UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
1201 NE Lloyd Boulevard, Suite 1100
PORTLAND, OR 97232-1274

Refer to NMFS Consultation No.:
WCRO-2020-00380

June 17, 2020

Michelle Walker
Chief, Regulatory Branch
U.S. Army Corps of Engineers
Seattle District
P.O. Box 3755
Seattle, Washington 98124-3755

Re: Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Railway Bridge Replacement Project, Columbia River/Rock Creek, Skamania, Washington (HUC 17070105, COE Number NWS-2019-974)

Dear Ms. Walker:

Thank you for your letter of February 25, 2020, requesting initiation of formal consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for a Railway Bridge Replacement Project. This consultation was conducted in accordance with the 2019 revised regulations that implement section 7 of the ESA (50 CFR 402, 84 FR 45016).

The enclosed document contains a biological opinion (opinion) that analyzes the effects of your proposal to permit the bridge project. In this opinion, we conclude that the proposed action, is not likely to jeopardize the continued existence of LCR Chinook salmon (*Oncorhynchus tshawytscha*), LCR coho salmon (*O. kisutch*), CR chum salmon (*O. keta*), LCR steelhead (*O. mykiss*), Middle Columbia River (MCR) steelhead, Upper Columbia River (UCR) spring-run Chinook salmon, UCR steelhead, Snake River (SR) spring/summer run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon (*O. nerka*), and Snake River Basin (SRB) steelhead. Further, we conclude that the proposed action will not result in the destruction or adverse modification of their designated critical habitats.

As required by section 7 of the ESA, we are providing an incidental take statement with the opinion. The incidental take statement describes reasonable and prudent measures we consider necessary or appropriate to minimize incidental take associated with this action.

The take statement sets forth nondiscretionary terms and conditions, including reporting requirements that the U.S. Army Corps of Engineers (COE) and any person who performs the action must comply with to carry out the reasonable and prudent measures. Incidental take from actions that meet these terms and conditions will be exempt from the ESA take prohibition.

Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA)(16 U.S.C. 1855(b)) for this action. 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 three conservation recommendations to avoid, minimize, or otherwise offset potential adverse effects on EFH. Section 305(b)(4)(B) of the MSA requires Federal agencies to provide a detailed written response to NMFS within 30 days after receiving these recommendations.

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 the response is inconsistent with the EFH conservation recommendations, the Federal action agency must explain why the recommendations will not be followed, including the scientific justification for any disagreements over the effects of the action and the recommendations.

Please contact Chad Baumler of the Oregon Washington Coastal Office in Lacey, Washington, at 360-753-4126 or by e-mail at chad.baumler@noaa.gov if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

Kim W. Kratz, Ph.D.
Assistant Regional Administrator
Oregon Washington Coastal Office

cc: Ron Wilcox, COE

recovery. The species status section also helps to inform the description of the species' "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the function of the essential PBFs that help to form that conservation value.

One factor affecting the status of ESA-listed species considered in this opinion, and aquatic habitat at large, is climate change. Climate change is likely to play an increasingly important role in determining the abundance and distribution of ESA-listed species, and the conservation value of designated critical habitats, in the Pacific Northwest. These changes will not be spatially homogeneous across the Pacific Northwest. The largest hydrologic responses are expected to occur in basins with significant snow accumulation, where warming decreases snow pack, increases winter flows, and advances the timing of spring melt (Mote *et al.* 2014, Mote *et al.* 2016). Rain-dominated watersheds and those with significant contributions from groundwater may be less sensitive to predicted changes in climate (Tague *et al.* 2013, Mote *et al.* 2014).

During the last century, average regional air temperatures in the Pacific Northwest increased by 1-1.4°F as an annual average, and up to 2°F in some seasons (based on average linear increase per decade; Abatzoglou *et al.* 2014; Kunkel *et al.* 2013). Warming is likely to continue during the next century as average temperatures are projected to increase another 3 to 10°F, with the largest increases predicted to occur in the summer (Mote *et al.* 2014). Decreases in summer precipitation of as much as 30 percent by the end of the century are consistently predicted across climate models (Mote *et al.* 2014). Precipitation is more likely to occur during October through March, less during summer months, and more winter precipitation will be rain than snow (ISAB 2007; Mote *et al.* 2014). Earlier snowmelt will cause lower stream flows in late spring, summer, and fall, and water temperatures will be warmer (ISAB 2007; Mote *et al.* 2014). Models consistently predict increases in the frequency of severe winter precipitation events (i.e., 20-year and 50-year events), in the western United States (Dominguez *et al.* 2012). The largest increases in winter flood frequency and magnitude are predicted in mixed rain-snow watersheds (Mote *et al.* 2014).

Overall, about one-third of the current cold-water salmonid habitat in the Pacific Northwest is likely to exceed key water temperature thresholds by the end of this century (Mantua *et al.* 2009). Higher temperatures will reduce the quality of available salmonid habitat for most freshwater life stages (ISAB 2007). Reduced flows will make it more difficult for migrating fish to pass physical and thermal obstructions, limiting their access to available habitat (Mantua *et al.* 2010; Isaak *et al.* 2012). Temperature increases shift timing of key life cycle events for salmonids and species forming the base of their aquatic foodwebs (Crozier *et al.* 2011; Tillmann and Siemann 2011; Winder and Schindler 2004). Higher stream temperatures will also cause decreases in dissolved oxygen and may also cause earlier onset of stratification and reduced mixing between layers in lakes and reservoirs, which can also result in reduced oxygen (Meyer *et al.* 1999; Winder and Schindler 2004, Raymondi *et al.* 2013). Higher temperatures are likely to cause several species to become more susceptible to parasites, disease, and higher predation rates (Crozier *et al.* 2008; Wainwright and Weitkamp 2013; Raymondi *et al.* 2013).

As more basins become rain-dominated and prone to more severe winter storms, higher winter stream flows may increase the risk that winter or spring floods in sensitive watersheds will damage spawning redds and wash away incubating eggs (Goode *et al.* 2013). Earlier peak stream flows will also alter migration timing for salmon smolts, and may flush some young salmon and steelhead from rivers to estuaries before they are physically mature, increasing stress and reducing smolt survival (McMahon and Hartman 1989; Lawson *et al.* 2004).

In addition to changes in freshwater conditions, predicted changes for coastal waters in the Pacific Northwest as a result of climate change include increasing surface water temperature, increasing but highly variable acidity, and increasing storm frequency and magnitude (Mote *et al.* 2014). Elevated ocean temperatures already documented for the Pacific Northwest are highly likely to continue during the next century, with sea surface temperature projected to increase by 1.0-3.7ºC by the end of the century (IPCC 2014). Habitat loss, shifts in species' ranges and abundances, and altered marine food webs could have substantial consequences to anadromous, coastal, and marine species in the Pacific Northwest (Tillmann and Siemann 2011, Reeder *et al.* 2013). Moreover, as atmospheric carbon emissions increase, increasing levels of carbon are absorbed by the oceans, changing the pH of the water. Acidification also impacts sensitive estuary habitats, where organic matter and nutrient inputs further reduce pH and produce conditions more corrosive than those in offshore waters (Feely *et al.* 2012, Sunda and Cai 2012).

