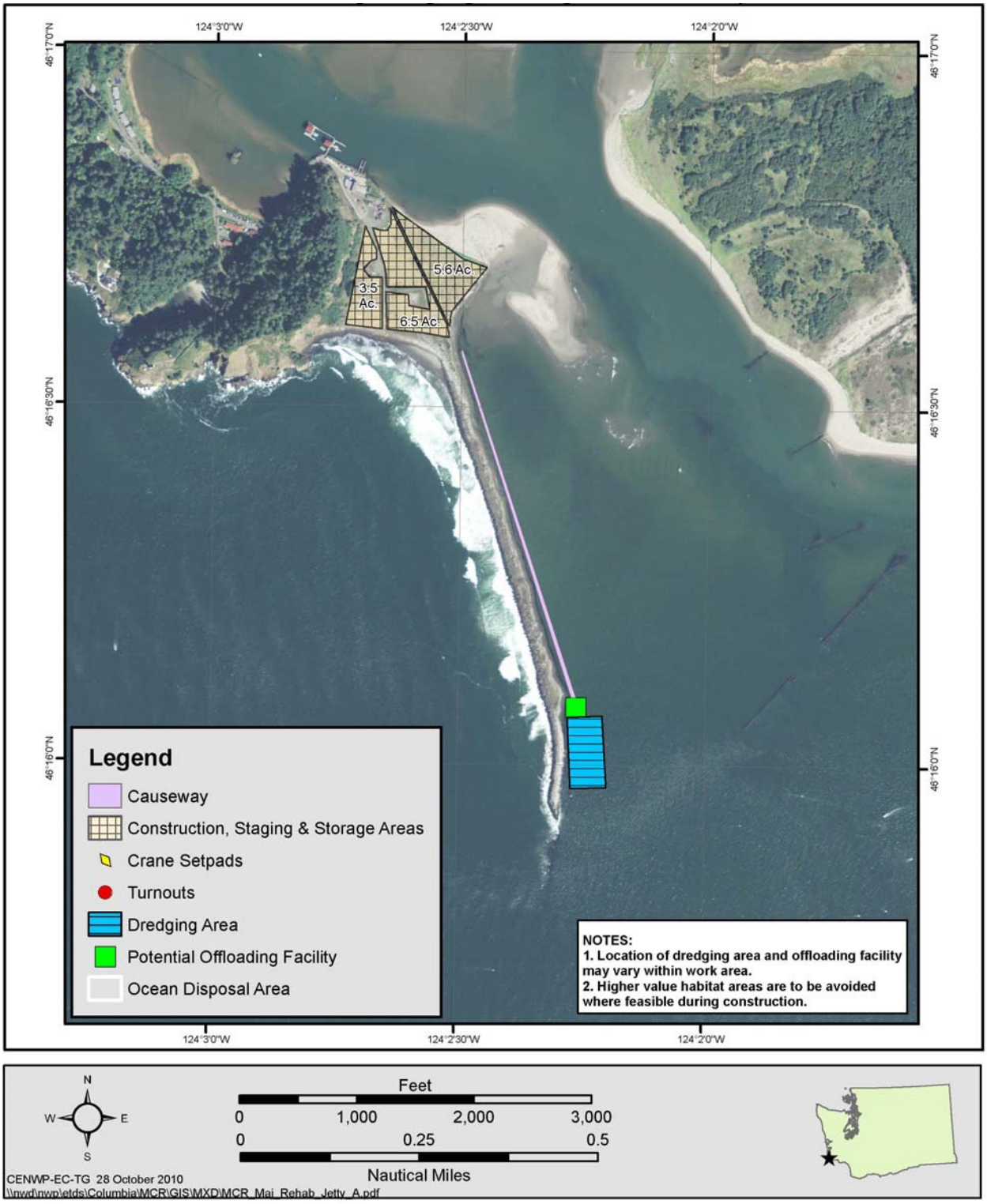


Figure 18. Jetty A offloading, staging, storage and causeway facilities.



The following existing private facilities may serve as potential offloading sites depending on availability for Corps' use:

- Commercial Site in Ilwaco. For the North Jetty, barges would pull up to a dock at Ilwaco where rock would be transferred by crane onto trucks that would proceed by public road to Cape Disappointment State Park. Trucks would then pass through the park grounds to the staging area adjacent to the jetty. For Jetty A, trucks would proceed through the Coast Guard facility to the staging area near the root of the jetty.

- Commercial Site in Warrenton. Nygaard Logging has a deep-water offloading site that could be used to offload rock. For the North Jetty/Jetty A. This site needs no improvement to accommodate deep-draft vessels.

If existing facilities are not available or do not have adequate capacity to provide access, barge offloading facilities could be constructed at each jetty, as described below:

- North Jetty: Between or on the spur groin at/between Station 50 or 70, a barge offloading facility will be constructed. If wave conditions make it feasible, the spur groin designed for this area will first function as an offloading facility prior to conversion and stone removal to reach the spur's design depth. Otherwise, a separate facility will be installed in the reach between these two stations such that wave conditions allow safe offloading. This offloading facility will require 4-8 dolphins of 3 piles each for vessel tie-up, and sheet-pile installation will be required to shore-up and retain rock at the offloading point.

- Jetty A: An offloading facility will be sited near the location of the proposed spur groin around Station 81, at the upstream portion of the jetty near the head. A 15-ft causeway will also be constructed along the entire length of the jetty on existing relic stone that runs adjacent to and abutting the upstream eastern portion of the jetty. This facility will likely remain a permanent facility, but may deteriorate due to wave and tidal action. This offloading facility will require 4-8 dolphins of 3 piles each for vessel tie-up, and sheet-pile installation will be required to shore-up and retain rock at offloading point.

- South Jetty: The South Jetty could have up to two associated offloading sites. One will be located at parking lot area D near the northeastern-most corner of the Spit. The second facility will be located along the jetty and will resemble an extra-large turn-out facility. It is likely to be located somewhere on the northern, channel-side of the jetty and west of Station 270 to take advantage of deeper bathymetry and subsequently less need for dredging. The facility at parking lot area D may be removed after 5 or more years depending on hydraulic impacts of the structure and spit. The facility along the jetty will likely be partially removed and rebuilt after each repair to avoid the potential for wave-focusing on the jetty. Otherwise, it will remain in place until around 2033. Each offloading facility will require 4-8 dolphins of 3 piles each for vessel tie-up, and sheet-pile installation will be required to shore-up and retain rock at offloading point.

Dredging for Barge Offloading Facilities. Transport of rock would most likely be done by ocean-going barges that require deeper draft (20-22 feet) and bottom clearance than river-going barges when fully loaded. Therefore, dredging will be required to develop each of the

barge offloading facilities. Under-keel clearance should be no less than 2 feet. The elevation at barge offloading sites should have access to navigable waters and a dredge prism with a finish depth no higher than -25 feet MLLW, with advance maintenance and disturbance zone depths not to extend below -32 feet MLLW. These facilities should also provide for a maneuvering footprint of approximately 400 feet x 400 feet. The depth along the barge unloading sites would be maintained during the active period for which the rock barges will be unloaded.

Subsequently, periodic maintenance may be required as facilities weather wave and current conditions at the MCR. Facilities may also occasionally be partially removed and reconstructed, which could slightly increase the frequency of disturbance. Depending on the specific facility and contemporary conditions at the time, removal would then occur at the end of the scheduled construction duration. Temporally, this limits the repetition of disturbance activities associated with the construction of these facilities. Use of the facilities may be annual with periodic breaks in between, depending on the construction schedule and conditions at the Jetties. Annual use is likely at one or more of the facilities and will be seasonally concentrated in the spring, summer, and fall. Though unlikely, occasional breaks in weather could allow offloading at other times of the year.

A clamshell dredge would likely be used for all dredging, though there is a small chance that a pipeline dredge could be feasible but is unlikely to be used. The material to be dredged is medium to fine-grained sand, typical of MCR marine sands. Disposal of material would occur in-water at an existing, approved disposal site. The volume of material to be dredged is shown in Table 7; these estimates are based on current bed morphology and may change. Also, maintenance dredging to a finish depth of -25 feet MLLW will be needed before offloading during each year of construction. Dredging is likely to occur on a nearly annual basis for the duration of the project construction period, but this will be intermittent per jetty, depending on which one is scheduled for construction in a particular year.

Table 7. Estimated dredging volumes for barge offloading facilities.

Location*	Estimated Dredging Volume (cy)		Approximate Acres
	Initial	Est. Maintenance**	
North Jetty	30,000	30,000	3.73
Jetty A	60,000	80,000	3.73
South Jetty	20,000	20,000	4.19
South Jetty - Parking Area D	20,000	20,000	4.19

* Some of the locations will not be used on an annual basis; it depends on the construction schedule for each jetty.
**All dredging will be based on surveys that indicate depths shallower than -25 feet MLLW.

Clamshell dredging will be done using a bucket operated from a crane or derrick that is mounted on a barge or operated from shore. Sediment removed from the bucket is generally placed on a barge before disposal. This type of dredge is typically used in shallow-water areas.

The following overall impact minimization practices and best management practices (BMPs) will be used for all maintenance dredging for offloading facilities:

1. To reduce the potential for entrainment of juvenile salmon or green sturgeon, the cutterheads will remain on the bottom to the greatest extent possible and only be raised 3 feet off the bottom when necessary for dredge operations.
2. To reduce turbidity, if a clamshell bucket is used, all digging passes shall be completed without any material, once in the bucket, being returned to the wetted area. No dumping of partial or half-full buckets of material back into the project area will be allowed. No dredging of holes or sumps below minimum depth and subsequent redistribution of sediment by dredging dragging or other means will be allowed. All turbidity monitoring will comply with the state of Oregon's 401 water quality certification conditions.
3. If the captain or crew operating the dredges observes any kind of sheen or other indication of contaminants, he/she will immediately stop dredging and notify the Corps' environmental staff to determine appropriate action.
4. If routine or other sediment sampling determines that dredged material is not acceptable for unconfined, in-water placement, then a suitable alternative disposal plan will be developed in cooperation with the NMFS, EPA, Oregon Department of Environmental Quality (ODEQ), Washington Department of Ecology (WDOE), and other agencies.

Dredged Material Disposal Sites. Two dredged material disposal sites, the shallow-water site (SWS) and the North Jetty site, are located near the North Jetty. These are the most likely sites to be used for the proposed action. Modeling (BA) has showed that the potential changes to the two disposal sites from the proposed action would not inhibit their use as disposal sites. Spur groin construction at the North Jetty would avoid the North Jetty disposal site. The northern-most cells of this site immediately adjacent to the jetty will be avoided to reduce the possibility of vessel impact with the spur groins.

Pile Installation and Removal

For initial construction of all four facilities combined, approximately up to 96 Z- or H-piles could be installed as dolphins, and up to 373 sections of sheet pile to retain rock fill. All piles will be between 12 and 16 inches in diameter. As mentioned earlier, inclement weather and sea conditions during the preferred in-water work window (IWWW) preclude safe working conditions during this time period. Therefore, installation of piles is most likely to occur outside the IWWW. Pile installation and subsequent removal is likely to occur once, likely in the late spring or early summer prior to or during the first season of construction on the associated jetty. The Portland District Corps of Engineers has proposed to prohibit installation of pilings associated with the major rehabilitation of the jetty system at the Mouth of the Columbia River until on or after May 1 of each year during construction of the proposed action. The change was made to prevent pile driving effects on Southern Resident Killer Whales that have been known to visit the MCR region in March or April. Subsequently, periodic maintenance may be required as piles weather barge use and wave and current conditions at the MCR. Piles may also occasionally be partially removed and installed, which could slightly increase the frequency of disturbance.

The piles will be located within 200 feet of the jetty structure. Because the sediments in the region are soft (sand), use of a vibratory driver to install piles is feasible and the only pile driving method that Corps is proposing. The presence of relic stone may require locating the piling further from the jetty so that use of this method is not precluded by the existing stone. The dolphins/Z- and H-piles would be composed of either untreated timber or steel piles installed to a depth of approximately 15 to 25 feet below grade in order to withstand the needs of off-loading barges and heavy construction equipment. Because vibratory hammers will be implemented in areas with current velocities greater than 1.6 feet/second, the need for hydroacoustic attenuation is not an anticipated issue. Piling will be fitted with pointed caps to prevent perching by piscivorous birds to minimize opportunities for avian predation on listed species. Some of the pilings and offloading facilities may be removed at the end of the construction period.

Rock Placement

Placement of armor stone and jetty rock on the MCR jetties would be accomplished by land or limited water-based equipment. Only clean stone will be used for rock placement, where appropriate and feasible. Where appropriate, there may also be some re-working and reuse of the existing relic and jetty prism stone. Fill for the jetty haul roads will not be cleaned prior to installation. Dropping armor stone from a height greater than 2 feet will be prohibited. During placement there is a very small chance of stone slippage down the slope of the jetty. However, this is unlikely to occur due to the size and cost of materials and placement.

A jack-up barge may also be used to do water-based rock placement. This would only be applicable at the South Jetty. For armor stone and rock placement at the head, a jack-up barge with crane could be used to serve as a stable work platform. Once into place, the jack-up barge would be jacked up on six legs so that the deck is at the same elevation as the jetty. The legs are designed to use high-pressure water spray from the end of the legs to agitate the sand and sink the legs under their own weight. The jacking process does not use any lubricants that contain oils, grease, and/or other hydrocarbons. The stone and rock will be barged to the jackup barge and offloaded onto the jetty head. The jackup barge will keep moving around the head of the jetty to complete the work. A jack-up barge would not be used on the North Jetty or Jetty A to avoid interference with navigation of fishing boats and crab and fish migrations.

For land-based rock placement, a crane or a large track-hoe excavator could be situated on top of the jetty. The placement operation would require construction of a haul road along the jetty crest within the proposed work area limits. The crane or excavator would use the haul road to move along the top of jetty. Rock would be supplied to the land-based placement operation by land and/or marine-based rock delivery. For marine-based rock, the land-based crane or excavator would pick up rock directly from the barge or from a site on the jetty where rock was previously offloaded and stockpiled, and then place the rock within the work area. For land-based rock, the crane or excavator would supply rock via a truck that transports rock from the stockpile area. The crane or excavator would advance along the top of the jetty via the haul road as the work is completed.

In order to place stones, a haul road will be constructed on the 30-foot crest width of each jetty to allow crane and construction vehicle access. Roads will consist of an additional 3 feet of top fill

material, which could also entail an additional 2 feet of width spill-over. These roads will remain in place for the duration of construction. Due to ocean conditions and the wave environment, these roads will likely need yearly repair and replacement. They will not be removed upon completion. Ramps from the beach up to the jetty road will also be constructed to provide access at each jetty.

At approximately 1,000-foot intervals, turnouts to allow equipment access and passage will be constructed on the North and South jetties. These will consist of 50-foot long sections that are an additional 20 feet wide. Some of this stone for these facilities may encroach below MLLW. On the North Jetty, there will be approximately two turnouts. South Jetty will have approximately eight turnouts with two additional larger-sized turnouts. These larger turnouts will be in the range of 300 feet long with an additional 20-foot width. One of these larger turnouts will function as an offloading facility on South Jetty. At Jetty A, the causeway will function as the turnout facility.

Towards the head of each jetty, additional crane set up pads will be constructed at approximately 40-foot increments to allow crane operation during the placement of the larger capping stones. Set-up pads will roughly entail the addition of 8 extra feet on each side of the crest for a length of about 50 feet. Some of this stone for these facilities may encroach below MLLW. Approximately five set-up pads will be required to construct each jetty head.

Construction Staging, Storage, and Rock Stock Piles

Jetty repairs and associated construction elements would entail additional footprints for activities involving equipment and supply staging and storage, parking areas, access roads, scales, general yard requirements, and rock stock pile areas. For the most efficient work flow and placement, a 2-year rock supply would be maintained on site and would be continuously replenished as placement occurred on each jetty. In order to estimate the area needed, a surrogate area was determined for a reference volume of 8,000 cy, which was then used to extrapolate the area needed at each jetty. These results are shown in Table 8.

Table 8. Acreages needed for construction staging, storage, and rock stock piles.

Location	Approximate Acres
North Jetty	31
Jetty A	23
South Jetty	44

Several actions will be taken to avoid and minimize impacts from these activities. Staging and stockpiles will remain above MHHW, and where feasible have also been sited to avoid impacts to wetlands and habitats identified as having higher ecological value. In order to maintain erosive resilience along the shoreline, a vegetative buffer will be preserved. When available and possible, partial use will be made of existing parking lots. Additional measures specific to each jetty have also been considered. Besides access roads in the areas identified in Figures 16, 17 and 18, no additional roadways or significant roadway improvements are anticipated. Some roadway

repair and maintenance will likely be required on existing roads experiencing heavy use by the Corps.

At the North Jetty, the lagoon and wetland fill necessary for root stabilization will also serve a dual purpose as for the bulk of staging and storage activities. At the South Jetty, a small spur road will be required to connect the existing road with the proposed staging area and is indicated in Figures 16, 17, and 18. The existing road along the neck of the South Jetty that will be used for dune augmentation work may require minor repair/improvements for equipment access. Construction access to the area receiving dune augmentation will be limited to an existing access road along the relic jetty structures at the neck of the spit. Equipment will be precluded from delivery using the access point from parking lot B in order to avoid impacts to water quality and razor clam beds in the vicinity of the proposed dune fill area. Grading equipment may have to access the area by driving along the shore, but this route will be used as a last resort and equipment will be limited to dry sand where feasible. Additionally, the proposed actions will avoid the more sensitive habitat areas south of parking lot D.

If possible, the project will avoid and minimize impacts to the adjacent marshland by allowing crossing between the construction area and jetty via a Bailey bridge, which may require small removable abutments on either end of the marsh crossing. Otherwise a series of culverts and associated fill will be installed, or equipment will be required to enter and exit from the same access road on the northeast end of the main staging area indicated in Figures 16, 17 and 18.

Additionally, at the outlet of the marsh complex a culvert will be installed under the construction access road, which will allow continuous hydrologic connectivity between affected portions of the marsh and ocean exchange through the jetty. This will also avoid equipment passage through marsh waters. To connect the staging area to the jetty haul road, a temporary gravel access road would be constructed from the staging area nearest the jetty to the jetty crest. The access road would measure approximately 400 feet in length by 25 feet in width, would be above MHHW, would require approximately 4,000 cy of sand, gravel and rip rap, and would require the installation and removal of a temporary culvert near station 178+00 to maintain tidal exchange into and out of the intertidal wetland and through the jetty. The staging areas and haul roads, except for the jetty haul road, would be removed and restored to pre-construction conditions once repairs to the jetty are completed.

Prior to in-water work for installing the construction access road and culverts across the southern portion of the marsh wetland outlet at the South Jetty, the Corps will conduct fish salvage and implement fish exclusion to and from the wetland complex upstream of the proposed culvert. Also, post-installation of the culvert, the Corps will develop and implement fish monitoring as necessary to ensure that no listed fish species are stranded. If listed fish species are found, NMFS will be contacted immediately to determine the appropriate course of action.

For the previous North and South Jetties rehabilitation, the Corps conducted fish monitoring in the marsh wetland at the South Jetty. During monitoring, non-listed species, *e.g.*, threespine stickleback (*Gasterosteus aculeatus*), were observed in the marsh wetland. No salmon, green sturgeon, or eulachon were observed. The NMFS does not expect listed species to occur in the marsh wetland based on previous monitoring information. In addition, the marsh wetland

location at the backside of the South Jetty, and the sub-marginal habitat—intermittent wetland with poor water quality and dense algae—make listed species presence unlikely.

At Jetty A, adequate area may not be available for the estimated storage and staging needs. Therefore, construction sequencing will accommodate the supply that can be fit into the acreage available. Land-based delivery options may be precluded due to road access constraints, though some existing access may prove available and feasible depending on load and truck sizes.

The following measures will also be required at each location to further avoid and minimize impacts to species. Before significant alteration of the project area, the project boundaries will be flagged. Sensitive resource areas, including areas below ordinary high water, wetlands and trees to be protected will be flagged. Chain link fencing or something functionally equivalent will likely encircle much of the construction areas.

Temporary Erosion Controls

Temporary erosion controls will be in place before any significant alteration of the site. If necessary, all disturbed areas will be seeded or covered with coir fabric at completion of ground disturbance to provide immediate erosion control. Erosion control materials (and spill response kits) will remain on-site at all times during active construction and disturbance activities (*e.g.*, silt fence, straw bales). If needed these measures will be maintained on the site until permanent ground cover or site landscaping is established and reasonable likelihood of erosion has passed. When permanent ground cover and landscaping is established, temporary erosion prevention and sediment control measures, pollution control measures and turbidity monitoring will be removed from the site, unless otherwise directed.

An erosion sediment and pollution control plan (ESPCP) or stormwater pollution prevention plan (SWPPP), as applicable to each State, will outline facilities and BMPs that will be implemented and installed prior to any ground disturbing activities on the project site, including mobilization. The Corps retains a general 1200-CA permit from Oregon Department of Environmental Quality (DEQ), and will also work with US Environmental Protection Agency (EPA) to obtain use of the NPDES general permit for stormwater discharge from construction activities. At a minimum, these ESCP and SWPPP plans will include the following elements and considerations. Construction discharge water generated on-site (debris, nutrients, sediment and other pollutants) will be treated using the best available technology. Water quality treatments will be designed, installed, and maintained in accordance with manufacturer’s recommendation and localized conditions. In addition, the straw wattles, sediment fences, graveled access points, and concrete washouts may be used to control sedimentation and construction discharge water. Construction waste material used or stored on-site will be confined, removed, and disposed of properly. No green concrete, cement grout silt, or sandblasting abrasive will be generated at the site.

Emergency Response

To avoid the need for emergency response, a Corps Government Quality Assurance Representative will be on-site or available by phone at all times throughout construction. Emergency erosion/pollution control equipment and BMPs will be on site at all times; Corps

staff will conduct inspections and ensure that a supply of sediment control materials (*e.g.*, silt fence, straw bales), hazardous material containment booms and spill containment booms are available and accessible to facilitate the cleanup of hazardous material spills, if necessary.

Hazardous Materials

Spill Containment and Control (BA). A description of spill containment and control procedures will be on-site, including: notification to proper authorities, specific cleanup and disposal instructions for different products, quick response containment and cleanup measures that will be available on the site including a supply of sediment control materials, proposed methods for disposal of spilled materials, and employee training for spill containment. Generators, cranes, and any other stationary power equipment operated within 150 feet MHHW will be maintained as necessary to prevent leaks and spills from entering the water. Vehicles / equipment will be inspected daily for fluid leaks and cleaned as needed before leaving staging and storage area for operation within 150 feet of MHHW. Any leaks discovered will be repaired before the vehicle / equipment resumes service. Equipment used below MHHW will be cleaned before leaving the staging area, as often as necessary to remain grease-free. Additionally, the Corps proposes to use a Wiggins fast fuel system or equivalent to reduce leaks during fueling of cranes and other equipment in-place on the Jetties. Also, spill pans will be mounted under the crane and monitored daily for leaks.

