UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
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Refer to NMFS No.:
WCRO-2022-01498

January 4, 2023

Eric Veach
Forest Supervisor
United States Department of Agriculture, Forest Service
Gifford Pinchot National Forest
501 E 5th Street #44
Vancouver, Washington 98661

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Yellowjacket Vegetation Management Project, (HUC 170800040402)

Dear Mr. Veach:

This letter responds to your June 23, 2022, request for initiation of consultation with the National Marine Fisheries Service (NMFS) pursuant to Section 7 of the Endangered Species Act (ESA) for the subject action. Your request qualified for our expedited review and analysis because it met our screening criteria and contained all required information on, and analysis of, your proposed action and its potential effects to listed species and designated critical habitat.

We reviewed the Gifford Pinchot National Forest's (GPNF's) consultation request and related initiation package. Where relevant, we have adopted the information and analyses you have provided and/or referenced but only after our independent, science-based evaluation confirmed they meet our regulatory and scientific standards.

We adopt by reference here:

- The description of proposed action commercial timber harvest on pages 9 and 10, and 12-15 of the Biological Assessment (BA)
- The description of proposed action transportation system improvements on pages 11 and 12 and 16-18 of the BA.
- The description of proposed action haul activities on page 16 of the BA.
- The description of proposed action project design criteria and mitigation on pages 18-32 of the BA
- The description of the action area on pages 32 and 51 of the BA and Appendix 1 Map 5 on page 86 of the BA.
- The description of the status of ESA listed species and critical habitat on pages 33-36 of the BA
- The description of the environmental baseline on pages 36-49 of the BA
- The description of the effects analysis on pages 49-68 of the BA.
- The description of cumulative effects analysis on pages 69-73 of the BA.
- The Magnuson-Stevens Fishery Conservation and Management Act analysis on pages 73-75 of the BA.

We note where we have supplemented information in the BA with our own data and analysis. The BA will be included in the administrative record for this consultation and we will send it to readers of the biological opinion as an email reply attachment to requests sent to Tom.Hausmann@noaa.gov.

The GPNF sent NMFS a BA and consultation request for the proposed action on June 24, 2022. We reviewed the material and did not request any additional information. We initiated consultation on June 24, 2022.

On July 5, 2022, the U.S. District Court for the Northern District of California issued an order vacating the 2019 regulations that were revised or added to 50 FR part 402 in 2019 ("2019 Regulations," see 84 FR 44976, August 27, 2019) without making a finding on the merits. On September 21, 2022, the U.S. Court of Appeals for the Ninth Circuit granted a temporary stay of the district court's July 5 order. As a result, the 2019 regulations are once again in effect, and we are applying the 2019 regulations here. For purposes of this consultation, we considered whether the substantive analysis and conclusions articulated in the biological opinion and incidental take statement would be any different under the pre-2019 regulations. We have determined that our analysis and conclusions would not be any different.

Action: The GPNF is proposing to award a contract under the Forest and Rangeland Renewable Resources Planning Act of 1974 to harvest timber on 4809 acres of the Lower Cispus fifth field watershed including Yellowjacket Creek and Camp Creek sixth field subwatersheds along with a small portion of Middle Cispus fifth field and Schooley Creek sixth field watershed. The contractor will thin from below 3,765 acres of Matrix[1], late successional reserve[2] and riparian reserve[3,4] to 40 to 60 percent canopy closure removing the trees with the lowest canopy position first to achieve a residual density that optimizes stand volume growth. The contractor will regenerate 181 acres of Matrix and adaptive management area[5] (AMA) lands by removing all trees greater than 5-inch double breast height leaving 9 trees per acre and planting approximately 435 trees per acre. The contractor will thin from below 863 acres 15-30 percent canopy closure to enhance huckleberry growth (see BA page 10). The contractor will adhere to Project Design Criteria (PDC) 1, 2, 3, 4, 6, 7, 8, 9, 10, 12, 13, 14, 15, 21, 23, 24 on BA pages 19-25.

The contractor will haul logs from landings to mills on system and non-system (temporary) roads. The contractor will construct approximately 901 landings (161 acres) (see BA page 13) and approximately 42 miles of temporary (non-system) roads with 23 stream crossings to access

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[1] Federal lands outside of reserved allocations where most timber harvest and silvicultural activities were expected to occur.

[2] Lands reserved for the protection and restoration of late successional/old growth (LSOG) forest ecosystems and habitat for associated species; including marbled murrelet reserves (LSR3) and northern spotted owl activity core reserves (LSR4).

[3] Protective buffers along streams, lakes, and wetlands designed to enhance habitat for riparian-dependent organisms, provide good water-quality dispersal corridors for terrestrial species, and provide connectivity within watersheds.

