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 No:
WCRO-2019-00409

March 9, 2020

Ron Wong
Manager
U.S. Fish and Wildlife Service
Quilcene National Fish Hatchery
281 Fish Hatchery Road
Quilcene, Washington 98376

Re: Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Quilcene National Fish Hatchery Weir Rehabilitation and Maintenance Activities, Jefferson County, Washington

Dear Mr. Wong:

Thank you for your letter of May 1, 2019, requesting initiation of 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 Quilcene National Fish Hatchery (NFH) Weir Rehabilitation and Maintenance Activities 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).

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.

The enclosed document contains a biological opinion (opinion) that analyzes the effects of the proposed action. In this opinion, we conclude that the proposed action is not likely to jeopardize the continued existence of Puget Sound (PS) steelhead (*Oncorhynchus mykiss*) and Hood Canal summer-run chum salmon (HCSRC; *O. keta*). Further, we conclude that the proposed action will not result in the destruction or adverse modification of their designated critical habitats.

This document also contains five conservation recommendations that are intended 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 this recommendation. If the response is inconsistent with the EFH conservation recommendations, the U.S. Fish and Wildlife Service (USFWS) must explain why the recommendations will not be followed, including the scientific justification for any disagreements over the effects of the action and 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.

Please contact Dr. Jeff Vanderpham, Central Puget Sound Branch in Lacey, Washington, at (360) 753-5834 or jeff.vanderpham@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: Yvonne Detlaff, USFWS

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the

Quilcene National Fish Hatchery Weir Rehabilitation and Maintenance Activities

NMFS Consultation Number: WCRO-2019-00409

Action Agency: United States Fish and Wildlife Service

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely To Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Puget Sound Steelhead (*Oncorhynchus mykiss*)	Threatened	Yes	No	Yes	No
Hood Canal Summer-run Chum Salmon (*O. keta*)	Threatened	Yes	No	Yes	No

Fishery Management Plan That Identifies EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon	Yes	Yes

Consultation Conducted By: National Marine Fisheries Service, West Coast Region

Issued By:

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

Date: March 9, 2020

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1. INTRODUCTION

This Introduction section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3, below.

1.1 Background

The National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 et seq.), and implementing regulations at 50 CFR 402, as amended.

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801 et seq.) and implementing regulations at 50 CFR 600.

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at NMFS' Lacey, Washington office.

1.2 Consultation History

NMFS received a request to initiate ESA Section 7 consultation from the United States Fish and Wildlife Service (USFWS) on May 1, 2019. The initiation package included a biological assessment (BA; ESA BA and MSA Essential Fish Habitat Consultation, Quilcene NFH Fish Weir Rehabilitation and Maintenance Activities, Jefferson County) with a cover letter, and a detailed project description (Quilcene NFH Weir Rehabilitation and Maintenance Activities Project Description, Attachment 1 to the BA).

On July 24, 2019, the USFWS provided additional information on fish presence in the project area in response to NMFS's July 11, 2019, request for more information. We determined that these materials provided all necessary information to complete Section 7 ESA consultation, and formal consultation was initiated on July 24, 2019.

We later received, by email, additional information from the USFWS in response to subsequent questions, clarifying project details (timing, work-site isolation areas, etc.).

1.3 Proposed Federal Action

"Action," under the ESA, means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02).

For the EFH consultation, “Federal action” means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal Agency (50 CFR 600.910).

The proposed action includes repairs to the Quilcene NFH weir, water intakes and associated structures, maintenance to bank stabilization structures, and removal of buildup in settling basins and adjacent to the fish ladder (Figure 1), as described in the project BA and Attachment 1.

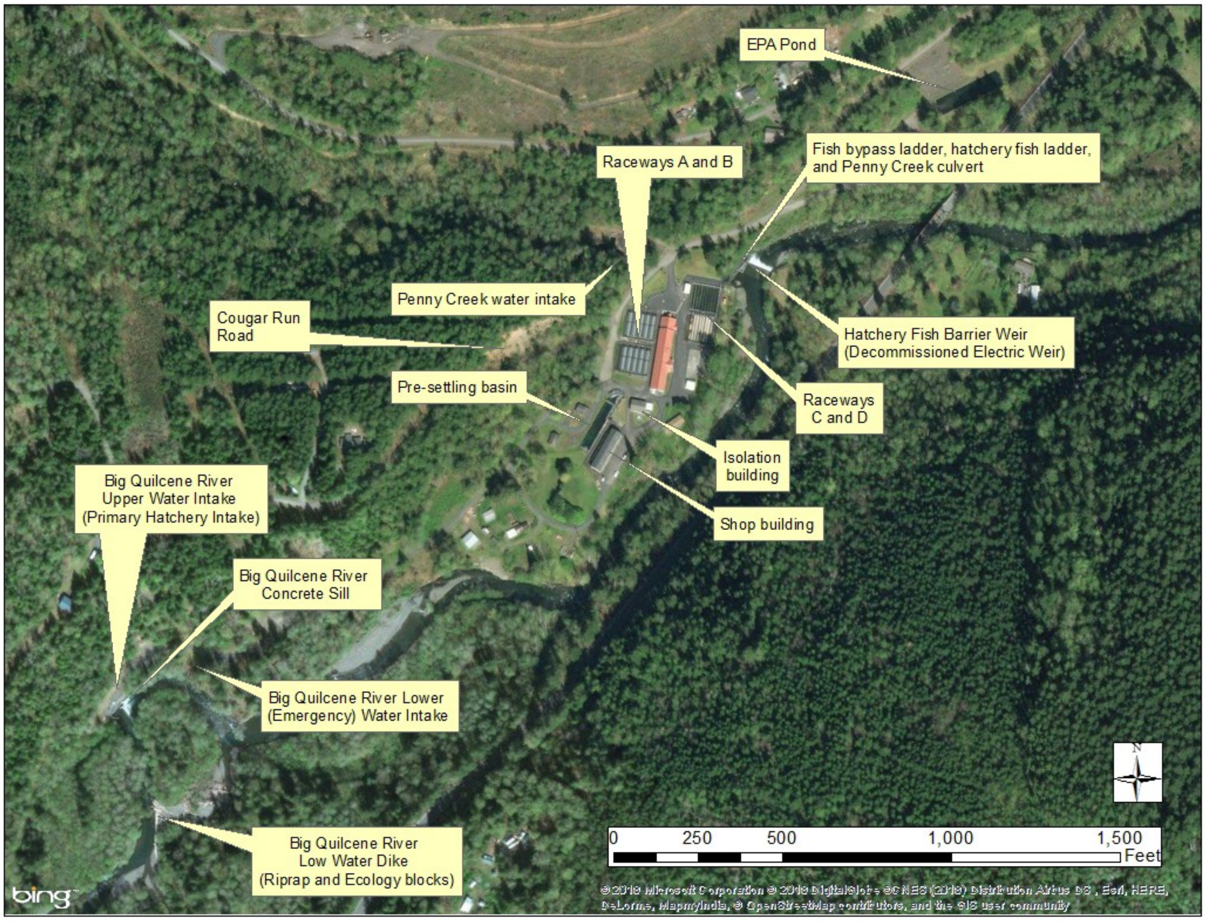

Figure 1. Quilcene NFH Aerial Map and Project Feature Locations (from BA Attachment 1)

1.3.1 Hatchery Structure Repair and Maintenance Activities

Near-term (starting in 2020) work actions include rehabilitation of the concrete deck of the hatchery fish weir and water intake sill, renovation of the existing rock barbs, and gravel removal at the upstream exit of the fish bypass ladder. Longer-term work actions include various maintenance activities implemented over a 5-year period. Not including the maintenance activities, work activities are expected to be completed in one summer work-season and would require approximately 40 work days. The proposed action is described in detail in Attachment 1 of the BA. The following provides a summary of the primary activities that may affect fish, aquatic habitat, and riparian areas. In-water work (work within the river’s wetted-width) would begin in June and be completed by late July to early August.

1. Fish Weir Rehabilitation – To address ongoing erosion of the concrete deck and apron of the existing hatchery weir in the Big Quilcene River would be rehabilitated by installing ½-inch thick carbon steel plates on the apron. Prior to construction activities, the work area would be dewatered by isolating half the concrete slab with a cofferdam. Any gaps in the cofferdam structure would be temporarily sealed with an impermeable liner. Water would be allowed to pass on the opposite side of the river from the construction area. Following construction activities on half the weir, the cofferdam would be relocated to the other side of the river and construction activities would continue there. Clear water remaining behind the cofferdam after its construction would be pumped directly back into the river. Any muddy water or subsequent seepage into the work area would be pumped into a temporary settling basin located above the OHWM.

   Penny Creek, which flows into the Big Quilcene River near the upstream side of the fish by-pass ladder, would be diverted to the extent possible at the Penny Creek intake system through existing hatchery pipelines and valves to the EPA settling pond. The water would then be released into the Big Quilcene River.

   Fish salvage would be conducted to remove fish from the work site after cofferdam installation, and before and during dewatering of the area. A fish biologist would net or seine for fish, and relocate all captured fish to the river. Estimated sizes and types of fish would be recorded. Once fish are removed and dewatering is completed, any remaining muddy areas and any subsequent seepage would be pumped into an existing settling basin at the hatchery. If settling basin capacity is insufficient or not available, pumped water may be discharged into a dissipation/sediment filtration device, such as a geotextile filter bag or straw bale structure, located in an upland area.

   The construction work would be completed by an excavator stationed on an existing cleared area along the left bank of Penny Creek, and on a gravel bar, if needed. The excavator would remain entirely above the waterline. Construction would take approximately six to eight weeks to complete and is planned between May and August. Preparation for in-water work activities may start as early as April. Routine maintenance such as tree trimming, and gravel road maintenance activities may occur year round.

2. Intake Concrete Sill Rehabilitation – To address ongoing erosion of the concrete sill on the Big Quilcene River at the upper hatchery intake, rehabilitation is proposed concurrently with the weir rehabilitation or within a 5-year period. Rehabilitation would include either installation of ½-inch thick carbon steel plates overtopping the existing concrete structure, or patching the sill with new concrete. If concrete patching is done, sections of the sill would first be demolished with mechanical means, such as a jackhammer or concrete cutter. Forms would then be used for the new concrete. A cofferdam would be used to isolate the work area and fish salvage would occur prior to dewatering, following the same steps used for weir construction activities.

3. Rock Barb Repair – Twenty-one rock barbs were previously installed along the right bank of the Big Quilcene River upstream of the weir to move the river's thalweg towards the center of the channel. Over time, erosion of the rock barbs has reduced their effectiveness and the

thalweg has shifted to the right bank. To address rock settling or eroding away from 4 of the rock barbs, an excavator would place new boulders, or boulders that have moved would be returned to the rock barbs. River bed sediment may also be removed from an area approximately 2-feet deep by 12-feet wide and up to 15-feet long. The excavator would work from the right bank or the gravel bar on the left bank, remaining above the waterline. If the excavator cannot reach across the river, a temporary platform adjacent to the gravel bar may be created using excavated material from the gravel bar that is proposed to be removed.

If any of the repairs require in-water work, the work area would be dewatered using sandbags, liners or other methods to create a dry area around the rock barb(s). Clear water that may initially remain which could impede the rock barb repair will be pumped directly back into the river. As described above for weir repair activities, fish salvage would be conducted in prior to and during dewatering. Any muddy water and any subsequent seepage into the work area would be pumped into a dissipation/sediment filtration device in an upland area. The rock barb extension would take between two and four days, with in-water work lasting approximately nine hours.