Water Quality Monitoring. In-water work will require turbidity monitoring that will be conducted in accordance with 401 water quality certifications conditions to ensure the project maintains compliance with State water quality standards. Dynamic conditions at the Jetties in the immediate action area preclude the effective use of floating turbidity curtains (or approved equal). BMPs will be used to minimize turbidity during in-water work. Turbidity monitoring will be conducted and recorded each day during daylight hours when in-water work is conducted. Representative background samples will be taken according to the schedule set by the resource agencies at an undisturbed area up-current from in-water work. Compliance samples will be taken on the same schedule, coincident with timing of background sampling, down-current from in-water work. Compliance sample will be compared to background levels during each monitoring interval. Additional 401 water quality certification conditions and protocols may be required.

Habitat Improvement Projects. The Corps has incorporated a suite of habitat improvement projects to assist with the recovery of ESA-listed species. These actions are not proposed to directly mitigate or compensate for any project-related impacts to listed species, but are proposed as conservation measures under section 7(a)(1) of the ESA. These actions represent the Corps' affirmative commitment to fulfill responsibility to assist with conservation and recovery of ESA-listed species.

Habitat improvement features will be designed to create or improve fish habitat, specifically tidal marsh, swamp, and shallow-water and flats habitat, and to improve fish access to these habitat features. Habitat improvement projects currently address three general categories: actions that create, improve, and restore wetlands; actions that improve in-water habitats, and actions that restore upland habitats. From the list of possible habitat improvement features shown in Table 9,

one or a combination of projects will be selected for further development and implementation. Selection will occur with input from the AMT, and work is likely to be completed concurrently with jetty repair actions.

Actions intended to provide benefits and improvements to in-water habitat include levee breaches, inlet improvements, or tide gate retrofits, as appropriate. Additional associated actions include: (1) Excavation in sand dunes and uplands to specified design elevations in order to create additional intertidal shallow-water habitat with dendritic channels and mud flats; and (2) excavation for potential expansion of the floodplain terraces.

Specific opportunities for additional projects such as the following were not identified but could warrant further investigation if none of the projects in the list is determined to be feasible: (1) Removal of overwater structures and fill in the estuary; (2) removal of relic pile-dike fields; (3) removal of fill from Trestle Bay or elsewhere; (4) removal of shoreline erosion control structures and replacement with bioengineering features; (5) beneficial use of dredged material to create ecosystem restoration features (Lois Island Embayment from Columbia River Channel Improvement is an example that may be applicable here); and (6) restoration of eelgrass beds. Certain pile fields and engineering features may be providing current habitat benefits that could be lost with removal, and such actions would require appropriate hydraulic analysis coordination with engineers and resource agencies.

For potential habitat improvement projects located in Trestle Bay, there are additional monitoring and assessment opportunities. A separate hydraulic/engineering study should investigate whether or not an expansion of low-energy, intertidal habitat near Swash Lake could effectively provide additional storage capacity and affect circulation in the Bay such that erosive pressure at neck of Clatsop Spit could be reduced. It would be worth evaluating whether or not projects that expand floodplain and intertidal areas in the Bay provide significant energy dissipation and additional low-energy storage capacity to offset or redirect erosive pressures. Alternatively, if other habitat improvement concepts are pursued that include removal of additional piles or creation of additional inlets; it would be worth investigating whether these actions could have indirect positive impacts that further reduce concern with erosion at the neck. Evaluating actions in this light would provide valuable information and insight regarding possible solutions and concerns for erosion and breaching at the neck area of Clatsop Spit on Trestle Bay.

Monitoring and maintenance of habitat improvement actions will likely be required to ensure successful establishment of goals and satisfactory return on investment. Regular coordination with the AMT will further facilitate selection and implementation of habitat improvement actions.

Wetland Mitigation. As required under section 404 of the Clean Water Act, the Corps will mitigate for impacts to wetlands that could not be otherwise avoided or minimized. The Corps estimated that 38.28 acres of wetlands will be filled in association with the proposed action, and the Corps will mitigate at a 2:1 ratio for a total of 76.56 acres of restored wetland habitats. Wetland mitigation plans currently address three general categories: actions that create, improve, and restore wetlands; actions that improve in-water habitats, and actions that restore

upland habitats. From the list of possible wetland mitigation and habitat improvement features shown in Table 9, one or a combination of projects will be selected for further development and implementation. Selection will occur with input from the AMT, and work is likely to be completed concurrently with jetty repair actions.

Wetlands and shallow-water habitat will be filled as a result of the project. Official wetland delineations have not yet been completed for all three of the Jetties. However, available preliminary information has allowed the project delivery team (PDT) to site construction activities and features to reduce anticipated impact to wetlands. This information has also been used to calculate initial estimates regarding the possible acreage of impacts. The approximated acreages identified as potentially impacted are North Jetty ~4.78 acres, South Jetty up to ~22 acres and Jetty A up to ~11 acres. This comes to an estimated total of ~38.28 acres of potential wetlands impacts. To reiterate, official delineations must be completed, and these numbers will be revised accordingly after report results and project design details are further developed and available. These estimates are on the conservatively high end of what final wetland impacts will likely be.

In-water habitats, both shallow intertidal and deeper subtidal areas will also be affected by the project. Changes to in-water habitats will occur from maintenance dredging and from placement of the spur groins, jetty cross-sections, turnouts, barge offloading facilities, and causeways. There will also be permanent lagoon fill at the North Jetty root. Without drawing a distinction between depths, initial acreage estimates for all in-water impacts include North Jetty ~11.75 acres, South Jetty ~21.2 acres, and Jetty A ~7.23 acres. This comes to an approximated total of ~40.18 acres of potential in-water conversions. Shallow-water habitat is especially important to several species in the estuary; therefore, specific initial estimates were also calculated regarding shallow-water habitat (defined as -20 feet to -23 feet below MLLW). About 30 acres (out of the ~40 acres mentioned above) of area at these depths will be affected by groins, maintenance dredging, and construction of the causeways and barge offloading facilities. However, this estimate does not include any expansion of the jetty's existing footprint or overwater structures from barge offloading facilities. The approximate acreage breakdowns entail: spur groin fill = 1.56 acres (defined as -20 feet or less below MLLW; ~3.26 acres total area including all depths); dredging areas for barges ~20 acres, likely all shallow (less than -23 feet below MLLW); and causeway fill~ 7 acres, likely all shallow (less than -23 feet deep below MLLW). For this analysis, there was no distinction drawn between periodically exposed intertidal habitat and shallow-water sandflat habitat. As with wetland estimates, these approximations will be updated as project designs are refined and as additional analyses and surveys are completed to quantify changes in jetty and dune cross-sections.

Table 9. Possible wetland mitigation and habitat improvement features.

Feature/Site	Area Affected	Type and Function
Trestle Bay	5-8 acres with potential of additional acres	Estuarine Saltwater Marsh Wetland and Intertidal Mudflat Creation and Restoration • Create and expand estuarine intertidal brackish saltwater marsh wetland habitat. • Expand and restore Lyngby sedge plant community. • Expand/increase intertidal shallow-water habitat, including dendritic mud flats and off-channel habitat. • Remove and control invasive species and improve/restore diversity and density of native plant assemblages. • Increase habitat complexity for fisheries benefit. • Potentially expand floodplain terrace and improve riparian function. • (Re)introduce natural tidal disturbance regime to area currently upland dunes.
Walooskee to Youngs Bay	~151 acres	Levee Breach for Estuarine Emergent Wetland and Brackish Intertidal Shallow-water Habitat Restoration • Restore connection between Walooskee and Youngs River via levee breach. • Restore and expand estuarine intertidal brackish marsh wetland habitat. • Expand and restore Lyngby sedge and native estuarine vegetation community to improve trophic foodweb functions. • Restore and expand brackish intertidal shallow-water habitat including dendritic mud flats and off-channel edge habitat. • Remove and control invasive species and improve/restore diversity and density of native plant assemblages. • Increase habitat access and complexity for fisheries benefit including expanded foraging, rearing, and refugia habitat types. • Improve riparian function. • Potentially restore floodplain terrace and increase flood storage capacity. • (Re)introduce natural tidal disturbance regime to area currently diked pasture land. • Restore hydrologic regime and restore/improve water quality function. • Improve capacity for additional carbon sequestration via native root masses. • Increase and restore hyporheic functions for improved water quality and potential creation of cold water refugia.
Walooskee to Youngs Bay	~39 acres	Levee Breach and/or Tide Gate Retrofits for Emergent Wetland and Intertidal Shallow-water Habitat Restoration • Restore connection with Walooskee River via levee breach and/or tide gate retrofits. • Restore and expand intertidal marsh wetland habitat. • Expand and restore native vegetation community to improve trophic foodweb functions. • Restore and expand intertidal shallow-water habitat including dendritic and off-channel edge habitat. • Remove and control invasive species and improve/restore diversity and density of native plant assemblages. • Increase habitat access and complexity for fisheries benefit including expanded foraging, rearing, and refugia habitat types. • Improve riparian function. • Potentially restore floodplain terrace and increase flood storage capacity. • Restore hydrologic and natural tidal disturbance regime and restore/improve water quality function to area currently functioning as diked pasture land. • Improve capacity for additional carbon sequestration via native root masses. • Increase and restore hyporheic functions for improved water quality and potential creation of cold water refugia.
Slough to Youngs River	~250-500 acres	Levee Breach for Estuarine Wetland and Intertidal Restoration • Restore connection between Slough and Youngs River via levee breach. • Restore and expand estuarine intertidal brackish marsh wetland habitat. • Expand and restore Lyngby sedge and native estuarine vegetation community to improve trophic foodweb functions. • Restore and expand brackish intertidal shallow-water habitat including dendritic mud flats and off-channel edge habitat.

Feature/Site	Area Affected	Type and Function
		• Remove and control invasive species and improve/restore diversity and density of native plant assemblages. • Increase habitat access and complexity for fisheries benefit including expanded foraging, rearing, and refugia habitat types. • Improve riparian function. • Potentially restore floodplain terrace and increase flood storage capacity. • Restore hydrologic and natural tidal disturbance regimes to an area currently functioning as diked pasture land. • Improve capacity for additional carbon sequestration via native root masses. • Increase and restore hyporheic functions for improved water quality and potential creation of cold water refugia.
Youngs River - Diked Farmland, Freshwater Intertidal Restoration	45-50 acres With potential up to 80 acres	Levee Breach for Wetland and Intertidal Restoration • Restore connection with Youngs River via levee breach. • Restore and expand freshwater intertidal wetland habitat. • Expand and restore native vegetation community to improve trophic foodweb functions. • Restore and expand intertidal shallow-water habitat including dendritic mud flats and off-channel edge habitat. • Remove and control invasive species and improve/restore diversity and density of native plant assemblages. • Increase habitat access and complexity for fisheries benefit including expanded foraging, rearing, and refugia habitat types. • Improve riparian function. • Potentially restore floodplain terrace and increase flood storage capacity. • (Re)introduce natural tidal disturbance regime to area currently diked pasture land. • Restore hydrologic regime and restore/improve water quality function. • Increase and restore hyporheic functions for improved water quality and potential creation of cold water refugia.
Tributary Cr. to Youngs River	~5 or more acres	Estuarine Wetland and Intertidal Restoration; Tributary Reconnection to Youngs Bay • Convert diked pasture land to brackish estuarine wetland and shallow-water intertidal habitat. • Improve and restore hydrologic regime and increase regular hydrologic connectivity between Crosel Cr. And Youngs Bay estuary. • Improve and restore fish passage and provide access throughout greater range of flows to off-channel juvenile rearing, refuge and foraging habitats. • Remove and control invasive species and improve/restore diversity and density of native plant assemblages. • Increase habitat complexity for fisheries benefit. • Improve adult salmonid access to headwaters and potential spawning habitat. • Potentially expand floodplain terrace and improve riparian function. • (Re)introduce natural flow regime and tidal disturbance regime to area currently functioning as pasture land.
Tributary Cr. and Slough to the Columbia River - near Clatskanie	Up to ~43 acres	Levee Breach and/or Tide Gate Retrofits for Emergent Wetland and Intertidal Shallow-water Habitat Restoration and Tributary Reconnection • Restore connection between Tandy and Graham creeks and Westport Slough and Columbia River via levee breach and/or tide gate retrofits. • Restore and expand intertidal wetland habitat. • Expand and restore native vegetation community to improve trophic foodweb functions. • Restore and expand intertidal shallow-water habitat including dendritic and off-channel edge habitat. • Remove and control invasive species and improve/restore diversity and density of native plant assemblages. • Increase habitat access and complexity for fisheries benefit including expanded foraging, rearing, and refugia habitat types. • Improve riparian function. • Potentially restore floodplain terrace and increase flood storage capacity. • Restore hydrologic and natural tidal disturbance regime and restore/improve water quality function to area currently functioning as diked pasture hayfields.

Feature/Site	Area Affected	Type and Function
		• Improve capacity for additional carbon sequestration via native root masses. • Increase and restore hyporheic functions for improved water quality and potential creation of cold water refugia. • Improve adult salmonid access to headwaters and potential spawning habitat.
Knappa - Warren Slough	~100 or more acres	Preservation and Expansion of Estuarine Intertidal Restoration; Improve Tributary Reconnection for Fish Passage • Maintain and enhance evolving restoration that has occurred since inundation of previously diked pasture land to estuarine wetland and shallow intertidal habitat. Maintain restored ecosystem function and intertidal shallow-water habitat established post-breach. • Maintain and enhance restored hydrologic regime and increase regular hydrologic connectivity between Hall Cr. and Warren Slough. • Maintain and improve existing fish passage and provide access throughout greater range of flows to off-channel juvenile rearing, refuge and foraging habitat types. • Maintain and increase habitat complexity for fisheries benefit. • Improve adult salmonid access to headwaters and potential spawning habitat. • Remove and control invasive species and improve/restore diversity and density of native plant assemblages; Improve riparian function as appropriate. • Potentially expand floodplain terrace. • Maintain restored natural tidal disturbance regime, dendritic channels, and connection between Hall Cr. and Warren Slough.
Snowy Plover Work on Clatsop Spit	Up to ~22 acres	Forego Revegetation and Convert Upland Areas to Snowy Plover Habitat • Convert upland scrub-shrub habitat with invasive species to snowy plover habitat via periodic tilling and application of shell hash.
Wetland Creation at Cape Disappointment	Up to ~10 acres	Creation and Expansion of Interdunal Wetland Complex • Excavation of new interdunal wetlands adjacent to existing wetlands. • Establishment of native wetland plant communities and removal of invasive species around a buffer zone. • Restoration or provision of hydrology to newly excavated wetlands via appropriate elevation design. • Restoration of wetland connectivity between existing fragmented wetlands via culvert retrofits, if feasible.
Tide Gate Retrofits for Salmonid Passage	Variable	Select Tributaries from ODFW Priority Culvert Repair List - Tributary Reconnection • Restore and improve existing fish passage and provide access throughout greater range of flows to off-channel juvenile rearing, refuge and foraging habitat types. • Restore and increase habitat complexity for fisheries benefit. • Restore and improve adult salmonid access to headwaters and potential spawning habitat.

The Corps seeks to achieve no net loss in wetland habitat; to protect, improve and restore overall ecosystem functions; and to provide actions that would benefit listed species in the vicinity of the project. Towards that end, specific project footprints and activities described above have been identified, categorized, and quantified with conservative estimates where appropriate. The calculated extents were strictly based on the area of habitat that was converted. They did not include value or functional assignments regarding the significance of the conversion; whether it would be beneficial, neutral, or detrimental effect; or whether conversions would create unforeseen, indirect far-field effects. For example, acreage of conversion for shallow sandy sub-tidal habitat to rocky sub-tidal habitat was calculated in the same manner as conversion from shallow intertidal habitat to shallow sub-tidal habitat. Per initial consultation with resource agencies, a preliminary suggested ratio of 2:1 for wetland mitigation will likely be required.

Specific opportunities have been identified in the Columbia River estuary and Youngs Bay (Table 9) and are under consideration to improve and restore functions affected in each of the generalized habitat categories (wetland, in-water, and upland). Depending on further development of wetland mitigation and habitat improvement alternatives, a specific project or combination of projects will be designed and constructed concurrently as the proposed repair and rehabilitation options are completed over time. Mitigation actions and extents will be commensurate with wetland impacts and ratios identified. Proposed projects are subject to further analysis, and unforeseen circumstances may preclude further development of any specific project. In all cases, final selection, design, and completion of specific improvement features is contingent on evolving factors and further analyses including hydraulic and hydrologic conditions, real estate actions, cultural resource issues, *etc.* For this reason a suite of potential proposals has been identified, and subsequent selection of one or some combination of projects and designs will occur during continued discussion with resource agencies participating on the AMT. Depending on the projects selected for wetland mitigation, some of these wetland restoration actions may require separate consultations under the ESA.

Actions adjacent to or in the vicinity of the North and South Jetties that could potentially mitigate wetland impacts include: (1) Excavation of low and high saltwater marsh wetlands and new interdunal wetlands adjacent to existing wetlands; (2) establishment of native wetland plant communities and removal of invasive species around a buffer zone for wetlands; (3) restoration or provision of hydrology to newly excavated wetlands via appropriate elevation design; and (4) restoration of wetland connectivity between existing fragmented wetlands.

Post-construction upland restoration would include the following actions: (1) Re-establishing native grasses, shrubs, and trees where appropriate; (2) controlling and removing invasive species like scotch broom and European beach grass in the project vicinity; and (3) re-grading/tilling the area to restore natural contours.

Monitoring and maintenance of wetland mitigation actions will likely be required to ensure successful establishment of goals and satisfactory return on investment. Regular

coordination with the AMT will further facilitate selection and implementation of wetland mitigation actions.

Action Area

"Action area" means all areas to be affected directly or indirectly by the action and not merely the immediate area involved in the action (50 CFR 402.02). For this consultation, the action area (Figure 1) includes: (1) An area extending 6.2 miles offshore of Columbia River mile -1; (2) an area extending 6.2 miles north and 6.2 miles south of the Columbia River mile -1; and (3) The Columbia River from river mile zero to river mile 13.5.

This action area is based on the effects from pile installation and removal which will extend over a 6.2 mile radius, including behavioral effects to marine mammals.

NMFS initially considered a larger action area that included off-shore shipping lanes associated with barge traffic for rock transport. However, at the time of this consultation it is unknown where the rock will come from. Because rock may be transported from any or all of the quarries identified as potential rock sources listed in Table 5, NMFS did not have sufficient information to consult on the potential effects. What we do know is that rock will be delivered to the MCR Jetties, and that effects associated with barge traffic will occur within the action area as defined above.

Federally-listed anadromous fish, marine mammals, and turtle species are present in the action area (Table 10), as well as EFH species including five coastal pelagic species, 40 Pacific Coast groundfish species, and coho, Chinook, and pink salmon (Table 18).

Table 10. Federal Register notices for final rules that list threatened and endangered species, designate critical habitats, or apply protective regulations to listed species considered in this consultation. Listing status: 'T' means listed as threatened under the ESA; 'E' means listed as endangered; "P" means proposed.

Species	Listing Status	Critical Habitat	Protective Regulations
Marine and Anadromous Fish			
Chinook salmon (*Oncorhynchus tshawytscha*)			
Lower Columbia River	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Willamette River	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Columbia River spring-run	E 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	ESA section 9 applies
Snake River spring/summer run	T 6/28/05; 70 FR 37160	10/25/99; 64 FR 57399	6/28/05; 70 FR 37160
Snake River fall-run	T 6/28/05; 70 FR 37160	12/28/93; 58 FR 68543	6/28/05; 70 FR 37160
Chum salmon *(O. keta*)			
Columbia River	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Coho salmon (*O. kisutch*)			
Lower Columbia River	T 6/28/05; 70 FR 37160	1/10/2011; 76 FR 1392	6/28/05; 70 FR 37160
Oregon Coast	T 2/11/08; 73 FR 7816	2/11/08; 73 FR 7816	2/11/08; 73 FR 7816
Southern Oregon / Northern California Coasts	T 6/28/05; 70 FR 37160	5/5/99; 64 FR 24049	6/28/05; 70 FR 37160
Sockeye salmon (*O. nerka*)			
Snake River	E 6/28/05; 70 FR 37160	12/28/93; 58 FR 68543	ESA section 9 applies
Steelhead (*O. mykiss*)			
Lower Columbia River	T 1/05/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Willamette River	T 1/05/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Middle Columbia River	T 1/05/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Columbia River	T 1/05/06; 71 FR 834	9/02/05; 70 FR 52630	2/018/06; 71 FR 5178
Snake River Basin	T 1/05/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Green sturgeon (*Acipenser medirostris)*			
Southern	T 4/07/06; 71 FR 17757	10/09/09; 74 FR 52300	P 5/21/09; 74 FR 23822
Eulachon (*Thaleichthys pacificus*)			
Eulachon	PT 3/13/09; 74 FR 10857	1/05/11; 76 FR 515	Not applicable
Marine Mammals			
Eastern Steller sea lion (*Eumetopias jubatus*)	T 5/5/1997; 63 FR 24345	8/ 27/93; 58 FR 45269	11/26/90; 55 FR 49204
Blue whale (*Balaenoptera musculus*)	E 12/02/70; 35 FR 18319	Not applicable	ESA section 9 applies
Fin whale (*Balaenoptera physalus*)	E 12/02/70; 35 FR 18319	Not applicable	ESA section 9 applies
Humpback whale (*Megaptera novaeangliae*)	E 12/02/70; 35 FR 18319	Not applicable	ESA section 9 applies
Southern Resident Killer whale (*Orcinus orca*)	E 11/18/05; 70 FR 69903	11/26/06; 71 FR 69054	ESA section 9 applies
Sei whale (*Balaenoptera borealis*)	E 12/02/70; 35 FR 18319	Not applicable	ESA section 9 applies
Sperm whale (*Physeter macrocephalus*)	E 12/02/70; 35 FR 18319	Not applicable	ESA section 9 applies
Marine Turtles			
Leatherback turtle (*Dermochelys coriacea*)	E 6/02/70 ; 39 FR 19320	3/23/79; 44 FR 17710	ESA section 9 applies

ENDANGERED SPECIES ACT BIOLOGICAL OPINION

Section 7(a) (2) of the ESA requires Federal agencies to consult with NMFS to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. The Opinion that follows records the results of the interagency consultation for this proposed action. NMFS did not include an incidental take statement for marine mammals at this time because any taking of these listed species must first be authorized with the issuance of an incidental harassment authorization or letter of authorization for Steller sea lions and humpback whales.

To complete the jeopardy analysis presented in this Opinion, NMFS reviewed the status of each listed species[2] considered in this consultation, the environmental baseline in the action area, the effects of the action, and cumulative effects (50 CFR 402.14(g)). From this analysis, NMFS determined whether effects of the action were likely, in view of existing risks, to appreciably reduce the likelihood of both the survival and recovery of the affected listed species.