[4] All fish bearing streams with ESA listed fish, management indicator species or sensitive species will be restricted to commercial harvest in the outer 180-360 feet while the inner 0-180 feet remains protected.

[5] Identified to develop and test innovative management to integrate and achieve ecological, economic, and other social and community objectives. Some commercial timber harvest was expected to occur in these areas, but with ecological objectives.

harvest unit landings from roads (see BA page 16). The contractor will also reconstruct approximately 28 miles of system roads requiring 6 new stream crossings (see BA page 17). Approximately 21 miles of temporary roads will follow pre-existing routes and 21 miles of new temporary roads will be developed (see BA page 12). The aggregate for landings, system road reconstruction and non-system road construction will be blasted from local quarries (see BA page 17 and 18). Helicopter logging will be used where it is unfeasible to construct roads. The contractor will adhere to PDCs 5, 7, 11, 156, 16, 17, 18, 19, 20, 21, 22, 23, 24 (BA page 19-25) for landing and road construction and PDCs for Quarry development--rock blasting, crushing and removal (BA page 27-29), and PDCs for Crossing and road repair and aquatic organism passage (BA pages 29-32).

Status: We examined the status of each species that would be adversely affected by the proposed action to inform the description of the species' "reproduction, numbers, or distribution" as described in 50 CFR 402.02. We also examined the condition of critical habitat throughout the designated area and discuss the function of the physical or biological features essential to the conservation of the species that create the conservation value of that habitat.

The action area produces Cispus River Lower Columbia River (LCR) spring Chinook, Upper Cowlitz LCR fall Chinook salmon, Cispus River LCR coho and Cispus River LCR steelhead. The BA summarizes the status of Upper Cowlitz and Cispus populations of LCR Chinook salmon on page 34 noting that these populations have not seen pronounced increase in recent years and abundance is limited by high hatchery production and the downstream collection efficiency at Cowlitz Falls dam. The BA summarizes the status of the Cispus population of LCR coho salmon on BA page 34 noting that the short-term abundance trend is negative and limited by the downstream collection efficiency at Cowlitz Falls dam. The BA summarizes the status of the Cispus population of LCR steelhead on page 34 noting that the abundance is low with periods of improvement in the past 5 years and limited by the downstream collection efficiency at Cowlitz Falls dam. The BA describes the status of action area critical habitat on page 35 noting that water quality and quantity, substrate quality, channel connectivity in the action area are not functioning properly.

We supplement the BA's presentation of the status of LCR Chinook, LCR coho and LCR steelhead populations in the action area and the status of their action area critical habitat with information summarized in the following two tables that summarize the current overall status of the species and their critical habitat.

Table 1. Status of Species

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review/ Viability Assessment	Status Summary	Limiting Factors
Lower Columbia River Chinook salmon	Threatened 6/28/05	NMFS 2013a	Ford 2022 NMFS 2022	This ESU comprises 32 independent populations seven are at or near the recovery viability goals. Ten independent populations either had no abundance information (presumed near zero) or exist at very low abundances. 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. Many of the populations in this ESU remain at "high risk," with low natural-origin abundance levels. Hatchery contributions remain high for a number of populations, and it is likely that many returning unmarked adults are the progeny of hatchery-origin parents, especially where large hatchery programs operate. Increases in abundance were noted in about half of the fall-run populations, and in 75% of the spring-run populations for which data were available. Overall, the viability of the ESU has increased somewhat since the last status review, although the ESU remains at "moderate" risk of extinction (Ford, 2022b).	• 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 • Contaminants
Lower Columbia River coho salmon	Threatened 6/28/05	NMFS 2013a	Ford 2022 NMFS 2022	In contrast to the previous status review update (NWFSC, 2015), which occurred at a time of near-record returns for several populations, the ESU's abundance has declined during the last five years. Only six of the 23 populations for which we have data appear to be above their recovery goals. This includes the Youngs Bay and Big Creek DIPs, which have very low recovery goals, and the Tilton River and Salmon Creek DIPs, which were not assigned goals but have relatively high abundances. Of the remaining DIPs in the ESU, three are at 50–99% of their recovery goals, seven are at 10–50% of their recovery goals, and seven are at <10% of their recovery goals (this includes the Lower Gorge DIP, for which there are no data, but it is assumed that the abundance is low). Overall, abundance trends for the ESU are generally negative and the status remains at "moderate" risk (Ford, 2022b).	• 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/ Viability Assessment	Status Summary	Limiting Factors
Lower Columbia River steelhead	Threatened 1/5/06	NMFS 2013a	Ford 2022 NMFS 2022	This DPS comprises 23 historical populations, 17 winter-run populations and six summer-run populations. The majority of winter-run steelhead DIPs in this DPS continue to persist at low abundance levels (hundreds of fish), with the exception of the Clackamas and Sandy River DIPs, which have abundances in the low 1,000s. Although the five-year geometric abundance means are near recovery plan goals for many populations, the recent trends are negative. Summer-run steelhead DIPs were similarly stable, but also at low abundance levels. Summer-run DIPs in the Kalama, East Fork Lewis, and Washougal River DIPs are near their recovery plan goals; however, it is unclear how hatchery-origin fish contribute to this abundance. The decline in the Wind River summer-run DIP is a source of concern, given that this population has been considered one of the healthiest of the summer runs. The juvenile collection facilities at North Fork Dam in the Clackamas River appear to be successful enough to support increases in abundance. Hatchery interactions remain a concern in select basins, but the overall situation is somewhat improved compared to prior reviews. Although a number of DIPs exhibited increases in their five-year geometric means, others still remain depressed, and neither the winter- nor summer-run MPGs are near viability in the Gorge. Overall, the Lower Columbia River steelhead DPS is therefore considered to be at “moderate” risk, and the viability is largely unchanged from the prior review (Ford, 2022b).	• 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