4. Gravel Bar Excavation – A gravel bar has formed on the left bank of the river as a result of the thalweg shifting toward the right bank. The downstream end of the gravel bar is located at the fish bypass ladder exit just upstream of the weir, interfering with fish ladder function. Excavation of a small portion (10 to 200 cubic yards; 50-foot by 20-foot area) of the gravel bar is proposed to address this. A track-excavator would work from the gravel bar where it would extract sediment to make a temporary ramp. The temporary ramp would span approximately 60 feet from the upper end of the riverbank, located on a flat grassy surface down to the gravel bar. If needed, a dump truck would use the temporary ramp to receive gravel materials from the excavator. Some of this material would be taken to an upland disposal site. A portion (approximately 10 to 80 percent) of the material may be placed on the right bank of the Big Quilcene River, approximately 100 yards downstream of the hatchery fish weir, to allow gravel to be replenished into the Big Quilcene River during high flow events. The amount of material transferred to the right bank would depend on whether the material is decent fish spawning material (versus woody debris), and the area available to receive the gravel, as a result of prior high flow events washing away material. The gravel bar removal would take approximately eight days, with one day each required for setting up and removing the sedimentation barrier, one day each for constructing and removing the temporary ramp, and two to four days for removing a portion of the gravel bar

   Prior to any work on the gravel bar, a temporary sediment barrier, made of woven, synthetic filtration fabric supported by steel or wood posts (i.e., silt fence) would be constructed from the downstream end of the gravel bar to the upper end of gravel bar. Fish salvage would be conducted. The silt fence would be removed once the temporary ramp is deconstructed.

5. Riprap Protection Repairs – Repair of riprap may be required in various hatchery locations during the next five years, including the Big Quilcene River water intakes and their associated structures; structures at the Penny Creek intake; and an area along Big Quilcene River of a recently acquired property in the location of the upper water intake/sill and its

adjacent low water dike. All methods and materials for each of these project areas are described in detail in Attachment 1 of the BA.

With the exception of the shoreline repair along a recently acquired property, all riprap repairs would be within the footprint of existing riprap. As with all in-water work activities, the work area will be dewatered using sandbags or other methods to create a dry area around the riprap, and fish salvage would be conducted prior to and during dewatering. The riprap work activities are expected to take two days but may extend to five days.

6. Water Control Structure Cleaning - Several water control structures require periodic maintenance (i.e. dredging and cleaning), including a concrete pre-settling basin that settles out sediment from the Big Quilcene River before the water enters fish production raceways; a concrete EPA pond that settles out fish waste and cleaning effluent from 39 raceways and from hatchery incubation/rearing units; Penny Creek water intake settling areas; and an isolation building concrete chlorine contact chamber (1,500 gallon) that allows chlorine to be in contact with effluent water from the isolation building for 30 minutes before water is de-chlorinated. The chlorine contact chamber can accumulate sediment from the incubators and fish tanks. The isolation building is not currently operating at the hatchery, but it may be brought back into use if a listed species program is initiated. If so, sediment would need to be episodically removed from the chlorine contact chamber.

   The length of time between cleaning each of these structures can vary from annual to triennial, depending on previous winter weather and upland activities. Maintenance cleanings are generally carried out during the low flows between July and September but may start as early as May. All methods for cleaning of each of these project areas are described in detail in Attachment 1 of the BA.

7. Hatchery Structure Maintenance – Periodic maintenance is expected to be required on various hatchery structures, including the Penny Creek culvert; hatchery water intakes and associated structures (Big Quilcene River upper water intakes, Penny Creek water intakes, the fish ladder, concrete sill and low water dike at the Big Quilcene River upper water intake, and the hatchery fish weir, fish ladder and fish bypass ladder); the Big Quilcene River lower water (emergency) intake; and the EPA settling pond outfall. Maintenance activities for each of these project sites are described in detail in Attachment 1 of the BA.

8. Tree Trimming and Removal of Hazardous Woody Debris and Trees - Tree trimming and hazard tree removal would be required periodically within the next 5 years, to minimize debris falling on structures and in roadways. Trees would be trimmed with a chainsaw or pruning saw. Trimming in the riparian area would be limited whenever possible to only the extent needed to minimize hazards or negative potential impacts to hatchery facilities, employees, and the public. Native trees with a diameter greater than 10 inches diameter at breast height (dbh) would not be removed unless they present a safety hazard or limit proper hatchery operations. Any trees greater than 10 inches dbh, slated to be removed would be checked first by an arborist and would be spared if the arborist finds them to be in good health, suitable for their location, and not hazardous.

To minimize impacts from any tree removal activities, native trees and brush would be replanted at a ratio of two new trees for every one lost. Hatchery staff would monitor replanted trees for five years and replant any tree that fails to take root. Any trees that provided shade along river shorelines, would be replanted along the shoreline. During the next five years, no more than 10 trees above 10 inches dbh would be removed.

Additionally, woody debris that threatens or impacts infrastructure may require removal or relocation. Occasionally, during high flows, large woody debris can obstruct hatchery structures such as the water intakes, weir, or sill. Most of this work would be completed by hand, by physically moving the material off structures. A chainsaw may be required in the removal of larger size material. Specific structures that have an upland service area, such as the Big Quilcene River water intake may use a truck or backhoe to help move the woody debris. Unless it poses a hazard to downstream structures, staff would relocate material downstream.

9. Gravel Road Maintenance – Periodic grading and gravel application are required on hatchery gravel service roads, around Penny Creek water intake, in the vicinity of Big Quilcene River water intakes, along gravel service roads on the east side of the hatchery fish weir, around the Little Cabin, and occasionally on Cougar Run Road, which leads northwest from the hatchery to hatchery property and private property. Any gravel required would be sourced from Penny Creek quarry. No roads would be widened. Road work would require typical construction equipment, such as backhoes, large trucks and excavators.

10. General Maintenance, Landscaping and Infrastructure Cleaning – Proposed routine maintenance includes landscaping, and cleaning activities for hatchery program building infrastructure and grounds. Hatchery infrastructure in need of maintenance also includes the outdoor raceways and tanks, ponds, pipelines and other water management systems. Occasionally the replacement, modification, repair or installation of new hatchery infrastructure, like buildings or raceways, would also occur. All of these activities would be located in the upland and are not expected to generate any turbidity.

1.3.2 Minimization Measures

General minimization measures that would be implemented include the following best management procedures (BMPs), as described in Attachment 1 of the BA:

- Daily inspection of equipment in order to prevent spills or runoff of deleterious material into the surface water.

- To the extent possible, disturbance of riparian vegetation would be avoided. To minimize impacts, new trees would be planted to compensate for any severely damaged (not expected to re-grow) red alder or willows greater than 10 inches dbh. The goal is to rehabilitate the impacted vegetation to before or better than before conditions as quickly as possible. Replanting is scheduled for September or October. Hatchery staff would monitor new seedlings for five years and replace those that do not survive.

- All refueling would be done at least 150 feet from Big Quilcene River or Penny Creek.
- A Spill Prevention Control and Countermeasures (SPCC) Plan would be created and implemented for the duration of the Project.
- Equipment would be cleaned to remove noxious weeds/seeds, aquatic invasive species, and petroleum products prior to mobilizing to the site.

The following minimization measures would be implemented for work below the ordinary high water mark (OHWM):

- Excavators and loaders would contain hydraulic fluid certified as non-toxic to aquatic organisms, and equipment would be free of any leaking hydraulic fluids or oil.
- The placement of material would occur starting at lower elevations and working to higher elevations, to the extent practicable.
- Materials would not be stockpiled below the OHWM or other sensitive areas, as feasible.
- Imported materials would consist of clean, granular material, free of contaminants and all other deleterious material.

Additional minimization measures would also be implemented:

- After placement of in-stream worksite isolation structures (i.e. cofferdams), fish exclusion would be conducted, if necessary, by a professional biologist using hand seines and dip nets. If fish are observed, any in-water work will be halted until fish can be removed to a downstream site or until they have moved away from the area. That biologist will note the estimated sizes and types of any fish removed. If fish types are unknown, the biologist will photograph the fish.
- Water pumping for the initial water removal from work-site isolation areas would use a screened pump, and water would be channeled into a settling pond or to an infiltration system. Only non-treated wood would be used for in-water work.
- Prior to any on-site construction activities, temporary erosion and sediment prevention control plan measures would be installed. These measures include temporary orange plastic construction fencing, sediment fencing, and installation of straw wattles as needed. These measures would be used to prevent any stormwater runoff that may occur during construction from carrying any sediment into the creek. These measures would be maintained, replaced, or upgraded as necessary during construction to ensure their effectiveness. USFWS staff would review the measures daily and require contractors to take additional measures as needed. Disturbed soil areas would be repaired and protected with adequate ground cover (straw, compost, mulch, etc.). After construction has been completed, the site would be cleaned of sediment and construction debris before removal of temporary cofferdams.
- All Project activities would comply with the water quality standards (Revised Code of Washington 940.48 and Washington Administrative Code 173-201A) set forth by the

Washington State Department of Ecology (Ecology). The current Ecology Water Quality Implementing Agreement allows for a mixing zone distance of 300 feet downstream of the Project. At 300 feet, sediment levels are not to exceed 5 nephelometric turbidity units (NTUs) over background turbidity. Turbidity testing by a monitoring team would occur during in-water work activities. The monitoring team may cause all work activities to be suspended until sediment levels are compliant with the water quality standards.

- All construction debris would be removed upon completion of work.
- Removal of trees would be avoided as much as possible.
- Activities that may generate sound levels in excess of 92 decibels (dB) (e.g., concrete cutting) are to begin no earlier than 2 hours after sunrise and stop no later than 2 hours before sunset, and construction disturbance would not usually exceed 10 hours per day.
- Construction staging areas would be located directly on hatchery grounds, on existing paved areas, or gravel roads. There would be no additional clearing of vegetation.

1.3.3 Other Activities Caused by the Proposed Action

We considered whether or not the proposed action would cause any other activities and determined that it would not.

Operations of the hatchery, including the hatchery program, are assessed in the Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat (EFH) Consultation National Marine Fisheries Service (NMFS) Evaluation of Ten Hatchery and Genetic Management Plans for Salmon and Steelhead in Hood Canal under Limit 6 of the Endangered Species Act Section 4(d) Rule (WCR-2014-1688). This included an assessment of the Hatchery and Genetic Management Plan (HGMP) for the Quilcene NFH (yearling coho salmon production; USFWS 2013). Because hatchery operations are assessed in the Biological Opinion, and no change to operations are part of the current proposed action, an assessment of operations is not included in the present Opinion. There are no other activities caused by the proposed action.

2. ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, each Federal agency must ensure that its actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provide an opinion stating how the agency’s actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

2.1 Analytical Approach

This biological opinion includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "jeopardize the continued existence of" a listed species, which is "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

This biological opinion relies on the definition of "destruction or adverse modification," which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species" (50 CFR 402.02).

The designation(s) of critical habitat for (species) use(s) the term primary constituent element (PCE) or essential features. The 2016 critical habitat regulations (50 CFR 424.12) replaced this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a ''destruction or adverse modification'' analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

The 2019 regulations define effects of the action using the term "consequences" (50 CFR 402.02). As explained in the preamble to the regulations (84 FR 44977), that definition does not change the scope of our analysis and in this opinion we use the terms "effects" and "consequences" interchangeably.

We use the following approach to determine whether a proposed action is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- Evaluate the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Evaluate the environmental baseline of the species and critical habitat.
- Evaluate the effects of the proposed action on species and their habitat using an exposure-response approach.
- Evaluate cumulative effects.
- In the integration and synthesis, add the effects of the action and cumulative effects to the environmental baseline, and, in light of the status of the species and critical habitat, analyze whether the proposed action is likely to: (1) directly or indirectly reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species, or (2) directly or indirectly result in an alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species.
- If necessary, suggest a reasonable and prudent alternative to the proposed action.

2.2 Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that would be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and 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% 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. 2013). Earlier snowmelt will cause lower stream flows in late spring, summer, and fall, and water temperatures will be warmer (ISAB 2007; Mote et al. 2013). 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

The PS steelhead distinct population segment (DPS) was listed as threatened on May 11, 2007 (72 FR 26722), with a status review completed in 2015 (NWFSC 2015). The PS steelhead recovery plan was completed in 2019 (NMFS 2019). This DPS comprises 32 populations. The DPS is currently at very low viability, with most of the 32 populations and all three population groups at low viability. Information considered during the most recent status review indicates that the biological risks faced by the PS steelhead DPS have not substantively changed since the listing in 2007, or since the 2011 status review. Furthermore, the PS Steelhead TRT recently concluded that the DPS was at very low viability, as were all three of its constituent MPGs, and many of its 32 populations. In the near term, the outlook for environmental conditions affecting PS steelhead is not optimistic. While harvest and hatchery production of steelhead in PS are currently at low levels and are not likely to increase substantially in the foreseeable future, some recent environmental trends not favorable PS steelhead survival and production are expected to continue.