For the critical habitat destruction or adverse modification analysis, NMFS considered the status of the entire designated area of the critical habitat considered in this consultation, the environmental baseline in the action area, the likely effects of the action on the function and conservation role of critical habitat, and cumulative effects. NMFS used this assessment to determine whether, with implementation of the proposed action, critical habitat would remain functional, or retain the current ability for the primary constituent elements (PCEs) to become functionally established, to serve the intended conservation role for the species.[3]

If the action under consultation is likely to jeopardize the continued existence of an ESA-listed species, or destroy or adversely modify critical habitat, NMFS must identify any reasonable and prudent alternatives for the action that avoid jeopardy or destruction or adverse modification of critical habitat and meet other regulatory requirements (50 CFR 402.02).

Status of the Species

The summaries that follow describe the status of the ESA-listed species, and their designated critical habitats, that occur within the geographic area of this proposed action and are considered in this Opinion. More detailed information on the status and trends of these listed resources, and their biology and ecology, can be found in the listing regulations and critical habitat designations published in the Federal Register (Table 11).

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[2] An "evolutionarily significant unit" (ESU) of Pacific salmon (Waples 1991) and a "distinct population segment" (DPS) (Policy Regarding the Recognition of District Vertebrate Population; 61 FR 4721, Feb 7, 1996) are both "species" as defined in section 3 of the ESA.

[3] Memorandum from William T. Hogarth to Regional Administrators, Office of Protected Resources, NMFS (November 7, 2005) (Application of the "Destruction or Adverse Modification" Standard Under Section 7(a)(2) of the Endangered Species Act).

It is also likely that climate change will play an increasingly important role in determining the abundance of ESA-listed species, and the conservation value of designated critical habitats, in the Pacific Northwest. During the last century, average regional air temperatures increased by 1.5°F, and increased up to 4°F in some areas (USGCRP 2009). Warming is likely to continue during the next century as average temperatures increase another 3 to 10°F (USGCRP 2009). Overall, approximately one-third of the current cold-water fish habitat in the Pacific Northwest is likely to exceed key water temperature thresholds by the end of this century (USGCRP 2009).

Precipitation trends during the next century are less certain than for temperature but more precipitation is likely to occur during October through March and less during summer and more of the winter precipitation is likely to fall as rain rather than snow (ISAB 2007, USGCRP 2009). Where snow occurs, a warmer climate will cause earlier runoff so stream flows in late spring, summer, and fall will be lower and water temperatures will be warmer (ISAB 2007, USGCRP 2009).

Higher winter stream flows increase the risk that winter floods in sensitive watersheds will damage spawning redds and wash away incubating eggs (USGCRP 2009). Earlier peak stream flows will also flush some young salmon and steelhead from rivers to estuaries before they are physically mature, increasing stress and the risk of predation (USGCRP 2009). Lower stream flows and warmer water temperatures during summer will degrade summer rearing conditions, in part by increasing the prevalence and virulence of fish diseases and parasites (USGCRP 2009). Other adverse effects are likely to include altered migration patterns, accelerated embryo development, premature emergence of fry, and increased competition and predation risk from warm-water, non-native species (ISAB 2007).

The earth's oceans are also warming, with considerable interannual and inter-decadal variability superimposed on the longer-term trend (Bindoff *et al.* 2007). Historically, warm periods in the coastal Pacific Ocean have coincided with relatively low abundances of salmon and steelhead, while cooler ocean periods have coincided with relatively high abundances (Scheuerell and Williams 2005, Zabel *et al.* 2006, USGCRP 2009). Ocean conditions adverse to salmon and steelhead may be more likely under a warming climate (Zabel *et al.* 2006).

Over the past few decades, the sizes and distributions of the populations considered in this Opinion generally have declined due to natural phenomena and human activity, including the operation of hydropower systems, over-harvest, hatcheries, and habitat degradation. Enlarged populations of terns, seals, sea lions, and other aquatic predators in the Pacific Northwest have been identified as factors that may be limiting the productivity of some Pacific salmon and steelhead populations (Bottom *et al.* 2005, Fresh *et al.* 2005).

Climate change, as described in the introduction above, is likely to adversely affect the conservation value of designated critical habitats in the Pacific Northwest. These effects are likely to include, but are not limited to, depletion of cold water habitat and other

variations in quality and quantity of tributary spawning, rearing and migration habitats and estuarine areas.

Species Descriptions and Limiting Factors.

Eulachon. Eulachon (smelt) are endemic to the eastern Pacific Ocean ranging from northern California to southwest Alaska and into the southeastern Bering Sea. Eulachon occur only on the coast of northwestern North America, from northern California to southwestern Alaska. In the portion of the species' range that lies south of the U.S./Canada border, most eulachon production originates in the Columbia River Basin. In this basin, the major and most consistent spawning runs occur in the mainstem of the Columbia River (from just upstream of the estuary, RM 25 to immediately downstream of Bonneville Dam at RM 146). Periodic spawning occurs in the Grays, Skamokawa, Elochoman, Kalama, Lewis, Cowlitz, and Sandy rivers (Emmett *et al.* 1991, Musick *et al.* 2000). In the Columbia River and its tributaries, spawning usually begins in January or February (Beacham *et al.* 2005).

Eulachon are anadromous fish that spawn in the lower reaches of rivers in early spring. They typically spend 3 to 5 years in saltwater before returning to freshwater to spawn from late winter through mid-spring. Spawning occurs over sand or coarse gravel substrates. Eggs are fertilized in the water column, sink, and adhere to the river bottom. Most adults die after spawning and eggs hatch in 20-40 days. Larvae are carried downstream and are dispersed by estuarine and ocean currents shortly after hatching. Runs tend to be erratic, appearing in some years but not others, and appearing only rarely in some river systems (Hinrichsen 1998). Eulachon are important in the food web as a prey species. Eulachon spawning runs have declined in the past 20 years, especially since the mid-1990s (Hay and McCarter 2000). The cause of these declines remains uncertain. Eulachon are caught as bycatch during shrimp fishing, but in most areas the total bycatch is small (Beacham *et al.* 2005). Predation by pinnipeds may be substantial, and other risk factors include global climate change and deterioration of marine and freshwater conditions (73 FR 13185).

The major factors limiting recovery of eulachon include climate change on ocean conditions, climate change on freshwater habitat, eulachon by-catch, dams and water diversions, and predation (NMFS 2008a).

Steller Sea Lion. The eastern DPS Steller sea lions range from southeast Alaska to southern California with a minimum abundance of 45,000 animals (NMFS 2008c), and have increased at 3% per year for the past 30 years (NMFS 2008c). The greatest increases have occurred in southeast Alaska and British Columbia (together accounting for 82% of pup production), but performance has remained poor in California at the southern extent of their range. In Southeast Alaska, British Columbia and Oregon, the number of Steller sea lions has more than doubled since the 1970s. There are no substantial threats to the species, and the population continues to increase at approximately 3% per year. The final Steller sea lion recovery plan identifies the need to initiate a status review for the eastern Steller sea lion and consider removing it from the Federal List of Endangered Wildlife

and Plants (NMFS 2008c). The eastern Steller sea lion breeds on rookeries in southeast Alaska, British Columbia, Oregon, and California; there are no rookeries in Washington. Haulouts are located throughout the eastern population's range (NMFS 2008c).

Steller sea lions are generalist predators, able to respond to changes in prey abundance. Their primary prey includes a variety of fishes and cephalopods. Some prey species are eaten seasonally when locally available or abundant, and other species are available and eaten year-round (review in NMFS 2008c). Pacific hake appears to be the primary prey item across the range of eastern Steller sea lion (NMFS 2008c). Other prey items include Pacific cod, walleye Pollock, salmon, and herring, among other species.

Steller sea lions occur in Oregon waters throughout the year, and use breeding rookeries at Rogue Reef and Orford Reef and haulout locations along the Oregon coast. There are four haulout sites used by Steller sea lions in the lower Columbia River and these include the tip of the South Jetty, where greater than 500 Steller sea lions commonly occur, and three locations proximate to and at the Bonneville Dam tailrace area where Steller sea lions occasionally occur. Critical habitat of Steller sea lions is not affected by the proposed action, and is therefore not discussed.

<u>Steller sea lion use of the South Jetty.</u> The South Jetty of the Columbia River is used by Steller sea lions for hauling out and is not designated critical habitat. Use occurs chiefly at the concrete block structure and the rubble mound. The proposed action will re-build the cap of the South Jetty at its present location, which is approximately 600 feet from the rubble mound and 1,400 feet from then concrete block structure. Erosion has turned the block structure and the rubble mound into islands. California sea lions (*Zalophus californianus*) also use this area and can intermingle with Steller sea lions. Steller sea lions appear to out-compete California sea lions for the preferred haul out area on the concrete block structure. Both species use the rubble mound extensively during high tides, when the concrete block structure is underwater.

Steller sea lions are present, in varying abundances, all year (Table 11). Abundance is typically lower from May-July when adults are at the breeding rookeries, although this is not always true as evidenced by a flyover count of the South Jetty on May 23, 2007 where 1,146 Steller sea lions were observed on the concrete block structure and none on the rubble mound (WDFW 2007). Those counts represent a high-use day on the South Jetty. Only non-breeding individuals are typically found on the jetty during May-July, and a greater percentage of juveniles are present. Abundance increases following the breeding season. All population age classes, and both males and females, use the South Jetty to haul out.

Table 11. Average number of pinnipeds by month at the South Jetty, 1995-2004.

Month	Number of Years Surveyed	Average Number of Steller Sea Lions
January	1	246
February	4	246
March	1	635
April	3	613
May	4	252
June	8	245
July	4	385
August	2	486
September	0	---
October	1	168
November	1	923
December	1	1,106

Data from Oregon Department of Fish and Wildlife.

Humpback Whales. Humpback whales occur in all major oceans of the world. The abundance and population trends of humpback whales are difficult to estimate, but based on the available data humpback whales appear to be increasing in abundance across much of their range (Carretta *et al*. 2010). Calambokidis *et al*. (2008) estimated that the current population of humpback whales in the North Pacific is approximately 18,000 to 20,000 whales, not counting calves. More recently, the abundance was estimated to be over 21,000 individuals (Barlow *et al*. 2011). The estimated growth rate for this stock is between 7% and 8%, annually (Carretta *et al*. 2010).

There are at least three separate populations of humpback whales in the North Pacific, of which one population migrates and feeds along the U.S. west coast. This population, previously called the California / Oregon / Washington stock, winters in coastal waters of Mexico and Central America and migrates to areas ranging from the coast of California to southern British Columbia in summer/fall (Carretta *et al*. 2010). Within this population, regional abundance estimates vary among the feeding areas. Average abundance estimates ranged from 200 to 400 individuals for southern British Columbia/northern Washington, and 1,400 to 1,700 individuals for California/Oregon (Calambokidis *et al*. 2008). There is a high degree of site fidelity in these feeding ranges with almost no interchange between these two feeding regions.

Humpback whales forage on a variety of crustaceans, other invertebrates and forage fish (review in NMFS 1991). In their summer foraging areas, humpback whales tend to occupy shallow, coastal waters. In contrast, during their winter migrations humpback whales tend to occupy deeper waters further offshore, and are less likely to occupy shallow, coastal waters. Humpback whales are sighted off the Washington and Oregon coasts close to shore (Figure 1 from Carretta *et al*. 2010, Lagerquist and Mate 2002, Oleson *et al*. 2009).

Humpback whales are known to predictably forage an average of 22 miles offshore of Grays Harbor, Washington during spring and summer months (Oleson *et al*. 2009). Grays Harbor is approximately 45 miles north of the project site. Oleson *et al*. (2009) documented 147 individual humpback whales foraging off Grays Harbor from 2004 to 2008, and foraging whales (1-19 whales sighted per day) were sighted on 50% of the days surveyed (22 of 44 survey days).

We have limited fine-scale information about humpback whale foraging habits and space use along the Washington coast, and do not have specific fine-scale information for the project area. Based on the available information, humpback whales are likely to occur within 6.2 miles of the Jetties or 8.6 miles of shore (where in-water sound from pile driving activities may be audible) given their general tendency to occupy shallow, coastal waters when foraging, and the available information on their fine-scale use of a proximate location. Based on this information humpback whales are likely to pass through and may forage in the project vicinity.

Current threats to the species include mortality and serious injury from entanglement with fishing gear and collisions with ships, whale watch harassment, proposed harvest (*i.e*., Japan's proposal for scientific whaling), and anthropogenic sound in the ocean that is a habitat concern for low-frequency sound specialists, such as humpback whales (NMFS 1991).

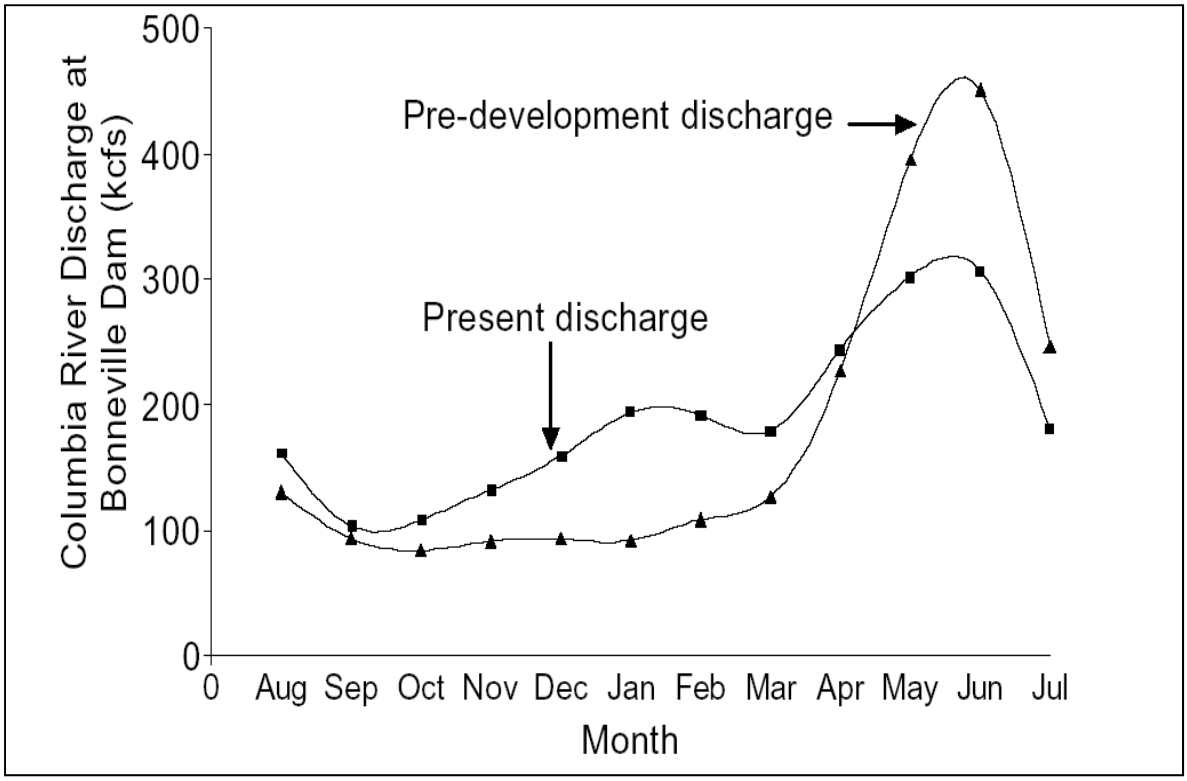
Environmental Baseline

The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

Overview

The Lower Columbia River extends from Bonneville Dam (RM 146) to the mouth of the Columbia River. Historically, unregulated discharges at the mouth ranged from 79,000 cubic feet per second (cfs) to over 1 million cfs, with average discharges of 273,000 cfs (Figure 19). Currently, discharge at the mouth of the river ranges from 100,000 to 500,000 cfs, with an average of 260,000 cfs.

Figure 19. Annual monthly river discharge at Bonneville Dam under current operations as compared to historical river discharge with no mainstem dams.



Source: Corps Portland District

The highest discharges in the river occur between December and March. Stream discharge in the lower Columbia River is influenced by snowmelt, winter rainstorms, and dam regulation. Stream discharge peaks generally occur during April through June. Local flooding in the lower Columbia River now begins when stream discharge reaches about 450,000 cfs, while the unregulated peak discharge would have been 602,000 cfs. Low stream flow generally occurs between August and October.

Discharge and sediment load have been altered by construction of 31 irrigation and hydropower dams, and 162 smaller dams, in the basin since 1890. Before 1890, the Columbia River estuary had extensive sand beds and variable river discharges. However, the construction of upriver hydroelectric dams has dramatically changed the nature of the estuary, as these dams have translated into different discharge rates and sediment discharges. Moreover, channel deepening, use of jetties and dredging to stabilize channels, development of perennial wetland areas, and isolation of remaining wetlands from the mainstem river have altered the physical character of the estuary; these changes have affected the biological systems supported by the estuary.

Physical Characteristics

The Columbia River estuarine environment extends from the river's mouth to approximately RM 38. The river varies from 2 to 5 miles wide throughout the estuary. Tidal effect extends almost 150 miles upstream (Corps 1983), but the saltwater wedge is limited to approximately RM 20 (Corps 1999). The North and South Jetties and Jetty A were constructed at the mouth to help stabilize the channel, reduce the need for dredging, and provide protection for ships. A series of pile dikes also were historically constructed for similar reasons. The navigation channel is currently maintained at authorized depths of 48 to 55 feet deep below MLLW and 0.5-mile wide from RM -3 to RM 3. River flows are controlled by upstream storage dams. A dredged material disposal site near the North Jetty was established in 1999 to protect the North Jetty from erosion. Approximately 100,000 to 500,000 cy of sand are placed there annually. The MCR shallow-water site (SWS), deep water site (DWS), and Chinook Channel Area D Sites are also active disposal locations within the action area but offshore and upstream of MCR, respectively. Historic disposal sites no longer active within vicinity of the Jetties include Site E located within the expanded SWS and sites A, B, and F, which are in deeper water but still shoreward of the active DWS.

The Corps regularly conducts operations and maintenance activities to maintain the jetty system and the authorized navigation channels and facilities. In the action area, there are several turning and mooring basins and Federally-authorized periodically dredged channels extending to various ports from the navigation channel. The Columbia River channel improvements project was recently completed and deepened the navigation channel to -48 feet CRD from approximately RM 3 to 104.

Waves, Currents, and Morphology

The MCR is a high-energy environment. The ocean entrance at the MCR is characterized by large waves and strong currents interacting with spatially variable bathymetry. Approximately 70% of all waves approaching the MCR are from the west-northwest. During winter storm conditions, the ocean offshore of the Jetties river entrance is characterized by high swells approaching from the northwest to southwest combined with locally generated wind waves from the south to southwest. From October to April, average offshore wave height and period is 9 feet and 12 seconds, respectively. From May to September, average offshore wave height and period is 5 feet and 9 seconds, respectively, and waves approach mostly from the west-northwest (Figure 20).

Occasional summer storms produce waves approaching MCR from the south-southwest with wave heights of 6.5 to 13 feet and wave periods of 7 to 12 seconds. Astronomical tides at MCR are mixed semi-diurnal with a diurnal range of 7.5 feet. The instantaneous flow rate of estuarine water through the MCR inlet during ebb tide can reach 1.8 million cfs. Tidally dominated currents within the MCR can exceed 8.2 feet per second. A large, clockwise-rotating eddy current has been observed to form between the North Jetty, the navigation channel, and Jetty A during ebb tide. A less pronounced counter-clockwise eddy forms in response to flood tide. Horizontal circulation in the estuary is generally

clockwise (when viewed from above), with incoming ocean waters moving upstream in the northern portion of the estuary and river waters moving downstream in the southern portion. Vertical circulation is variable, reflecting the complex interaction of tides with river flows and bottom topography and roughness (Corps 1983). The North Jetty eddy has varying strength and direction (based on location and timing of tide) ranging from 0.3 to 3.3 feet per second.

Figure 20. Photograph of the South Jetty in September.

As waves propagate shoreward toward the mouth of the Columbia River, the waves are modified (waves begin to shoal and refract) by the asymmetry of the mouth of the Columbia River underwater morphology. Nearshore currents and tidal currents are also modified by the Jetties and the mouth of the Columbia River morphology. These modified currents interact with the shoaling waves to produce a complex and agitated wave environment within the mouth of the Columbia River.

The asymmetric configuration of the mouth of the Columbia River and its morphology is characterized by the significant offshore extent of Peacock Spit on the north side of the North Jetty, southwesterly alignment of the North/South jetties and channel, and the absence of a large shoal on the south side of the mouth of the Columbia River. The asymmetry of the mouth of the Columbia River causes incoming waves to be focused onto areas which would not otherwise be exposed to direct wave action. An example of this wave-focusing effect is the area along the south side of the North Jetty. Upon initial inspection, it would appear that this area is most susceptible to wave action approaching the mouth of the Columbia River from the southwest. However, this is not the case; the opposite is what occurs. The area located between the North Jetty, the navigation channel, and Jetty A is affected by wave action during conditions when the offshore wave direction is from the west-northwest, because of the refractive nature of Peacock Spit. Waves passing over Peacock Spit (approaching from the northwest) are focused to enter

the mouth of the Columbia River along the south side of the North Jetty. Conversely, large waves approaching the mouth of the Columbia River from the southwest are refracted/diffracted around the South Jetty and over Clatsop Spit, protecting the south side of the North Jetty from large southerly waves.

Channel stability at the mouth of the Columbia River is related to the Jetties and the morphology of Peacock and Clatsop spits (Moritz *et al.* 2003). Because of phased jetty construction from 1885 to 1939, and the associated response of morphology, mouth of the Columbia River project features and the resultant morphology are now mutually dependent both in terms of structural integrity and project feature functional performance.

Foundation Conditions

The project has two main shoaling areas. The outer shoal extends from approximately RM -1.6 to RM -1.0. The inner shoal, Clatsop Shoal, extends from approximately RM 0.0 to RM 2.6, beginning on the south side and crossing the channel near RM 1.0. To maintain the channel's depth, dredging is conducted and materials dredged from the project are placed in one of two EPA ocean dredged material disposal sites designated under Section 102 of the Marine Protection, Research, and Sanctuaries Act (MPRSA)—DWS or the SWS, or alternately in a Clean Water Act Section 404 North Jetty site (Corps 2008).

The MCR jetties were constructed on these underwater sand shoals which are crucial project elements. These shoals are currently receding, which could affect the sediment budget supplying the adjacent littoral zones north and south of the MCR. As morphology near the Jetties undergoes significant erosion, the Jetties will be undermined by waves and currents.