Global sea levels are expected to continue rising throughout this century, reaching likely predicted increases of 10-32 inches by 2081-2100 (IPCC 2014). These changes will likely result in increased erosion and more frequent and severe coastal flooding, and shifts in the composition of nearshore habitats (Tillmann and Siemann 2011, Reeder *et al.* 2013). Estuarine-dependent salmonids such as chum and Chinook salmon are predicted to be impacted by significant reductions in rearing habitat in some Pacific Northwest coastal areas (Glick *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, and therefore these species are predicted to fare poorly in warming ocean conditions (Scheuerell and Williams 2005; Zabel *et al.* 2006). This is supported by the recent observation that anomalously warm sea surface temperatures off the coast of Washington from 2013 to 2016 resulted in poor coho and Chinook salmon body condition for juveniles caught in those waters (NWFSC 2015). Changes to estuarine and coastal conditions, as well as the timing of seasonal shifts in these habitats, have the potential to impact a wide range of listed aquatic species (Tillmann and Siemann 2011, Reeder *et al.* 2013).

The adaptive ability of these threatened and endangered species is depressed due to reductions in population size, habitat quantity and diversity, and loss of behavioral and genetic variation. Without these natural sources of resilience, systematic changes in local and regional climatic conditions due to anthropogenic global climate change will likely reduce long-term viability and sustainability of populations in many of these ESUs (NWFSC 2015). New stressors generated by climate change, or existing stressors with effects that have been amplified by climate change, may also have synergistic impacts on species and ecosystems (Doney *et al.* 2012). These conditions will possibly intensify the climate change stressors inhibiting recovery of ESA-listed species in the future.

2.2.1 Status of the Species

Table 1, below provides a summary of listing and recovery plan information, status summaries and limiting factors for the species addressed in this opinion. More information can be found in recovery plans and status reviews for these species. These documents are available on the NMFS West Coast Region website (http://www.westcoast.fisheries.noaa.gov/).

Table 1. Listing classification and date, recovery plan reference, most recent status review, status summary, and limiting factors for each species considered in this opinion.

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Upper Columbia River spring-run Chinook salmon	Endangered 6/28/05	Upper Columbia Salmon Recovery Board 2007	NWFSC 2015	This ESU comprises four independent populations. Three are at high risk and one is functionally extirpated. Current estimates of natural origin spawner abundance increased relative to the levels observed in the prior review for all three extant populations, and productivities were higher for the Wenatchee and Entiat populations and unchanged for the Methow population. However, abundance and productivity remained well below the viable thresholds called for in the Upper Columbia Recovery Plan for all three populations.	• Effects related to hydropower system in the mainstem Columbia River • Degraded freshwater habitat • Degraded estuarine and nearshore marine habitat • Hatchery-related effects • Persistence of non-native (exotic) fish species • Harvest in Columbia River fisheries
Snake River spring/summer-run Chinook salmon	Threatened 6/28/05	NMFS 2016a	NWFSC 2015	This ESU comprises 28 extant and four extirpated populations. All expect one extant population (Chamberlin Creek) are at high risk. Natural origin abundance has increased over the levels reported in the prior review for most populations in this ESU, although the increases were not substantial enough to change viability ratings. Relatively high ocean survivals in recent years were a major factor in recent abundance patterns. While there have been improvements in abundance and productivity in several populations relative to prior reviews, those changes have not been sufficient to warrant a change in ESU status.	• Degraded freshwater habitat • Effects related to the hydropower system in the mainstem Columbia River, • Altered flows and degraded water quality • Harvest-related effects • Predation

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Snake River fall-run Chinook salmon	Threatened 6/28/05	NMFS 2015a	NWFSC 2015	This ESU has one extant population. Historically, large populations of fall Chinook salmon spawned in the Snake River upstream of the Hells Canyon Dam complex. The extant population is at moderate risk for both diversity and spatial structure and abundance and productivity. The overall viability rating for this population is 'viable.' Overall, the status of Snake River fall Chinook salmon has clearly improved compared to the time of listing and compared to prior status reviews. The single extant population in the ESU is currently meeting the criteria for a rating of 'viable' developed by the ICTRT, but the ESU as a whole is not meeting the recovery goals described in the recovery plan for the species, which require the single population to be "highly viable with high certainty" and/or will require reintroduction of a viable population above the Hells Canyon Dam complex.	• Degraded floodplain connectivity and function • Harvest-related effects • Loss of access to historical habitat above Hells Canyon and other Snake River dams • Impacts from mainstem Columbia River and Snake River hydropower systems • Hatchery-related effects • Degraded estuarine and nearshore habitat.
Columbia River chum salmon	Threatened 6/28/05	NMFS 2013	NWFSC 2015	Overall, the status of most chum salmon populations is unchanged from the baseline VSP scores estimated in the recovery plan. A total of 3 of 17 populations are at or near their recovery viability goals, although under the recovery plan scenario these populations have very low recovery goals of 0. The remaining populations generally require a higher level of viability and most require substantial improvements to reach their viability goals. Even with the improvements observed during the last five years, the majority of populations in this ESU remain at a high or very high risk category and considerable progress remains to be made to achieve the recovery goals.	• Degraded estuarine and nearshore marine habitat • Degraded freshwater habitat • Degraded stream flow as a result of hydropower and water supply operations • Reduced water quality • Current or potential predation • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake strandings • Contaminants

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River coho salmon	Threatened 6/28/05	NMFS 2013	NWFSC 2015	Of the 24 populations that make up this ESU, 21 populations are at very high risk, 1 population is at high risk, and 2 populations are at moderate risk. Recent recovery efforts may have contributed to the observed natural production, but in the absence of long term datasets it is not possible to parse out these effects. Populations with long term data sets exhibit stable or slightly positive abundance trends. Some trap and haul programs appear to be operating at or near replacement, although other programs still are far from that threshold and require supplementation with additional hatchery-origin spawners. Initiation of or improvement in the downstream juvenile facilities at Cowlitz Falls, Merwin, and North Fork Dam are likely to further improve the status of the associated upstream populations. While these and other recovery efforts have likely improved the status of a number of coho salmon populations, abundances are still at low levels and the majority of the populations remain at moderate or high risk. For the Lower Columbia River region land development and increasing human population pressures will likely continue to degrade habitat, especially in lowland areas. Although populations in this ESU have generally improved, especially in the 2013/14 and 2014/15 return years, recent poor ocean conditions suggest that population declines might occur in the upcoming return years	• Degraded estuarine and near-shore marine habitat • Fish passage barriers • Degraded freshwater habitat: Hatchery-related effects • Harvest-related effects • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake strandings • Contaminants