Table 2. Status of Critical Habitat

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Lower Columbia River Chinook salmon	9/02/05 70 FR 52630	Critical habitat encompasses 10 subbasins in Oregon and Washington containing 47 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some, or high potential for improvement. We rated conservation value of HUC5 watersheds as high for 30 watersheds, medium for 13 watersheds, and low for four watersheds.
Lower Columbia River coho salmon	2/24/16 81 FR 9252	Critical habitat encompasses 10 subbasins in Oregon and Washington containing 55 occupied watersheds, as well as the lower Columbia River and estuary rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 34 watersheds, medium for 18 watersheds, and low for three watersheds.
Lower Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses nine subbasins in Oregon and Washington containing 41 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 28 watersheds, medium for 11 watersheds, and low for two watersheds.

We also supplement the information provided in the BA with the following summary of the effects of climate change on the status of ESA listed species considered in this opinion and aquatic habitat at large.

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. Major ecological realignments are already occurring in response to climate change (IPCC Working Group II, 2022). Long-term trends in warming have continued at global, national and regional scales. Global surface temperatures in the last decade (2010s) were estimated to be 1.09 °C higher than the 1850-1900 baseline period, with larger increases over land ~1.6 °C compared to oceans ~0.88 (IPCC WGI, 2021). The vast majority of this warming has been attributed to anthropogenic releases of greenhouse gases (IPCC WGI, 2021). Globally, 2014-2018 were the 5 warmest years on record both on land and in the ocean (2018 was the 4th warmest) (NOAA NCEI 2022). Events such as the 2013-2016 marine heatwave (Jacox et al. 2018) have been attributed directly to anthropogenic warming in the annual special issue of Bulletin of the American Meteorological Society on extreme events (Herring et al. 2018). Global warming and anthropogenic loss of biodiversity represent profound threats to ecosystem functionality (IPCC WGII 2022). These two factors are often examined in isolation, but likely have interacting effects on ecosystem function.

Updated projections of climate change are similar to or greater than previous projections (IPCC Working Group I, 2021). NMFS is increasingly confident in our projections of changes to freshwater and marine systems because every year brings stronger validation of previous predictions in both physical and biological realms. Retaining and restoring habitat complexity, access to climate refuges (both flow and temperature) and improving growth opportunity in both freshwater and marine environments are strongly advocated in the recent literature (Siegel and Crozier, 2020a).

Climate change is systemic, influencing freshwater, estuarine, and marine conditions. Other systems are also being influenced by changing climatic conditions. Literature reviews on the impacts of climate change on Pacific salmon (Crozier, 2015, 2016, 2017; Crozier and Siegel, 2018; Siegel and Crozier, 2019, 2020b) have collected hundreds of papers documenting the major themes relevant for salmon. Here we describe habitat changes relevant to Pacific salmon and steelhead, prior to describing how these changes result in the varied specific mechanisms impacting these species in subsequent sections.

Forests

Climate change will impact forests of the western U.S., which dominate the landscape of many watersheds in the region. Forests are already showing evidence of increased drought severity, forest fire, and insect outbreak (Halofsky et al., 2020). Additionally, climate change will affect tree reproduction, growth, and phenology, which will lead to spatial shifts in vegetation. Halofsky et al. (2018) projected that the largest changes will occur at low- and high-elevation forests, with expansion of low-elevation dry forests and diminishing high-elevation cold forests and subalpine habitats.