Landforms

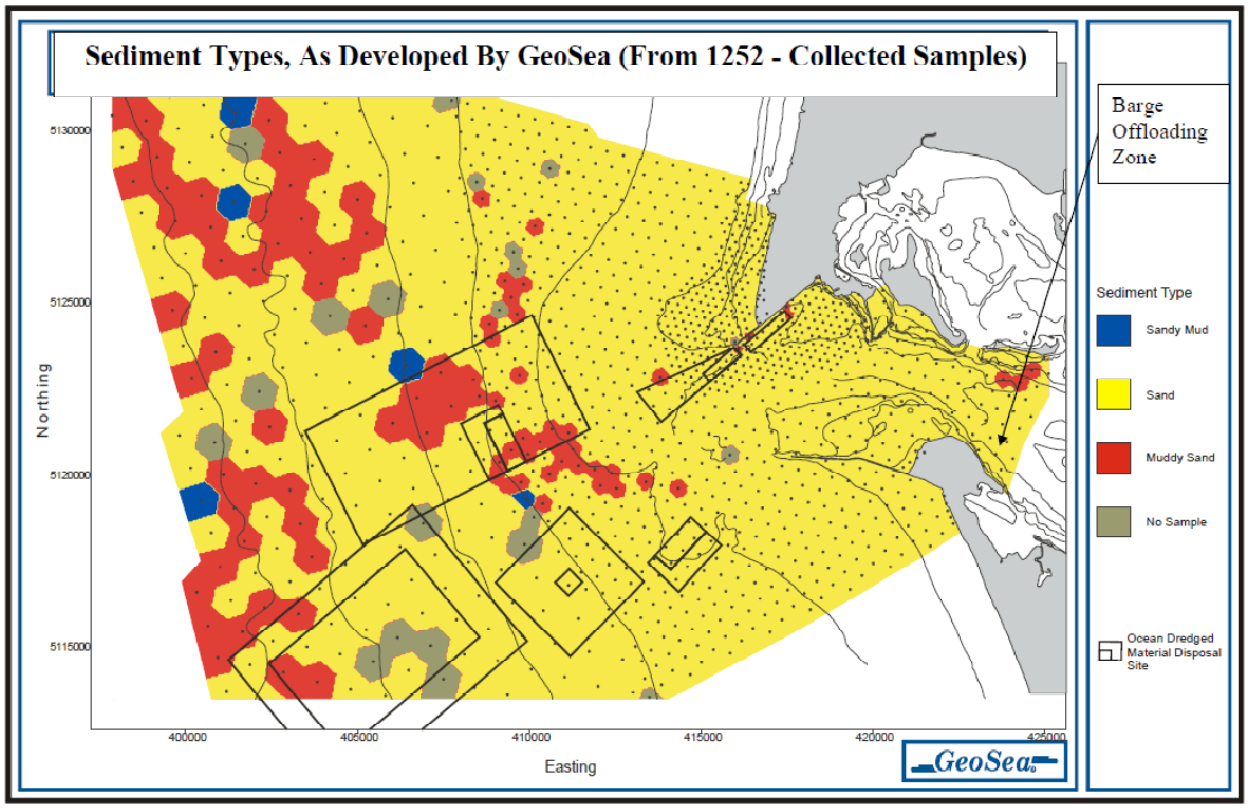
Near the Oregon shore of the estuary, Clatsop Spit is a coastal plain. On the Washington shore, Cape Disappointment is a narrow, rocky headland. Extensive accretion of land has occurred north of the North Jetty since its construction. This accreted land, however, is now in the process of recession as is evident by erosion at Benson Beach. The Corps is in the process of placing Columbia River sand back into the littoral drift cell north of the North Jetty at Benson Beach. Behind the headland are a beach dune and swale. Wetlands occur on accreted land north of the North Jetty and on Clatsop Spit.

Sediment Quality

In 2000 a sediment trend analysis (STA) was conducted by GeoSea Consulting, under contract to the Corps. Over twelve hundred (1,252) samples were collected in the MCR and surrounding off-shore locations (Figure 21). Physical analyses, of the samples surrounding the study area (6 samples selected), indicate the project area consists of >99% sand. Select samples (10) from the GeoSea study for the MCR maintenance dredging program were analyzed for physical and chemical contamination. These

samples indicated that no contaminates were detected at or near the dredged material evaluation framework (DMEF) screening levels. See: http://www.nwp.usace.army.mil/ec/h/hr/Reports/Mcr/mouth00.pdf for the complete report on chemical results (Corps 2008).

Figure 21. Sediment trend analysis in MCR area.



In 2005, a Tier I evaluation was conducted near the proposed the South Jetty barge offloading site following procedures set forth in the Inland Testing Manual (ITM) and the Upland Testing Manual (UTM). The methodologies used were those adopted for use in the DMEF for the Lower Columbia River Management Area, November 1998, and its updated draft 2005 version, the Sediment Evaluation Framework (SEF). This Tier I evaluation of the proposed dredge material indicated that the material was acceptable for both unconfined in-water and upland placement. No significant, adverse ecological impacts in terms of sediment toxicity were expected from disposal (Corps 2005a).

In 2008 using USEPA's ocean survey vehicle Bold, ten Van Veen surface grab samples were collected from sites previously sampled during the September 2000 sediment evaluation study. Percent sand averaged 98.45% with a range of 99.3 to 97.0%. Percent silt and clay averaged 1.59%, ranging from 3.0 to 0.7%. Per the Project Review Group approved sediment evaluation plan, no chemical analyses were conducted. Physical results for the 2000 and 2008 sampling events were compared. The mean percent sand for all samples in September 2000 was 98.11%, for June 2008 it was 98.45%. Within both

data sets, sediment towards the outer portion of the mouth was finer than sediments towards the center of the mouth (Corps 2008).

Other Activities and Conditions

Commercial and recreational fishing activities also have some influence on listed species and their prey items in the action area. The major fisheries are for bottom fish, salmon, crab, and other species of shellfish. Crab fishing occurs from December to September with the majority of the catch occurring early in the season. Most crab fishing occurs north of the Columbia River mouth at depths ranging from 25 to 250 feet mean sea level (MSL). Dungeness crab population numbers are subject to large cyclic fluctuations in abundance. Modeling studies by Higgins and others (1997) show that small scale environmental changes, such as a short delay in the onshore currents in spring, can dramatically impact survival of young-of-the-year crab but have no effect on adults and older juveniles inshore. Bottom fishing by trawl for flatfish, rockfish, and pink shrimp occurs year-round throughout the entire offshore area, primarily at depths offshore from the Jetties. Many of these species interact with listed species in a predator-prey relationship that, in some cases, can change over the course of each species' life history. Fisheries could have some effect on prey availability and species numbers in the action area.

Physical Environment at the MCR

The MCR is a high-energy, stochastic environment. For example, from October to April, average offshore wave height and period is 9 feet and 12 seconds, respectively. From May to September, average offshore wave height and period is 5 feet and 9 seconds, respectively, and waves approach mostly from the west-northwest (Figure 20). Occasional summer storms produce waves approaching MCR from the south-southwest with wave heights of 6.5 to 13 feet and wave periods of 7 to 12 seconds. Astronomical tides at MCR are mixed semi-diurnal with a diurnal range of 7.5 feet. The instantaneous flow rate of estuarine water through the MCR inlet during ebb tide can reach 1.8 million cfs. Tidally dominated currents within the MCR can exceed 8.2 fps.

Navigation Channels

Offshore and inland navigation channels in the Pacific Ocean from Vancouver British Columbia in Puget Sound, to Eureka, and Humbolt Bay, California are connected to a navigation route that extends along the entire western seaboard called the Pacific Deep Water Spine. The Spine can be accessed from approximately 33 routes. These access routes are not maintained and are generally in the 40-foot or deeper range. The Spine is also not maintained, and is up to and over 100 feet deep. Generally, ships transit anywhere between 5 and 20 miles offshore depending on weather (in high winds or seas they may need to tack or 'zigzag' to avoid rolling too violently or losing too much speed, *etc.*). A few areas along the coast are rocky farther off the shoreline, and those spots are given wider berth. Between Eureka, California, and the Port Angeles Puget Sound, there are roughly 192 ports, moorages, terminals, and wharf facilities that serve various types

and levels of vessel traffic. At any one time, there can be hundreds or thousands of commercial and pleasure crafts in transit between Eureka and Puget Sound.

A large suit of actions have impacted and are continuing to impact the environment within these channels, including but not limited to dredging, disposal, jetties, boating, floating navigational and fishing devices, fishing, float planes, sonar, contaminant leaks and disposal, and submarines. However, NMFS is unaware of any past, present, or contemporaneous projects or impacts from Federal, State, or private actions and other human activities that are relevant to the interaction of the proposed action and listed species within the navigation channels described above. That interaction of the proposed action and listed species is described in the effects to marine mammals section, below.

Effects of the Action

Effects of the action refers to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Insignificant effects are so mild that the effect cannot be meaningfully measured, detected, or evaluated. Discountable effects cannot be reasonably expected to occur. Beneficial effects are contemporaneous positive effects without any adverse effects to the species or critical habitat.

Effects on Habitat

The only proposed activities NMFS expects will affect Steller sea lions are rock placement and pile installation and removal. The only proposed activity NMFS expects to affect humpback whales is pile installation and removal.

For Pacific salmon and steelhead, green sturgeon, and eulachon, NMFS expects construction-related effects on water quality, hydraulic and hydrological processes and estuarine, marine, and upland habitats to be insignificant or discountable.

The following is a discussion of each project element and the rationales supporting our effects analysis.

Rock Transport. As discussed in the proposed action, barge transport of stone from quarry sites is likely and would occur mostly during daylight hours along major navigation routes in existing harbors and navigation channels. Traffic from the proposed action will be limited mostly to summer months when fair weather allows safe passage. Although transport will occur on an annual basis, stone may or may not be delivered to one or more jetties seasonally. Loaded water-borne container traffic identified as foreign in- and outbound to/from Portland that would likely have crossed the MCR in 2008

totaled approximately 195,489 ships (Corps 2010). The number of additional barge trips per year attributable to the proposed action is likely to be somewhere between 8 and 25 ships. This is small annual percentage increase (0.004 to 0.01%) relative to the current number of other commercial and recreational vessels already using any of these potential routes. Due to the slow travel speed of the barges of less than 12 knots, infrequency of these vessel trips, geographic limitation to existing navigation channels, and the minimal duration of barges in any particular area, NMFS concludes that the effects to estuarine, marine, and upland habitats associated with rock transport are discountable.

Rock Placement. As described in the proposed action, rock placement will occur on an annual basis starting in the late spring through the late to early fall, will occur at more than one jetty per season, and will occur regularly throughout the duration of construction. The vast majority of the stone placement for construction of the jetty head, trunk, and root features will occur on existing relic jetty stone and within the existing structural prism. Jetty barbs, crane set-up pads and vehicle turnouts will also require the placement of rock. Rock placement on each jetty is discussed below.

North Jetty

- **Jetty Trunk:** Approximately 58% of the overall rock placement on trunk of the jetty will be placed above MHHW; approximately 25% of the volume will be placed between MHHW and MLLW; and approximately 18% of the volume placed will be below MLLW. The footprint will not be extended beyond the relic jetty stone or structure.
- **Spur Groins:** A small percentage (approximately 0.1%) of the overall stone placement for spur groins will be above MHHW; approximately 4% will be placed between MHHW and MLLW; and approximately 95.9% will be placed below MLLW. Spur groin placement may result in a change in habitat type, sandy to rocky, of up to 1.55 acres. Channel-side groins will be submerged a minimum of 5 to 35 feet below MLLW.
- **Capping:** Approximately 49% of the overall stone placement on the capping portions of the jetty will be placed above MHHW; approximately 24% of the volume will be placed between MHHW and MLLW; and approximately 27% of the volume placed will be below MLLW. Capping stone will not be placed beyond the footprint of the relic jetty stone.
- **Barge offloading facilities:** Rock placement for barge offloading facilities, turn-outs, and set-up pad facilities may result in a change in habitat type, sandy to rocky, of up to 0.63 acres.

South Jetty

- **Jetty Trunk:** Approximately 68% of the overall stone placement on the trunk of the jetty will be placed above MHHW; approximately 19% of the volume will be placed between MHHW and MLLW; and approximately 13% of the volume placed will be below MLLW. The footprint will not be extended beyond the relic jetty stone or structure.

- **Spur Groins:** A small percentage (approximately 0.1%) of the overall stone placement for spur groins will be above MHHW; approximately 12.3% will be placed between MHHW and MLLW; and approximately 87.6% will be placed below MLLW. Spur groin placement may result in a change in habitat type, sandy to rocky, of up to 1.10 acres.
- **Capping:** Approximately 52% of the overall stone placement on the capping portions of the jetty will be placed above MHHW; approximately 25% of the volume will be placed between MHHW and MLLW; and approximately 23% of the volume placed will be below MLLW. This feature will not be expanded beyond the footprint of the relic jetty stone or structure.
- **Barge Offloading Facilities:** Stone placement for barge offloading facilities, causeways, turn-out, and set-up pad facilities may result in a change in habitat type, sandy to rocky, of up to 1.96 acres.

Jetty A

- **Jetty Trunk**: Approximately 63% of the overall stone placement on the trunk of the jetty will be placed above mean higher high water (MHHW); approximately 29% of the volume will be placed between MHHW and MLLW; and approximately 8% of the volume placed will be below MLLW. The footprint of Jetty A is likely to be expanded beyond the relic jetty stone or structure, but will not extend more than 10 feet beyond the existing prism. This may result in a change in habitat type, sandy to rocky, of up to 1.2 acres.
- **Spur Groins:** 100% of the spur groin construction will be below MLLW, and may result in a change in habitat type, sandy to rocky, of up to 0.61 acres. Both groins will be submerged a minimum of 5 below MLLW.
- **Capping:** Approximately 44% of the overall stone placement on the capping portions of the jetty will be placed above MHHW; approximately 26% of the volume will be placed between MHHW and MLLW; and approximately 30% of the volume placed will be below MLLW. This feature will not be expanded beyond the footprint of the relic jetty stone or structure.
- **Barge Offloading Facilities:** Stone placement for barge offloading facilities, causeways, turn-out, and set-up pad facilities may result in a change in habitat type, sandy to rocky, of up to 2.89 acres.

Rock placement will have two types of effects: direct effects on the substrate on which the rock is placed, and indirect effects on hydraulic and hydrological processes. The indirect effects will be discussed in the *Hydraulic and Hydrological Processes* section below.

Direct effects of rock placement will include covering the existing substrate and changing the elevation of rock in that location. The estimated total footprint for all rock placement actions is approximately 82.36 acres (approximately 992,371 cy). This includes actions from stone placement at the trunk, root, head cap, spur groins, and barge offloading facilities. Of the approximately 82.36 acres of rock placement, approximately 49.91 acres (North Jetty approximately 15.41 acres; South Jetty approximately 27.2 acres; and Jetty

A approximately 7.3 acres) will be on top on relic stone above MHHW, and therefore have no direct effects on aquatic habitat. Of the remaining 32.45 acres of rock placement, 22.49 acres will be on top of existing rock in rocky subtidal habitats and intertidal habitat, and approximately 9.96 acres will be on top of sub-tidal and intertidal habitats that will change from sandy to rocky substrate (North Jetty approximately 2.18 acres; South Jetty approximately 3.06 acres; and Jetty A approximately 4.7 acres). The majority of habitat change will happen at the spur groin locations.

As summarized above, approximately 22.49 acres of rocky subtidal and intertidal habitat will have new rock placed on top of the existing rock. The subtidal and intertidal species, *e.g.*, barnacles, sea stars, anemones, mussels, in this approximate 22.49 acres of rocky habitat, will be affected. When repair and rehabilitation activities are completed, there will be an increase in rocky habitat for these subtidal and intertidal species. Effects on subtidal and intertidal species are not expected to meaningfully affect productivity and abundance as field sampling for benthic infauna densities in the subtidal habitats in MCR ranges between 7,999 taxa richness to 267,283 taxa richness per 10.8 square feet of subtidal substrate sampled (Siipola 1994).

While individual subtidal and intertidal species will be affected, the placement of rock in these habitat types is not likely to have significant effects on the subtidal and intertidal habitat affected or the subtidal and intertidal species in the MCR for the following reasons: as summarized above, rock placement will result in approximately 9.96 acres of sub-tidal and intertidal habitat to change from a sandy substrate to one with a rocky substrate. In these areas, subtidal and intertidal species associated with the sandy substrate will be affected. The new rocky substrate will be quickly recolonized by these subtidal and intertidal species that are associated with rocky habitat on the rest of the jetty system.

The approximate 9.96 acres of sandy substrate habitat is a small percentage of the total jetty area and a small percentage of the available adjacent remaining shallow-water sand habitat in the vicinity of the Jetties. Within an estimated 3-mile proximity of the MCR jetties, approximately 19,575 acres of shallow-water habitat exists, *i.e.*, anything -20 feet or shallower, of which 9.96 acres represents a maximum potential change in habitat type, sandy to rocky, of 0.05%.

Increases in suspended sediment will occur during rock placement. Residence time of suspended sediment in the water column is likely to be short lived and attenuate to background levels within minutes. Rock placement will take place in areas with continuous wave activity and are highly dispersive areas. Habitat-associated effects on water quality (*i.e.*, increases in suspended sediment) will be insignificant as natural background levels of suspended sediments in the vicinities of the Jetties tend to be high due to turbulent and dynamic hydraulic forces.

Therefore, NMFS concludes the effects associated with rock placement on estuarine, marine, sub-tidal and intertidal habitats will be insignificant.

Construction Access, Staging, Storage, and Rock Stockpiling. Activities related to staging, storage, and rock stockpiling will occur on an annual basis, throughout the year, and may occur at one or more jetties simultaneously. BMPs such as protective fencing, set-backs, and an erosion and sediment control plan or stormwater protection plan will be implemented to avoid stormwater erosion and run-off from disturbed areas. Whenever feasible, stabilizing dune vegetation and riparian vegetation will be preserved. Avoidance and minimization measures have reduced the construction footprint where possible. When construction activities are suspended for the season, appropriate demobilization and site stabilization plans will limit the distribution and duration of any effects. For higher value habits like marsh wetlands and slough sedge communities, activities will be limited to areas where previous disturbance and development have already occurred. Therefore, NMFS expects effects on fish-bearing waters to be negligible.

Effects to upland habitats will occur above mean high tide elevation and may include: repetitive ground disturbance, de-vegetation, residual rock side-cast, and soil compaction. Vegetation to be removed is located in upland areas above mean high tide elevation. Vegetation in these upland areas provides no functional habitat for listed species as the area is comprised of sand and European beachgrass. BMPs will prevent sediments disturbed by construction staging, storage, and rock stockpiling from reaching marine and estuarine waters.

Therefore, NMFS concludes the effects associated with construction access, staging, storage, and rock stockpiling on estuarine, marine, and upland habitats will be insignificant.

Dredging. Dredging will be performed before and during the construction and maintenance of barge offloading facilities, and is likely to occur during early summer, but is unlikely to occur at all facilities annually. It is likely only one or perhaps two facilities would be dredged on a periodic basis as needed. For Jetty A, the initial amount of material to be dredged is 60,000 cy with maintenance dredging at 80,000 cy per year of activity (2 years) for a total of 220,000 cy. For the North Jetty, the initial amount of material to be dredged is 30,000 cy with 30,000 cy per year of activity (9 years) for a total of 300,000 cy. For the South Jetty and South Jetty Area D, the initial amount of material to be dredged is 40,000 cy with 40,000 cy per year of activity (11 years) for a total of 480,000 cy.

The effects of dredging on physical habitat features include intermittent bottom elevation changes and intermittent increases in suspended sediment. Dredging will temporarily increase water depths of intertidal habitats to subtidal, or shallow subtidal habitats to deeper subtidal habitats. While dredging will change water depths in the dredged areas, the effects on habitat quality adjacent to the Jetties are unlikely to be significant as these areas are subject to stochastic changes associated with wave action, particularly winter storms, which can deposit ocean-derived sediment measuring several feet in a single storm. Dredging at Area D will temporarily increase water depths in the area delineated for dredging. While water depths in this area are less than -20 feet MLLW, NMFS does

not expect dredging to result in significant effects to riverine habitats as this area represents 0.02% of the estimated 19,575 acres of shallow-water habitat in the MCR.

Increases in suspended sediment will occur during dredging. Increases in suspended sediment in the water column are likely to be short-lived and attenuate to background levels within minutes. This is because the dredging, especially in areas adjacent to the Jetties, will take place in areas with continuous wave activity and highly dispersive currents. Also, sediment tests have confirmed that material to be dredged is 97% or greater sand, which creates little suspended sediment when dredged. Because the dredged material is 97% or greater sand it does not pose a risk of resuspending contaminants.

Therefore, NMFS concludes the effects associated with dredging on estuarine and marine habitats and benthic infauna are insignificant.

Disposal of Dredged Materials. Disposal is likely to occur on an annual basis, originating from one or more of the offloading facilities. The duration of disposal will be limited, and disposal will likely occur early in the construction season prior to use of offloading facilities. As mentioned previously, all disposal of dredged material will be placed at previously evaluated and approved in-water disposal sites. NMFS has previously evaluated the effects of disposal of dredged materials at these disposal sites (NMFS 2005a) and concluded that disposal of dredged materials for the Columbia River operations and maintenance dredging program did not result in adverse effects to estuarine, marine habitats.

Therefore, NMFS concludes the effects of disposal of dredged materials on estuarine and marine habitats will be insignificant.

Barge Offloading Facilities. As described in the proposed action, the installation of 4 barge offloading facilities and one causeway is likely to occur once, likely in the late spring or early summer prior to or during the first season of construction on the associated jetty. Effects of barge offloading facility installation and removal are discussed under their respective sections, *i.e., Rock Placement, Pile Installation and Removal, and Dredging*.

Pile Installation and Removal. For initial construction of all four facilities, up to 96 Z- or H-piles could be installed as dolphins, and up to 373 sections of sheet pile installed to retain rock fill. Installation of piles is likely to happen between May and June. Piles may be removed and installed several times using a vibratory hammer. NMFS conservatively estimates in this analysis that all the piles will be all be driven and removed, and that 31 piles will be driven and removed twice for a total of less than 1,000 pile driving or removed events. Installation and removal of piles with a vibratory hammer will introduce sound waves into the MCR area intermittently over 20 years.

Habitat-associated effects with pile installation and removal are in and of themselves insignificant. For example, the average sound pressure level recorded during a recent test pile program in Newport, Oregon in 2010 (NMFS 2010d), using vibratory hammers was

146 dB SEL-average, well below the potential onset of injury threshold of sound pressure levels of 206 dB, and accumulated sound exposure levels of 183 dB (for fish that weigh 2 grams or less) and 187 dB (for fish that weigh greater than 2 grams). The relevant issue is the sound exposure level (SEL), psi or dB, produced, expressed, and transmitted through the water and the potential effects, *e.g.*, barotrauma, the transient energy field poses to fishes. Effects to habitat, such as suspended sediment, are likely to be so minor and transient that they could not be measured against background levels.

Therefore, NMFS concludes effects associated with pile installation and removal on estuarine and marine habitats will be insignificant.