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Snake River sockeye salmon	Endangered 6/28/05	NMFS 2015b	NWFSC 2015	This single population ESU is at very high risk dues to small population size. There is high risk across all four basic risk measures. Although the captive brood program has been successful in providing substantial numbers of hatchery produced fish for use in supplementation efforts, substantial increases in survival rates across all life history stages must occur to re-establish sustainable natural production In terms of natural production, the Snake River Sockeye ESU remains at extremely high risk although there has been substantial progress on the first phase of the proposed recovery approach – developing a hatchery based program to amplify and conserve the stock to facilitate reintroductions.	• Effects related to the hydropower system in the mainstem Columbia River • Reduced water quality and elevated temperatures in the Salmon River • Water quantity • Predation
Upper Columbia River steelhead	Threatened 1/5/06	Upper Columbia Salmon Recovery Board 2007	NWFSC 2015	This DPS comprises four independent populations. Three populations are at high risk of extinction while 1 population is at moderate risk. Upper Columbia River steelhead populations have increased relative to the low levels observed in the 1990s, but natural origin abundance and productivity remain well below viability thresholds for three out of the four populations. The status of the Wenatchee River steelhead population continued to improve based on the additional year's information available for the most recent review. The abundance and productivity viability rating for the Wenatchee River exceeds the minimum threshold for 5 percent extinction risk. However, the overall DPS status remains unchanged from the prior review, remaining at high risk driven by low abundance and productivity relative to viability objectives and diversity concerns.	• Adverse effects related to the mainstem Columbia River hydropower system • Impaired tributary fish passage • Degraded floodplain connectivity and function, channel structure and complexity, riparian areas, large woody debris recruitment, stream flow, and water quality • Hatchery-related effects • Predation and competition • Harvest-related effects

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River steelhead	Threatened 1/5/06	NMFS 2013	NWFSC 2015	This DPS comprises 23 historical populations, 17 winter-run populations and six summer-run populations. Nine populations are at very high risk, 7 populations are at high risk, 6 populations are at moderate risk, and 1 population is at low risk. The majority of winter-run steelhead populations in this DPS continue to persist at low abundances. Hatchery interactions remain a concern in select basins, but the overall situation is somewhat improved compared to prior reviews. Summer-run steelhead populations were similarly stable, but at low abundance levels. The decline in the Wind River summer-run population is a source of concern, given that this population has been considered one of the healthiest of the summer-runs; however, the most recent abundance estimates suggest that the decline was a single year aberration. Passage programs in the Cowlitz and Lewis basins have the potential to provide considerable improvements in abundance and spatial structure, but have not produced self-sustaining populations to date. Even with modest improvements in the status of several winter-run DIPs, none of the populations appear to be at fully viable status, and similarly none of the MPGs meet the criteria for viability.	• Degraded estuarine and nearshore marine habitat • Degraded freshwater habitat • Reduced access to spawning and rearing habitat • Avian and marine mammal predation • Hatchery-related effects • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake strandings • Contaminants

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Middle Columbia River steelhead	Threatened 1/5/06	NMFS 2009b	NWFSC 2015	This DPS comprises 17 extant populations. The DPS does not currently include steelhead that are designated as part of an experimental population above the Pelton Round Butte Hydroelectric Project. Returns to the Yakima River basin and to the Umatilla and Walla Walla Rivers have been higher over the most recent brood cycle, while natural origin returns to the John Day River have decreased. There have been improvements in the viability ratings for some of the component populations, but the DPS is not currently meeting the viability criteria in the MCR steelhead recovery plan. In general, the majority of population level viability ratings remained unchanged from prior reviews for each major population group within the DPS.	• Degraded freshwater habitat • Mainstem Columbia River hydropower-related impacts • Degraded estuarine and nearshore marine habitat • Hatchery-related effects • Harvest-related effects • Effects of predation, competition, and disease
Snake River basin steelhead	Threatened 1/5/06	NMFS 2016a	NWFSC 2015	This DPS comprises 24 populations. Two populations are at high risk, 15 populations are rated as maintained, 3 populations are rated between high risk and maintained, 2 populations are at moderate risk, 1 population is viable, and 1 population is highly viable. Four out of the five MPGs are not meeting the specific objectives in the draft recovery plan based on the updated status information available for this review, and the status of many individual populations remains uncertain A great deal of uncertainty still remains regarding the relative proportion of hatchery fish in natural spawning areas near major hatchery release sites within individual populations.	• Adverse effects related to the mainstem Columbia River hydropower system • Impaired tributary fish passage • Degraded freshwater habitat • Increased water temperature • Harvest-related effects, particularly for B-run steelhead • Predation • Genetic diversity effects from out-of-population hatchery releases

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River Chinook salmon	Threatened 6/28/05	NMFS 2013	NWFSC 2015	This ESU comprises 32 independent populations. Twenty-seven populations are at very high risk, 2 populations are at high risk, one population is at moderate risk, and 2 populations are at very low risk Overall, there was little change since the last status review in the biological status of this ESU, although there are some positive trends. Increases in abundance were noted in about 70% of the fall-run populations and decreases in hatchery contribution were noted for several populations. Relative to baseline VSP levels identified in the recovery plan, there has been an overall improvement in the status of a number of fall-run populations, although most are still far from the recovery plan goals.	• Reduced access to spawning and rearing habitat • Hatchery-related effects • Harvest-related effects on fall Chinook salmon • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Contaminant

(increased noise and turbidity), and longer terms effects like increasing overwater coverage that can bear on the quality of downstream migration and expose smolts and juvenile out-migrating fish to predation.

Species Use of the Action Area

Despite degraded habitat conditions, juvenile ESA-listed species migrate through the action area at different rates, depending on species and life history. Numerous early life history strategies of CR salmonids have been lost as a result of past management actions discussed under the environmental baseline (Bottom *et al.* 2005). Today, salmonids expected in the action area will generally exhibit either a stream-maturing or ocean-maturing life history type. A stream-type life history is exemplified by juvenile salmon and steelhead that typically rear in upstream tributary habitats for over a year. Salmonids exhibiting this life history include LCR Chinook salmon (spring runs), LCR steelhead, LCR coho salmon, MCR steelhead, SR spring/summer Chinook salmon, UCR Chinook salmon, SR steelhead, SR sockeye, and UCR steelhead. These juvenile fish will migrate through the action area as smolts, approximately 100 to 200 mm in size, move quickly downstream, and pass by the action area within one to two days (Dawley *et al*. 1986), except for LCR Chinook and steelhead that may use Rock Creek and Cove as rearing habitat. An ocean-type life history is exemplified by juvenile salmon that move out of spawning streams and migrate towards the LCR estuary as sub-yearlings. Fish that exhibit these life histories include LCR Chinook salmon (fall runs), CR chum salmon, and SR fall-run Chinook salmon; they will generally be smaller in size and may be more susceptible to the effects of the action.