Forest fires affect salmon streams by altering sediment load, channel structure, and stream temperature through the removal of canopy. Holden et al. (2018) examined environmental factors contributing to observed increases in the extent of forest fires throughout the western U.S. They found strong correlations between the number of dry-season rainy days and the annual extent of forest fires, as well as a significant decline in the number of dry-season rainy days over the study period (1984-2015). Consequently, predicted decreases in dry-season precipitation, combined with increases in air temperature, will likely contribute to the existing trend toward more extensive and severe forest fires and the continued expansion of fires into higher elevation and wetter forests (Alizadeh et al., 2021).

Agne et al. (2018) reviewed literature on insect outbreaks and other pathogens affecting coastal Douglas-fir forests in the Pacific Northwest and examined how future climate change may influence disturbance ecology. They suggest that Douglas-fir beetle and black stain root disease could become more prevalent with climate change, while other pathogens will be more affected by management practices. Agne et al. (2018) also suggested that due to complex interacting effects of disturbance and disease, climate impacts will differ by region and forest type.

Freshwater Environments

The following is excerpted from Siegel and Crozier (2019), who present a review of recent scientific literature evaluating effects of climate change, describing the projected impacts of climate change on instream flows:

> Cooper et al. (2018) examined whether the magnitude of low river flows in the western U.S., which generally occur in September or October, are driven more by summer conditions or the prior winter's precipitation. They found that while low flows were more sensitive to summer evaporative demand than to winter precipitation, interannual variability in winter precipitation was greater. Malek et al. (2018), predicted that summer evapotranspiration is likely to increase in conjunction with declines in snowpack and increased variability in winter precipitation. Their results suggest that low summer flows are likely to become lower, more variable, and less predictable.

The effect of climate change on ground water availability is likely to be uneven. Sridhar et al. (2018) coupled a surface-flow model with a ground-flow model to improve predictions of surface water availability with climate change in the Snake River Basin. Projections using RCP 4.5 and 8.5 emission scenarios suggested an increase in water table heights in downstream areas of the basin and a decrease in upstream areas.

As cited in Siegel and Crozier (2019), Isaak et al. (2018), examined recent trends in stream temperature across the Western U.S. using a large regional dataset. Stream warming trends paralleled changes in air temperature and were pervasive during the low-water warm seasons of 1996-2015 (0.18-0.35°C/decade) and 1976-2015 (0.14-0.27°C/decade). Their results show how continued warming will likely affect the cumulative temperature exposure of migrating sockeye salmon *O. nerka* and the availability of suitable habitat for brown trout *Salmo trutta* and rainbow trout *O. mykiss*. Isaak et al. (2018) concluded that most stream habitats will likely remain suitable for salmonids in the near future, with some becoming too warm. However, in cases where habitat access is currently restricted by dams and other barriers salmon and steelhead will be confined to downstream reaches typically most at risk of rising temperatures unless passage is restored (FitzGerald et al., 2021; Myers et al., 2018).

Streams with intact riparian corridors and that lie in mountainous terrain are likely to be more resilient to changes in air temperature. These areas may provide refuge from climate change for a number of species, including Pacific salmon. Krosby et al. (2018), identified potential stream refugia throughout the Pacific Northwest based on a suite of features thought to reflect the ability of streams to serve as such refuges. Analyzed features include large temperature gradients, high canopy cover, large relative stream width, low exposure to solar radiation, and low levels of human modification. They created an index of refuge potential for all streams in the region, with mountain area streams scoring highest. Flat lowland areas, which commonly contain migration corridors, were generally scored lowest, and thus were prioritized for conservation and restoration. However, forest fires can increase stream temperatures dramatically in short time-spans by removing riparian cover (Koontz et al., 2018), and streams that lose their snowpack with climate change may see the largest increases in stream temperature due to the removal of temperature buffering (Yan et al., 2021). These processes may threaten some habitats that are currently considered refugia.

Marine and Estuarine Environments

Along with warming stream temperatures and concerns about sufficient groundwater to recharge streams, a recent study projects nearly complete loss of existing tidal wetlands along the U.S. West Coast, due to sea level rise (Thorne et al., 2018). California and Oregon showed the greatest threat to tidal wetlands (100%), while 68% of Washington tidal wetlands are expected to be submerged. Coastal development and steep topography prevent horizontal migration of most wetlands, causing the net contraction of this crucial habitat.