Limiting factors for the PS steelhead DPS include, continued destruction and modification of habitat; widespread declines in adult abundance despite significant reductions in harvest; threats to diversity posed by use of two hatchery steelhead stocks; declining diversity in the DPS, including the uncertain but weak status of summer-run fish; a reduction in spatial structure; reduced habitat quality; urbanization; and dikes, hardening of banks with riprap, and channelization.

The Hood Canal Summer-run chum (HCSRC) evolutionarily significant unit (ESU) was listed as threatened on June 28, 2005 (70 FR 37160), with a status review completed in 2015 (NWFSC 2015). A recovery plan was proposed in 2005 (HCCC 2005) and adopted by NMFS in 2007 (NMFS 2007). This ESU is made up of two independent populations in one major population group. Natural-origin spawner abundance has increased since ESA-listing and spawning abundance targets in both populations have been met in some years. Productivity was quite low at the time of the last review, though rates have increased in the last five years, and have been greater than replacement rates in the past two years for both populations. However, productivity of individual spawning aggregates shows only two of eight aggregates have viable performance. Spatial structure and diversity viability parameters for each population have increased and nearly meet the viability criteria. Despite substantive gains towards meeting viability criteria in the Hood Canal and Strait of Juan de Fuca summer chum salmon (comprising the HCSRC ESU) populations, the ESU still does not meet all of the recovery criteria for population viability at this time. Limiting factors for the ESU include reduced floodplain connectivity and function; poor riparian condition; loss of channel complexity; sediment accumulation; and altered flows and water quality.

2.2.2 Status of Critical Habitat

This section describes the status of designated critical habitat affected by the proposed action by examining the condition and trends of the essential physical and biological features of that habitat throughout the designated areas. These features are essential to the conservation of the ESA-listed species because they support one or more of the species' life stages (e.g., sites with conditions that support spawning, rearing, migration and foraging).

For most salmon and steelhead, NMFS's critical habitat analytical review teams (CHARTs) ranked watersheds within designated critical habitat at the scale of the fifth-field hydrologic unit code (HUC5) in terms of the conservation value they provide to each ESA-listed species that they support (NMFS 2005). The conservation rankings were high, medium, or low. To determine the conservation value of each watershed to species viability, the CHARTs evaluated the quantity and quality of habitat features, the relationship of the area compared to other areas within the species' range, and the significance to the species of the population occupying that area. Even if a location had poor habitat quality, it could be ranked with a high conservation value if it were essential due to factors such as limited availability, a unique contribution of the population it served, or is serving another important role.

Critical habitat for PS steelhead was designated on February 24, 2016 (81 FR 9252). Critical habitat includes 2,031 stream miles. Nearshore and offshore marine waters were not designated for this species. There are 66 watersheds within the range of this DPS. Nine watersheds received a low conservation value rating, 16 received a medium rating, and 41 received a high rating to the DPS. Critical habitat for HCSRC was designated on September 2, 2005 (70 FR 52630). Critical habitat includes 79 miles of rivers and 377 miles of nearshore marine habitat in Hood Canal. Critical habitat for HCSRC and PS steelhead within the action area includes freshwater spawning sites, freshwater rearing sites and freshwater migration corridors.

2.3 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 action area is determined by the greatest extent of physical, chemical and biological effects stemming from the project. For the proposed action, there are both short-term construction-related effects and long-term permanent structure-related effects. The greatest extent of physical, chemical or biological effects stemming from the proposed action is associated with the short-term suspension of sediments during construction activities. Elevated turbidity levels are expected to be detectable up to 1,200 feet downstream of in-water work (see BA). The upstream limit of effects is expected to be within 600 feet of project activities to account for potential long-term impacts from riverine changes caused by head cutting and downcutting in response to placement of riprap and rock barbs, gravel removal and bank modifications associated with proposed activities. Therefore, the action area includes the project area within and adjacent to the Big Quilcene River and Penny Creek, the area within both rivers 600 feet upstream of the upstream-most construction activities, and the area within the Big Quilcene River 1,200 feet downstream of the downstream-most construction activities.

2.4 Environmental Baseline

The "environmental baseline" refers to the condition of the listed species or its 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 action area is located in the Big Quilcene River watershed, including portions of the Big Quilcene River and Penny Creek, and adjacent riparian areas. The Big Quilcene watershed encompasses 53,016 acres from Mount Constance (7,747 feet elevation) to Quilcene Bay in Hood Canal. Approximately 41,734 acres (79%) of the watershed is administered by the U.S. Forest Service, 6,449 acres are owned by private or other municipal groups, 3,676 acres are managed by the Washington State Department of Natural Resources, and 1,158 acres are within the Olympic National Park. The watershed includes 117 miles of streams draining approximately 83 square miles of the eastern Olympic Peninsula.

The largest population center in the watershed is the town of Quilcene near the mouth of the Quilcene River. Flood control measures (diking) in the town to the mouth of the river have caused the river mouth to extend 1,700 feet into Quilcene Bay. Flood control measures were initiated as early as the 1880s. Diking, filling, and excavation have altered about 26 percent of the historic Quilcene Bay delta (see WDFW and PNPTT 2000). In the mid-1950s, the Hiddendale community was established at about RM 3.8 on the south bank of the Big Quilcene River. Streambank work, including barbs and revetment, has been installed on the river mainstem to protect private property in Hiddendale.

In 1928, the City of Port Townsend constructed a timber crib diversion dam to meet its municipal and industrial water requirements. The dam is located above anadromous fish access on the Big Quilcene River just below its confluence with Tunnel Creek. The water is piped underground approximately 28 miles to Port Townsend, where it is used by the city and a paper mill.

Within the watershed, timber harvest is the most consistent and long-lived commercial venture. Recorded acres clear-cut ranged from a low of 21 during the 1920s to a high of 2,489 during the 1980s (USFS 1994). Effects associated with logging include increased bank erosion and sediment accumulation, fish passage issues at logging road crossings, and decreased riparian cover. These effects are additive in the system and reduced the quality of spawning and rearing habitat for juvenile salmonids (Hartman et al. 1996).

Within the action area the primary impacts to the aquatic habitat are associated with the Quilcene NFH. In 1911, the NFH was constructed at the confluence of the Big Quilcene River and Penny Creek, and has been in operation since. Overall, habitat quality below the hatchery weir located on RM 2.8, provides marginal trout and salmon habitat. The reach between the mouth of Big Quilcene River and the weir lacks significant pools, shade, woody debris, side channels, tributaries, and suitable spawning substrate (Tschaekofske et al. 2004; Zajac 2002). Past forest practices have reduced woody debris recruitment and increased flash flooding. This decreased channel complexity has left few pools, increased channelization, and increased sediment in the lower reaches of the Big Quilcene River. Below RM 1, diking and dredging have routinely occurred to protect infrastructure in the original town site of Quilcene. Approximately 41 percent of the lower two miles is diked or armored (see NMFS 2006). Gradient in this reach estimated to be less than 1 percent.

Above the weir to RM 3.9 gradients range from 0.5 to 1.5 percent, with minimal woody debris. The wide channel has a canopy cover of 20 to 50 percent with predominantly gravel and small cobble substrate (Tschaekofske et al. 2004). The channel upstream of RM 3.9 becomes narrow, with substrate becoming larger than the first 3.9 RM. Substrate consists primarily of cobbles and boulders. This reach has a good complex of run and pool habitat. 70 percent of the channel is shaded by a mixture of trees and canyon walls. The channel becomes narrower, particularly past the Elbo Creek confluence (Tschaekofske et al. 2004). Once the Big Quilcene River reaches RM 8, the channel narrows even further and contains an impassable waterfall.

The Quilcene NFH electric weir was constructed in 1989. The electric weir is no longer being operated, but anadromous fish are not able to pass upstream over the concrete apron when flows are below 70 cfs unless the fish bypass ladder is open. Hatchery personnel open the sliding gates periodically from September through December on the fish bypass ladder to allow some coho salmon and all steelhead to pass upstream. From January 1 through July, the gates for the ladder are opened continuously. The fish ladder is closed the rest of the year to avoid fish pathogen issues from anadromous fish, except for periodic openings to manage coho passage. Approximately 600 to 3,000 adult coho salmon are typically passed above the hatchery fish weir for natural spawning and nutrient enhancement each year. Fish that are able to pass above the hatchery are not expected to be above a fish barrier near RM 7.6. The weir is not a barrier to downstream migration.

The Quilcene NFH currently operates an intake structure (acts as a diversion dam) located in Penny Creek to supply water to the hatchery. The hatchery can draw up to 25 cfs of water to supply their egg incubation and raceway rearing facilities. Average monthly flows ranged from the low of 5.8 cfs in September and a high of 30.4 cfs in February (R2 Resource Consultants, Inc. 2008). Penny Creek is approximately three miles long, with the gradient ranging from 1.9 to 5.2. Due to low Penny Creek summer flows, water rights from the Big Quilcene River was later added to the hatchery water source. The headwaters consist of a beaver pond complex. Daily hatchery operation routines include fish feeding, lawn mowing, and spawning operations activities.

The effects of the operation of the hatchery and associated structures was previously assessed by NMFS (2016). The proposed action does not include any change to operation of the hatchery or associated structures, and thus operations are included as part of the baseline.

According to the best available information, which was provided in the BA, the Big Quilcene River contains coho, pink, fall and summer-run chum salmon; PS steelhead, rainbow, brook, and sea run cutthroat trout; and sculpins. A 2008 survey documented cutthroat trout (*Oncorhynchus clarki*) and brook trout (*Salvelinus fontinalis*) in Penny Creek (R2 Resource Consultants, Inc. 2008). Neither HCSRC nor PS steelhead occur in Penny Creek (WDFW 2020).

ESA-listed species in the action area include PS steelhead and HCSRC. Critical habitat is designated for PS steelhead in the Big Quilcene River and Penny Creek throughout the action area, and for HCSRC in the Big Quilcene River into the lower end of the action area, just downstream of the hatchery.

Index count of steelhead redds in Little Quilcene River, and anecdotal observation suggests there are approximately 50 to 100 steelhead spawners in both the Little Quilcene and Big Quilcene rivers (NMFS 2006). PS steelhead adult migrations occur during the fall and winter, spawning in the winter and spring, and juvenile outmigration in the spring (Correa 2002; NMFS 2005; see BA). Juveniles may rear in natal streams for up to two years. It is possible that during the late summer, juvenile steelhead (age-0 to age-2 classes) could be dispersed in riffle habitat and concentrated in pools in the Big Quilcene River, including the action area. Past surveys in 2012 and 2013 have observed adult PS steelhead in the Big Quilcene River below the hatchery, and two smolts were trapped in a rotary screw trap in 2011 (see Biological Opinion WCR-2014-1688). However, only one steelhead has been encountered in the Quilcene NFH weir over the last 15 years (see Biological Opinion WCR-2014-1688). No steelhead have been captured or observed during general hatchery operations in the past five years.

As documented in the BA, HCSRC were raised at the Quilcene NFH from 1992 to 2003 to increase summer chum in the area. During this time, many returned to the hatchery, with spawners seen just below the weir. HCSRC returns to the hatchery have steadily decreased, with none observed since 2008. Both WDFW and USFWS staff have noted that HCSRC are spawning further downstream, with the majority now spawning the first mile of the river. However, HCSRC are likely to continue to access the entire 2.8 river miles available for spawning. NMFS has noted that the Big Quilcene River is likely the "center of abundance for the Hood Canal population of the summer-run chum" (NMFS 2006). This is one of two populations in the ESU and is considered essential for recovery (NMFS 2006). HCSRC have historically persisted in major rivers draining the Olympic Mountains, including Big Quilcene (TRT Report 2007).

Return timing for HCSRC ranges from mid-August to mid-October. HCSRC are being monitored by WDFW with assistance from the hatchery. HCSRC in the Big Quilcene River primarily spawn from September to October (see BA). Fry typically emerge from the gravel in April and immediately move downstream to rear in estuaries (see Tynan et al. 1997). The number of HCSRC in the action area is low since they primarily spawn in the lower mile of the river. Although HCSRC are expected to use the entire 2.8 miles of the Big Quilcene River below the hatchery for spawning, none have been sighted in the action area since 2008.