2.4 Effects of the Action

Under the ESA, "effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 CFR 402.17). In our analysis, which describes the effects of the proposed action, we considered 50 CFR 402.17(a) and (b).

Effects of the proposed action, and actions caused by the proposed action, are reasonably certain to include: 1) Acoustic impacts, 2) enhancement of piscivorous predator habitat, 3) reduction of water quality and forage, and 4) reduction riparian habitat. The magnitude of these effects will vary temporally, and are discussed in turn below.

2.4.1 Effects on Critical Habitat

Designated critical habitat within the action area for ESA-listed salmon and steelhead considered in this opinion consists of freshwater rearing sites and freshwater migration corridors and their essential physical and biological features (PBFs); these are also called primary constituent elements (PCEs). The primary constituent elements for freshwater rearing include floodplain connectivity, forage, natural cover, water quality, and water quantity. Primary constituent elements for freshwater migration include unobstructed migratory corridor, natural cover, water quality, and water quantity. These PCEs fulfill many functions for migrating salmonids, including allowing them to successfully avoid predators.

There are four primary effects to critical habitat from the proposed action.

1. Pile driving degrades water quality for migrating and rearing salmon and steelhead by creating noise that can affect behavior and pressure waves that can damage fish tissue. BNSF temporary bridge pile driving is expected to take place off and on over the entire in-water work window during the first year so water quality will be periodically degraded but then immediately return to normal when pile driving ceases. The impact pile driver will be used for a maximum of 9,000 strikes per day for a total of approximately three hours. Assuming 9 piles per day are installed the impact hammer will be used for 30 days in total.

2. The temporary bridge piles adversely affect the freshwater migration corridor critical habitat PCEs. For juvenile salmon and steelhead, the bridge piles create ambush habitat for piscine predators such as pike minnow, smallmouth bass and largemouth bass. Piscine predators exploit areas of shade and slow water velocity to get an advantage over their prey. Martinelli and Shively (1997) found pike minnow in all of the Columbia River locations that they studied with water velocities of less than 1 meter per second. Faler et al. (1988) monitored the movements of 23 pike minnows below McNary Dam and found them to use habitats with velocities ranging from 0 to 70 centimeter per second. Smallmouth bass in McNary reservoir also preferred slow-velocity habitats. Pribyl et al. (2005) and Tabor et al. (1993) report that smallmouth bass in the nearshore utilized piles and floating structures. Rondorf et al. (2010) cites studies that pike minnows and smallmouth bass seek out low velocity habitats and utilize overwater structures for cover. Therefore NMFS believes that the temporary bridge piles will be used by piscine predators that would not otherwise be present at this location. The long term effect is reduced ambush points due to the temporary piles being removed along with the deteriorated creosote piles and docks.

3. The temporary fill areas and temporary bridge piles will include 2,224 cubic yards of temporary fill covering 21,100 square feet of substrate below the OHWM of Rock Cove, removing benthic forage habitat for up to two years. Benthic forage supplements drifting macroinvertebrates for all listed salmon and steelhead (Groot and Margolis, 1991). Sediment eroded into the river from upland construction sites and sediment entrained by river during the installation and removal of the temporary bridge piles will adversely affect the freshwater rearing and freshwater migration corridor critical habitat PCEs. Adverse effects include; reduced primary production in the water column and an increased fine sediment fraction in downstream habitat. The reduction in primary production will be minimal because the turbidity plume area will be a very small fraction of the Columbia River, the in-water work window is during the winter when primary production is already low and the water column near the temporary bridge is already shaded by the State highway and the existing railroad bridge. The effect of relocating sediment to downstream areas is also very small because there is no spawning gravel

substrate downstream within the action area. The effects of suspended sediment on listed species are analyzed below.

4. The project will remove up to 29 trees of varying size, which may impair critical habitat functions in the action area. The tree and riparian vegetation removal is reasonably certain to indirectly reduce aquatic macroinvertebrate salmonid prey (that otherwise would forage on the riparian-derived detritus) and overwater shade (that otherwise would buffer elevated temperatures during summer) and cover from piscivorous birds. The duration of these adverse effects will persist decades or longer, improving incrementally only as tree canopy slowly re-establishes.

The proposed action effects on critical habitat described above are from temporary piles and fill that are removed when the new bridge is complete. Areas of injurious sound pressure waves, piscine predation, lost benthic forage, increased turbidity and lost riparian vegetation are very small fractions of, and unlikely to diminish, the overall quality of LCR salmonid migration and rearing critical habitat. The applicant will also remove creosote piles and docks from the action area. The removal of the current bridge, remnant creosote piles and docks will have a permanent beneficial effect on water quality and will reduce the number of ambush points for predators.

2.4.2 Effects on Species

Adult and juvenile LCR coho salmon, LCR Chinook salmon, LCR steelhead, UCR steelhead, and MCR steelhead and are likely to be migrating past or rearing in the action area during the in water work window and will be exposed to the proposed action effects from:

1. Noise/Sound pressure increases from pile driving;
2. Increased exposure to predation;
3. Changed water quality (increased turbidity);
4. Reduced riparian vegetation, and
5. Reduced forage .

All other salmonid species will migrate past the action area between the two work windows and may be exposed to predation, decreased forage and reduced riparian vegetation.

Exposure

Juvenile salmonids – Because of the overlap of life histories in the Columbia River, the proposed action constrains in-water work to the time of year when the density of sub-yearlings salmonids will be low to reduce the number of individual animals exposed to the effects of construction, but not avoid it. Thus, a small number of juvenile salmonids will likely be exposed to construction effects.

Adult Salmonids - Peak migratory periods for adult salmonids in the action area vary by species, but adult CR salmonids are reasonably certain to be present in the action area year-round (from passage data at Bonneville Dam 10-year average, http://www.cbr.washington.edu/dart/adult_hrt.html), thus some salmonids are likely to be exposed to the construction effects and all will be exposed to increased predation.

Table 3. Presence of ESA-listed fish species in the Lower Columbia River by life stage, NMFS' Northwest Fisheries Science Center, and NMFS' Protected Resources Division (2017). Fish abundance is denoted using a combination of text and shading [no shading (-) = not presence; light shading (P) = presence; medium shading (R) = relatively abundant; dark shading (A) = peak abundance]. The in water work window is November 1st to February 28th outlined in red.