Rising ocean temperatures, stratification, ocean acidity, hypoxia, algal toxins, and other oceanographic processes will alter the composition and abundance of a vast array of oceanic species. In particular, there will be dramatic changes in both predators and prey of Pacific salmon, salmon life history traits and relative abundance. Siegel and Crozier (2019) observe that changes in marine temperature are likely to have a number of physiological consequences on fishes themselves. For example, in a study of small planktivorous fish, Gliwicz et al. (2018) found that higher ambient temperatures increased the distance at which fish reacted to prey. Numerous fish species (including many tuna and sharks) demonstrate regional endothermy, which in many cases augments eyesight by warming the retinas. However, Gliwicz et al. (2018) suggest that ambient temperatures can have a similar effect on fish that do not demonstrate this trait. Climate change is likely to reduce the availability of biologically essential omega-3 fatty acids produced by phytoplankton in marine ecosystems. Loss of these lipids may induce cascading trophic effects, with distinct impacts on different species depending on compensatory mechanisms (Gourtay et al., 2018). Reproduction rates of many marine fish species are also likely to be altered with temperature (Veilleux et al., 2018). The ecological consequences of these effects and their interactions add complexity to predictions of climate change impacts in marine ecosystems.

Perhaps the most dramatic change in physical ocean conditions will occur through ocean acidification and deoxygenation. It is unclear how sensitive salmon and steelhead might be to the direct effects of ocean acidification because of their tolerance of a wide pH range in freshwater (although see Ou et al. (2015); (Williams et al., 2019)), however, impacts of ocean acidification and hypoxia on sensitive species (e.g., plankton, crabs, rockfish, groundfish) will likely affect salmon indirectly through their interactions as predators and prey. Similarly, increasing frequency and duration of harmful algal blooms may affect salmon directly, depending on the toxin (e.g., saxitoxin vs domoic acid), but will also affect their predators (seabirds and mammals). The full effects of these ecosystem dynamics are not known but will be complex. Within the historical range of climate variability, less suitable conditions for salmonids (e.g., warmer temperatures, lower streamflows) have been associated with detectable declines in many of these listed units, highlighting how sensitive they are to climate drivers (Ford, 2022a; Lindley et al., 2009; Ward et al., 2015; Williams et al., 2016). In some cases, the combined and potentially additive effects of poorer climate conditions for fish and intense anthropogenic impacts caused the population declines that led to these population groups being listed under the ESA (Crozier et al., 2019).

Climate change effects on salmon and steelhead

In freshwater, year-round increases in stream temperature and changes in flow will affect physiological, behavioral, and demographic processes in salmon, and change the species with which they interact. For example, as stream temperatures increase, many native salmonids face increased competition with more warm-water tolerant invasive species. Changing freshwater temperatures are likely to affect incubation and emergence timing for eggs, and in locations where the greatest warming occurs may affect egg survival, although several factors impact intergravel temperature and oxygen (e.g., groundwater influence) as well as sensitivity of eggs to thermal stress (Crozier et al., 2021). Changes in temperature and flow regimes may alter the amount of habitat and food available for juvenile rearing, and this in turn could lead to a restriction in the distribution of juveniles, further decreasing productivity through density dependence. For migrating adults, predicted changes in freshwater flows and temperatures will likely increase exposure to stressful temperatures for many salmon and steelhead populations, and alter migration travel times and increase thermal stress accumulation for ESUs or DPSs with early-returning (i.e. spring- and summer-run) phenotypes associated with longer freshwater holding times (Crozier et al., 2020; FitzGerald et al., 2021). Rising river temperatures increase the energetic cost of migration and the risk of en route or pre-spawning mortality of adults with long freshwater migrations, although populations of some ESA-listed salmon and steelhead may be able to make use of cool-water refuges and run-timing plasticity to reduce thermal exposure (Barnett et al., 2020; Keefer et al., 2018).

Marine survival of salmonids is affected by a complex array of factors including prey abundance, predator interactions, the physical condition of salmon within the marine environment, and carryover effects from the freshwater experience (Burke et al., 2013; Holsman et al., 2012). It is generally accepted that salmon marine survival is size-dependent, and thus larger and faster growing fish are more likely to survive (Gosselin et al., 2021). Furthermore, early arrival timing in the marine environment is generally considered advantageous for populations migrating through the Columbia River. However, the optimal day of arrival varies across years, depending on the seasonal development of productivity in the California Current, which affects prey available to salmon and the risk of predation (Chasco et al., 2021). Siegel and Crozier (2019) point out the concern that for some salmon populations, climate change may drive mismatches between juvenile arrival timing and prey availability in the marine environment. However, phenological diversity can contribute to metapopulation-level resilience by reducing the risk of a complete mismatch. Carr-Harris et al. (2018), explored phenological diversity of marine migration timing in relation to zooplankton prey for sockeye salmon *O. nerka* from the Skeena River of Canada. They found that sockeye migrated over a period of more than 50 days, and populations from higher elevation and further inland streams arrived in the estuary later, with different populations encountering distinct prey fields. Carr-Harris et al. (2018) recommended that managers maintain and augment such life-history diversity.