2.5 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).

Likely effects from the proposed action are associated with short-term construction impacts, and long-term impacts of the proposed structural changes. Temporary effects associated with construction activities include: 1) localized water quality reduction from increased turbidity; 2) substrate modification and reduced pool habitat; 3) reduced habitat availability from work-site isolation; 4) reduced riparian vegetation; and 5) fish disturbance and handling.

Long-term effects of the project (50 years contemporaneous with the estimated life of structures) include: 1) substrate modification; 2) reduced riparian vegetation; 3) reduced habitat availability; and 4) impeded migration.

2.5.1 Effects on Critical Habitat

The designation of critical habitat for PS steelhead and HCSRC use the term primary constituent element (PCE) or essential features. The new critical habitat regulations (81 FR 7414) replace this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a ''destruction or adverse modification'' analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

The anticipated temporary and permanent effects of the proposed action would alter aquatic habitat conditions within the action area. The construction-related effects and long-term effects of placement of permanent structures influence the condition of PBFs of designated critical habitat of HCSRC and PS steelhead. Critical habitat has been designated for both HCSRC and PS steelhead in the action area in the Big Quilcene River, and for PS steelhead in the action area in Penny Creek. The PBFs of HCSRC and PS steelhead critical habitat in the action area include:

(1) Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development;

(2) Freshwater rearing sites with:

i. Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility;
ii. Water quality and forage supporting juvenile development; and
iii. Natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

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

Temporary Effects

Temporary, localized impacts to critical habitat of the proposed action may result from the proposed hatchery structure repairs (fish weir and intake concrete sill), rock barb repair, riprap bank protection repairs and gravel bar excavation. Water quality, substrate, pool habitat, habitat availability, cover and forage, and migration access are all habitat conditions that could be temporarily altered by the proposed action and affect PBFs of HCSRC and PS steelhead critical habitat in the action area.

1) Water Quality. The generation of suspended sediments is expected during in-water construction activities and during work on river banks, which would reduce water quality, a PBF of PS steelhead and HCSRC critical habitat. Increased concentrations of suspended sediment would expected at worksites and throughout the downstream action area during gravel bar removal, and rock barb, riprap and weir repairs. Proposed BMPs, such as worksite isolation (i.e. cofferdams) and temporary erosion and sediment prevention control plan measures, would minimize the generation of suspended sediment. Excess sedimentation would be expected to be diluted to background levels within approximately 1,200 feet downstream of the worksite. Per the requirements of Washington Administrative Code 173-201A, suspended sediment levels (turbidity) would only be allowed to exceed 5 NTUs over background turbidity within a 300-foot mixing zone downstream of the project disturbance. Reduced water quality from in-water work is expected during no more than the anticipated forty work days (non-consecutive) for completion of the proposed action, not including maintenance activities (maintenance activities are not expected to affect water quality). Breaks during in-water construction activities, including stopping work at night, would also allow turbidity to return to background levels throughout the action area during the project.

Suspended sediment can adversely affect the availability of rearing habitat, as well as migration by creating unsuitable water quality conditions. Salmonids have been shown to alter their behavior at turbidity levels of approximately 30 parts per million (ppm), and may experience direct mortality from extended exposure to levels above 1,000 ppm (Cook-Tabor 1995). Effects on critical rearing habitat from suspended sediment largely, but not exclusively, arise from a loss of water clarity. A loss in visual clarity, particularly for salmonids unhabituated to waters with naturally high sediment loads (e.g. rivers of glacial origin) reduces the quality of the habitat for rearing by affecting feeding efficiency and predator avoidance abilities (Lloyd 1987; Gregory 1993; Bash et al. 2001). At very high concentrations, over sufficient duration, suspended sediment can lead to displacement, at least temporarily, from occupied habitats (Bison and Bilby 1982; Bash et al. 2001).

In areas adjacent to or in close proximity downstream of in-water work (i.e. within the 300-foot mixing zone), temporary exceedances of the 30 ppm tolerance value are expected. Elevated turbidity levels would be highest within the 300-foot mixing zone, but may extend downstream approximately 1,200 feet. Juvenile HCSRC and PS steelhead rearing in the action area, and adults on upstream migrations are expected to avoid or move out of portions of the action area with elevated turbidity. It is possible that some fish could be exposed to one or more turbidity plumes and experience minor to moderate physiological or behavioral stress caused by a disruption of normal behavior. Therefore, project effects to water quality would temporarily reduce the function of the rearing and migration PBFs in the action area.

Effects of turbidity caused by in-water construction activities on the PBFs of HCSRC migration and spawning are expected to be minor because construction timing (June – early August) avoids peak adult migration from mid-August to mid-October and subsequent spawning from September through October, and also avoids juvenile outmigration in the winter and spring (see BA; Tynan 1997). Furthermore, although there is potential for spawning to occur in the action area, they primarily spawn between the mouth of the Big Quilcene river and RM 1, and no HCSRC have been sighted in the action area since 2008 (see BA). When HCSRC fry emerge from the gravel they immediately move downstream to rear in estuaries, spending very little time in natal streams (see Tynan et al. 1997), thus resulting in a negligible effect of turbidity on rearing juveniles in the action area.

Turbidity effects from in-water construction on the PBFs of PS steelhead adult and juvenile migration and spawning habitat are also expected to be minor with adult migrations during the fall and winter, juvenile outmigration in the spring, and peak spawning in the winter and spring (Correa 2002; NMFS 2005; see BA), and construction proposed for the summer. PS steelhead typically rear in natal streams for up to 2 years, and therefore turbidity is likely to diminish the function of the PBFs of rearing habitat in the action area for that period.

Elevated turbidity levels may also occur year round following project completion as rains or elevated river levels deliver sediment to the river from streambanks and adjacent areas disturbed by construction. The sediment levels from these streambank and upland activities are expected to be highest during the first rain event (the first flush). Sediment production from areas with eroded surfaces is expected to remain elevated for two seasons (approximately September through March). After two seasons, root systems of grasses and shrubs are expected to have become more established and have stabilized remaining sediment. Therefore, we anticipate elevated levels of turbidity during this period from sediment plumes to have minor, short-term, infrequent effects on the water quality PBF of HCSRC and PS steelhead migration, spawning and rearing.

2) Substrate modification and reduced pool habitat. The deposition of sediment mobilized during in-stream construction activities and disturbance of riparian areas would increase embeddedness in downstream areas. Clay, silt and fine sand particles would settle out in the Big Quilcene River and infiltrate interstices of course channel substrate. Embeddedness would be expected to be greatest immediately downstream of work areas, decreasing with distance downstream. Although some finer particles may stay in suspension to the end of the river at Quilcene Bay, beyond the action area the effect is expected to be negligible with turbidity reaching background levels.

Once well embedded, the deposited material may remain until scoured by a future significant bedload-transporting event, such as a 5-year peak flow. When such a peak flow occurs, we expect that the majority of the sediments originally mobilized by the proposed action would be transported out of the Big Quilcene River and into Quilcene Bay. Therefore, assuming that such sediments would require a 5-year flow to be mobilized, we expect any effects of embeddedness on HCSRC and PS steelhead critical habitat to last for up to approximately five years.

This anticipated filling of interstitial spaces by fine sediment would likely reduce the suitability of gravels for HCSRC and PS steelhead spawning in the action area. Because spawning habitat in the action area is of only moderate quality, generally absent of suitable spawning substrate, we anticipate only minor effects on the substrate PBF of critical habitat for spawning by both species. This is particularly true for HCSRC that primarily spawn well downstream of the action area between the river mouth and RM 1. The interstitial spaces between larger substrate (e.g. cobble and boulder) provide cover for juvenile fish and thus embeddedness may cause a minor, localized reduction to the cover PBF of juvenile rearing habitat of both HCSRC and PS steelhead in the action area.

The filling of interstitial spaces in the substrate also reduces surface area for invertebrate prey species, and reduces intergravel water flow and associated oxygen supply (see Kemp et al. 2011). This can adversely affect the survival and productivity of benthic invertebrates in the river (see Birtwell 1999; Rabeni et al. 2005; Kemp et al. 2011). As a result, we anticipate a short-term localized reduction to the forage PBF of HCSRC and PS steelhead critical habitat in the action area.

The deposition of sediment in pools downstream of construction areas would result in pools becoming shallower. Pools provide important holding areas for upstream migration of salmonids (see Cram et al. 2015). Thus a reduction in pool habitat may reduce the quality and quantity of adequate holding area for adults in the action area, making upstream migration more difficult, and delaying migration or requiring greater energy expenditure. Therefore we anticipate a short-term (2 years minimum, persisting until a high water volume event scours the sediment out of the pools) condition with localized diminished function of critical habitat for HCSRC and PS steelhead migration.

3) Reduced Habitat Availability. Isolation of in-water work areas would temporarily reduce available habitat for HCSRC and PS steelhead. Work-site isolation and fish removal, if needed, is proposed during hatchery fish weir rehabilitation, intake concrete sill rehabilitation, rock barb repair if in-water work is needed, and riprap bank protection repair. Additionally, a temporary sediment barrier would isolate, and remove fish from, a portion of the Big Quilcene River during the proposed gravel bar excavation. Isolation would be short-term, with construction expected to take six to eight weeks for weir rehabilitation, one to three weeks for intake concrete sill rehabilitation and one to two weeks for gravel bar excavation. Riprap bank protection repairs are planned over the next five years, and individual components would have a similarly short-term duration. The isolated areas would be small relative to the available habitat within the action area and the lower Big Quilcene River, and available habitat is not expected to be limited for the number of fish present in the action area during construction. We anticipate a small reduction in available critical habitat for HCSRC and PS steelhead for the duration of in-water construction activities.

4) Reduced riparian vegetation. Disturbance of riparian areas for work-site access and staging, and proposed hazardous tree removal is expected to temporarily reduce cover provided by overhanging vegetation, a PBF of HCSRC and PS steelhead critical habitat. This in turn also reduces the input of woody debris into the stream thereby reducing in-water cover. Proposed BMPs, such as using existing paved or graveled areas for staging and selecting access routes that avoid trees, would minimize this disturbance. The proposed gravel bar extraction and rock barb repairs would destroy and remove several small trees 10 inches diameter at breast height (DBH) or less from riparian areas. The proposed removal of hazardous trees may also remove some trees from riparian area. Any trees in riparian areas over 10 inches DBH would be replaced with new trees planted in the fall after construction is complete, and would be monitored for 5 years, replacing any that do not survive. The small trees, herbaceous and shrub vegetation expected to be disturbed provide only minimal cover to aquatic habitat in the action area, and riparian vegetation would be expected to recover quickly following project completion. Therefore, we expect any impacts of construction activities on the cover PBF of HCSRC and PS steelhead critical habitat for spawning and rearing to be minor, localized and brief.

The proposed tree trimming and removal of hazardous woody debris and trees for a 5-year period may also reduce overhead and in-water cover. Where tree trimming or removal occurs in riparian areas, or when woody debris is removed from the river channel, we expect a reduction to available cover for HCSRC and PS steelhead, spawning, rearing or migrating in the action area. The proposed conservation measures to limit trimming in riparian areas and avoid removal of native trees with a diameter greater than 10 inches DBH when possible would help minimize impacts. Additionally, under the proposed action, native trees and brush would be replanted at a 2:1 ratio (two for every one removed). Replanted trees would be monitored for five years and any tree that fails to take root would be replanted. If the trees removed provide shade along the river shoreline replanting would be done along the shoreline. No more than 10 trees above 10 inches dbh would be removed. Because of replanting efforts, we anticipate impacts to be temporary while plants become re-established. Therefore, we expect any effect on the cover PBF of HCSRC and PS steelhead critical habitat to be short-term (5 – 10 years, until the height and canopy of the newly planted trees are large enough to cast shade and supply detrital prey inputs), minor and localized.

Permanent Effects

Permanent effects on critical habitat of the proposed action are likely to result from the proposed hatchery structure repairs (fish weir and intake concrete sill), rock barb repair, and riprap bank protection repairs. Habitat effects resulting from the proposed permanent structures would remain for roughly 50 years, and affect individuals from each annual cohort of the Big Quilcene population of the two fish species for the life of the project. The proposed construction work would extend the life of structures and thus also extend the duration of effects on critical habitat in the action area. Substrate, forage, cover and clear migration corridors are PBFs of HCSRC salmon and PS steelhead critical habitat for spawning, rearing and migration that may be permanently affected by the proposed action. Additionally, permanent in-water structures directly reduce habitat availability for both species.