Wetland and Lagoon Fill and Culvert Replacement. Wetland (1.78 acres) and lagoon (4.71 acres) fills and culvert replacements will occur above the high tide line and will be functionally disconnected from the Columbia River as the wetland and lagoon areas are located on the landward side of North Jetty (Figure 2). The filling of the wetland and lagoon that drain into the MCR is likely to have small but insignificant effects on water quality and nutrient inputs to the Columbia River.

Therefore, NMFS concludes effects associated with wetland and lagoon fill and culvert replacement on estuarine and marine habitats will be insignificant.

Dune Augmentation. Under existing conditions, the shoreline at the root of the South Jetty will continue to erode and recede, resulting in a possible shoreline breach into Trestle Bay in approximately 8 to 16 years, and the MCR inlet would establish a secondary flow way from the estuary to the ocean along this area (south of South Jetty). Although the effects of preventing a breach at Trestle Bay on riverine and marine habitats and listed species are unknown and uncertain, the proposed action will maintain the primary flow from the estuary and result in limited changes to the existing physical nature of the inlet.

The dune augmentation at a beach below the South Jetty will occur above mean high tide. The Corps determined that the dune augmentation actions will have immeasurable effects on riverine and marine habitats. Since all work will occur above MHHW NMFS concludes effects associated with dune augmentation on estuarine and marine habitats will be insignificant.

Jetty Road System. The roads on top of the Jetties will be built with a mix of rock and sediment. These roads are likely to deteriorate during storm events. The rate of erosion and the release of substrate through the Jetties are likely to be immeasurable in terms of effects on estuarine and marine habitats.

Therefore, NMFS concludes effects associated with the jetty road system on riverine and oceanic habitats will be insignificant.

Construction-Associated Leaks and Spills. The Corps will require the contractor to provide a spill prevention and management plan that will include measures

to avoid and minimize the potential for leaks and spills, and to respond quickly to minimize damages should spills occur. Good construction practices, proper equipment maintenance, appropriate staging set-backs, and use of a Wiggins fueling system, a pressure lock-out fueling device that prevents fuel leaks, would further reduce the likelihood of leak and spill potential and exposure extent and its associated effects. NMFS has determined that spills large enough to adversely affect habitat functions cannot be reasonably expected to occur.

Therefore, NMFS concludes effects associated with the construction and contaminants on estuarine, marine, and upland habitats will be discountable.

Hydraulic and Hydrological Processes. The United States Geological Survey (USGS) and Engineer Research and Development Center (ERDC) conducted numerical modeling studies to evaluate changes in circulation and velocity, salinity, and sediment transport at the MCR for various rehabilitation design scenarios of the MCR jetty system (USGS 2007). The purpose of the USGS evaluation was to assess the functional performance of the extended jetty system and to aid in the assessment of potential impacts to habitat from repair and rehabilitation. The proposed action is significantly different from what was modeled in this study, because under the current proposal the Jetties are not being built out to their original lengths. However, results under the larger build-out scenario are still relevant for comparing and evaluating previously estimated potential changes to the MCR system as a whole. Previous modeling work also remains reasonably valid for consideration because the current proposed action would cap the Jetties at their present location, which is essentially the same length as the original base conditions used for the previous models.

As summarized above, the hydraulic and hydrological models completed by the USGS and ERDC in 2007 make predictions based on previous MCR jetty designs that were larger but similar in shape to the current proposed action. It is likely that any previously predicted effects to hydraulic and hydrological conditions would be significantly greater than those effects under the current proposed action. Likewise, 2007 and 2010 models made predictions for the most high-energy time of the year, October and November, because these months represent the time at which the jetty rebuild is most likely to have significant hydraulic and hydrological effects. Therefore, the proposed action will have similar effects as modeled in 2007, but with significantly smaller magnitudes. These effects are described in detail below.

Water Circulation and Velocity. The primary factors controlling circulation in the Columbia River estuary are river flow, tides, and currents. The Columbia River estuary has a large range between high and low tides and receives a huge river discharge. These conditions result in rapid and turbulent currents. The variability in the above mentioned parameters also results in a large variability in velocity. Quinn (2005) noted that there is great spatial variation in estuaries and that physiochemical attributes of the water such as depth, salinity, temperature, turbidity, and velocity vary over complex temporal scales including season, lunar, and tidal periods. The USGS modeling results, for example, show that in near-surface waters near the landward portions of the North Jetty, velocities

with tides can exceed 3.3 feet/second during August and September. Under the larger rebuild scenario, changes to bed and surface velocities and current directions predicted by the models were minor, particularly with respect to fluctuations that already occur. Therefore, any previously predicted effects to water circulation and velocity will be significantly less and of smaller magnitude under the current proposed action.

Salinity. As described above, the primary factors controlling circulation in the Columbia River estuary are river flow, tides, and currents. Salinity distribution is, in turn, determined by the circulation patterns and the mixing process which is driven by tidal currents. The variability in the above mentioned parameters results in a large variability in salinity. The USGS modeling results, for example, showed that in near-surface waters near the landward portions of the North Jetty, salinity naturally varies with tides from 12 parts per thousand (ppt) to 30 ppt during October-November (USGS 2007, Moritz 2010).

During the August-September timeframe, changes to bed layer salinity were predicted in the water between Jetty A and the North Jetty. An increase in range of mean salinities of 0-4 ppt from 26-28 ppt to 28-30 ppt was predicted to occur over some of this area (Moritz 2010, and USGS 2007). This could be calculated as up to approximately 15% change, but was still well under the 20 ppt (or up to 67%) range of natural variability.

A salinity pattern change was predicted for the near-surface layer in waters between Jetty A and the North Jetty, where mean salinity was also predicted to increase 0-4 ppt from 18-20 ppt to 20-22 ppt. For the near-surface layer, this increase in mean salinities included the area in close proximity to much of the landward portion of the North Jetty. For the near-surface layer, a decrease in mean salinities of 0-4 ppt from 12-14 ppt to 14-16 ppt was predicted to occur over a relatively small area south of West Sand Island, which is located just east of Jetty A (USGS 2007, Moritz 2010).

In summary, the larger rebuild scenario was predicted to have minor, localized effects on mean salinities. These resulting effects to salinity are minor with respect to fluctuations that already occur in the MCR. Therefore, the proposed action will have similar effects as modeled in 2007, but with significantly smaller magnitudes under the current proposed action.

Plume Dynamics. The Columbia River plume is the zone of freshwater/saltwater interface where the freshwater exiting the Columbia River meets and rises above the denser saltwater of the Pacific Ocean, just seaward of the MCR. The plume is formed as thin, buoyant lenses of fresher water flowing over denser, oceanic water and is more pronounced when flow from the river is large in comparison to tidal volume. The Columbia River plume is ephemeral (may persist for several hours) and is controlled by fluctuating tide. A frontal boundary (front) is formed between the river plume and adjacent marine waters. The front is richer in zooplankton than adjacent marine waters and plume waters, due to increased abundance of surface-oriented organisms (Morgan *et al.* 2005). The plume front is easily identified by well-defined horizontal gradients in salinity and water clarity and by the accumulations of foam and flotsam (De Robertis *et al.* 2005).

The USGS model for the larger rebuild scenario predicted small changes to residual velocity and current directions for both the bed layer and the near-surface layer for the August-September and October-November timeframes in the plume. A decrease in bed layer salinity of 0-4 ppt (from 28-30 ppt to 26-28 ppt) was predicted in the plume over an oval area west of the terminus of the North Jetty. Only small changes were predicted to residual bed load transport and residual total load transport within the plume for the August-September and October-November timeframes (USGS 2007, Moritz 2010).

As stated above for other effects to hydraulic/hydrological conditions, the changes that were previously predicted for the larger rebuild scenario are significantly less likely to be produced by the current proposed action and are likely to be of smaller in magnitude, duration, and extent because of the smaller scale of the proposed action.

Bed Morphology. Temporary effects from hydraulics and hydrologic process would occur as a single event with construction as described under Rock Placement. Any minor subsequent effects would be long-term, but are insignificant when considered within the range of natural dynamic conditions and are of limited geographical extent.

The larger rebuild scenario with spur groins would have caused some bed level changes along the seaward channel side of the North Jetty. The USGS model predicted changes for both modeled timeframes, but were more pronounced in the winter with an average differences of 8.3% in bed elevation of 4.1 to 4.9 feet change from the existing 39.4- to 78.7-foot depth. The predicted change is small considering the dynamic environment at the MCR. The ERDC modeling also predicted that a temporary increase in bed level due to sedimentation would occur upstream of the spurs and that a temporary decrease in bed level due to erosion would occur immediately downstream of the spurs. The larger rebuild scenario was predicted to change bed levels. The largest change to bed level predicted was hydraulic changes that led to a deeper water habitat than currently exists along the channel side of the seaward half of the North Jetty. For both the August-September and the October-November time frames the models predicted this change in bed level, but the change was more pronounced for the latter, with differences in bed elevation of 4.1 to 4.9 feet. However, this change is relatively small, because the water here is already 39.4 to 78.7 feet deep (Connell and Rosati 2007, Moritz 2010).

As stated above for other effects to hydraulic/hydrological conditions, the changes that were previously predicted for the larger rebuild scenario are likely to be of smaller magnitude because of the smaller scale of the current proposed action.

In summary, previous modeling results indicated the changes to velocities, currents, salinity, plume dynamics, and bed morphology are minimal under the much larger jetty length rebuild scenarios. Also, the existing or “original” conditions of the previous model represented jetty lengths that are retained under the proposed action. Based on these previous results, no significant overall changes to the hydraulics or hydrology, and associated processes of the MCR system are likely under the new, significantly smaller proposed action. Therefore, NMFS concludes that the hydraulic and hydrological effects

from repair and rehabilitation of the Jetties on estuarine and marine habitats will be insignificant.

Occurrence of Listed Species in the Action Area

Salmonids. A variety of anadromous fish occur in the Columbia River near-and offshore areas. Occurrence of adult salmon in the offshore area is correlated primarily with their period of upstream migration. Juvenile salmon are present following their migration out of the Columbia River estuary, primarily in the spring.

Anadromous species occur throughout the year, with many using the estuary as a rearing and nursery area. Adult salmonids use the estuary during upstream migrations on their way to spawning grounds. Juvenile salmonids occur in the action area during their out-migration to the ocean (Figure 22 and Table 12). Juveniles that have already become smolts are present in the lower river for a short time period. Juveniles that have not become smolts, such as lower river stock Chinook subyearlings, spend extended periods of time rearing in the lower river. They normally remain in the lower river or estuary until summer or fall, or even until the following spring when they smoltify and then migrate to the ocean.

Figure 22. General trends in presence and abundance of juvenile salmonids in the lower Columbia River estuary at and downstream of Jones Beach (RKM 75; Dawley *et al.* 1986, McCabe *et al.* 1986, Roegner *et al.* 2004, Bottom *et al.* 2008, Carter *et al.* 2009).

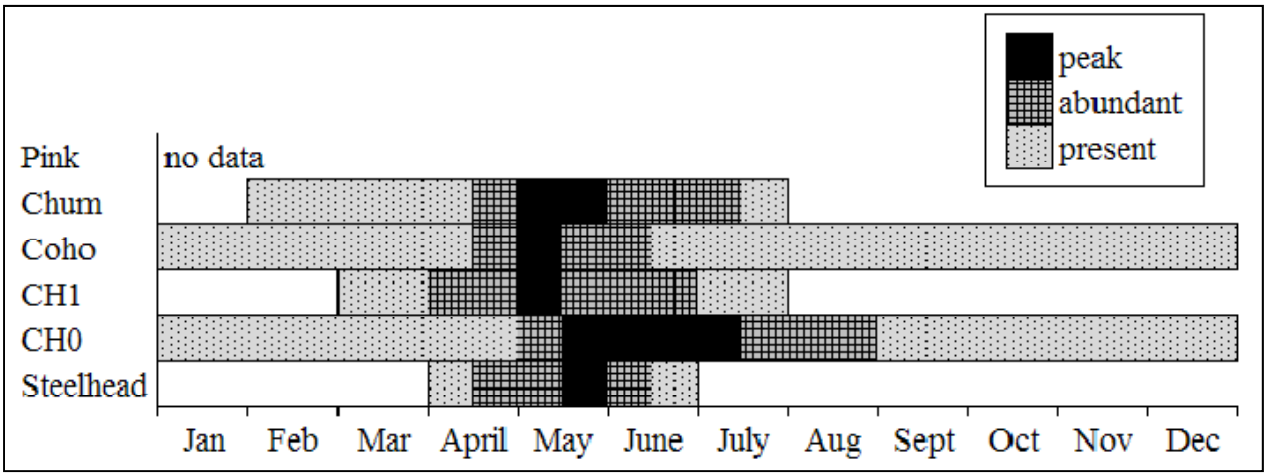
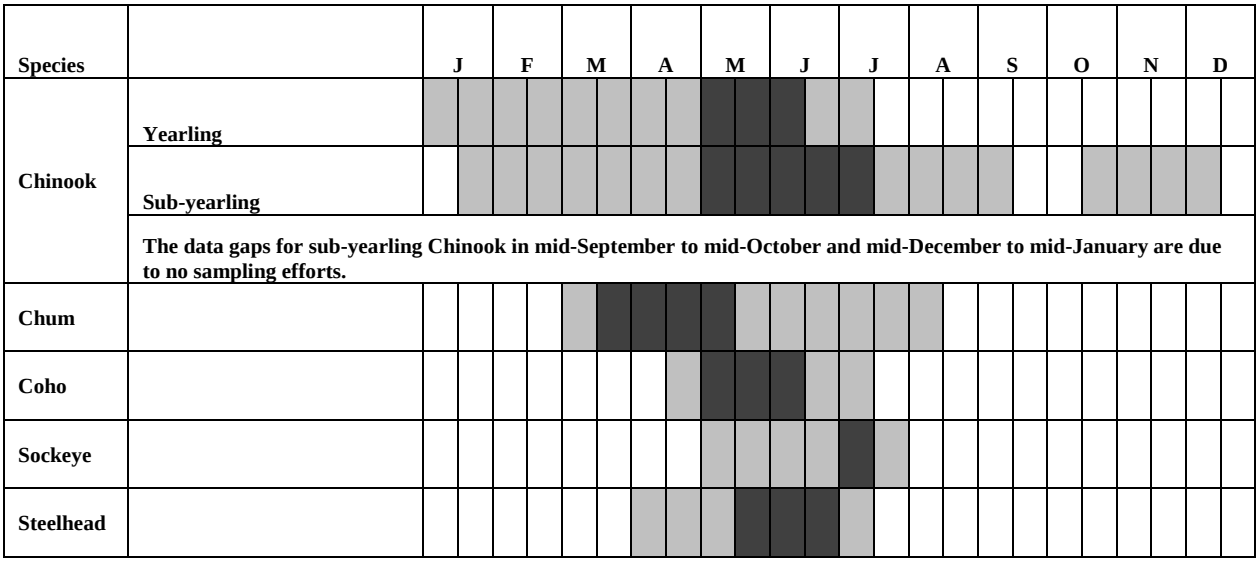


Table 12. Migration timing of juvenile salmon and steelhead (stock composite) in the Lower Columbia River based on Dawley *et al.* (1984) and ODFW (2003) (for chum salmon).



Dark shading represents peak (high abundance) migration. **Light shading represents non-peak (low abundance) migration or rearing.**

In 2005, Pacific Northwest National Lab (PNNL) initiated a multi-year study on acoustically tagged sub-yearling and yearling Chinook salmon and steelhead in the vicinity of the MCR North and South jetties (McMichael *et al.* 2006). Detection nodes were placed across the channel at RM 5.6 (primary node) and at RM 1.8 (secondary node). The secondary node did not extend all the way to the south side of the channel, however. As a result, fish could pass close to the South Jetty without being detected. A third set of detection nodes were placed near the North Jetty disposal area. Chinook salmon, both sub-yearling and yearling, were run-of-the-river fish tagged and released at the Bonneville Second Powerhouse bypass at the juvenile fish facility. Steelhead were Snake River-origin hatchery fish that were collected from fish transport barges between John Day and Bonneville dams and released mainly at Skamania Landing downstream of Bonneville Dam (some were transported and released at Astoria-Megler Bridge).

Based on a review of the 2005 through 2009 acoustic tag studies, the earlier studies deployed a narrower set of detection nodes. In subsequent years detection nodes were placed within ±300 feet of the North Jetty and ±800 feet of the South Jetty, with a detection range of 656 feet. Although fish may pass close to the South Jetty without being detected, the data from the multi-year study indicates that salmon and steelhead are oriented towards the navigation channel, and were consistently detected at distances greater than 656 feet from the North and South Jetties. Although this does not mean salmon or steelhead do not occur in the area between the Jetties and the navigation channel, an area measuring 3,200 feet wide and 6,500 feet wide, for the North Jetty and South Jetty, respectively, the data consistently indicate that salmon and steelhead in these areas outside of the navigation channel and between the Jetties are highly unlikely to

occur within a few hundred feet of the Jetties. Furthermore, in addition to the information provided from the acoustic studies that report only 5.5% of fish detected occurred in the large area between the Jetties and the navigation channel, based on the description of the physical conditions described above under *Physical Environment at the MCR*, NMFS does not expect salmon or steelhead to occur in the construction zone as there is no biological reason, (*e.g.*, food, high-energy refugia, predator avoidance) for listed species to expend energy in this high-energy, hostile environment.

In the 2005 study, sub-yearling Chinook salmon moved back and forth past the nodes, remaining longer in the vicinity of the nodes than yearling Chinook salmon and steelhead, and tended to use nearshore areas (closer to the North Jetty) more than yearling Chinook salmon and steelhead. Yearling Chinook salmon and steelhead were concentrated more in deeper waters near the navigation channel than sub-yearling Chinook salmon. Larger fish tended to spend less time (9 to 24 minutes) within the MCR detection area that smaller subyearling Chinook (mean = 160 minutes). Yearling Chinook salmon and steelhead demonstrated a more directed emigration pattern relative to sub-yearling Chinook salmon. Sub-yearling Chinook salmon residence times within the detection areas were up to 15 to 20 times longer than yearling Chinook salmon and steelhead, usually passing on two to three ebb tides instead of one. Also, they took longer to reach the MCR from Bonneville Dam (average 4.5 days) than yearling Chinook salmon and steelhead (mean = 3.5 days; McMichael *et al.* 2006).

Though these metrics do not indicate actual time fish spent in the area around the Jetties themselves, they can be used to roughly extrapolate the overall range of residence time in the area. Considering the sampled area was approximately 70 acres out of approximately 2,600 acres across the river between the tips of the Jetties and Cape Disappointment, extrapolating from the data indicate that subyearling Chinook salmon could spend anywhere from a few hours to a maximum of approximately 4.6 days within the larger MCR area. Steelhead and yearling Chinook salmon spend even less time (usually a few hours to less than 1 day), as they are more directed in their emigration (McMichael *et al.* 2006). Furthermore, detections at each array were within a spherical range of approximately 656 feet, which means fish detected on arrays closest to the Jetties could still be up to 656 feet away from the structure itself (McMichael *et al.* 2010). Therefore, juvenile residence time within the MCR area and their potential exposure to jetty repair activities is of short and relatively limited duration.

The PNNL conducted subsequent similar studies that monitored and mapped migration pathways and habitat associations and behaviors relative to these pathways for acoustic-tagged juvenile yearling Chinook salmon, steelhead, and subyearling Chinook salmon downstream of Bonneville Dam as they migrated seaward through the Columbia River and its estuary. In the action area in 2009, receiver arrays were deployed across the entire river channel at two locations near the mouth of the river at East Sand Island and the Columbia River bar. Partial arrays were also deployed across the primary channel at the Astoria Bridge (McMichael *et al.* 2010).

The 2009 PNNL study indicated that acoustic-tagged yearling Chinook detected in the Bonneville Dam forebay and at the mouth of the Columbia River had a mean travel time of 3.4 days. Travel times decreased throughout the migration period. Travel rates of both yearling Chinook salmon and steelhead decreased as they moved between Oak Point and the Astoria Bridge, and increased and was more variable downstream of RM 13.7. Steelhead had a mean travel time of 3.1 days, and travel times decreased throughout the migration period. Subyearling Chinook salmon had a mean travel time of 4.1 days between RM 5.2 and RM 146. Travel times increased slightly throughout the migration period. Travel rate of subyearling Chinook salmon decreased as they moved between the array at Cottonwood Island, RM 8.7 and RM 70, and then increased and was more variable downstream of RM 13.7. Furthermore, timing of arrival of tagged fish at most arrays in the lower 31 miles of the estuary was influenced more by tide than by time of day for all three groups. Most tagged fish passed the lower three arrays on ebb tides, and this relationship was most evident when the difference between high and low tide was greatest (McMichael *et al.* 2010).

These studies give some indication of distribution near the Jetties and offloading facilities, although arrays were not specifically at these locations. Similar to the 2007 and 2008 studies, results obtained from 2009 also indicated that a greater proportion of subyearling Chinook salmon migrated through off-channel areas (outside the primary channel) than yearling Chinook salmon or steelhead, which concentrated more towards the navigation channel (McMichael *et al.* 2010). For 2007 and 2008 (when more arrays were located nearer the South Jetty than in 2005) migration patterns for subyearling Chinook indicated cross-channel distribution that in the vicinity of the MCR was more skewed towards the Washington shore. However, fish distribution did not peak at the nodes in closest proximity to the Jetties (Carter *et al.* 2009). Furthermore, in 2007, approximately 93% of juvenile yearling Chinook detected passed farther than 656 feet away from the North Jetty (656 feet is the approximate spherical detection radii of the arrays), and over 99% detected passed at an even greater distance away from the South Jetty (Carter *et al.* 2009). In 2008, approximately 96% of detected juvenile subyearling Chinook passed at a distance greater than 656 feet from the North Jetty, and over 99% passed at an even farther distance away from the South Jetty (Carter *et al.* 2009). Results for 2009 showed similar trends for all juveniles, and in particular subyearling Chinook.

In 2010, nodes were briefly moved for a short time so that one node was placed on the upriver side of Jetty A, one at the tip of Jetty A, and one on the western, oceanside of Jetty A (McMichael *et al.* 2010). Preliminary results indicated that 378 subyearling Chinook were detected at the upstream node, 385 at the tip, an only eight at the ocean side node. This seems to indicate that fish move downstream towards Jetty A without moving very close to Jetty A on the ocean side (McMichael *et al.* 2010). Furthermore, at the array near the mouth, in 2010, seven out of the 1,144 fish (or 0.6%) detected on the array passed on the node nearest the North Jetty (McMichael *et al.* 2010).

Green Sturgeon. Green sturgeon spend more time in the marine environment than other sturgeon species (Adams *et al.* 2002 and in press). Juvenile and adult green sturgeon are likely to use the action area as habitat for adult and subadult migration and

feeding, as well as growth and development to adulthood by subadults. When not spawning, this anadromous species is broadly distributed in nearshore marine areas from Mexico to the Bering Sea (NMFS 2010e). Green sturgeon use bays, estuaries, and sometimes the deep riverine mainstem in lower elevation reaches of non-natal rivers along the west coast of North America, but the distribution and timing of estuarine use is poorly understood (NMFS 2010e). Green sturgeon in the ocean will usually remain inside the 328-foot depth contour (Erickson and Hightower 2004).