Synchrony between terrestrial and marine environmental conditions (e.g., coastal upwelling, precipitation and river discharge) has increased in spatial scale causing the highest levels of synchrony in the last 250 years (Black et al., 2018). A more synchronized climate combined with simplified habitats and reduced genetic diversity may be leading to more synchrony in the productivity of populations across the range of salmon (Braun et al., 2016). For example, salmon productivity (recruits/spawner) has also become more synchronized across Chinook populations from Oregon to the Yukon (Dorner et al., 2018; Kilduff et al., 2014). In addition, Chinook salmon have become smaller and younger at maturation across their range (Ohlberger et al., 2018). Other Pacific salmon species (Stachura et al., 2014) and Atlantic salmon (Olmos et al., 2020) also have demonstrated synchrony in productivity across a broad latitudinal range.

At the individual scale, climate impacts on salmon in one life stage generally affect body size or timing in the next life stage and negative impacts can accumulate across multiple life stages (Gosselin et al., 2021; Healey, 2011; Wainwright and Weitkamp, 2013). Changes in winter precipitation will likely affect incubation and/or rearing stages of most populations. Changes in the intensity of cool season precipitation, snow accumulation, and runoff could influence migration cues for fall, winter and spring adult migrants, such as coho and steelhead. Egg survival rates may suffer from more intense flooding that scours or buries redds. Changes in hydrological regime, such as a shift from mostly snow to more rain, could drive changes in life history, potentially threatening diversity within an ESU (Beechie et al., 2006). Changes in summer temperature and flow will affect both juvenile and adult stages in some populations, especially those with yearling life histories and summer migration patterns (Crozier and Zabel, 2006; Crozier et al., 2019; Crozier et al., 2010).

At the population level, the ability of organisms to genetically adapt to climate change depends on how much genetic variation currently exists within salmon populations, as well as how selection on multiple traits interact, and whether those traits are linked genetically. While genetic diversity may help populations respond to climate change, the remaining genetic diversity of many populations is highly reduced compared to historic levels. For example, Johnson et al. (2018), compared genetic variation in Chinook salmon from the Columbia River Basin between contemporary and ancient samples. A total of 84 samples determined to be Chinook salmon were collected from vertebrae found in ancient middens and compared to 379 contemporary samples. Results suggest a decline in genetic diversity, as demonstrated by a loss of mitochondrial haplotypes as well as reductions in haplotype and nucleotide diversity. Genetic losses in this comparison appeared larger for Chinook from the mid-Columbia than those from the Snake River Basin. In addition to other stressors, modified habitats and flow regimes may create unnatural selection pressures that reduce the diversity of functional behaviors (Sturrock et al., 2020). Managing to conserve and augment existing genetic diversity may be increasingly important with more extreme environmental change (Anderson et al., 2015), though the low levels of remaining diversity present challenges to this effort (Freshwater et al., 2019). Salmon historically maintained relatively consistent returns across variation in annual weather through the portfolio effect (Schindler et al., 2015), in which different populations are sensitive to different climate drivers. Applying this concept to climate change, Anderson et al. (2015) emphasized the additional need for populations with different physiological tolerances. Loss of the portfolio increases volatility in fisheries, as well as ecological systems, as demonstrated for Fraser River and Sacramento River stock complexes (Freshwater et al., 2019; Munsch et al., 2022).

Action Area: "Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02).

The Yellowjacket project area is the area that is inclusive of all of the harvest units, system and non-system roads and quarries of the proposed action. The distribution of harvest units in the Yellowjacket Creek, Camp Creek-Cispus and North Fork Cispus watershed are shown in BA Appendix 1, Map 1 on page 82. The transportation system haul routes are shown in BA Appendix 1, Map 3 on page 84. The location of quarries is shown on BA Appendix 1, Map 8 on page 93.

The BA baseline and effects analysis are based on the part of the project area that is proximal (less than or equal to 0.25 miles) to the distribution of anadromous fish in the project area (BA page 51). This subset of the project area is the action area for the purpose of this biological opinion. The action area is shown as a continuous pink line around the dark blue line over the parts of the Cispus River, Dry Creek, Camp Creek and Yellowjacket Creek with LCR Chinook, LCR coho and LCR steelhead on BA Appendix 1, Map 5 on page 86.