1) Substrate modification and bank hardening. Any structures, including steel, concrete and riprap, that are placed within the Big Quilcene River and Penny Creek channels would modify river substrate. Rather than natural substrate typical of the action area (sand, gravel and cobble), riprap and boulders placed in the river for the proposed rock barb repair and riprap bank repairs would be the dominant substrate at those specific locations. Likewise, the installation of steel plates or concrete for the maintenance of the fish weir and intake concrete sill would ensure the continued existence of artificial substrate providing no habitat complexity at those locations. For the proposed riprap placement, most would be placed on top of existing riprap that has failed and eroded into the channel, and thus, like the weir and intake sill structures, most of the substrate modification is associated with the continued presence of artificial substrate in those areas as a result of the proposed maintenance. The riprap, steel and concrete are not suitable to HCSRC or PS steelhead spawning. Although the riprap may provide some cover for rearing juveniles in interstitial spaces, the steel and concrete structures lack interstitial spaces thereby providing no in-water cover. These effects would be localized to the specific sites where the concrete, steel and riprap are located in the river. We expect effects to the cover PBF of critical habitat for HCSRC and PS steelhead spawning and rearing be minor given the small area effected relative to the availability of higher quality habitat elsewhere in the action area and beyond the action area, adjacent to, upstream and downstream of affected sites.

The proposed riprap rock barb repairs would also harden the bank of approximately 200 linear feet of the Big Quilcene River, preventing at least this length of stream bank from returning to its natural condition. Stream bank hardening limits habitat diversity and would prevent channel migration and reduce recruitment of large woody debris. Laterally migrating channels create complex and diverse habitats that are important to salmon productivity (Hall et al. 2007; Naiman et al. 2010). In particular to HCSRC and PS steelhead critical habitat PBFs, we expect a long-term reduction in side channel formation and undercut banks, localized to the approximately 200-foot long hardened bank. This would negatively affect the quality of critical habitat for rearing and migration of both species.

2) Reduced riparian vegetation. We expect long-term reductions to riparian vegetation in the 200-foot long section of the Big Quilcene River where riprap would be placed on the bank as part of the proposed rock barb repairs, and also in areas of proposed riprap protection repairs in the Big Quilcene River and Penny Creek. Although a portion of the rock barb repair bank area and most of the proposed riprap protection repairs would occur where riprap is already present, the proposed placement of additional riprap would ensure its continued existence. The riprap would preclude the establishment and growth of riparian vegetation for the life of the project.

As a result of the reduced riparian vegetation we expect a long-term reduction in overwater and in-water cover for HCSRC and PS steelhead adults and juveniles in the action area. We expect a localized, minor reduction in the cover PBF of critical habitat for spawning and rearing of both species, particularly relative to the availability of suitable habitat in adjacent areas within the action area, as well as outside of the action area. Cover aids in fish avoidance of predators, from both above (e.g. birds and humans) and within (other fish) the stream, therefore. Therefore, we anticipate increased predation risk and a small number of fish being injured or killed as a result.

We also expect a slight increase in water temperatures in the action area because of the reduction in shading provided by riparian vegetation (see WDOE 2004). As detailed in the BA, water temperatures in the lower Big Quilcene River average below 16 degrees Celsius, but ranges from 13 to 18 degrees Celsius in late August through October, during the HCSRC spawning season. The preferred water temperature for HCSRC ranges from 8.3 to 15.6 degrees Celsius (see NMFS 2006). Therefore, the preferred temperatures for HCSRC spawning are sometimes exceeded. Thus we expect a minor effect on habitat quality for HCSRC spawning. We do not anticipate changes in temperature to effect habitat quality for HCSRC juveniles, nor for PS steelhead, as they are mostly present in the action area during the cooler fall, winter and spring seasons when water temperatures are not a concern. Although we are unable to calculate the anticipated increase in summer water temperatures, we expect that the effects of the proposed action to be minor given the small scale of riparian impacts relative to the size of the Big Quilcene River. We anticipate a localized, minor reduction to the water quality (water temperature) PBF of HCSRC and PS steelhead critical habitat for spawning.

3) Reduced habitat availability. The placement structures or material that fill aquatic habitat, and any activities that maintain such structures, would result in reduced availability of critical habitat for HCSRC and PS steelhead. The proposed placement of carbon steel plates for the fish weir and intake concrete sill rehabilitation in the Big Quilcene River, boulders for the rock barb repair in the Big Quilcene River, and riprap for various riprap repairs at hatchery structures in the Big Quilcene River and Penny Creek would reduce habitat availability in the footprint of those structures. Where these structures are located within the stream channels (i.e. within the bankfull width) there is a direct reduction in critical habitat equal to the volume of the structures below ordinary high water (OHW), localized to the footprint of the structures. These areas would be small relative to the available habitat within the action area and the lower Big Quilcene River and Penny Creek, and available habitat is not considered limited. We anticipate a long-term, small reduction in available critical habitat for HCSRC and PS steelhead.

4) Impeded migration. The proposed action will maintain the function of the Quilcene NFH weir, which acts as a barrier to upstream fish migration when flows are below 70 cfs, unless the fish bypass ladder is open. The weir is not a barrier to downstream migration. The fish bypass ladder is opened periodically from September through December to allow all steelhead to pass upstream. From January 1 through July, the ladder is continuously open. The ladder is closed in August. Fish that encounter the weir during upstream migrations when the fish ladder is closed would experience delayed migration. Over the life of the structure, we expect very few HCSRC to be experience delayed spawning migrations as adults are unlikely to migrate this far up the Big Quilcene River, spawning primarily in the lower mile of the river. Adult PS steelhead may be delayed by the weir during fall and winter spawning migrations. However, because the bypass ladder is opened periodically through December to allow all steelhead to pass upstream, and continuously open after January 1, and with flows sometimes high enough to allow fish to pass over the weir, we anticipate this delay to be brief. Thus we anticipate a minor effect on the PBFs of critical habitat for HCSRC and PS steelhead migration.

2.5.2 Effects on Species

This effects analysis reviews anticipated habitat effects that would lead to changes in fish behavior, and habitat-modifications that would cause injury or death of individual HCSRC and PS steelhead. Although conservation measures and BMPs are proposed that minimize exposure of ESA-listed species to impacts of the proposed action, they do not completely avoid fish exposure to construction effects. Further, exposure to the permanent effects, caused by the proposed structures and removal of other structures, would remain, and affect individuals from each fish species for the life of the project.

We anticipate the above effects to critical habitat to affect adult and juvenile HCSRC and PS steelhead that occur in the action area. In addition to these habitat effects, we also anticipate direct short-term effects to individual fish from disturbance by construction noise, vibrations and visual disturbance, and fish handling associated with the proposed in-water work-site isolation. Worksite isolation and handling is intended to reduce the number of fish that are exposed to deleterious construction effects. However, isolation and handling have their own effects on the individuals.

Fish Disturbance and handling. Noise, vibration and visual disturbance of fish, as well as fish handling may interrupt migration and rearing activity in the action area during construction. We anticipate that HCSRC and PS steelhead exposed to in-water activities would avoid the area. However, some may remain in the area of disturbance and would experience a disruption to normal foraging and migration behavior. Displacement and disruption to behavior could result in lost foraging opportunities or drive fish into lower quality habitat, for example with reduced forage potential or reduced cover. It may also temporarily delay migration with fish avoiding and not moving through the action area.

Isolation of in-water work areas (e.g. with cofferdams) would prevent fish from coming into direct contact with construction equipment and increase the distance from noise and turbidity sources, thereby reducing disturbance intensity. In-water construction would also not be continuous for the entire project duration, and would cease at night, allowing fish to move within, or pass through, the action area. These impacts are expected to be short-term and localized to areas in the immediate vicinity of the current in-water construction disturbance.

Although it is expected that fish would avoid or move away from in-water construction areas prior to complete isolation by the installation of cofferdams, there is potential for fish to become stranded. Fish would be removed from the work areas isolated by cofferdams areas prior to dewatering by a professional biologist using hand seines and dip nets. If any fish were observed near in-water construction areas, in-water work would be halted until fish are removed to a downstream site or until have moved away from the area.

Capturing and handling fish during fish exclusion could cause short-term stress, disrupt normal behavior and may result in injury or mortality (Frisch and Anderson 2000). Fish behavioral response to handling may include reduced predator avoidance (Olla et al. 1995). We anticipate that juvenile HCSRC and juvenile PS steelhead may be present in dewatered areas and would be harassed or handled during exclusion or removal. Because protocols would be followed and fish removal and relocation would be conducted or directed by a qualified biologist, we anticipate that few fish would be injured or killed, however, there is the chance of a fatality. At the population level, the impact of injury or mortality in a small number of fish would be expected to be minor (not resulting in decreased population fitness or productivity). The risk of harm would be short-term (until fish removed and released) and it would be localized to the dewatered areas.

Likelihood of Exposure by Species and Lifestage

As noted above in the effects to critical habitat, the project has both temporary and permanent effects. The temporary effects, including localized water quality reduction from increased turbidity; substrate modification and reduced pool habitat; reduced habitat availability from work-site isolation; reduced riparian vegetation; and fish disturbance and handling all occur during or shortly after construction and maintenance of hatchery structures in the Big Quilcene River and Penny Creek. The presence of the proposed hatchery structures are considered a permanent effect. Our exposure and response analysis identifies the multiple life-stages of listed species that use the action area, and whether they would encounter these effects, as different life-stages of a species may not be exposed to all effects, and when exposed, can respond in different ways to the same habitat perturbations.

*Juvenile Salmonid Exposure to Temporary Effects***.** As described in Section 1.3 (Proposed Federal Action), all in- water work would occur between June and early August. This work window would minimize potential for overlap of in-water construction activities with emigrating juvenile HCSRC and PS steelhead. Juvenile HCSRC outmigrate in the winter and spring, immediately after fry emergence, and thus would have moved out of the Big Quilcene River prior to in-water work. Additionally, only a very small number of juvenile HCSRC are expected to occur in the action area at any time of the year as spawning occurs primarily in the lower mile of the river and fish moving immediately to estuarine habitat after emergence. No HCSRC have been sighted in the action area since 2008. Accordingly we consider Juvenile HCSRC unlikely to be exposed to the habitat related construction effects of this project.

Juvenile PS steelhead are expected to have completed outmigration through the action area in the spring, prior to in-water work. However, because PS steelhead may rear in the action area for up to two years, they would likely be present in the action area during in-water work and would be exposed to all short-term habitat effects, though in very low numbers.

Neither HCSRC nor PS steelhead occur in Penny Creek.

As described in Section 2.5.1 (Effects on Critical Habitat), temporary effects of the proposed action would extend beyond the in-water work period. These prolonged temporary effects include elevated turbidity levels resulting from sediment delivery from disturbed streambanks and adjacent areas during rain and high flow events; streambed substrate embeddedness and decreased pool habitat; and decreased riparian vegetation in disturbed areas. We anticipate these effects to extend for two years (turbidity effects) to five years (riparian vegetation, substrate and pool effects). Any fish present in the action area over this period would be exposed to these effects.

*Juvenile Salmonid Exposure to Permanent Effects***.** The Big Quilcene River is accessible up through the action area for HCSRC and they may utilize habitat for spawning beyond the lower mile of the river. In consideration of the potential for the HCSRC population to increase and for individual fish to move further upriver over the life of the permanent structures, we anticipate a slightly greater, but still very small, number of juvenile HCSRC to be exposed to long-term habitat effects.

As described in the BA, only one steelhead has been encountered at Quilcene NFH weir over the past 15 years no steelhead have been captured or observed during general hatchery operations over the past five years. We thus anticipate only a small number of juvenile PS steelhead to be present in the action area at any time of year where they would experience the long-term habitat effects of the proposed action.