Observations of green sturgeon in the Columbia River are concentrated in the estuary but have been made as far upriver as Bonneville Dam. No evidence exists for spawning in this system (Rien *et al.* 2002). Radio-tagged southern DPS green sturgeon in the Sacramento River occur seasonally in northern estuaries including the Columbia River estuary during the summer and early fall (Moser and Lindley 2006). In the Columbia River, Israel and May (2006) found the percentage of southern DPS fish to exceed 80% of total northern and southern DPS fish during late summer and early fall of some years.

The Corps and USGS have recently been working on a study of green sturgeon in the Coos and Columbia River estuaries. Although results are preliminary and sample sizes are relatively small, acoustic receivers detected green sturgeon several times off the tip of Jetty A, near the North Jetty, and in the area of Social Security beach off the Clatsop Spit (Parsley 2010). Information about specific use in the action area is still under development.

The preliminary acoustic telemetry work by the USGS on green sturgeon in the Columbia River estuary included the placing of acoustic receiver arrays approximately 300 feet from Jetty A and the North Jetty. The USGS used both acoustic and pressure-sensitive tags for this study. The receivers were capable of detecting tagged fish within 2,000 feet of the receiver, with 70 percent detection efficiency. The pressure-sensitive tags were able to detect fish at minimum depths, *e.g.*, 100 feet. Both receivers cannot determine how close the fish are to the Jetties, only that the fish were within the range of detection.

Although the USGS acoustic telemetry study does not provide information on proximity of fish relative to the Jetties, the behavioral and distribution information available on green sturgeon and their use of the Columbia River suggests that green sturgeon are likely to be in deeper areas of the MCR. Although information on habitat preferences is limited for subadult and adult green sturgeon in the Columbia River, information on white sturgeon (*Acipenser transmontanus*) in the Columbia River suggests that larger fish tend to congregate in deep pools. In a study by Parsley and Beckman (1994) they reported average water depths for juvenile white sturgeon in the Columbia River of 55 feet. This suggests, assuming habitat preferences are similar between the two species, that green sturgeon are unlikely to be found in proximity of the footprint or construction zone of the Jetties, but located more towards the navigation channel at the MCR.

Eulachon. A large percentage of the total eulachon production originates in the Columbia River basin. Spawning occurs in the mainstem of the Columbia River upstream of the estuary (Emmett *et al.* 1991, Musick *et al.* 2000) in January or February (Beacham

et al. 2005). Additionally, eulachon usually spawn every year in the Cowlitz River, with inconsistent runs and spawning events occurring in the Gray's, Elochoman, Lewis, Kalama, and Sandy rivers (ODFW and WDFW 2009). Prior to the construction of Bonneville Dam, occasional reports were received of smelt occurring upstream as far as Hood River, Oregon, and possibly farther (Smith and Saalfeld 1955). In times of great abundance, (*e.g.*, 1945, 1953) eulachon have been known to migrate as far upstream as Bonneville Dam (Smith and Saalfeld 1955, Howell et al 2001), and are suspected of passing through the ship locks, having reached the Klickitat River (Smith and Saalfeld 1955). Though eulachon have been observed migrating up the Columbia River, spawning has not been documented in the mainstem above RM 80 (Romano *et al.* 2002).

Larval forms outmigrate through the estuary and juvenile forms rear in marine waters extending out along the continental shelf (NMFS 2008a). Eulachon larvae are approximately 0.2 inches in length and, are rapidly flushed to the ocean, often within days of hatching, and subsist on their yolk sac during this downstream dispersal (WDFW and ODFW 2001).

Information on the distribution and ecology of juvenile eulachon is scarce because they are too small to be detected in fisheries surveys, and too large to capture in ichthyoplankton surveys (Hay and McCarter 2000). It is likely that juvenile eulachon rear in near-shore marine areas at moderate or shallow depth (Barraclough 1964) and feed on pelagic plankton, including euphausiids (krill). As they grow at sea, they tend to utilize waters of greater depths and have been found as deep as 2,051 feet (Allen and Smith 1988).

Adult eulachon range in size from 5.5 to 12 inches and are planktivorous in the ocean, but stop feeding when returning to fresh water to spawn (McHugh 1939, Hart and McHugh 1944). The homing instinct of eulachon is not clearly understood, but it is postulated that larvae may spend weeks to months in nearby estuarine environments, where they grow significantly in size and may develop the capacity to imprint on large estuaries and eventually home to these areas as adults (McCarter and Hay 1999, Hay and McCarter 2000).

Eulachon return to fresh water to spawn at 2 to 5 years of age. Spawning in the lower Columbia River can occur soon after freshwater entry (ODFW and WDFW 2009). Eulachon typically enter the Columbia River in early to mid-January (although a small 'pilot' run may occur in December), followed by tributary entry in mid- to late January. Peak tributary abundance is usually in February, with variable abundance through March and an occasional showing in April (ODFW and WDFW 2009). Therefore, adult eulachon are unlikely to be present as in-water work, which is scheduled for April through October with June through October being the most likely time for in-water work due to high ocean wave and high river flow conditions in spring, and river entry have little if any overlap.

Larvae eulachon may be present in the near-and offshore oceanic environments of the action area. Although most larval eulachon should have been flushed out of the estuary to

the ocean prior to the April through October in-water construction period, it is likely that not all larvae will be pelagic by April or May.

Effects on Listed Species

NMFS expects rock placement and pile installation and removal to adversely affect Steller sea lions, pile installation and removal to adversely affect humpback whales, and maintenance dredging to adversely affect eulachon.

The NMFS expects effects of construction (*i.e.*, rock transport, rock placement, construction access, staging, rock stockpiling, dredging, disposal of dredge materials, barge offloading facilities, pile installation and removal, lagoon and wetland fill, culvert replacement, dune augmentation, water quality, hydraulic and hydrological processes) on salmon, steelhead, and green sturgeon to be insignificant or discountable.

The following is a discussion of the effect of each project element on listed species and the rationales supporting our effects analysis.

Pacific Salmon and Steelhead, Green Sturgeon, and Eulachon

Rock Transport. Loaded water-borne container traffic identified as foreign in- and outbound to/from Portland that would likely have crossed the MCR in 2008 totaled approximately 195,489 ships (Corps 2010). The number of additional barge trips per year attributable to the proposed action is likely to be somewhere between 8 and 25 ships. This represents a small annual percentage increase of 0.004 to 0.01% relative to the current number of other commercial and recreational vessels already using any of these potential routes. NMFS is not aware that ship traffic in the shipping lanes of the Pacific Coast or in the MCR is currently adversely affecting salmonid, eulachon, or green sturgeon behavior. Therefore, an increase in ship traffic of 0.004 and 0.01% is unlikely to affect salmon, steelhead, eulachon, or green sturgeon behavior, fitness, migration patterns, physiology, or spatial distribution, especially since barges will be traveling at less than 12 knots. Therefore, NMFS concludes that the effects associated with rock transport on listed species are discountable.

Construction Access, Staging, Storage, and Rock Stockpiling. As described in the *Effects on Habitat* section above, effects to upland habitats will occur above mean high tide elevation. Vegetation to be removed is located in upland areas above mean high tide elevation; vegetation in these upland areas provides no habitat functions for listed species as the area is comprised of sand and European beachgrass, and BMPs will prevent disturbed sediments created by construction staging, storage, and rock stockpiling from reaching marine and estuarine waters. Therefore, NMFS concludes effects associated with construction access, staging, storage, and rock stockpiling on listed species are discountable.

Rock Placement. NMFS does not expect any listed species to be injured or killed during or as a result of placing rock for repairs and rehabilitation. This is because most of

the rock will be placed on existing, relic stone that is not used by listed species (Steller sea lions being the exception). On average, 55% of all rock will be placed above MHHW, and will have no effect on listed species, except Steller sea lions. On average 24% of all rock will be placed between MLLW and MHHW. Therefore 79% of the rock will be placed in areas where few if any listed species are likely to occur, significantly reducing the probability for listed species to be injured or killed. While on average 21% of the rock will be placed below MLLW, NMFS does not expect listed species to occur in this zone as there is no biological reason (*e.g.*, food, high-energy refugia, predator avoidance) for listed species to expend energy in this high-energy, hostile environment.

Adult salmonids use deep-water water habitats when migrating through the MCR and adult and sub-adult green sturgeon migrate in deep water at the MCR, farther offshore than the spur groins and barge offloading facilities. Because rock placement will occur during June through October, eulachon larvae are unlikely to be present, and construction-related effects are expected to be discountable.

NMFS expects affects to behavior, fitness, migrating rates, or spatial distribution for adult eulachon will be insignificant as the spur groins are small (60 to 250 feet) lateral extensions of the Jetties that extend from the jetty roots to enhance stabilization of the jetty base. The MCR is more than 2 miles wide and affects on adult eulachon behavior, fitness, migration patterns, physiology, or spatial distribution are not reasonably certain to occur.

Therefore, NMFS concludes effects associated with the rock placement on listed species, are discountable.

Habitat-Species Effects. As described in the *Effects on Habitat* section, 9.96 acres of sandy, shallow-water inter-tidal habitat will change to rocky inter-tidal or above-tidal habitat, and 22.49 acres of rocky sub- or inter-tidal habitat will change to rocky sub-, inter-, or above- tidal habitat. The proposed habitat-type changes are not likely to result in adverse effects on behavior, fitness, migration patterns, physiology, or spatial distribution of juvenile salmon and steelhead, adult salmon and steelhead, green sturgeon, and eulachon, for the following reasons.

For salmon and steelhead, green sturgeon, and eulachon, the MCR is not used for extended periods of time, and the research on juvenile salmon and steelhead behavior at the MCR suggest that the Jetties provide no ecological function for behavioral or physiological requirements as they migrate to the ocean.

Within an estimated 3-mile proximity of the MCR jetties, approximately 19,575 acres of shallow water (-20 feet MLLW or shallower) habitat exists, of which 9.96 acres represents a conversion of 0.05 % of the shallow-water habitat. In comparison to higher peaks in distribution nearer the navigation channel, only a small percentage of juvenile salmon and steelhead, *e.g.*, approximately 5.5% use the areas between the navigation channel and the Jetties.

Based on a review of the 2005 through 2009 acoustic tag studies, the earlier studies deployed a narrower set of detection nodes. In subsequent years detection nodes were placed within ±300 feet of the North Jetty and ±800 feet of the South Jetty, with a detection range of 656 feet. Although fish may pass close to the South Jetty without being detected, the data from the multi-year study indicates that salmon and steelhead are oriented towards the navigation channel, and were consistently detected at distances greater than 656 feet from the North and South Jetties. Although a small percent occurred in the area between the Jetties and the navigation channel, an area measuring 3,200 feet wide and 6,500 feet wide, for the North Jetty and South Jetty, respectively, the data consistently indicate that salmon and steelhead in these areas outside of the navigation channel and between the Jetties are highly unlikely to occur within a few hundred feet of the Jetties. Furthermore, based on the description of the physical conditions described above under *Physical Environment at the MCR*, NMFS does not expect salmon or steelhead to occur in the construction zone as there is no biological reason, (*e.g.*, food, high-energy refugia, predator avoidance) for listed species to expend energy in this high-energy, hostile environment..

Residence time of juveniles within the larger MCR area ranges from a few hours up to, at most, a few days for the less-directed subyearling Chinook emigrants. The residence of these fish within proximity of the Jetties is therefore likely to be even shorter than the above estimates. While green sturgeon are likely to occur in the MCR as they enter and exit the Columbia River, it is likely they will be deep pools or the navigation channel rather, than near the Jetties. Eulachon are not dependent upon these rocky sub- or inter-tidal habitats in the MCR for spawning or emigration of larvae.

The anticipated area of shallow-water habitat to be altered by the proposed action intermittently is so small compared to the overall area available in the MCR, 0.05% of the area, that no significant reduction in prey available to listed species or behavioral effects are likely to result. More importantly, salmonids in the MCR feed primarily on marine insects, euphausiids (krill), zooplankton, crab megalopa, fishes, *e.g.*, Pacific herring, Groot and Margolis (1991), as opposed to benthic organisms.

Therefore, NMFS concludes effects associated with the rock placement and habitat changes on listed species will be insignificant.

Fish Predation. While piscivorous fish (*e.g.*, Pacific staghorn sculpin (*Leptocottus armatus*), and lingcod (*Ophiodon elongates*) may occupy suitable areas of new rock, these species currently occur at the Jetties and it is most likely these fish will recolonize areas where rock is being placed on existing rock habitat. Therefore, it is unknown whether piscivorous fish would increase or merely redistribute. Even if the number of piscivorous fish along the Jetties increased, it is unknown if predation rates on listed species would increase, especially since few if any listed fish are likely to be within a few hundred feet of the Jetties, based on the acoustic telemetry data, and the harsh physical environmental conditions.

As a result of jetty repairs and rehabilitation, NMFS does not expect adult or larval life stages of eulachon to be subject to potential increases in predation associated with the proposed action as: (1) There is no data available to suggest a relationship, and (2) larval eulachon are likely too small at 0.2 inches to provide any energy benefit to predators like Staghorn sculpin and lingcod.

NMFS does not expect adult and juvenile green sturgeon, adult salmon and steelhead to be affected by the proposed increase in rocky habitat for predators because they are too large to be eaten by these predators.

The proposed increase in rocky habitat and potential increase in piscivorous fish density is not reasonably likely to lead to increases in predation rates on listed fish by piscivorous fish for the following reasons:

1. The acoustic telemetry studies suggest only a small percentage of juvenile salmon and steelhead, approximately 5.5% use the areas between the Jetties and the navigation channel. This indicates that very few if any of listed salmon and steelhead will pass close enough to the Jetties to be consumed via ambush predation.
2. The MCR is a high energy, stochastic environment even during summer and fall when most of the repair and rehabilitation activities will take place, and residence time of juveniles within the larger MCR area ranges from a few hours up to at most a few days.
3. The increase in the jetty prism and expansion of the footprint below MHHW will be very small relative to the existing structure; therefore, the increase in piscivorous fish habitat and the potential increased recruitment of piscivorous fish will also be very small relative to the current number of those already along the Jetties.

Based on the above, NMFS concludes predation-associated effects on listed species are discountable.

Bird Predation. Key avian predators in the vicinity of the structures includes Bonaparte's gull (*Larus philadephia*), surf scoter (*Melanitta perspicillata*), common loon (*Gavia immer*), Pacific loon (*Gavia pacifica*), cormorants (*Phalacrocorax* spp.), Northwestern crow (*Corvus caurinus*), tern (*Sterna* spp.), Western grebe (*Aechmophorus occidentalis*), and bald eagle (*Haliaeetus leucocephalus*). The proposed increase in rock, particularly above MHHW, is reasonably likely to be used for perching by piscivorous birds. However, perching opportunities are already abundant along the Jetties and in the MCR. Neither avian density nor avian predation success in the MCR is likely to be limited by the quantity of rocky perches. Therefore, new perching sites are not likely to increase avian predation in a way that could be meaningfully attributed to the proposed action. Therefore, NMFS concludes predation-associated effects of the proposed action on listed species are discountable.

Mammal Predation. Marine mammals (*i.e.*, Steller sea lions, California sea lions) already use rock on the Jetties as a haul-out, mostly at the South Jetty. These animals likely prey on salmon, steelhead and sturgeon (green and white) in the MCR. It is unlikely that the quantity of haul-out space in the MCR would increase the size of marine mammal populations. The increase in haul-out area above MHHW may provide more surface area for marine mammals, but it is unlikely to increase the number of marine mammals at the MCR as this area is not a rookery. Therefore, the increase in haul-out space is unlikely to increase the magnitude, rate, or intensity of existing predation on listed species.

Dredging. The most likely adverse effect on listed species associated with dredging is entrainment. Entrainment studies of out-migrating fish carried out by Larson and Moehl (1999) at the MCR during May through October, the peak out-migration period of salmon and steelhead in the Columbia River basin, reported no entrained salmon or steelhead. The 4-year study examined 798 disposal samples. In Grays Harbor, Washington, four independent studies that monitored 798 disposal samples resulted in entrainment of 1 chum salmon over the 5-year study period (Bengston and Brown 1977, Tegelberg and Arthur 1977, Stevens 1981, and Armstrong *et al.* 1982, as cited in R2 1999).

An entrainment study carried out by R2 in 1999 examined 391 disposal samples (140 samples from the Columbia River and 251 from the Oregon Coast) and reported entrainment of two Chinook salmon at the Columbia River site. The R2 studies occurred during May through August, the peak out-migration period of salmon and steelhead in the Columbia River basin.

Buell *et al.* (1992) carried out entrainment studies on the Columbia River between RMs 102.2 and 102.5. Buell *et al.* monitored maintenance dredging of 700,000 cy between March 24 and April 10, the time of peak out-migration of salmon and steelhead in the Columbia River basin. In the Buell *et al.* study, no salmon or steelhead were entrained.

Braun (1974), as cited in Reine and Clarke (1998), reported no salmon fry entrained as a result of dredging in the Fraser River. Carlson *et al.* (2001) examined the vertical distribution of juvenile salmon in the Columbia River between RMs 32 and 43 and reported that juvenile salmon were, on average 7 to 27 feet from the bottom of the river.

Looking at the information in Larson and Moehl (1999), which examined 798 disposal samples from the MCR, approximately equal to 4 million cy of dredged material, during peak out-migration for salmon and steelhead, and the fact that they reported no entrainment of salmon or steelhead, it is unlikely that dredging of 780,000 cy spread out over a 20-year period will entrain any salmon or steelhead. Additionally, the Buell *et al.* (1992) study, which examined disposal samples for 9 days of dredging and 700,000 cy, and at depths ranging between 60 and 80 feet in the Columbia River, during the peak out-migration of salmon and steelhead, and the fact that they reported no entrainment of salmon or steelhead, it is unlikely that dredging of 780,000 cy spread out over a 20-year period will entrain any salmon or steelhead. Based on the above assessment of the

literature that examined entrainment of fishes in Oregon, Washington, and British Columbia, especially the Larson and Moehl (1999) and Buell *et al.* (1992), the information on the vertical distribution of juvenile salmon in the Columbia River, the operations of dredging, *i.e.*, keeping the draghead/cutterhead below the bottom of the river, and the proposed BMPs to place the draghead/cutterhead motors in neutral if they rise 3 feet above the bottom, NMFS considers the probability of entrainment of listed species to be discountable, except for eulachon.

NMFS expects a small percentage of the approximate 1,900,000,000 to 6,500,000,000 eulachon larvae produced each year in the Columbia River basin (based on 2009 spawner biomass estimates, NMFS 2010a) to be entrained during dredging since dredging may overlap with eulachon emigration in late spring or early summer. Since eulachon larvae are dispersal migrants and may occur anywhere in the water column, NMFS considers the entrainment of larvae eulachon to be reasonably certain to occur. Entrainment will kill these eulachon larvae. Nonetheless, NMFS expects the magnitude of effect (*i.e.*, number of larvae entrained) will be small because: (1) Dredging will take place below the river bottom; (2) the dragheads or cutterheads will not be engaged if raised more than 3 feet above the river bottom; (3) the relative volume associated with dredging compared to the volume of the river flow is approximately 0.0001%; and (4) the timing of dredging will range from 3.3 to 13.3 hours per year, relative to the total outmigration period of larval eulachon of 95 to 200 days.

Dredging is likely to entrain benthic infauna. However, the magnitude and significance of effects is likely to be insignificant for listed species, as the small quantity of material dredged each year, 20,000 to 80,000 cy, represents a fraction of habitat available for benthic infauna in the MCR, *e.g.*, benthic infauna densities in the subtidal habitats in MCR ranges between 7,999 individuals to 267,283 individuals per 10.8 square feet of subtidal substrate sampled (Siipola 1994). More importantly, these areas represents a minor source of food for listed species as the primary forage items for juvenile salmon and steelhead in the MCR are marine-based, *e.g.*, marine insects, euphausiids (krill), zooplankton, crab megalopa, and fishes, Groot and Margolis (1991). Because eulachon larvae feed on plankton, their foraging habitat will not be affected by dredging. Therefore, NMFS does not expect effects associated with dredging to adversely affect behavior, fitness, migration patterns, physiology, or spatial distribution for listed species.

Increases in suspended sediment will occur during disposal. Residence time of suspended sediment in the water column is likely to be short, and increases will attenuate to background levels within minutes because the dredged material is comprised of 97% or greater sand. Dredging, especially in areas adjacent to the Jetties, will take place in areas where sediment tests have confirmed that material to be dredged is 97% or greater sand. The dredging volume will be small, between 20,000 and 80,000 cy per year, and the dredged material does not pose a risk as a source of contaminants because it consists of very little organic matter for contaminants to bind to. Based on these factors, NMFS does not expect dredging to adversely affect water quality in a manner that would meaningfully affect the behavior, fitness, migration patterns, physiology, or spatial

distribution for listed species. Therefore, NMFS concludes that effects associated with dredging on listed species will be insignificant, except for eulachon.

Disposal of Dredged Materials. Disposal is likely to occur on an annual basis originating from one or more of the offloading facilities. The duration of disposal will be limited to 1 to 3 hours of disposal per year. As mentioned previously, all disposal of dredged material will be at previously evaluated and approved in-water disposal sites. NMFS has previously evaluated the effects of disposal of dredged materials at these disposal sites (NMFS 2005a), on listed fish. Using the model in NMFS 2005a to estimate the number of listed fish potentially affected by disposal, NMFS estimates that between 0.000045 to 0.00018 fish per year may be affected from disposal. Based on this estimate, NMFS concludes that effects associated with disposal of dredged materials on listed fish are discountable.

Increases in suspended sediment will occur during disposal. Residence time of suspended sediment in the water column is likely to be short, and increases will attenuate to background levels within minutes because the dredged material is comprised of 97% or greater sand. Dredging, especially in areas adjacent to the Jetties, will take place in areas where sediment tests have confirmed that material to be dredged is 97% or greater sand. The dredging volume will be small, between 20,000 and 80,000 cy per year, and the dredged material does not pose a risk as a source of contaminants because it consists of very little organic matter for contaminants to bind to. Based on these factors, NMFS does not expect dredging to adversely affect water quality in a manner that would meaningfully affect the behavior, fitness, migration patterns, physiology, or spatial distribution for listed species. Therefore, NMFS concludes that effects associated with disposal of dredged materials on listed species will be insignificant.

Barge Offloading Facilities. As described in the *Effects on Habitat* section, the installation of four barge offloading facilities and one causeway is likely to occur once, likely in the late spring or early summer prior to or during the first season of construction on the associated jetty. Effects of barge offloading facility installation and removal are discussed under the sections *Rock Placement, Pile Driving, and Dredging* as those are the components of constructing the facilities.