Species	Life Stage	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Chinook Salmon																									
LCR	Adult	-	-	-	-	R	R	R	R	A	A	A	A	A	R	R	R	R	R	R	R	-	-	-	-
	Adult spawning	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Eggs & pre-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Juvenile rearing	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
	Juvenile	-	-	-	-	A	A	R	A	A	A	A	A	A	A	A	A	R	R	R	R	R	R	-	-
UCR	Adult	-	-	-	-	-	-	-	-	R	A	A	-	-	-	-	-	-	-	-	-	-	-	-	-
	Adult spawning	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Eggs & pre-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Juvenile rearing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Juvenile	-	-	-	-	A	A	R	A	A	A	A	A	A	A	A	A	R	R	R	R	R	R	-	-
SR spr/sum	Adult	-	-	-	-	R	R	A	A	A	R	R	R	R	R	R	R	R	R	-	-	-	-	-	-
	Adult spawning	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Eggs & pre-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Juvenile rearing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Juvenile					R	R	R	A	A	A	A	R	R	R	R	P	P	P	P	P	-	-	-	-

Species	Life Stage	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
SR fall	Adult	-	-	-	-	-	-	R	R	A	A	A	A	A	R	R	R	R	R	-	-	-	-	-	-
	Adult spawning	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Eggs & pre-emergence	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Juvenile rearing	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
	Juvenile emigration	-	-	R	R	A	A	R	A	A	A	A	A	A	A	A	A	R	R	R	R	R	R	R	R
Chum Salmon																									
CR	Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	R	A	A	A	A	A	A	A
	Adult spawning	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Eggs & pre-emergence	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Juvenile rearing	R	R	R	R	R	R	R	R	R	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Juvenile emigration[4]	-	-	R	R	R	R	A	A	R	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Coho Salmon																									
LCR	Adult	A	A	A	A	-	-	-	-	-	-	R	R	R	R	R	R	R	R	A	A	A	A	A	A
	Adult spawning	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Eggs & pre-emergence	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Juvenile rearing	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
	Juvenile emigration	-	-	-	-	R	R	R	A	A	A	A	A	A	R	R	P	P	P	P	P	-	-	-	-
Sockeye Salmon																									
SR	Adult	-	-	-	-	-	-	-	R	R	A	A	R	R	-	-	-	-	-	-	-	-	-	-	-
	Adult spawning	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Eggs & pre-emergence	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Juvenile rearing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Juvenile emigration	-	-	-	-	R	R	R	R	A	A	A	R	R	P	P	P	P	P	P	-	-	-	-	-
Steelhead																									
LCR	Adult	-	-	-	-	-	-	R	A	A	A	A	R	-	-	-	-	-	-	-	-	-	-	-	-
	Adult spawning	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Eggs & pre-emergence	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Juvenile rearing	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
	Juvenile emigration	-	-	-	-	p	p	R	A	A	A	A	R	R	P	P	P	P	P	P	P	-	-	-	-
MCR	Adult	-	-	-	-	-	-	R	A	A	A	A	R	-	-	-	-	-	-	-	-	-	-	-	-
	Adult spawning	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Eggs & pre-emergence	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Juvenile rearing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Juvenile emigration	-	-	-	-	P	P	R	A	A	A	A	R	R	P	P	P	P	P	P	P	-	-	-	-
UCR	Adult	-	-	-	-				R	R	A	A	R	R	-	-	-	-	-	-	-	-	-	-	-
	Adult spawning	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Eggs & pre-emergence	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Juvenile rearing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Juvenile emigration	-	-	-	-	P	P	R	A	A	A	A	R	R	P	P	P	P	P	P	P	-	-	-	-

Response to sound pressure waves

The project will use a vibratory hammer for piling removal and to drive the temporary piles that will support the trestles during construction. An impact hammer will be required should for proofing each of the piles. When an impact hammer is required, the project will deploy a bubble curtain for sound attenuation during impact hammer driving.

While vibratory driving produces lower levels of noise and reduced sound pressure relative to impact hammer strikes, NMFS conservatively estimates that the applicant's contractor will produce up to 9,000 hammer strikes a day. Physical injury to salmonids present during construction because of in-water impact driving is likely occur with impact driving, despite the use of a bubble curtain, as sound levels will exceed thresholds for injury. The degree to which an individual fish exposed to underwater sound will be affected is dependent on the number of variables such as species of fish, size of the fish, presence of a swim bladder, sound pressure intensity and frequency, shape of the sound wave (rise time), depth of the water around the pile and the bottom substrate composition and texture. High levels of underwater sound have been shown to have negative physiological and neurological effects on a wide variety of vertebrate species (Yelverton et al. 1973; Yelverton and Richmond 1981; Cudahy and Ellison 2002; Hastings and Popper 2005). Risk of injury from underwater noise appears related to the effect of rapid pressure changes, termed barotraumas, especially on gas-filled spaces in the bodies of exposed organisms (Turnpenny et al. 1994). Broadly, the effects of underwater noise on organisms range from no observable effects to immediate death. Over this range of effect, there is no easily identifiable point at which behavioral responses occur or where the effects transition to physical injury or death. The sounds from impact pile driving can injure and/or kill fishes, as well as temporarily stun them or alter their behavior. (Turnpenny et al. 1994; Turnpenny and Newell 1994; Popper 2003; Hastings and Popper 2005).

The applicant provided distance calculations when a bubble curtain was applied that were made starting with baseline single strike levels of 205 dB peak, 199 dB accumulated sound exposure level (SEL), and 190 dB root mean square (RMS) for a 24-inch steel piling.The onset of physical injury is expected within 631 meters for fish; behavioral effects may be felt at a distance of 4,642 meters.

Fish with swim bladders appear to be more susceptible to barotraumas from impulsive sounds (sounds of very short duration with a rapid rise in pressure) because the sounds cause their swim bladders to resonate. When a sound pressure wave strikes a gas-filled space such as the swim bladder, it causes that space to expand and contract. When the amplitude of this vibration is sufficiently high, the pulsing swim bladder can press against, and strain, adjacent organs, such as the liver and kidney. This pneumatic compression causes injury, in the form of ruptured capillaries, internal bleeding, and maceration of highly vascular organs (CalTrans 2002). Sound waves can cause different types of tissue to vibrate at different frequencies, and this differential vibration can tear mesenteries and other sensitive collective tissues (Hastings and Popper 2005). Exposure to high noise levels can also lead to injury through "rectified diffusion," the formation and growth of bubbles in tissues. These bubbles can cause inflammation and cellular damage and block or rupture capillaries, arteries, and veins (Crum and Mao 1996; Vlahakis and Hubmayr

2000; Stroetz et al. 2001). Death from barotrauma and rectified diffusion injuries can be instantaneous or delayed for minutes, hours, or even days after exposure.