Adult Salmon and Steelhead Exposure. The proposed in-water work window (June to early August) would minimize potential for overlap of construction activities with adult HCSRC and PS steelhead presence in the action area. HCSRC return to the Big Quilcene River from mid-August to mid-October and spawn from September to October. However, any early returning HCSRC adults may overlap with the start of in-water work and a small number could be exposed to immediate short-term effects of proposed construction activities (turbidity, disturbance and isolation of work areas). PS steelhead adults return during the fall and winter, and spawn in the winter and spring. Therefore, we do not expect adult PS steelhead to be exposed to these short-term effects associated with active in-water construction activities.

However, as described above, some of the temporary effects (elevated turbidity, substrate embeddedness, reduced pool habitat and reduced riparian vegetation) would occur over an estimated 2-10 years, and thus adult fish in the action area would be exposed to these effects. And, long-term habitat effects of the permanent structures constructed or maintained by the proposed action would also be ongoing for the life of the structures (estimated 50 years), making it likely that adult HCSRC and PS steelhead will be exposed at some time to these enduring habitat effects.

As a small number of adult HCSRC and PS steelhead are expected to be present in the action area at any time of the year, only a small number of adult HCSRC and PS steelhead are expected to be exposed to the short-term and long-term effects of the proposed action.

Response to Temporary Effects

1) ***Water quality/Turbidity*** - As described above, despite the use of multiple minimization measures/best management practices, over the two years of work, instream turbidity levels are expected to be above background within a zone of about 300 feet downstream from the point of construction.

Salmonids, particularly adults, are highly mobile and would be expected to avoid areas with elevated levels of turbidity, which would limit the duration of potential exposure. While this is a normal reaction, it is a behavioral response that may impede migration, or in the case of steelhead, reduce feeding. For adult HCSRC and PS steelhead, because of the minor, localized and short-term changes to water quality, and the capacity for fish to avoid the affected area, any exposure to suspended sediments is expected to be below both the duration and intensity that could be injurious. However, juvenile PS steelhead rearing within the mixing zone during construction, and juvenile HCSRC and juvenile PS steelhead in the action area when turbid conditions arise following project completion, may be exposed to harmful turbidity levels (total suspended sediment levels above 30 ppm). Such turbid conditions may also disrupt the normal behavior patterns of juveniles by causing fish to avoid those rearing, migration, or foraging areas.

2) Substrate and Pool Habitat - The reduced habitat quality from substrate embeddedness and reduced pool habitat due to construction-related sediment delivery to the stream is expected to temporarily reduce available spawning gravels, flow refuge in pools for migrating fish, and forage. Because spawning habitat is considered unlikely in the action area due to generally poor spawning habitat conditions and the low number of fish expected in the action area under baseline conditions, we do not expect a measureable effect on HCSRC or PS steelhead spawning activity or fecundity. We anticipate that any effect of substrate embeddedness on forage would be localized to areas downstream of sediment disturbance in the action area and would persist for no more than five years. Because the effects are localized and short-term, and scale of the effect is small relative to available suitable habitat elsewhere in the action area and beyond, we do not anticipate a measurable effect on the survival of individual HCSRC or PS steelhead. Any potential for a limitation in forage or habitat availability for HCSRC or PS steelhead is particularly unlikely given the very low number of fish that occur in the action area.

3) Riparian Vegetation - Construction-related disturbance and removal of riparian vegetation may result in a short-term reduction in forage and cover for HCSRC and PS steelhead. These effects would be minor and localized to a very small area relative to suitable habitat elsewhere in the action area and beyond. We expect no measureable effect on HCSRC or PS steelhead survival or productivity.

4) Reduced Habitat Access - Although work area isolation is a conservation measure expected to reduce adverse effects from in-water work activities, fish exclusion and fish handling associated with worksite isolation also poses a direct risk to fish. The isolation of the in-water work areas for the proposed in-water construction activities would require dewatering of those portions of the creek. The in-stream work areas would be isolated by cofferdams, or a sediment barrier in the case of the gravel bar excavation, and then would be dewatered with pumps. We expect that most fish, particularly adults present in the work areas would move away from the initial disturbance caused by personnel and construction equipment, and by the installation of the initial portions of the cofferdam or barrier structures (i.e. placement of first sandbags). Once the installation is complete, while water is drawn down (using screened pumps), any fish within the isolation area would be removed by a biologist using hand seines and dip nets. Removal with nets would be expected to cause stress to fish and has the potential to injure fish (e.g. scale abrasion). There is also a slight risk of impingement of fish on the pump intake screens, but with monitoring by a biologist we expect this risk to be low.

To estimate the number of HCSRC and PS steelhead that would be affected by isolation of work areas we use existing observation data and estimates provided in the BE. As described above and in the BE, HCSRC primarily spawn in the lower mile of the Big Quilcene River and no HCSRC have been sighted in the action area since 2008. Only one steelhead has been encountered at the Quilcene NFH weir over the past 15 years no steelhead have been captured or observed during general hatchery operations over the past five years. Because of the in-water construction timing also avoids primary adult spawning and migration timing by both species, we do not expect adult fish to be present during work-site isolation activities. Only rearing PS steelhead juveniles are considered likely to be in the action area during this period due to their year-round use of natal streams for rearing.

Only one steelhead has been encountered at the Quilcene NFH weir over the last 15 years, and none have been captured or observed during general hatchery operations over the past 5 years. However, past surveys in 2012 and 2013 have observed adult PS steelhead in the Big Quilcene River below the hatchery, and two smolts were trapped in a rotary screw trap in 2011 (USFWS 2015). The Biological Opinion for HCSRC and PS steelhead propagation programs in Hood Canal completed by NMFS in 2016 (WCR-2014-1688), estimated, and issued take for 4,000 eggs, 50 juveniles, and five adult PS steelhead are observed/harassed each year due to hatchery operations. It also estimated that five juveniles and four adult steelhead are captured, handled, or released (considered as mortality). Because no steelhead have been observed at the hatchery over the past five years, and we expect most fish to move away from worksite isolation areas before isolation, we consider it a conservative estimate that 50 juvenile steelhead could be harassed or captured/handled during work-site isolation.

Response to Permanent Effects

The proposed action is expected to result in decreased habitat availability, cover and forage for HCSRC and PS steelhead in footprint of structures installed or maintained by the proposed action, and adjacent to areas of bank hardening (e.g. riprap). This would be expected to result in a decrease in fish survival from reduced prey availability (forage), and increased predation associated with a decrease in available cover. Furthermore, the structural footprints with the river and any avoidance behavior of low quality habitat translates to reduced habitat availability, particularly rearing juveniles, and may result in increased competition in other areas. This may ultimately lead to decreased fitness and survival of individual HCSRC and PS steelhead that occur in the action are.

The reduction in habitat, prey base and cover associated with the permanent structures would be localized to the structural footprints and immediately adjacent areas. Use of habitat in the action area for spawning, migration and rearing by HCSRC and PS steelhead is anticipated over the life of the structures. Reductions in cover may reduce the ability of individual salmonids to avoid predation, and reduced forage may lead to decreased growth rates, fitness and survival of individuals. However, the area of impacted habitat is very small relative to suitable habitat available elsewhere in the within and beyond the action area. Therefore, we expect that effects to habitat availability and quality (forage and cover) for HCSRC and PS steelhead to culminate in a very small decrease in survival.

We also expect slightly delayed migration at the hatchery weir. Although the fish ladder and protocols to allow fish to pass the weir, we anticipate a slight delay with fish use of the ladder or waiting to be passed. This could require greater energy expenditure by migrating adult HCSRC and PS steelhead, and longer exposure to potential predation. Because of the practices in place to pass fish, we expect any delay to be short and have a very small effect on fish survival.

2.6 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.

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline *vs.* cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the environmental baseline (Section 2.4). Over the 50 year life of the project, some of the effects that may become more pronounced include warming riverine temperatures, and greater variability in high and low flows as both flooding and drought become more likely.

Future agricultural, residential and commercial use and development, and associated infrastructure, in the Big Quilcene River watershed, particularly around the community of Hiddendale and the town of Quilcene, is expected to have ongoing impacts on habitat quality for fish. NMFS believes the majority of environmental effects related to future developments will be linked to land clearing, associated land-use changes (i.e., from forest to lawn or pasture) and increased impervious surface and related watershed changes. Land use changes and development of the built environment are likely to continue under existing zoning. Further, NMFS believes that many of the existing local and state regulatory mechanisms intended to minimize and avoid effects on watershed function and listed species from future commercial, industrial, and residential development are generally not adequate, or not implemented sufficiently. Though these existing regulations could decrease adverse effects or watershed function, as currently constructed and implemented they still allow incremental degradation to occur. However, the low population density in the Big Quilcene River watershed (e.g. one residence per 20 acres in the predominant residential zoning) and the majority of the watershed being in federal ownership (approximately 85%), suggests that any increase in land-use will be slow and of a low intensity (HWS 2020a).

Major restoration work in the lower Big Quilcene River is currently underway, with future projects being developed, that will include improved floodplain connectivity, water quality, fish passage and riparian habitat quality (HWS 2020b). Because the projects often involve multiple parties using Federal, state and utility funds, it can be difficult to distinguish between projects with a Federal nexus and those that can be properly described as cumulative effects.

When considered together, these cumulative effects are likely to have a small, adverse effect on salmon and steelhead population abundance and productivity. To the extent that recovery actions are implemented and on-going actions continue, adverse cumulative effects may be minimized, but will probably not be completely avoided.

2.7 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.

HCSRC and PS steelhead are listed as threatened based on their overall reductions in abundance, diversity and spatial structure, and current limits to their productivity relative to historical conditions. Both species are considered at moderate risk of extinction, but abundance and productivity have been trending upward for several of the component populations. The quality of their critical habitat varies across basins in the PS, but most has been degraded by human development. Conditions in the environmental baseline currently limit productivity for these species in the action area. This is primarily related to impaired habitat quality and quantity resulting from the footprint of hatchery structures in and adjacent to the river, and the impacts of human development in the lower reach of the Big Quilcene River, particularly diking and other bank stabilization structures.

To this baseline, we add the temporary and permanent effects of the proposed action. The proposed maintenance of hatchery structures, channel realignment and placement of riprap would permanently reduce habitat quantity and quality at the location of the structures. Construction activities are anticipated to generate localized short-term increases in suspended sediment, creating a temporary (2-10 year) reduction in habitat availability for adult and juvenile HCSRC and PS steelhead that avoid disturbed areas. Work-site isolation would also reduce habitat availability by excluding fish from those areas, for up to 2 years.

When considering critical habitat, the quality of critical habitat at the designation scale varies, with much of the habitat degraded by human activities. In the action area, habitat quality is degraded, with some characteristics of habitat functioning properly and some not. With proposed minimization measures, the action's adverse effects are localized and minor. Even when potential impacts of climate change are added to the effects of the action, the scale of impact is very small. Accordingly, the temporal and spatial extent of these reductions, when added to the baseline and in the context of cumulative effects, are unlikely to diminish carrying capacity of the action area in a manner that reduces the conservation value of the action area for the affected populations. Given the scale of impacts, we consider that the effect of the action would not impair the conservation value of critical habitat for either species.

The habitat diminishments, together with the exclusion of fish from the in-water work areas all have the potential to harm, injure, or kill individual fish from the affected populations. To evaluate whether the effects of the proposed action are likely to appreciably reduce the likelihood of both survival and recovery of the HCSRC ESU or PS steelhead DPS, we assessed the magnitude of the proposed action's effects on the Big Quilcene River basin populations, and the role of the populations in the ESU/DPS overall viability. HCSRC and PS steelhead that occupy the the action area, represent a small segment of the total Big Quilcene watershed populations.

Although the Big Quilcene River HCSRC population is one of two populations in the ESU considered essential for recovery (NMFS 2006), we expect the proposed action to have minor effects on the population. The Big Quilcene River PS steelhead population has not been identified as an essential population for recovery of the DPS (NMFS 2020), and we also expect minor effects to the population. Only a small number of HCSRC and PS steelhead relative to the affected populations would be killed or injured by the proposed action. Even when these impacts are added to the current and future effects of climate change, the anticipated reduction in abundance is so small that the effect on population viability is not meaningful. Therefore, the effects on productivity, diversity and spatial structure are not expected to be discernible, and therefore unlikely to alter the current trends for HCSRC or PS steelhead. In other words, we expect that the total effects of the proposed action on individual fish identified in this opinion would be indiscernible at the population level. Additionally, HCSRC and PS steelhead, although currently well below historic levels, are distributed widely enough and are presently at high enough abundance levels that any adverse effects resulting from the project would not have an observable effect on the spatial structure, productivity, abundance and diversity of these species. Therefore, when considered in light of existing risk, environmental baseline effects, and cumulative effects, the project itself does not increase risk to the affected populations to a level that would reduce appreciably the likelihood for survival and recovery of HCSRC and PS steelhead.