Pile Installation and Removal. As described in the *Effects on Habitat* section, up to 96 Z- or H-piles (12 to 16 inch diameter) could be installed as dolphins, and up to 373 sections of sheet pile installed to retain rock fill. Installation of piles is likely to happen between April and June and will be done using vibration. Piles may be removed and installed several times for a total of 1,000 pile driving or removed events. Installation and removal of piles with a vibratory hammer will introduce sound waves into the MCR area intermittently over 20 years.

Injury and death of fish from underwater noise are caused by rapid pressure changes, especially on gas-filled spaces in the bodies of fish. For this analysis, NMFS is assuming that vibratory pile driving has a similar effect on eulachon and green sturgeon as it does on salmonids, even though eulachon do not have swim bladders.

Generally, sounds from vibratory hammers are generally 10-20 dB lower than those from impact pile driving (CalTrans 2009, 4-16). While peak sound levels generated by vibratory hammers can exceed 180 dB, the sound levels rise more slowly than the sound levels generated by impact hammers (CalTrans 2009). Therefore, vibratory hammers avoid the abrupt over-and under-pressure changes exhibited by impact hammer use. General agreement does not exist on what vibratory sound exposure level (SEL) threshold value should be used for fish injury, although the likely range is 187 to 220 dB (CalTrans 2009, 4-22).

The average sound pressure levels recorded during a recent test pile program during vibratory hammering was 160 dB (peak-average); 199 dB (peak-maximum), 146 dB (SEL-average); and 181 dB (SEL-maximum) (NMFS 2010b). Therefore, given the absence of large over/under pressure changes, the understanding that injury SEL threshold values are likely in the 187 to 220 dB range, and that SEL values for vibratory hammer use are likely to be less than the discussed injury threshold, NMFS expects the proposed action would not result in the injury of fish present in the action area. Furthermore, while it is a reasonable hypothesis that SEL below 187 dB may result in behavioral responses, the data is inconclusive to determine a threshold for salmonid fishes, green sturgeon, and eulachon. Nonetheless, the data from the test pile program suggest that fishes in close proximity to the pile during installation or removal are unlikely to exhibit any behavioral responses as the reported SEL at 146 dB SEL-average is significantly below the 187 dB potential injury onset threshold. To assess potential behavioral responses in fishes, NMFS calculated the root mean square for 150 dB threshold to be at 328 feet from the source. NMFS expects few, if any, fish within a few hundred feet of the Jetties, based on the acoustic telemetry data, and therefore does not expect pile installation or removal to illicit behavioral responses in fishes.

Based on the above information, NMFS does not expect sound generated from pile installation and removal using a vibratory hammer to cause adverse effects to behavior, fitness, migration patterns, physiology, or spatial distribution of listed species, except Steller sea lions and humpback whales, which are analyzed later in this Opinion. Therefore, NMFS concludes effects associated with pile installation and removal on Pacific salmon and steelhead, green sturgeon, and eulachon will be insignificant.

Wetland and Lagoon Fill and Culvert Replacement. As described in the Effects on Habitat section, wetland (1.78 acres) and lagoon (4.71 acres) fills and culvert replacements will occur above the high tide line and will be functionally disconnected from the Columbia River as the wetland and lagoon areas are located on the landward side of North Jetty (Figure 2). The filling of the wetland and lagoon that drain into the MCR is likely to have small but insignificant effects on water quality and nutrient inputs to the Columbia River. Therefore, NMFS concludes that effects associate with wetland and lagoon fill and culvert replacement on listed species will be insignificant.

Dune Augmentation. The dune augmentation at a beach below the South Jetty will occur above mean high tide. The Corps determined that the dune augmentation actions will have immeasurable effects on listed species. Since all work will occur above

MHHW, NMFS concludes effects associated with dune augmentation on listed species will be insignificant.

Jetty Road System. As described in the *Effects on Habitat* section, the roads on top of the Jetties will be built with a mix of rock and sediment. These roads are likely to deteriorate during storm events. However, the rate of erosion and the release of road base materials through the Jetties are likely to be immeasurable as washout of the road base will occur during winter storms when waves overtop the Jetties and wave-generated suspended sediment is very high. Therefore, NMFS concludes effects associated with the jetty road system on listed species are insignificant.

Construction-Associated Leaks and Spills. As described in the *Effects on Habitat* section, the Corps will require the contractor to provide a spill prevention and management plan that will include measures to avoid and minimize the potential for leaks and spills to respond quickly to minimize damages should spills occur. Good construction practices, proper equipment maintenance, appropriate staging set-backs, and use of a Wiggins fueling system would further reduce the likelihood of leak and spill potential and exposure extent and its associated effects. NMFS has determined that spills large enough to adversely affect habitat functions cannot be reasonably expected to occur.

Therefore, NMFS concludes effects associated with the construction and contaminants on listed species are discountable.

Hydraulic and Hydrological Processes. As described in detail in the *Effects on Habitat* section, previous modeling results indicated the changes to velocities, currents, salinity, plume dynamics, and bed morphology were minimal under the much larger jetty length rebuild scenarios. Based on these previous results, no significant overall changes to the hydraulics or hydrology, and associated processes of the MCR system are likely under the new, significantly smaller proposed action. The modeling results on hydraulic and hydrological processes was run for a significantly larger project, *e.g.*, restoring the South Jetty to its original length—an additional 5,000 feet in length from its present location. Those modeling results showed minor changes to velocities, currents, salinity, plume dynamics, and bed morphology, all within the range of variability. Because the current proposed action is significantly smaller, *e.g.*, no restoration of jetty lengths, the effects on velocities, currents, salinity, plume dynamics, and bed morphology are likely to be significantly less than previously determined. Although it is likely that listed species cue in on these parameters while in the MCR area, minor and intermittent changes to velocities, currents, salinity, plume dynamics, and bed morphology associated with the proposed action are within the range of natural variability and any connection to meaningful changes, positive or negative, are not possible to quantify.

Therefore, NMFS concludes that there are no hydraulic and hydrological-associated effects on listed species from repairs and rehabilitation of the Jetties.

Mitigation. The Corps estimated that a total of 38.28 acres of wetland habitats will be filled or degraded. The Corps is proposing a 2:1 mitigation ratio for wetland

impacts for a total of 76.56 acres of restoration. Short-term effects associated with these activities are described above under *Habitat-Species Effects* and *Wetland and Lagoon Fill and Culvert Replacement*. In the long term, these habitat restoration actions will improve intertidal and subtidal estuarine habitats for listed species.

Steller Sea Lions

The only proposed activities NMFS anticipates will affect Steller sea lions are rock placement and pile driving, as described in detail below.

Rock Placement. Some Steller sea lions using haulout sites (rubble mound or concrete block) on the South Jetty are reasonably likely to be disturbed by the proposed rock placement activities. The response of Steller sea lions to the proposed rock placement may include alert behavior, approaches to the water, and flushes into the water. These potential disturbances could be caused by the movement of construction machinery and/or the noise produced by the machinery. The proposed action may also include measures to intentionally deter the Steller sea lions from using the portion of the jetty where work will occur. Such activities will be authorized under MMPA section 109(h)(1)(a), and the Steller sea lion regulations at 50 CFR 223.202(b)(2) should deterrence become necessary to protect the animals from injury during construction.

Sea lions are likely to be disturbed during the rehabilitation of the South Jetty cap and 500 feet of the jetty trunk. Steller sea lions will likely be hauling out in this area for the duration of the proposed project, *i.e.*, intermittently for the next 20 years. The remaining majority of construction work will occur a significant distance from the nearest location where Steller sea lions have been observed hauling out. The number of Steller sea lions that will be incidentally or purposefully disturbed during the 20 year span of the proposed action is unknown, but all individuals that use the haulout are likely to be exposed to these activities.

The number of Steller sea lions exposed daily will vary based on weather conditions, season, and daily fluctuations of abundance at the South Jetty. Given the time of year that most of the placement will occur (spring/summer), the number of Steller sea lions affected daily could range from between 200 to 600 animals, based on past surveys (see Status of the Species). The number of Steller sea lions affected daily is likely to increase over the 20 years of project activities, because the population is currently increasing at 3% per year. It is likely that individuals will be repeatedly exposed to the rock placement activities over the 20-year period. Behaviorally, Steller sea lions may respond to rock placement by vacating the area. Some sea lions may redistribute themselves along portions of the jetty away from construction activities and to other haul out sites in the lower river and along the coast to the south and north.

Steller sea lions were flushed into the water during the repairs that were performed on the South Jetty in 2006 and 2007 (refer to NMFS No.: 2005/06359), and the effects of this proposed action are expected to be similar. During construction in 2006 and 2007, sea lions were often seen in the water close to the jetty and to a lesser extent on the jetty but

appeared to be unaffected by construction activities. They often swam close to construction activities and at times appeared to feed in close proximity to construction activities. Two disturbances of pinnipeds were reported during the 2007 interim repairs. The majority of Steller sea lions occurring on the concrete block structure were far away from construction activities and undisturbed.

Based on these past responses to similar activities, NMFS finds it likely that Steller sea lion exposure to rock placement activities will change their use of the South Jetty area and the amount of time they would otherwise spend foraging in the immediate vicinity. However, there are alternative foraging areas available to the affected individuals. Repetitive, short-term displacement is likely to cause repetitive, short-term disruptions in their normal behavioral patterns at the South Jetty.

Pile Driving. As described in the proposed action and effects to the environment, approximately 24 Z- or H-piles of 12 to 16 inches in diameter could be installed as dolphins, and up to 94 sections of Z or H sheet pile (24 inch) could be installed to retain rock fill. The piles for this facility are likely to be installed as close as 600 feet from the rubble mound and 1,400 feet from the concrete block structure but as far as 6,000 feet from the concrete block structure used by Steller sea lions.

NOAA is currently developing comprehensive guidance on sound levels likely to cause injury and behavioral disruption for marine mammals in the context of the Marine Mammal Protection Act and the ESA, among other statutes. Until formal guidance is available, NMFS uses conservative exposure thresholds of sound pressure levels from broadband sounds that cause behavioral disturbance (160 dBrms re: 1µPa for impulse sound and 120 dBrms re: 1µPa for continuous sound) and injury (190 dBrms re: 1µPa for pinnipeds) (70 FR 1871). In the air, sound pressure levels greater than 100 db re:20µPa have been shown to affect behavior.

Based on these conservative thresholds, the Corps anticipates that their proposed pile driving and removal would produce sound pressure levels that are likely to disturb Steller sea lions. Underwater sound produced by the proposed vibratory pile driving and removal is anticipated to be below the injury threshold at the source. Based on conservative sound modeling, noise from vibratory installation and removal will attenuate to the 120 dB disturbance threshold within 6.2 miles (in the direction of the ocean, whereas land would be encountered on either shore of the river system prior to attenuating to the 120 dB threshold). As described for rock placement above, all individual Steller sea lions that use the South Jetty haulout are likely to be exposed to pile driving sound above the in-air and underwater disturbance thresholds of 100 dB and 120 dB, respectively, repeatedly over the 20-year period when pile driving would intermittently occur. Given the time of year that most of the pile driving would occur (spring/summer), the number of Steller sea lions affected daily could range from between 200 to 600 animals, and could increase over time because the population is growing at a rate of 3% annually (see Status of the Species).

NMFS finds it likely that Steller sea lions will be exposed to and disturbed by sound generated by pile driving activities. Steller sea lions will likely spend less time at the South Jetty haulout or foraging in the immediate vicinity. However, there are alternative foraging and haul out areas available to the affected individuals. Repetitive, short-term displacement is likely to cause repetitive, short-term disruptions in their normal behavioral patterns at the South Jetty.

Humpback Whales

The only proposed activities NMFS anticipates may adversely affect humpback whales are pile driving activities, as described in detail below.

Pile Driving. Proposed activities with potential stressors that may affect humpback whales include in-water noise from pile driving that extends out 6.2 miles into the ocean from the jetty locations. Based on the sound thresholds for marine mammals described above (see the Effects Analysis for Steller sea lions), the Corps anticipates that their proposed pile driving and removal would produce sound pressure levels that could disturb humpback whales. Sound produced by the proposed vibratory pile driving and removal is anticipated to be below the injury threshold at the source. Under-water sound produced by vibratory pile installation and removal is estimated to attenuate to the 120 dB disturbance threshold within 6.2 miles. All individual humpback whales that feed or migrate through this area up to 8.6 miles off the mouth of the Columbia River are likely to be exposed to pile driving sound above the 120 dB threshold repeatedly over the 20-year period when pile driving would intermittently occur.

As described in the Status of the Species section, we do not have fine-scale information about humpback whale use of the project area, but their occurrence in the project area is likely given their general tendency to occupy shallow, coastal waters when foraging, and the available information on their fine-scale use of a proximate location (Grays Harbor) during spring and summer months. Based on this information, humpback whales are likely to pass through and may forage in the project vicinity, within 6.2 miles of the Jetties or within approximately 8.6 miles of shore. NMFS finds it reasonable to assume that the number of humpback whales that may forage or pass through the project vicinity when pile driving would occur is best estimated by evaluating humpback whales use patterns at the most proximate location where data is available, in this case off of Grays Harbor. Given the time of year that most of the pile driving would occur (spring/summer), humpback whales may be in the project vicinity on about 50% of the days and the number of humpback whales affected could range between 0 - 19 whales per day, based on surveys off of Grays Harbor (see Status of the Species). It is likely that individuals will be exposed repeatedly to the pile driving activities over the 20 years these activities are proposed.

Exposure of humpback whales to sound at or above 120 dB threshold is likely to elicit behavioral responses within the range of previously documented responses by low-frequency hearing specialists to non-pulse sound. Southall *et al*. (2007) conducted a comprehensive literature review of the effects of sound on marine mammals and based on

previous studies of low-frequency hearing specialists and their responses to non-pulse sound, they conclude that there is an increasing probability of avoidance and other behavioral effects in the 120 to 160 dB range (summarized in Table 14 from Southall *et al.* 2007). However, they caution that there is considerable variability in received levels associated with behavioral responses, and that context (*i.e*., novelty of the sound and what the animals are doing in the area) is likely as important if not more important than exposure level in predicting behavioral response.

There are no studies that document the response of low-frequency sound specialists to vibratory pile driving. Humpback whales exposed to sound from the proposed vibratory pile driving are unlikely to detect the physical presence of pile driving machinery (*i.e*., they are more likely to occur closer to the edge of the 6.2-mile radius area). For this reason, NMFS finds it reasonable to assume that of the non-pulse sound sources that have been studied, studies that have documented response to playback sound, as opposed to studies that documented response to both sound and physical presence of machinery, are most applicable to the likely response under evaluation (*i.e*., gray whales migrating: Malme *et al*. 1983, 1984, and gray whales feeding: Malme *et a*l. 1986). These studies documented responses that range from slight deviation in course and deflection around the sound (migrating whales) to avoidance of the area (feeding whales). Therefore, NMFS anticipates that humpback whales exposed to sound from the proposed pile driving in the project vicinity will respond by either a deviation in their course to deflect around the sound (in the case of whales otherwise passing through the area) or by avoiding the area (in the case of whales otherwise feeding in the area).

Exposed humpback whales are likely to be displaced and precluded from foraging in the project vicinity. However, there are alternate foraging areas available (*i.e*., areas offshore and closer to the shelf break and Grays Harbor to the north, as discussed above). Exposed humpback whales are also likely to deflect around the sound instead of passing through the area; however, the additional distance traveled is unlikely to cause a significant increase in an individual's energy budget, and effects would therefore be non-lasting. In either case, the likely behavioral responses, even considering potential for repeat exposures of individual whales, are not anticipated to reduce the reproductive success or increase the risk of injury or mortality for any individual humpback whale.

Critical Habitat within the Action Area

The effects of the proposed action on proposed and designated critical habitat are summarized below as a subset of the habitat-related effects of the action that were discussed more fully above.

<u>Pacific Salmon and Steelhead.</u>

1. Estuarine Areas
    a. Forage – Negligible and temporary reductions in benthic invertebrates are expected at localized dredging, disposal, and rock placement sites. Effects to prey resources for listed species are

expected to be insignificant as listed species using the MCR are pelagic, not benthic feeders.

b. Free of obstruction –At the North and South jetties, multiple spur groins have been in place for decades and likely do not pose behavioral concerns, *e.g.*, affect migration patterns, for fishes, based on acoustic telemetry data. The Corps is proposing to construct 11 new spur groins that will measure between 80 and 140 feet in length. Spur groins are small lateral extensions connected to the Jetties at their base. In view of the fact that the MCR is approximately 2.5 miles wide, and that few if any salmon are likely to occur within several hundred feet of the Jetties, based acoustic telemetry data, effects associated with the new jetty spur groins on passage are likely to be discountable.

c. Natural cover – Most of the construction and staging areas will occur above MHHW. Therefore, no effects are likely to occur.

d. Water quality – Negligible, localized, and temporary increases in suspended sediment due to dredging, disposal, rock placement, and piling installation and removal are likely. Placement could occur during a limited time window on a seasonal daily basis, and the other actions are temporally limited to a few days annually or a single event basis. There is also potential for spills or leaks, but BMPs reduce the likelihood of this occurrence. Monitoring will limit the levels and durations of suspended sediment. Therefore, effects on water quality will be insignificant.

e. Water quantity – No effects are likely to occur.

2. Nearshore Marine Areas

a. Free of obstruction – No effects are expected.

b. Natural cover –Most of the construction and staging areas will occur above MHHW, therefore, no effects are likely to occur.

c. Salinity – Based on the modeling, negligible effects to salinity are likely to occur.

d. Water quality – Negligible, localized, and temporary increases in suspended sediment due to dredging, disposal, rock placement, and piling installation and removal are likely. Placement could occur during a limited time window on a seasonal daily basis, and the other actions are temporally limited to a few days annually or a single event basis. There is also potential for spills or leaks, but BMPs reduce the likelihood of this occurrence. Monitoring will limit the levels and durations of suspended sediment. Therefore, effects on water quality will be insignificant.

e. Water quantity – No effects are likely to occur.

3. Adult and Juvenile Migration Corridors

a. Substrate – The substrate in the MCR is mostly sand (Figure 21). Adult and juvenile salmon and steelhead will not be affected by changes in substrate composition associated with repairs and rehabilitations as this is a migratory corridor and they are not

substrate-dependent for this behavior. Therefore, effects on migratory corridors will be insignificant.

b. Water quality – Negligible, localized, and temporary increases in suspended sediment due to dredging, disposal, rock placement, and piling installation and removal are likely. Placement could occur during a limited time window on a seasonal daily basis, and the other actions are temporally limited to a few days annually or a single event basis. There is also potential for spills or leaks, but BMPs reduce the likelihood of this occurrence. Monitoring will limit the levels and durations of suspended sediment. Therefore, effects on water quality will be insignificant.

c. Water quantity – No effects are likely to occur.

d. Water temperature – No effects are likely to occur.

e. Water velocity – Based on modeling, small localized changes will occur in the vicinity of the spur groins. However, these are not expected to have larger scale or system-wide effects that would have a meaningful affect on habitat, especially since background velocities can exceed 8 fps in the MCR.

f. Cover/shelter – No effects are likely to occur.

g. Food Resources –Negligible and temporary impacts to benthic invertebrates are expected at localized dredging, disposal, and rock placement sites. Effects to prey resources for listed species are expected to be insignificant as effects on benthic invertebrates will be minor and listed species utilizing the MCR are pelagic feeders.

h. Riparian vegetation – Most of the construction and staging areas will occur above MHHW and will not impact natural cover for listed species. Also, vegetation in rock storage and other affected areas is mostly European bunchgrass.

i. Space – No effects to behavior, fitness, migration patterns, physiology, or spatial distribution are expected.

j. Safe passage– At the North and South jetties, multiple spur groins have been in place for decades and likely do not pose behavioral concerns, *e.g.*, affect migration patterns, for fishes, based on acoustic telemetry data. The Corps is proposing to construct 11 new spur groins that will measure between 80 and 140 feet in length. Spur groins are small lateral extensions connected to the Jetties at their base. In view of the fact that the MCR is approximately 2.5 miles wide, and that few if any salmon are likely to occur within several hundred feet of the Jetties, based acoustic telemetry data, effects associated with the new jetty spur groins on passage are likely to be discountable.

4. Areas for Growth and Development to Adulthood

a. Ocean areas – (not identified) – No effects are expected.

Based on the above assessment, the effects on the PCEs noted above will not be significant at the watershed or the designation scale of critical habitat for Pacific salmon

and steelhead. Additionally, in the above analysis, the long-term beneficial effects from the proposed wetland mitigation and habitat improvement projects were not incorporated. However, the Corps is proposing to restore 76.56 acres associated with wetland impacts, and 60 acres associated with in-water impacts. These habitat restoration actions in the long term will improve intertidal and subtidal estuarine habitats for listed species. Therefore, these restoration actions are expected to beneficially affect critical habitat.

Green Sturgeon. Critical habitat was designated by the NMFS for green sturgeon. The PCEs of critical habitats relevant directly or indirectly in the action area include:

- Estuarine areas
- Coastal marine areas

1. Estuarine Areas
    a. Food Resources – Negligible and temporary reductions in benthic invertebrates are expected at localized dredging, disposal, and rock placement sites. Placement could occur during a limited time window on a seasonal daily basis, and the other actions are temporally limited to a few days only annually. This is not anticipated to have any significant or long-term effect on food abundance or distribution of green sturgeon.
    b. Migratory Corridor – The substrate in the MCR is mostly sand. Adult and juvenile green sturgeon will not be affected by changes in substrate composition associated with repairs and rehabilitations as this is a migratory corridor and they are not substrate-dependent for this behavior. Therefore, effects on migratory corridors will be insignificant.
    c. Sediment Quality – Harmful levels of contaminants have not been identified at the sites, and most of the substrate is 97% or greater sands. Therefore, no effects are likely to occur.
    d. Water Flow – No effects are likely to occur.
    e. Water Quality – Negligible, localized, and temporary increases in suspended sediment due to dredging, disposal, rock placement, and piling installation and removal are likely. Placement could occur during a limited time window on a seasonal daily basis, and the other actions are temporally limited to a few days annually or a single event basis. There is also potential for spills or leaks, but BMPs reduce the likelihood of this occurrence. Monitoring will limit the levels and durations of suspended sediment. Therefore, effects on water quality will be insignificant.
    f. Water Depth – Effects will be negligible.
2. Coastal Marine Areas
    a. Food Resources – Negligible and temporary reductions in benthic invertebrates are expected at localized dredging, disposal, and rock placement sites.

b. Migratory Corridor – No effects are expected.

c. Water Quality – Negligible, localized, and temporary increases in suspended sediment due to dredging, disposal, rock placement, and piling installation and removal are likely. Placement could occur during a limited time window on a seasonal daily basis, and the other actions are temporally limited to a few days annually or a single event basis. There is also potential for spills or leaks, but BMPs reduce the likelihood of this occurrence. Monitoring will limit the levels and durations of suspended sediment. Therefore, effects on water quality will be insignificant.