Even if fish are not killed, elevated noise levels can injure affect the fishes' survival and fitness (Slabbekoom et al. 2010). Similarly, if injury does not occur, noise may modify fish behavior in ways that may make them more susceptible to predation or reduce their ability to detect prey (Slabbekoom et al. 2010). Fish suffering damage to hearing organs may suffer equilibrium problems, and have a reduced ability to detect predators and prey (Turnpenny et al. 1994; Hastings 1996). Exposure to elevated noise levels can cause a temporary shift in hearing sensitivity (referred to as a temporary threshold shift, or TTS), decreasing sensory capability for periods lasting from hours to days (Turnpenny et al. 1994; Hastings 1996).

Thus, salmonids exposed to impact hammer derived sound pressure levels could experience direct injury and death if they occur in close proximity to the pile driving activities; the impact hammer use will be limited to proofing the piles and includes use of a bubble curtain. The majority of pile driving will be done by vibratory hammer, which can cause sub-lethal effects; however, we anticipate that these fish will not be severely affected. The pile driving will take place 2-4 hours a day for approximately 30 days during a window when the lowest numbers of juvenile salmonids, the most susceptible life stage, are present. Due to the majority of work being conducted with a vibratory hammer, the lower level of species presence and the use of BMPs, NMFS expects that pile driving will not have a measurable effect at the population level of listed species.

Response to enhanced piscivorous predation habitat

The temporary bridge piles confer an advantage to piscine predators of juvenile salmon. These advantages are shade and a flow wake on the back side of piles where predators can hide and ambush juvenile salmon. The reduced light regime under and around overwater structures improve hunting conditions for ambush predators like the pike minnow. Reduced light allows the predator to hide in shaded and lower velocity water from prey and ambush juvenile salmonids swimming past the pile. Swimming into shade decreases visual ability in juvenile salmon and steelhead so they are less likely to see ambush piscine predators. Petersen and Gadomski (1994) found the rate of predation by northern pikeminnow on subyearling Chinook salmon was inversely related to light intensity in laboratory studies, and five times more salmon were eaten in the darker setting than in the lighter conditions examined. New temporary piles will create a small amount of ambush habitat for pikeminnow predators and will likely lead to slightly increased predation losses for salmon and steelhead smolts during the one year that they are in place. The removal of creosote piles and docks will provide a permanent beneficial effect by eliminating structures used by piscine predators. The short time frame of the piles being in place and the permanent beneficial effects lead NMFS to expect no measurable effect at the population level for the species.

Response to decreased water quality – Elevated Turbidity

Turbidity/Suspended Sediment - Adult salmonid migration rates range up to a few miles per hour (Matter and Sandford, 2003), therefore we expect adult ESA-listed salmonids that do encounter turbidity plumes created during pile removal and installation to be moving upstream at such a rate as to limit this exposure to a matter of minutes. Adult salmonids typically migrate within the main river channel at depths of 10 to 20 feet below the water surface and off the bottom (Johnson et al. 2005).

The short term effects of elevated levels of suspended sediment and turbidity range from improved survival via reduced piscivorous predation, to physiological stress and reduced growth for rearing juveniles, resulting in reduced survival (Newcombe and Jensen 1996). In general, little sediment is released during vibratory pile installation. Fish near this activity are likely to experience brief, low-level amounts of sediment and exhibit responses (e.g., coughing, gill flaring, and temporary limitation in foraging) characterized as sub-lethal (Newcombe and Jensen 1996). Chronic exposure to turbid water can cause physiological stress responses that increase maintenance energy needs and reduce feeding and growth (Lloyd et al. 1987; Redding et al. 1987; Servizi and Martens 1991). In contrast, limited duration exposure to low intensity turbidity make these responses extremely unlikely.

Juvenile and adult salmonids exposed to elevated turbidity respond similarly, physiologically. Because the action will occur in relatively shallow water used by sub-yearling migrating juvenile salmonids, juveniles are more likely to be exposed in a way that will elicit adverse behavioral responses than yearling migrants and adults. Given the small area, quick dilution of the turbidity and the small number of ESA-listed salmonids likely to be present and exposed to elevated suspended sediment, only a few ESA-listed fish in the action area are likely to experience any of the adverse effects caused by suspended solids as described above.

Larger adult salmon readily respond by avoiding waters affected by suspended sediment to find refuge and/or passage conditions within unaffected adjacent areas. Studies show that salmonids are able to detect and distinguish turbidity and other water quality gradients (Bisson and Bilby 1982), and that larger salmonids are more tolerant to suspended sediment than smaller juveniles (Servizi and Martens 1991 and 1992). As salmonids grow and their swimming ability increases, their dependence on shallow nearshore habitat declines rapidly (Groot and Margolis 1991). Thus, to the extent that any adults are exposed to turbidity generated by project activities, they are expected to respond by avoiding excessively turbid conditions and find passage within unaffected adjacent areas. Specifically, we expect these fish to avoid the small turbidity plume created by pile extraction and placement without experiencing adverse effects.

Response to diminished forage

Loss of benthic production by the addition of temporary piles and fill for the construction of the bridge is biologically insignificant in the action area as forage items are otherwise already plentiful there. The effects on benthic forage will persist for the duration of the project, two in water work windows and the time in between them. However, due to the relatively small footprint and timeframe the amount of benthic forage reduction caused by the proposed action is not expected to be biologically meaningful to rearing juvenile salmonids. Rearing juveniles, therefore, are not expected to experience reduced growth or fitness as a consequence of benthic forage reduction. Adult salmon and steelhead rarely forage while moving upstream (Groot and

Margolis 1991). The reduction in invertebrate forage related to the loss of habitat will have no appreciable effect on adult salmon and steelhead.

While the new structure will decrease benthic production, NMFS does not expect an increase in juveniles affected due to the short lifespan of the project and removal of remnant pilings and structures that will permanently increase benthic habitat.

Response to reduced riparian shoreline

The removal of riparian vegetation will decrease shade and therefore may slightly elevate nearshore water temperatures, and in some cases to such an extent that the warmer water is not optimal for rearing juveniles. Other effects related to reduced riparian vegetation include: Removal of riparian tree cover reduces sources and abundances of prey including detrital insects (Kondolf *et al.* 1996, Naiman *et al.* 1993); the fill associated with the temporary causeway impairs prey types found in soils and sediments (Schmetterling *et al* 2001); these conditions decrease the amount of food, and consequently competition may increase among the rearing fish. Because the project is removing a maximum of 29 trees and the causeway is temporary, the amount of impact caused by the project will not have a measurable effect at the population level.

2.5 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 and 402.17(a)). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

The NMFS is unaware of specific, future non-Federal actions reasonably certain to occur in the action area. The action area is reasonably certain to continue to experience the influence of the on-going and future activities that will be caused by anthropogenic growth and development; Skamania County population grew an average 1.5 percent per year between 1990 and 2015 and this trend is expected to continue. While the growth in Skamania County is relatively low, NMFS considers human population growth and associated development to be one of the main drivers for future negative effects on ESA listed species and their habitat. While non-federal parties are also developing and implementing restoration projects and best management practices for development and resource extraction, these are ameliorating rather than offsetting impacts of development, and even when contemporaneous, are mitigation and restoration benefits are outpaced by the development impacts.