2.8 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 HCSRC and PS steelhead or destroy or adversely modify their designated critical habitat.

2.9 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.

2.9.1 Amount or Extent of Take

In the biological opinion, NMFS determined that because individuals of the two listed species will be exposed to both temporary and permanent effects of the proposed action, including handling, incidental take is reasonably certain to occur. While a number of fish to be handled can be estimated, because fish presence is highly variable over time it is impossible to estimate a number of fish that will be harmed by habitat modification, in which case we use a surrogate measure, causally linked to the form of take, called an extent of take. We describe the amount and extent of take as follows:

Extent of Harm from Temporarily Elevated Turbidity, and Sediment Deposition

The surrogate for take resulting from turbidity and sediment deposition relates to the extent of turbidity detectable downstream of the construction area. During in-water construction activities if turbidity exceeds Washington Department of Ecology's Water Quality Standards for Surface Waters of the State of Washington, Chapter 173-201A WAC, amended May 9, 2011, revised January 2012 (publication number 06-10-091) at any time, this take surrogate will be exceeded. Take will be exceeded if turbidity exceeds 5 NTU over background 300 feet downstream (turbidity mixing zone for a river over 100 cfs) of the turbidity source when the background is 50 NTU or less; or a 10% increase in turbidity when the background turbidity is more than 50 NTU. If at the time of construction flows were between 10 cfs and 100 cfs the point of compliance shall be 200 feet (instead of 300 feet) downstream of the activity causing the turbidity exceedance.

This surrogate for take is causally linked to the take resulting from turbidity because harassment and harm of fish from turbidity increases as the concentration of turbidity and as the area with elevated levels increases. We expect harassment or harm of fish from exposure to turbidity within the turbidity mixing zone during construction. We expect harm of fish within 1,200 feet downstream of in-water work areas where elevated turbidity levels are expected to be detectable and thus substrate embeddedness and reduced pool habitat may result. With no turbidity exceedances, we expect harassment and harm to be confined within these areas (turbidity mixing zone or 1,200 feet). If turbidity exceedances occur, we expect harassment and harm to occur beyond these areas, in which case a greater number of fish would be affected, and this take surrogate will have been exceeded. Turbidity levels will be monitored during on an ongoing basis during in-water work and so the surrogate functions as an effective reinitiation trigger.

Extent of Harm from Temporarily Reduced Riparian Vegetation

The surrogate for take resulting from reduced riparian vegetation during construction activities and the five-year period of hazardous tree removal is based on the proposed level of removal and disturbance. No more than 10 trees above 10 inches DBH would be removed over the five-year period as part of the hazardous tree removal. These trees and any red alder or willows greater than 10 inches DBH severely damaged or removed by construction activities would be replanted and monitored for five years to ensure survival. If more than 10 trees over 10 inches DBH are removed as part of the proposed hazardous tree removals, or trees are not replanted and monitored as proposed, we expect a greater number of fish to be harmed, and this take surrogate to have been exceeded.

Amount of Take from Fish Exclusion and Removal

Work area isolation is a conservation measure intended to reduce adverse effect from in-water work activities. However HCSRC or PS steelhead may be present in the action area and would be exposed to exclusion and removal which could cause harm or death of fish. As described in Section 2.5 (Effects of the action), we consider juvenile PS steelhead likely to be present during work-site isolation, and potentially as small number of adult HCSRC. Due to uncertainty in potential abundance and density when isolation measures occur, we based our analysis on the previous estimates of hatchery effects in NMFS (2016). NMFS (2016) estimated that 50 juvenile and five adult PS steelhead are observed/harassed each year due to hatchery operations. As a conservative estimate for the less than three months of proposed work-site isolation, we estimate that 25 juvenile PS steelhead and five adult HCSRC would be captured and handled during the work area isolation. We anticipate that the likely number of fish handled would be much lower than these estimates. If the number of HCSRC or PS steelhead captured and handled each year exceeds the above numbers, then the amount of take would be exceeded, and the reinitiation provisions of this opinion would be triggered.

Extent of Harm from Permanent Habitat Modification

Here the take surrogate is the aquatic habitat influenced by the physical habitat impacts of the permanent infrastructure. Specifically, for harm resulting from decreased habitat function caused by the proposed structures, the take surrogate is the spatial extent of impacts to cover and forage for HCSRC and PS steelhead. The spatial extent of impacts that could result in take is calculated as the footprint of all permanent structures (including bank stabilizing material) below OHWM. This surrogate for take is representative of take resulting from the proposed structures as impacts to habitat quality and quantity are proportional to the structural footprints. The footprint of the proposed concrete structures and riprap in the river reduces available aquatic habitat by that area. The footprint of structures and riprap on the banks reduces riparian habitat by that area. Additionally, bank stabilization structures reduce stream habitat complexity, including preventing channel migration and the accumulation of LWD. The extent of take would be exceeded if the surface area of any of the structures is greater than defined in the BA, project description and project drawings provided by the USFWS for this consultation. The USFWS has the ability to conduct compliance inspections and take actions to ensure compliance, including post-construction, and thus the surrogate functions as an effective reinitation trigger.

2.9.2 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.

2.9.3 Reasonable and Prudent Measures

"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).

1. Minimize incidental take from turbidity and sediment deposition.
2. Minimize incidental take from reduced riparian vegetation.
3. Minimize incidental take from the exclusion and removal of fish from work areas.
4. Minimize incidental take from habitat modification.
5. Complete monitoring and reporting to confirm that the take exemptions for the proposed action are not exceeded, and that the terms and conditions in this incidental take statement are effective in minimizing incidental take.

2.9.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the USFWS or any applicant must comply with them in order to implement the RPMs (50 CFR 402.14). The USFWS 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. The following terms and conditions implement reasonable and prudent measure 1 (sediment/turbidity):
    a. Conduct all in-water work for a brief a period, starting after June 1, and ending as early in August as possible (by August 15).
    b. Use silt curtains and other controls as best suited to minimize delivery of sediment to streams and generation of instream suspended sediment. After completion of in-water work in each isolated area, reintroduce streamflow slowly, allowing the streambed to reabsorb water and prevent a sudden flow to unduly increase generation of suspended sediment. Keep heavy equipment out of areas below OHW to the extent possible and minimize the construction footprints. Monitor and document all erosion control activities, including minimization measures and BMPs. The USFWS shall submit reports on the contractor's compliance with, and the effectiveness of the erosion control BMPs and minimization measures to NMFS (projectreports.wcr@noaa.gov and jeff.vanderpham@noaa.gov), within 60 days of completion of each in-water work period (in 2018 and 2019).
    c. Turbidity monitoring and response to exceedances shall follow the guidelines provided in Washington Department of Ecology's Water Quality Standards

for Surface Waters of the State of Washington, Chapter 173-201A WAC, amended May 9, 2011, revised January 2012 (publication number 06-10-091), as proposed. These guidelines shall be applied to all areas with potential project-related elevated turbidity, during any activity with potential to elevate turbidity levels. If water quality standards are exceeded, the proposed action will have exceeded the amount of take authorized, and the USFWS must reinitiate consultation with NMFS.

d. Document turbidity monitoring results. The USFWS shall report to NMFS (projectreports.wcr@noaa.gov and jeff.vanderpham@noaa.gov), within 60 days of completion of the in-water work period.

2. The following terms and conditions implement reasonable and prudent measure 2 (riparian vegetation):
   a. Minimize disturbance and removal of all vegetation to the maximum extent possible.
   b. In riparian areas replace all trees over 10 inches DBH removed or damaged to the point that survival is unlikely over 10 DBH. Monitor the survival of the trees for five years and replace as necessary.
   c. Replant with shrubs and small trees (e.g. alder and willow less than 10-inches DBH) all riparian areas (where possible) with shrubs or small trees are removed. Monitor the success or replanted areas for five years and replant as necessary.
   d. Document riparian vegetation removal/disturbance and associated replanting efforts and report to NMFS (projectreports.wcr@noaa.gov and jeff.vanderpham@noaa.gov), within 60 days of completion of the replanting.

3. The following terms and conditions implement reasonable and prudent measure 3 (fish handling/exclusion):
   a. Conduct all in-water work for a brief a period as practicable.
   b. Minimize dewatered areas to the extent possible (no larger than as proposed in the BA, project description and project drawings).
   c. Adhere to the fish exclusion and removal protocols and standards provided in the BA, conforming to USFWS (2012) and NMFS (2000).
   d. As practicable, allow all HCSRC and PS steelhead to migrate out of the work area, or remove fish before dewatering. Otherwise removed fish from the exclusion area as it is slowly dewatered with methods such as hand or dip-nets or seining, as proposed.
   e. A qualified fisheries biologist, with experience in work area isolation, shall supervise work area isolation to ensure safe handling of all fish.
   f. Document all HCSRC and PS steelhead encountered, and any observed injury or mortality during work area isolation and dewatering by submitting a fish salvage report to NMFS. The USFWS shall report to NMFS (projectreports.wcr@noaa.gov and jeff.vanderpham@noaa.gov) within 60 days of work area isolation and complete dewatering.

4. The following terms and conditions implement reasonable and prudent measure 4 (habitat modification) and 5 (monitoring):
   a. To the maximum extent possible, minimize the construction area footprint, including staging areas, access routes and work platforms.
   b. Restore disturbed areas to pre-construction, natural condition.
   c. Ensure that all structures and permanent materials are within the dimensions proposed in the BA, project description and project drawings.
   d. Conduct pre and post-construction photo monitoring of all project construction areas and measure the footprint of all structures below OHW (concrete, bank armor, etc.) to document constructed infrastructure. The USFWS shall provide photos electronically to NMFS (projectreports.wcr@noaa.gov and jeff.vanderpham@noaa.gov) within 60 days of project completion.

2.10 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).

1. To protect water quality use biodegradable lubricants and fuels such as vegetable oil or biodiesel that are certified as non-toxic to aquatic organisms in machinery working in or around water.

2. To minimize reductions to riparian vegetation and large woody material, as feasible, integrate riparian plantings and large woody material (e.g. root wads) into all bank armoring (i.e. rip rap).

2.11 Reinitiation of Consultation

This concludes formal consultation for the Quilcene NFH Weir Rehabilitation and Maintenance Activities.

As 50 CFR 402.16 states, reinitiation of consultation is required and shall be requested by the Federal agency or by the Service 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 identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological 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 USFWS 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 Sections 1.3 and 2.3, respectively. The action area includes areas designated as EFH for various life stages of Pacific Coast salmon (coho salmon, and pink salmon). The effects of the proposed action on EFH are the same as those described above in the ESA portion of this document (Section 2.5), as the EFH species (coho salmon and pink salmon) share the same habitats as chum salmon and steelhead. Although pink salmon have not been noted in the Big Quilcene River watershed, they are present in Hood Canal.

3.2 Adverse Effects on Essential Fish Habitat

Based on the information provided by the USFWS and the analysis of effects presented in Section 2.5 of this document, we conclude that the proposed action would have adverse effects on EFH designated for Pacific Coast salmon. The effects of the proposed action on EFH are the same as those described above in the ESA portion of this document (Section 2.5), and NMFS concurs with these findings for the EFH assessment.

3.3 Essential Fish Habitat Conservation Recommendations

Fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in section 3.2, above, approximately 3 acres of designated EFH for Pacific Coast salmon.

Recommendations 1 and 2 are identical to the Conservation Recommendations in Section 2.10. Recommendations 3 through 6 are identical to the Terms and Conditions in Section 2.9.4 of this Biological Opinion. The effects to habitat identified for ESA-listed species are the same for Pacific Coast salmon EFH in the action area, and therefore the Terms and Conditions are also protective of EFH.