Based on the above assessment, the effects on the PCEs noted above will not be significant at the watershed or the designation scale of critical habitat for green sturgeon. Additionally, in the above analysis, the long-term beneficial effects from the proposed wetland mitigation and habitat improvement projects were not incorporated. However, the Corps is proposing to restore 76.56 acres associated with wetland impacts, and 60 acres associated with in-water impacts. These habitat restoration actions in the long term will improve intertidal and subtidal estuarine habitats for listed species. Therefore, these restoration actions are expected to beneficially affect critical habitat.

Eulachon.

1. Estuarine Migration Corridors

a. Food Resources – The proposed action is not likely to have any significant or long-term effects on food resources or distribution for eulachon as juveniles eat phytoplankton, copepod eggs, copepods and other small zooplanktons and adults eat euphausiids and copepods. The project will not affect these pelagic food resources.

b. Migratory Corridor – At the North and South jetties, multiple spur groins have been in place for decades and likely do not pose behavioral concerns for eulachon. The Corps is proposing to construct 11 new spur groins that will measure between 80 and 140 feet in length. Spur groins are small lateral extensions connected to the Jetties at their base. In view of the fact that the MCR is approximately 2.5 miles wide, effects associated with the new jetty spur groins on migration habitat are likely to be discountable.

c. Water Flow – No effects are likely to occur.

d. Water Quality – Negligible, localized, and temporary increases in suspended sediment due to dredging, disposal, rock placement, and piling installation and removal are likely. Placement could occur during a limited time window on a seasonal daily basis, and the other actions are temporally limited to a few days annually or a single event basis. There is also potential for spills or leaks, but BMPs reduce the likelihood of this occurrence. Monitoring will

limit the levels and durations of suspended sediment. Therefore, effects on water quality will be insignificant.

2. Nearshore and Offshore Marine Areas
   a. Foraging habitat—Negligible are likely to occur.
   b. Water Quality— Negligible, localized, and temporary increases in suspended sediment due to dredging, disposal, rock placement, and piling installation and removal are likely. Placement could occur during a limited time window on a seasonal daily basis, and the other actions are temporally limited to a few days annually or a single event basis. There is also potential for spills or leaks, but BMPs reduce the likelihood of this occurrence. Monitoring will limit the levels and durations of suspended sediment. Therefore, effects on water quality will be insignificant.
   c. Available Prey— The proposed action is not likely to have any significant or long-term effects on food resources or distribution for eulachon as juveniles eat phytoplankton, copepod eggs, copepods and other small zooplanktons and adults eat euphausiids and copepods. The project will not affect these pelagic food resources.

Based on the above assessment, the effects on the PCEs noted above will not be significant at the watershed or the designation scale of critical habitat for eulachon. Additionally, in the above analysis, the long-term beneficial effects from the proposed wetland mitigation and habitat improvement projects were not incorporated. However, the Corps is proposing to restore 76.56 acres associated with wetland impacts, and 60 acres associated with in-water impacts. These habitat restoration actions in the long term will improve intertidal and subtidal estuarine habitats for listed species. Therefore, these restoration actions are expected to beneficially affect critical habitat.

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 of the Federal action subject to consultation (50 CFR 402.02).

Some types of human activities that contribute to cumulative effects are expected to have adverse effects on listed species and critical habitat PCEs, many of which are activities that have occurred in the recent past and had an effect on the environmental baseline. These can be considered reasonably certain to occur in the future because they occurred frequently in the recent past. Within the freshwater portion of the action area, non-Federal actions are likely to include human population growth, water withdrawals (*i.e.*, those pursuant to senior state water rights) and land use practices. In marine waters within the action area, state, tribal, and local government actions are likely to be in the form of legislation, administrative rules, or policy initiatives, shoreline growth management and resource permitting. Private activities include continued resource extraction, vessel traffic, development and other activities which contribute to non-point

source pollution and storm water run-off. Although these factors are ongoing to some extent and likely to continue in the future, past occurrence is not a guarantee of a continuing level of activity. That will depend on whether there are economic, administrative, and legal impediments (or in the case of contaminants, safeguards). Therefore, although NMFS finds it likely that the cumulative effects of these activities will have adverse effects commensurate to those of similar past activities; it is not possible to quantify these effects.

Synthesis and Integration of Effects

Steller Sea Lion

The Eastern DPS of Steller sea lions is a large population, which over the past 30 years has increased approximately 3% per year. Steller sea lions are generalist predators, and able to respond to changes in prey abundance. There are no substantial threats to the species, and the final recovery plan identifies the need to initiate a status review and consider removing the Eastern DPS from the Federal List of Endangered Wildlife and Plants.

The South Jetty of the Columbia River is used as a haulout all year by Steller sea lions. The only proposed activities NMFS anticipates will affect Steller sea lions are rock placement and pile driving. Given the time of year that most of the rock placement and pile driving activities will occur (spring/summer) over a 20-year timeframe, the number of Steller sea lions affected daily could range from at least 200 to 600 animals. The response of Steller sea lions to these activities are expected to be similar to repairs performed on the South Jetty in 2006 and 2007 (refer to NMFS No.: 2005/06359) and include alert behavior, approaches to the water, and flushes into the water.

NMFS finds it likely that Steller sea lions will be exposed to and disturbed by sound generated by pile driving activities. Steller sea lions will likely spend less time at the South Jetty haulout or foraging in the immediate vicinity. However, there are alternative foraging and haul out areas available to the affected individuals. Repetitive, short-term displacement is likely to cause repetitive, short-term disruptions in their normal behavioral patterns at the South Jetty. There are no current threats to the species that are either part of the environmental baseline or cumulative effects in the action area that are anticipated to affect Steller sea lion in addition to the activities of the proposed action, described above.

Humpback Whale

The current abundance of humpback whales in the North Pacific is approximately 18,000 to 21,000 whales, of which 1,400 to 1,700 individuals are part of the California/Oregon stock. Humpback whales are sighted off the Washington and Oregon coasts relatively close to shore and are known to predictably forage approximately offshore of Grays Harbor, Washington during spring and summer months.

Based on the available information about summer foraging habits of humpback whales along the Washington coast, humpback whales are likely to pass through and may forage in the project vicinity, within 6.2 miles of the Jetties or within approximately 8.6 miles of shore. The potential exposure of humpback whales to sound at or above 120 dB threshold is likely to elicit behavioral responses within the range of previously documented responses by low-frequency hearing specialists to non-pulse sound. Based on review of these documented responses, NMFS anticipates that humpback whales exposed to sound from the proposed pile driving in the project vicinity will respond by either a deviation in their course to deflect around the sound (in the case of whales otherwise passing through the area) or by avoiding the area (in the case of whales otherwise feeding in the area).

Exposed humpback whales are likely to be displaced and precluded from foraging in the project vicinity. However, there are alternate foraging areas available (*i.e.*, areas offshore and closer to the shelf break and Grays Harbor to the north, as discussed above). Exposed humpback whales are also likely to deflect around the sound instead of passing through the area. In both cases, the likely behavioral responses, even considering potential for repeat exposures of individual whales, are not anticipated to reduce the reproductive success or increase the risk of injury or mortality for any individual humpback whale. In addition, current threats to the species that may occur as part of the environmental baseline or cumulative effects in this area include vessel sound that is a habitat concern for low-frequency sound specialists, such as humpback whales. Effects of the action in addition to threats that are part of the environmental baseline or cumulative effects are not anticipated to appreciably reduce the species' ability to survive and recover.

Eulachon

For eulachon, NMFS expects effects to be limited to entrainment, which will kill a small number of eulachon larvae because: (1) Dredging will take place below the river bottom; (2) the dragheads or cutterheads will not be engaged if raised more than 3 feet above the river bottom; (3) the relative volume associated with dredging compared to the volume of the river flow is approximately 0.0001%; and (4) the timing of dredging will range from 3.3 to 13.3 hours per year, relative to the total outmigration period of larval eulachon of 95 to 200 days.

Therefore, it is unlikely that the proposed action will appreciably reduce the likelihood of survival and recovery of eulachon.

Critical Habitat at the Watershed and Designation Scales

As described in the *Effects to Habitat* and *Critical Habitat with the Action Area* sections, effects to critical habitat are either insignificant or discountable. The effects will not be scalable to a reduction in conservation value because they are either intermittent, short-lived, or do not meaningfully affect the PCEs or physical or biological features of critical habitat. Therefore, NMFS concludes that the effects of the proposed action on designated critical habitat for listed species considered in the Opinion will be insignificant or discountable at the watershed and designation scales.

Conclusion

After reviewing the status of Steller sea lions, humpback whales, and eulachon, the environmental baseline, the effects of the action, and cumulative effects, NMFS concludes that the proposed action will not jeopardize the continued existence of those species

Incidental Take Statement

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by NMFS as significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by Fish and Wildlife Service as an intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not prohibited under the ESA, provided that such taking is in compliance with the terms and conditions of an incidental take statement.

Because there are no protective regulations in place for eulachon via section 4(d) of the ESA, there is no take prohibition for eulachon.

The NMFS is not including an incidental take authorization for marine mammals at this time because the incidental take of marine mammals has not been authorized under section 101(a)(5) of the Marine Mammal Protection Act and/or its 1994 Amendments. Following issuance of such regulations or authorizations, NMFS may amend this Opinion to include an incidental take statement for marine mammals, as appropriate.

Conservation Recommendations

Section 7(a) (1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. The following recommendation is a discretionary measure consistent with this obligation and therefore should be carried out by the Corps:

> To improve the potential for recovery of ESA-listed species that use the MCR, the Corps should carry out management actions to reverse threats to species survival as identified in the Columbia River Estuary ESA Recovery Plan Module for Salmon and Steelhead (NMFS 2011).

Please notify NMFS if the Corps carries out this recommendation so that we will be kept informed of actions that are intended to improve the conservation of listed species or their designated critical habitats.

Reinitiation of Consultation

Reinitiation of formal consultation is required and shall be requested by the Federal agency or by NMFS where discretionary Federal involvement or control over the action has been retained or is authorized by law and: (a) If the amount or extent of taking specified in the incidental take statement is exceeded; (b) if new information reveals effects of the action that may affect listed species or designated critical habitat in a manner or to an extent not previously considered; (c) if the identified action is subsequently modified in a manner that has an effect to the listed species or designated critical habitat that was not considered in the biological opinion; or (d) if a new species is listed or critical habitat is designated that may be affected by the identified action (50 CFR 402.16).

To reinitiate consultation, contact the Oregon State Habitat Office of NMFS, and refer to the NMFS Number **2010/06104**.

NOT LIKELY TO ADVERSELY AFFECT DETERMINATIONS

Species Determinations

Blue Whales, Sei Whales, Sperm Whales, Fin Whales, Southern Resident Killer Whales, and Leatherback Sea Turtles. NMFS concurs with the Corps' "may affect, not likely to adversely affect" determinations for the following marine mammal and sea turtle species: blue whales, Sei whales, sperm whales, fin whales, Southern Resident killer whales, leatherback sea turtles. These ESA-listed species do not occur in the Columbia River, they will not be exposed to any potential stressors from the proposed activities that occur in the estuary and river proper, and no effects from activities in these areas are therefore anticipated. The above ESA-listed marine mammal and sea turtle species may occur outside of the Columbia River in the marine portion of the action area.

The proposed activity with a potential stressor in the marine portion of the action area that may affect these species is in-water noise from pile driving that extends out 6.2 miles into the ocean from the jetty locations where rock placement is proposed. Blue, fin, Sei and sperm whales and leatherback sea turtles are not generally distributed near shore. Their presence within range of in-water noise from pile driving is extremely unlikely and any effects from this activity are therefore discountable.

Southern Resident killer whales have been repeatedly observed feeding off the Columbia River plume in the vicinity of the Jetties in March and April during peak spring Chinook salmon runs (*i.e.*, in 2004: Krahn *et al*. 2004; in 2005: Zamon *et al*. 2007; in 2006: Hanson *et al*. 2008; and in 2009: Hanson *et al*. 2010). The Corps restricted the window in which piling installation will most likely be conducted (May through the summer) to

avoid possible project effects that overlap with limited peak killer whale use in the project vicinity (March through April). Southern Resident killer whales can occur near shore, but their presence is likely to be infrequent and transitory, such that co-occurrence of these killer whales and proposed pile driving from May through the summer is extremely unlikely and any effects from this activity are therefore discountable.

Additionally, the proposed action is not likely to cause a measurable reduction in the quantity of salmon and other ESA-listed or proposed fish, as described above and therefore will not affect the quantity of prey available to marine mammals. The quality of prey available to marine mammals will not be adversely affected by the proposed action, because there is no causal mechanism for the proposed activities to increase the concentration of persistent organic pollutants in fish.

NMFS concurs with the Corps' determinations that effects of the action are either insignificant or discountable and therefore are not likely to adversely affect blue whales, Sei whales, sperm whales, fin whales, Southern Resident killer whales, and leatherback sea turtles.

Fishes. The NMFS concludes that the proposed action is NLAA LCR Chinook salmon, UWR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer run Chinook salmon, SR fall-run Chinook salmon, CR chum salmon, LCR coho salmon, OC coho salmon, SONCC coho salmon, SR sockeye salmon, LCR steelhead, UWR steelhead, UCR steelhead, MCR steelhead, SRB steelhead, and southern green sturgeon.

Critical Habitat Determinations

Proposed Leatherback Sea Turtle Critical Habitat. The PCEs that NMFS identified as essential for the conservation of leatherback turtles when it proposed to revise critical habit to include marine waters off the U.S. West Coast, including the action area, are: (1) A sufficient quantity and quality of their jellyfish prey; and (2) migratory pathway conditions that allow for safe and timely passage to, from, and within high use foraging areas, including areas within the action area. No effects on prey quantity or quality are anticipated. In-water noise from pile driving activities would have a discountable effect on leatherback turtle passage, given the extremely unlikely nature of leatherback turtle occurrence in the action area.

NMFS concurs with the Corps' determination that effects of the action are either insignificant or discountable and therefore are not likely to adversely affect proposed critical habitat of leatherback turtles.

Fishes. After reviewing the status of critical habitats of fish species specified above for which critical habitat is proposed or designated NMFS also concludes that the proposed action is NLAA critical habitat for those species.

MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

The consultation requirement of section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions, or proposed actions that may adversely affect EFH. Adverse effects include the direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitats, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside EFH, and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that may be taken by the action agency to conserve EFH.

The Pacific Fishery Management Council (PFMC) described and identified EFH for groundfish (PFMC 2005), coastal pelagic species (PFMC 1998), and Chinook salmon, coho salmon, and Puget Sound pink salmon (PFMC 1999). The proposed action and action area for this consultation are described in the Introduction to this document. The action area includes areas designated as EFH for various life-history stages groundfish species, coastal pelagic species, and Pacific salmon (Table 13).

Table 13. Species of fish and life stages with designated EFH that may occur within the action area, activities and prey.

Groundfish Species	Life stage	Activity	Prey
Arrowtooth flounder	Adults	All	Gadids, *Theragra chalcogramma*, krill, clupeids, shrimp
	Eggs	Unknown	
	Larvae		
Big skate	Adults	All	Crustaceans, fish
Black rockfish	Juveniles	Feeding, growth to maturity	
	Adults	All	
Blue rockfish	Juveniles	All	
	Adults	All	
	Larvae	Feeding	
Bocaccio	Juveniles	Feeding	Euphausiids, copepods
Butter sole	Adults	All	Polychaetes, molluscs, fish, decapod crustaceans, amphipods, shrimp, sea stars
Cabezon	Adults	All	Fish eggs, lobsters, molluscs, small fishes, crabs
California skate	Eggs	Unknown	

Groundfish Species	Life stage	Activity	Prey
Canary rockfish	Juveniles	Feeding, growth to maturity	
Chilipepper	Adults	All	Clupeids, euphausiids, *Merluccius productus*, squids, copepods, euphausiids
	Juveniles	Feeding, growth to maturity	
Copper rockfish	Adults	All	Crustaceans, fish, shrimp, molluscs
Curlfin sole	Adults	All	Crustacean eggs, *Echiurid proboscises*, nudibranchs, polychaetes
Dusky rockfish	Adults	All	
English sole	Juveniles	Feeding, growth to maturity	Polychaetes, molluscs, cumaceans, copepods, amphipods, mysids
	Adults	All	Polychaetes, ophiuroids, molluscs, cumaceans, amphipods, crustaceans
Flathead sole	Adults	All	Polychaetes, mysids, shrimp, molluscs, clupeids, fish
Kelp greenling	Adults	All	Worms, crabs, octopi, shrimp, small fishes, brittle stars, snails
	Larvae		
Lingcod	Adults	All	Juvenile crab, demersal fish, squid, octopi
	Larvae	Feeding	Decapod larvae, copepods, euphausiids, copepod nauplii, copepod eggs, amphipods
Longnose skate	Adults	All	
Pacific cod	Juveniles		Amphipods, shrimp, copepods, crabs
	Larvae		Copepods
Pacific hake	Juveniles		Euphausiids
	Adults	All	
Pacific sanddab	Adults	All	Squids, octopi, crab larvae, clupeids
Petrale sole	Adults	All	Shrimp, *Eopsetta jordani*, euphausiids, ophiuroids, pelagic fishes
Quillback rockfish	Adults	All	Amphipods, molluscs, euphausiids, polychaetes, fish juveniles, shrimp, clupeids, crabs
Redstripe rockfish	Adults	All	Fish juveniles, squid, clupeids

Groundfish Species	Life stage	Activity	Prey
Rex sole	Adults	All	Cumaceans, euphausiids, larvacea, polychaetes
Rock sole	Adults	All	Tunicates, echinoderms, fish, molluscs, polychaetes, echiurans
Rosy rockfish	Adults	All	Crabs, shrimp
Sablefish	Adults		Octopi, clupeids, euphausiids, shrimp, rockfish
	Juveniles	Growth to Maturity	Krill, small fishes, squids, euphausiids, demersal fish, tunicates, cephalopods, amphipods, copepods
	Larvae	Feeding	
Sand sole	Adults	All	Polychaetes, clupeids, crabs, fish, mysids, shrimp, molluscs
	Juveniles	Growth to Maturity, feeding	Euphausiids, molluscs, mysids, polychaetes, shrimp
Silvergray rockfish	Adults	All	
Soupfin shark	Adults	All	Fish, invertebrates
	Juveniles	Growth to Maturity	Invertebrates, fish
Spiny dogfish	Adults	All	Pelagic fishes, invertebrates
Splitnose rockfish	Juveniles	Feeding	Copepods, cladocerans, amphipods
	Larvae		
Spotted ratfish	Adults	All	Amphipods, annelids, brittle stars, fish, algae, molluscs, squids, small crustacea, ostracods, opisthobranchs, nudibranchs
	Juveniles	Growth to Maturity	Small crustacea, squids, ostracods, ophisthobranchs, nudibranchs, molluscs, fish, brittle stars, amphipods, algae, annelids
Starry flounder	Adults	Growth to Maturity	Molluscs, fish juveniles, polychaetes, crabs
	Juveniles	Feeding	Polychaetes, copepods, amphipods
Stripetail rockfish	Adults	All	Euphausiids, copepods
	Juveniles	Growth to Maturity	Copepods
Tiger rockfish	Adults	All	Juvenile rockfish, amphipods, fish juveniles, shrimp, clupeids, crabs
Vermilion rockfish	Adults		Clupeids, juvenile rockfish, krill, octopi, squids
Widow rockfish	Juveniles	Growth to Maturity, feeding	Copepods, copepod eggs, euphausiid eggs
Yellowtail rockfish	Adults	All	Clupeids, euphausiids, tunicates, mysids, salps, squid, krill, *Merluccius productus*

Groundfish Species	Life stage	Activity	Prey
Coastal Pelagic Species	**Life stage**	**Activity***	**Prey**
Northern anchovy	Eggs		
	Larvae		
	Juvenile		
	Adult	All	Zooplankton
Pacific sardine	Eggs		
	Larvae		
	Juvenile		
	Adult	All	Zooplankton
Pacific mackerel	Eggs		
	Larvae		
	Juvenile		
	Adult	All	Zooplankton, micronekton
Jack mackerel	Adult		Krill, small crustacea
Market squid	Eggs		
	Larvae		
	Juvenile		
	Adult	All	Plankton, small crustacea, euphausiids, copepods

Pacific Salmon			
Coho salmon**	Juvenile		
	Adults	Feeding	
Chinook salmon	Juvenile		Plankton, insects, small fish
	Adults	Feeding	
Pink Salmon	Juvenile		Plankton, insects, small fish
	Adults	Feeding	

Based on information provided by the action agency and the analysis of effects presented in the ESA portion of this document, *Effects on Habitat*, NMFS concludes that proposed action will adversely affect EFH designated for groundfish species by reducing the quality of EFH from dredging and pile installation and removal. In the long term, the increased surface area of rock for the Columbia River Jetty System will likely have beneficial habitat effects for federally-managed rockfish species.

Essential Fish Habitat Conservation Recommendations

Although NMFS did identify adverse effects associated with the proposed action on EFH, NMFS does not propose any conservation recommendations at this time as the only conservation recommendation we would recommend would be to limit the timing for

dredging and pile installation and removal. Because the MCR is a high-energy environment, dredging is already limited due to weather and wave activity in the fall through spring, and dredging and pile installation and removal outside the proposed timing poses a safety hazard to dredge and pile operators.

Statutory Response Requirement

Federal agencies are required to provide a detailed written response to NMFS' EFH conservation recommendations within 30 days of receipt of these recommendations [16 U.S.C. 1855 (b)(4)(B)]. The response must include a description of measures proposed to avoid, mitigate, or offset the adverse affects of the activity on EFH. If the response is inconsistent with the EFH conservation recommendations, the response must explain the reasons for not following the recommendations. The reasons must include the scientific justification for any disagreements over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects.

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we ask that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

Supplemental Consultation

The Corps must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH [50 CFR 600.920(k)].

DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

Section 515 of the Treasury and General Government Appropriations Act of 2001 (Public Law 106-554) (Data Quality Act) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the Opinion addresses these Data Quality Act (DQA) components, documents compliance with the DQA, and certifies that this Opinion has undergone pre-dissemination review.

Utility: Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users.

This ESA consultation concludes that the proposed repair and rehabilitation of the Columbia River Jetty System will not jeopardize the affected listed species. Therefore, the Corps can carry out this action in accordance with its Congressional authority. The intended user is the Corps of Engineers.

Individual copies were provided to the Corps. This consultation will be posted on the NMFS Northwest Region website (http://www.nwr.noaa.gov). The format and naming adheres to conventional standards for style.

Integrity: This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

Objectivity:

Information Product Category: Natural Resource Plan.

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA Regulations, 50 CFR 402.01, *et seq.*.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the Literature Cited section. The analyses in this Opinion contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA implementation, and reviewed in accordance with Northwest Region ESA quality control and assurance processes.

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