The collective effects of these future non-federal activities will tend to be expressed most strongly in lower river systems where the impacts of numerous upstream land management actions aggregate to influence natural habitat processes and water quality. While widespread degradation of aquatic habitat associated with intense natural resource extraction is no longer common, ongoing and future land management actions are likely to continue to have a depressive effect on aquatic habitat quality in the Columbia River basin and within the action area, particularly when effects of climate change are also considered. Likely effects will be greater variability in the volume of water in the action area due to the increasing intensity of storm events and the increasing frequency of drought as precipitation patterns shift, and an increasingly warm temperature regime. Snowmelt dominated systems of the Columbia River Basin are expected to change extensively in the timing and extent of flow. Each of these effects is likely to alter food webs and ecosystems that salmonids are adapted to.

As a result, recovery of aquatic habitat is likely to be slow in most areas, and cumulative effects from basin-wide activities are likely to have a slightly negative impact on population abundance trends and the quality of critical habitat PBFs into the future.

2.6 Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) Reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

Considering the status of the ESA-listed species, all but two of the species considered in this opinion are listed as threatened, and two, UCR spring Chinook salmon and SR sockeye salmon, are listed as endangered. Most of the component populations of LCR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer run Chinook salmon, SR fall-run Chinook salmon, chum salmon, LCR coho salmon, SR sockeye salmon, LCR steelhead, MCR steelhead, UCR steelhead, and SRB steelhead are at a low level of persistence. All individuals from populations of the listed species are likely to move through the action area at some point during their life history.

Factoring the current environmental baseline, fish from the affected populations that move through the action area encounter habitat conditions that have been degraded by restricted natural flows, reduced water quality, loss of functioning floodplains and secondary channels, and loss of vegetated riparian areas and associated shoreline cover. The significance of the degradation is reflected in the limiting factors identified above including habitat access to floodplain and secondary channels, degraded habitat, loss of spawning and rearing space, pollution, juvenile fish stranding, and increased predation, highlighting the importance of protecting current functioning habitat and limiting water quality degradation, minimizing entrainment, and reducing potential predation of ESA-listed fish.

Within this context, the construction of the proposed action will create a brief physical disturbance in the water column, will create noise and turbidity, as well as the temporary placement of in-water structures that will modify fish migration and provide habitat for piscine predators, and reduce the production of benthic food items. The in-water structure and its disruption of rearing and migration values, including enhanced predator habitat, will persist for two years. These habitat alterations will displace a small number of adult and juvenile fish as they migrate around the structures. A relatively large number of juvenile fish migrating near the structure may be consumed by piscine predators using the piles as refugia and foraging habitat. Rearing conditions are slightly impaired by the structure, but fish may contemporaneously benefit slightly from improvements in habitat associated with the permanent pile and dock removal.

The last element in the integration of effects includes a consideration of the cumulative effects anticipated in the action area. Primarily, the recovery of aquatic habitat from the degraded baseline conditions is likely to be slow in the action area, and cumulative effects (from continued or increasing uses of the action area) are likely to have a negative impact on habitat conditions, which in turn may cause negative pressure on population abundance trends in the future. Moreover, we anticipate that the effects of climate change will continue to impair habitat conditions in the action area, most notably, water temperature, and dissolved oxygen.

However, even when we consider the current status of the threatened and endangered fish populations and degraded environmental baseline within the action area the effects of the proposed action on the abundance of fish is insufficient by itself to affect the distribution, diversity, or productivity of any of the component populations of the ESA-listed species at a measurable level, nor further degrade baseline conditions or limiting factors to a degree that discernibly affects the conservation value of the action area. The effects of the action will be too minor to have a measurable impact on the affected populations because the effects will cease during the second year's work window. Because the proposed action will not reduce the abundance, productivity, spatial structure, or diversity of the affected populations, the action, when combined with a degraded environmental baseline and additional pressure from cumulative effects, will not appreciably affect any of the listed species considered in this opinion.

In the context of the status of critical habitat and the specific baseline conditions of PBFs in the action area, the proposed action will add a slight obstruction to the migratory corridor, temporarily reduce water quality, and reduce some benthic forage, it will slightly reduce cover, and alter water temperature due to reduced riparian vegetation. When considering the cumulative effects of non-federal actions, recovery of aquatic habitat is likely to be slow in most of the action area and cumulative effects from basin-wide activities are likely to have a neutral to negative impact on the quality of critical habitat PBFs and the watershed scale.

As a whole, the critical habitat for migration and rearing is functioning moderately under the current environmental baseline in the action area. Given that the proposed action will have a highly-localized, low-level effect on the PBFs for migration, rearing, even when considered as an addition to the environmental baseline conditions, the proposed action is not likely to reduce the quality or conservation value of critical habitat for the any species considered in this consultation.

2.7 Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of or destroy or adversely modify designated critical habitat of any of the ESA-listed species considered in this opinion.

2.8 Incidental Take Statement

Section 9 of the ESA and Federal regulations 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 regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

2.8.1 Amount or Extent of Take

In this Biological Opinion, NMFS determined that incidental take is reasonably certain to occur as follows: (1) ESA-listed fish will be injured, killed or experience altered behavioral by sound pressure waves and suspended sediment from pile driving; (2) ESA-listed fish will be injured or killed by piscivorous predators that use the temporary bridge piles for ambush cover; and (3) ESA-listed fish that face less forage opportunities and elevated temperature due to riparian vegetation removal.

1. Impact pile driving to proof up to 230 piles to construct the temporary bridge will produce underwater sound pressure exceeding 206 dB_{peak} and 182 dB_{SEL}. These sound pressure levels can kill or injure juvenile salmon exposed to one impact strike within 9 meters of the piling or 9000 impact strikes within 631 meters of the piling. Quantifying the actual number of juvenile salmon that will be killed or injured is not practicable because even if the total number of juvenile salmon in the action area were to be determined, their distribution is too heterogeneous to use an area ratio to reasonably quantify take.

   When quantifying the amount of take as individuals is not practicable, NMFS identifies a take surrogate that serves the same role in that it may be monitored and serve as a clear reinitiation trigger. For the take of juveniles, the surrogate is 9,000 impact pile driver blows delivered to 24 inch diameter steel piles surrounded by a bubble curtain or cofferdam in a 24 hour period.

   Incidental take from suspended sediment concentrations in the vicinity of pile driving is tightly correlated with pile driving noise and sound pressure waves. The suspended sediment concentration in the water column around a pile will increase with pile driving begins and return to normal when pile driving ends, albeit with considerably longer rise and fall times. Like sound pressure waves, suspended sediment concentration will be high near the piling and fall off as the distance from the pile increases. Fish exposed to pile driving effects are much more likely to be injured by sound pressure waves than suspended sediment and the terms and conditions that minimize take from sound pressure waves would also minimize take from suspended sediment so for the proposed action a separate take indicator for suspended sediment is not necessary.