Baseline: The "environmental baseline" refers to the condition of the listed species or their designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. 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 consultations, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

The BA describes the environmental baseline of the action area in BA Section V on pages 36 to 49. The BA sorts 18 indicators of environmental baseline conditions into three categories; properly functioning (PF), functioning and risk (FAR) and functioning at unacceptable risk (FAUR) (BA page 41).

1. Chemical/Nutrients (PF, page 42)
2. Stream bank condition (FAR, page 45)
3. Sediment/turbidity/substrate (FAR, page 42)
4. Pool frequency (FAR, page 43)
5. Pool quality (FAR, page 43)
6. Off-channel habitat (FAR, page 44)
7. Width to depth (FAUR, page 45)
8. Floodplain connectivity (FAR, page 46)
9. Peak/base flows (FAR, page 46-47)
10. Drainage network increase (FAR, page 47)
11. Temperature (FAR, page 41)
12. Physical barriers (FAUR, page 42-43)
13. Large woody debris (FAUR, page 43)
14. Refugia (FAUR, page 44)
15. Road density/location (FAR, page 39-40)
16. Disturbance regime (FAR, page 47-48)
17. Disturbance history (FAR, page 48)
18. Riparian reserves (FAUR, page 49)

We supplement the BA's description of the environmental baseline with the following:

- The Upper Cowlitz and Cispus populations of LCR coho are primary populations with a 2015-2019 average to target abundance of 631/4,000 annual spawners.
- The Cispus population of spring LCR Chinook salmon is a primary population with a 2015-2019 average to target abundance of 171/1,800 annual spawners.
- The Upper Cowlitz population of fall Chinook salmon is a stabilizing population with a 2015-2019 average abundance of 1,761.
- The Upper Cowlitz and Cispus populations of winter steelhead are primary populations with a 2015-2019 Upper Cowlitz average to target abundance of 199/500 average annual spawners and a 2015-2019 Cispus average to target abundance of 'not available'/500 annual spawners (Ford, 2022a; NMFS, 2013).

Effects: 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).

The BA provides a detailed discussion and comprehensive assessment of the effects of the proposed action in Section VI of the initiation package, and is adopted here (50 CFR 402.14(h)(3)). NMFS has evaluated this section and after our independent, science-based evaluation determined it meets our regulatory and scientific standards. Seventeen of 131 harvest units, 2 miles of system road reconstruction, 2.4 of 42 miles of temporary road construction and

22 of 112 stream crossings and 8 new crossings on reconstructed roads are proximal to listed fish habitat (LFH) and in the action area (BA pages 50 and 51).
The short-term effects of the Yellowjacket project are:

- Sediment transport to LFH from system road/culvert reconstruction and log haul across stream crossings are likely to have short term adverse effects to turbidity and substrate quality (BA page 55-57).
- Trees removed to construct three temporary road crossings and thinning in outer riparian reserves will have short term adverse effects to riparian reserve functions (BA page 63-64).
- Road density will temporarily increase while temporary roads and landings are in place.
- The Yellowjacket project will be neutral to the other 16 watershed indicators listed above (BA page

The Upper Cowlitz and Cispus populations of LCR Chinook salmon, the Cispus population of LCR coho salmon and the Upper Cowlitz and Cispus populations of LCR steelhead will be affected by the proposed action. The effects of Yellowjacket will be temporary and will not impact more than ten cohorts of the affected populations. There is no permanent loss or degradation of habitat quality resulting from the proposed action and the project is designed to enhance several habitat quality indicators. At most, a few eggs or individuals within one population of each species will die each year as a result sediment in the water or substrate from the proposed action.

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.

BA Section IX analyzes the cumulative effects of all Federal, state and private actions in the entire Lower Cispus HUC 5 watershed which includes private forest lands. However, the much smaller action area considered for this biological opinion is entirely GPNF land and any future actions will require separate section 7 consultation.

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 to the environmental baseline and the cumulative effects, taking into account the status of the species and critical habitat, 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.

As shown in Table 1, ESA-listed salmon and steelhead are at a low level of persistence and moderate risk of extinction. The BA section IV make it clear that individuals from the Table 1 species Upper Cowlitz and Cispus populations are likely to migrate into or near the action area at some point in their life history. BA Section V makes it clear that all fish in the action area will encounter habitat conditions that have been degraded by human activity. BA Section VI shows that the proposed action will result in disturbances in the action area such that the fish that enter the action area will be exposed to effects from sediment, and that the response of some individuals could even include injury or death. Recovery of the action area from the baseline condition to properly functioning conditions is likely to be extremely slow because forest succession is an inherently slow process, so baseline "functioning at risk" and "functioning at unacceptable risk" indicators are likely to continue to cause negative pressure on population abundance trends into the future.