2. The temporary bridge piles will be installed during the first construction year in-water work window and removed during the second construction year in-water work window. Quantifying the number of juvenile salmon and steelhead that will be killed by piscivorous predators using the piling is not practicable because the number of juvenile fish and the number of piscivorous predators that use the temporary bridge piles for cover is not predictable. When quantifying the amount of take as individuals is not practicable, NMFS identifies a take surrogate that serves the same role in that it may be monitored and serve as a clear reinitiation trigger. For take of listed salmon and steelhead by piscivorous predators using the temporary bridge piling as cover, the surrogate is the number of temporary pilings, 179 24-inch piles and 50 14-inch H-piles.

3. Reduced salmonid prey and elevated temperatures from removal of riparian vegetation may affect a number of individuals of future cohorts, but quantifying the amount of take is not practicable. NMFS identifies a take surrogate that serves the same role in that it may be monitored and serve as a clear reinitiation trigger. For take of listed salmon and steelhead due to riparian vegetation the surrogate will be the number of trees removed, a maximum of 29.

<u>2.8.2 Effect of the Take</u>

In the biological opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

<u>2.8.3 Reasonable and Prudent Measures</u>

"Reasonable and prudent measures" are nondiscretionary measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02). The COE and/or its applicant shall:

1. Minimize take from pile installation;
2. Minimize take from piscine predation;
3. Minimize take from impacts to riparian vegetation; and
4. Ensure completion of a reporting form to confirm that the take exemption for the proposed action is not exceeded, and that the terms and conditions in this incidental take statement are effective in minimizing incidental take.

2.8.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the COE or any applicant must comply with them in order to implement the RPMs (50 CFR 402.14). The COE or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

1. To minimize take from pile installation:
    a. If an impact hammer is needed to embed piles:
        i. Conduct pile driving during daylight hours to avoid peak movement of salmonids;
        ii. Allow a minimum rest period of 12 hours between daily pile driving activities during which no impact pile driving occurs.
        iii. Ensure the number of piles does not exceed 230.
        iv. Ensure the number of impact strikes in a single 24 hour period does not exceed 9000.

2. To minimize take from piscine predation the COE shall:
    a. Confirm that the finished design does not exceed the following dimensions:
        i. The project installs only 230 piles associated with the structures.
        ii. Remove all temporary piles during the second in-water work window.

3. To minimize take from impacts to features of rearing and migration habitat, ensure that the disturbed riparian area is replanted with native tree species and that these are checked for survival for a period of 5 years. Replacement of failed plantings is required.

4. To provide a completion report within 60 days of the close of any work window, that includes:
    a. A discussion of implementation of the terms and conditions in #1, and #2 above.
    b. Any exceedance of take covered by this opinion.

    Submit monitoring reports to:

    National Marine Fisheries Service
    Attn:WCRO-2020-00380
    510 Desmond Drive SE, Suite 103
    Lacey, WA 98503
    or electronically to: chad.baumler@noaa.gov

2.9 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. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

NMFS would like to include the following discretionary recommendations within this biological opinion which support Section 7(a)(1) of the ESA, which identify and implement habitat enhancement or restoration activities within the action area:

1. Increase the amount of productive shallow-water habitat to benefit ESA-listed species;
2. Protect and restore riparian areas to improve water quality;
3. Improve or regrade and revegetate degraded streambanks;
4. Remove invasive plant species from riparian, and upland vegetation communities, and replant with native species.

Please notify NMFS if the COE carries out any of the previously described recommendations so that we will be kept informed of the actions that are intended to improve the conservation and recovery of ESA-listed species and/or their designated critical habitats.

2.10 Not Likely to Adversely Affect Determinations

Eulachon (*Thaleichthys pacificus*)

The action area is not designated critical habitat for eulachon. The location of the work above Bonneville Dam is above where eulachon have known spawning. As the likelihood of exposure to the adverse effects is extremely low, the project's effects on eulachon are discountable.

2.11 Reinitiation of Consultation

This concludes the ESA consultation for Railway Bridge Repair (NWS-2019-974).

As 50 CFR 402.16 states, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) The amount or extent of incidental taking specified in the ITS is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat that was not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT RESPONSE

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. The MSA (section 3) defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, 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 of it 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 can be taken by the action agency to conserve EFH.

This analysis is based, in part, on the EFH assessment provided by the COE and descriptions of EFH for, Pacific Coast salmon (PFMC 2014); contained in the fishery management plans developed by the PFMC and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

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 of Chinook and coho salmon as identified in the Fishery Management Plan for Pacific coast salmon (PFMC 2014).

3.2 Adverse Effects on Essential Fish Habitat

Based on information provided by the COE and the analysis of effects presented in the ESA portion of this document, NMFS concludes that proposed action will have adverse effects on EFH designated for Chinook and coho salmon. These effects include acoustic impacts from pile installation and removal, an increase in piscine predation and a short-term loss of benthic invertebrates due to sediment disturbance, and reduced riparian vegetation for a period of years. These effects are described in more detail in Section 2 of this document, above.

3.3 Essential Fish Habitat Conservation Recommendations

1. To minimize impacts from pile installation:
    a. If an impact hammer is needed to embed piles:
        i. Conduct pile driving during daylight hours to avoid peak movement of salmonids;
        ii. Allow a minimum rest period of 12 hours between daily pile driving activities during which no impact pile driving occurs.
        iii. Ensure the number of piles does not exceed 230.
        iv. Ensure the number of impact strikes in a single 24 hour period does not exceed 9000.

2. To minimize impacts from piscine predation the COE shall:
    a. Confirm that the finished design does not exceed the following dimensions:
        i. The project installs only 230 piles associated with the structures.
        ii. Remove all temporary piles during the second in-water work window.

3. To minimize take from impacts to features of rearing and migration habitat, ensure that the disturbed riparian area is replanted with native tree species and that these are checked for survival for a period of 5 years. Replacement of failed plantings is required.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the COE must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH Conservation Recommendations unless NMFS and the Federal agency have agreed to use alternative time frames for the Federal agency response. The response must include a description of measures proposed by the agency for avoiding, minimizing, mitigating, or otherwise offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the Conservation Recommendations, the Federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects (50 CFR 600.920(k)(1)).

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.

3.5 Supplemental Consultation

The COE must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH Conservation Recommendations (50 CFR 600.920(l)).

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are the COE. Other interested users could include the BNSF Railroad. Individual copies of this opinion were provided to the COE. The format and naming adheres to conventional standards for style.

4.2 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.

4.3 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., and the MSA implementing regulations regarding EFH, 50 CFR 600.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion and EFH consultation 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 and MSA implementation, and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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