While the project's temporary effects are negative, even when we consider the current status of the threatened and endangered fish populations and degraded environmental baseline within the action area, the proposed action's effect on abundance of any of the specific populations is expected to be very low, such that distribution, diversity, or productivity of any of the component populations of the ESA-listed species are not discernibly altered. Because the proposed action's reduction in abundance will not appreciably reduce the productivity, spatial structure, or diversity the affected populations, the action, even when combined with a degraded environmental baseline, we determine that the action will not appreciably reduce the likelihood of survival or recovery any of the listed species considered in this opinion.

With regards to critical habitat, because the proposed action is timber thinning and road (re)construction and haul, the reductions on PBFs are associated with sediment entering streams at crossings and small reductions in shade at crossings and are not expected to last beyond the completion of the project. The long term presence system roads does not increase the amount of habitat diminishment, but does retain the diminishment. The project will not likely to aggravate limiting factors in the action area and in the long run, promotes recovery of some watershed indicators.

In summary, ESA-listed salmon and steelhead occupying the action area will be exposed to effects from the proposed action but NMFS analysis did not identify effects with intensities or durations that would result in a reduction of the value of the designated critical habitat for migration, spawning or rearing, or reductions in productivity, diversity, or spatial structure of exposed populations, thus the survival and recovery of ESA-listed species are also not reduced.

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, the effects of other activities caused by the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of LCR Chinook salmon, LCR coho salmon, or LCR steelhead or destroy or adversely modify their designated critical habitat.

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.

Amount or Extent of Take

In the biological opinion, NMFS determined that incidental take is reasonably certain to occur as follows:

The proposed timber harvest project will take place when LCR Chinook salmon, LCR coho salmon, and LCR steelhead eggs, juveniles and adults are in the action area. This will expose some of these present fish to increased suspended sediment, and an increased fine sediment fraction in spawning substrate.

- Take in the form of harm is likely to result among juvenile salmonids from exposure to suspended sediment.
- Take in the form of death is likely to result among eggs in redds constructed from substrate with a high fraction of fine sediment introduced into streams as a consequence of the proposed action.

A definitive number of ESA-listed fish or eggs that will be harmed, injured, or killed cannot be estimated or measured because of the highly variable presence of species over time, and the inability to observe injured or dead specimens. Instead, NMFS will use habitat–based surrogates that are causally related to harm to account for the take, which is called an "extent" of take.

For this proposed action, the extent of take from sediment is the 30 stream crossings proximal to LFH. This extent is directly related to the forms of take because they are the main pathway by which upland sediment from roads will enter action area streams.

Effect of the Take

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.

Reasonable and Prudent Measures

"Reasonable and prudent measures" are measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02).

For this proposed action, PDCs listed under "Crossing and Road Repair and Aquatic Organism Passage" on BA pages 29-32 minimize incidental take to the greatest degree practicable. Section 9 requires that for each formal consultation include a RPM that the action agency provide NMFS with a report that shows that the incidental take surrogate was not exceeded. For this reason the single RPM is that the GPNF provide a post-project report.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Federal action agency must comply (or must ensure that any applicant complies) with the following terms and conditions. The GPNF or any timber lease holder 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.

The single term and condition is: Provide a report within 90 days of the completion of the Yellowjacket Project that documents that the number of stream crossings in the action area (within 0.25 miles of LFH) is less than or equal to 30.

Reinitiation of Consultation

Reinitiation of consultation is required and shall be requested by the GPNF or by NMFS, where discretionary Federal involvement or control over the action has been retained or is authorized by law and (1) the amount or extent of incidental taking specified in the ITS is exceeded, (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this biological opinion; or if (4) a new species is listed or critical habitat designated that may be affected by the identified action.

NMFS also reviewed the proposed action for potential effects on essential fish habitat (EFH) designated under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), including conservation measures and any determination you made regarding the potential effects of the action. This review was conducted pursuant to section 305(b) of the MSA, implementing regulations at 50 CFR 600.920, and agency guidance for use of the ESA consultation process to complete EFH consultation. In this case, NMFS concluded the action would not adversely affect EFH. Thus, consultation under the MSA is not required for this action.

This letter underwent pre-dissemination review using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The biological opinion will be available through NOAA Institutional Repository https://repository.library.noaa.gov. A complete record of this consultation is on file at Lacey, Washington.

Please contact Tom Hausmann, of the Washington Coast/Lower Columbia Branch, at his duty station in Portland, Oregon, 503-231-2315 or at tom.hausmann@noaa.gov if you have any questions concerning this consultation, or if you require additional information

Sincerely,

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cc: Joshua Jones, Fisheries Program Manager, Gifford Pinchot National Forest

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