1. To protect water quality use biodegradable lubricants and fuels such as vegetable oil or biodiesel that are certified as non-toxic to aquatic organisms in machinery working in or around water.

2. To minimize long-term reductions to riparian vegetation and large woody material, as feasible, integrate riparian plantings and large woody material (e.g. root wads) into all bank armoring (i.e. rip rap).

3. To minimize turbidity and sediment deposition effects:
    a. Conduct all in-water work for a brief a period, starting after June 1, and ending as early in August as possible (by August 15).
    b. Use silt curtains and other controls as best suited to minimize delivery of sediment to streams and generation of instream suspended sediment. After completion of in-water work in each isolated area, reintroduce streamflow slowly, allowing the streambed to reabsorb water and prevent a sudden flow to unduly increase generation of suspended sediment. Keep heavy equipment out of areas below OHW to the extent possible and minimize the construction footprints.
    c. Turbidity monitoring and response to exceedances should follow the guidelines provided in Washington Department of Ecology's Water Quality Standards for Surface Waters of the State of Washington, Chapter 173-201A WAC, amended May 9, 2011, revised January 2012 (publication number 06-10-091), as proposed. These guidelines should be applied to all areas with potential project-related elevated turbidity, during any activity with potential to elevate turbidity levels.

4. To minimize effects of reduced riparian vegetation:
    a. Minimize disturbance and removal of all vegetation to the maximum extent possible.
    b. In riparian areas replace all trees over 10 inches DBH removed or damaged to the point that survival is unlikely over 10 DBH. Monitor the survival of the trees for five years and replace as necessary.
    c. Replant with shrubs and small trees (e.g. alder and willow less than 10-inches DBH) all riparian areas (where possible) with shrubs or small trees are removed. Monitor the success or replanted areas for five years and replant as necessary.

5. To minimize effects of aquatic habitat modification:
    a. To the maximum extent possible, minimize the construction area footprint, including staging areas, access routes and work platforms.
    b. Restore disturbed areas to pre-construction, natural condition.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the USFWS 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 USFWS 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 user of this opinion are the USFWS. Other interested users could include state and local agencies, and others interested in the conservation of the affected ESUs/DPS. Individual copies of this opinion were provided to the USFWS. The format and naming adheres to conventional standards for style. The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. 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.

5. REFERENCES

Abatzoglou, J.T., Rupp, D.E. and Mote, P.W. 2014. Seasonal climate variability and change in the Pacific Northwest of the United States. Journal of Climate 27(5): 2125-2142.

Bash, J., C.H. Berman and S. Bolton. 2001 Effects of turbidity and suspended solids on salmonids. University of Washington Water Center, Seattle. Bison and Bilby 1982

Gorrea, G. 2002. Salmon and Steelhead Habitat Limiting Factors, Water Resource Inventory Area 17 – Quilcene - Snow Basin. Final Report, November 2002. Washington State Conservation Commission, Lacey, WA.

Cram, J.M., Torgersen, C.E., Klett, R.S., Pess, G.R., May, D., Pearsons, T.N. and A.H. Dittman. 2017. Spatial variability of Chinook salmon spawning distribution and habitat preferences. *Transactions of the American Fisheries Society*, *146*(2), pp.206-221.

Crozier, L. G., M. D. Scheuerell, and E. W. Zabel. 2011. Using Time Series Analysis to Characterize Evolutionary and Plastic Responses to Environmental Change: A Case Study of a Shift Toward Earlier Migration Date in Sockeye Salmon. *The American Naturalist* 178 (6): 755-773.

Dominguez, F., E. Rivera, D. P. Lettenmaier, and C. L. Castro. 2012. Changes in Winter Precipitation Extremes for the Western United States under a Warmer Climate as Simulated by Regional Climate Models. *Geophysical Research Letters* 39(5). Doney et al. 2012

Feely, R.A., T. Klinger, J.A. Newton, and M. Chadsey (editors). 2012. Scientific summary of ocean acidification in Washington state marine waters. NOAA Office of Oceanic and Atmospheric Research Special Report.

Frisch, A.J., and T.A. Anderson. 2000. The response of coral trout (*Plectropomus leopardus*) to capture, handling and transport and shallow water stress. Fish Physiology and Biochemistry 23: 23 – 34.

Glick, P., J. Clough, and B. Nunley. 2007. Sea-Level Rise and Coastal Habitats in the Pacific Northwest: An analysis for Puget Sound, southwestern Washington, and northwestern Oregon. National Wildlife Federation, Seattle, WA.

Goode, J.R., J.M. Buffington, D. Tonina, D.J. Isaak, R.F. Thurow, S. Wenger, D. Nagel, C. Luce, D. Tetzlaff and C. Soulsby. 2013. Potential effects of climate change on streambed scour and risks to salmonid survival in snow-dominated mountain basins. *Hydrological Processes*, *27*(5), pp.750-765.

Gregory, R.S. 1993. Effect of turbidity on the predator avoidance behaviour of juvenile Chinook salmon (*Oncorhynchus tshawytscha*). Canadian Journal of Fisheries and Aquatic Sciences 50.2: 241-246. Goode et al. 2013

Hall, J. E., D. M. Holzer, and T. J. Beechie. 2007. Predicting river floodplain and lateral channel migration for salmon habitat conservation. Journal of the American Water Resources Association 43(3):786-797. Hartman *et al.* 1996

HCCC (Hood Canal Coordinating Council), 2005. Hood Canal and Eastern Strait of Juan de Fuca. Summer Chum Salmon Recovery Plan. November 15, 2005.

HWS (Habitat Work Schedule). 2020a. Jefferson County – Big.Little Quilcene #3. Available at: http://hws.ekosystem.us/project/170/13495, accessed January 16, 2020.

HWS. 2020b. Lower Big Quilcene River Restoration Final Design #3-01-003. Available at: http://hws.ekosystem.us/project/170/60434, accessed January 16, 2020.

IPCC (Intergovernmental Panel on Climate Change). 2014. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.

Isaak, D.J., Wollrab, S., Horan, D. and Chandler, G., 2012. Climate change effects on stream and river temperatures across the northwest US from 1980–2009 and implications for salmonid fishes. *Climatic Change* 113(2): 499-524.

ISAB (Independent Scientific Advisory Board). 2007. Climate change impacts on Columbia River Basin fish and wildlife. *In:* Climate Change Report, ISAB 2007-2. Independent Scientific Advisory Board (editor), Northwest Power and Conservation Council. Portland, Oregon.

Kemp, P., Sear, D., Collins, A., Naden, P., & Jones, I. (2011). The impacts of fine sediment on riverine fish. Hydrological Processes, 25(11), 1800-1821.

Kunkel, K. E., L. E. Stevens, S. E. Stevens, L. Sun, E. Janssen, D. Wuebbles, K. T. Redmond, and J. G. Dobson. 2013. Regional Climate Trends and Scenarios for the U.S. National Climate Assessment: Part 6. *Climate of the Northwest U.S. NOAA Technical Report NESDIS 142-6*. 83 pp. National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service, Washington, D.C.

Lawson, P. W., Logerwell, E. A., Mantua, N. J., Francis, R. C., & Agostini, V. N. 2004. Environmental factors influencing freshwater survival and smolt production in Pacific Northwest coho salmon (*Oncorhynchus kisutch*). *Canadian Journal of Fisheries and Aquatic Sciences* 61(3): 360-373.

Lloyd, Denby S. 1987. Turbidity as a water quality standard for salmonid habitats in Alaska. North American journal of fisheries management 7.1: 34-45. Mantua et al. 2009

Mantua, N., I. Tohver, and A. Hamlet. 2010. Climate change impacts on streamflow extremes and summertime stream temperature and their possible consequences for freshwater salmon habitat in Washington State. *Climatic Change* 102(1): 187-223.McMahon and Hartman 1989

Meyer, J.L., M.J. Sale, P.J. Mulholland, and N.L. Poff. 1999. Impacts of climate change on aquatic ecosystem functioning and health. *JAWRA Journal of the American Water Resources Association* 35(6): 1373-1386.

Mote, P.W, A. K. Snover, S. Capalbo, S.D. Eigenbrode, P. Glick, J. Littell, R.R. Raymondi, and W.S. Reeder. 2014. Ch. 21: Northwest. In Climate Change Impacts in the United States: The Third National Climate Assessment, J. M. Melillo, T.C. Richmond, and G.W. Yohe, Eds., U.S. Global Change Research Program, 487-513.

Mote, P.W., D.E. Rupp, S. Li, D.J. Sharp, F. Otto, P.F. Uhe, M. Xiao, D.P. Lettenmaier, H. Cullen, and M. R. Allen. 2016. Perspectives on the cause of exceptionally low 2015 snowpack in the western United States, Geophysical Research Letters, 43, doi:10.1002/2016GLO69665

Mote, P.W., J.T. Abatzoglou and K.E. Kunkel. 2013. Climate: Variability and Change in the Past and the Future. Chapter 2 in M.M. Dalton, P.W. Mote and A.K. Snover (eds.) *Climate Change in the Northwest: Implications for Our Landscapes, Waters, and Communities*. Island Press, Washington D.C.

Naiman, R.J., J.S. Bechtold, T.J. Beechie, J.J. Latterell, and R. Van Pelt. 2010. A process-based view of floodplain forest patterns in coastal river valleys of the Pacific Northwest. Ecosystems 13:1-31.

NMFS (National Marine Fisheries Service). 2000. Guidelines for electrofishing waters containing salmonids listed under the Endangered Species Act. NMFS Northwest Region, June 2000,

NMFS. 2005. Assessment of NOAA Fisheries' critical habitat analytical review teams for 12 evolutionarily significant units of West Coast salmon and steelhead. NMFS, Protected Resources Division, Portland, Oregon.

NMFS. 2006. Final supplement to the Shared Strategy's Puget Sound salmon recovery plan. National Marine Fisheries Service, Northwest Region. Seattle NMFS 2007

NMFS. 2019. ESA Recovery Plan for the Puget Sound Steelhead Distinct Population Segment (Oncorhynchus mykiss). National Marine Fisheries Service. Seattle, WA. NWFSC (Northwest Fisheries Science Center). 2015. Status review update for Pacific salmon and steelhead listed under the Endangered Species Act: Pacific Northwest.

Olla, B.L., M.W. Davis, and C.B. Schreck. 1995. Stress-induced impairment of predator evasion and nonpredator mortality in pacific salmon. Aquaculture Research 26: 393-398.

PFMC (Pacific Fishery Management Council). 2014. Appendix A to the Pacific Coast Salmon Fishery Management Plan, as modified by Amendment 18. Identification and description of essential fish habitat, adverse impacts, and recommended conservation measures for salmon.

R2 Resource Consultants, Inc. 2008. Penny Creek Fish Passage Feasibility Study Phase 2: Assessment of Penny Creek Anadromous Salmonid Production Potential and Fish Passage Technical Considerations. Redmond, Washington.

Raymondi, R.R., J.E. Cuhaciyan, P. Glick, S.M. Capalbo, L.L. Houston, S.L. Shafer, and O. Grah. 2013. Water Resources: Implications of Changes in Temperature and Precipitation. *In* Climate Change in the Northwest: Implications for Our Landscapes, Waters, and Communities, edited by M.M. Dalton, P.W. Mote, and A.K. Snover, 41-58. Island Press, Washington, DC.

Reeder, W.S., P.R. Ruggiero, S.L. Shafer, A.K. Snover, L.L Houston, P. Glick, J.A. Newton, and S.M Capalbo. 2013. Coasts: Complex Changes Affecting the Northwest's Diverse Shorelines. *In* Climate Change in the Northwest: Implications for Our Landscapes, Waters, and Communities, edited by M.M. Dalton, P.W. Mote, and A.K. Snover, 41-58. Island Press, Washington, DC.

Scheuerell, M.D., and J.G. Williams. 2005. Forecasting climate-induced changes in the survival of Snake River spring/summer Chinook salmon (Oncorhynchus tshawytscha). Fisheries Oceanography 14:448-457.Shared Strategy for Puget Sound. 2007. Puget Sound salmon recovery plan. Volume 1, recovery plan. Shared Strategy for Puget Sound. Seattle.

Sunda, W. G., and W. J. Cai. 2012. Eutrophication induced CO2-acidification of subsurface coastal waters: interactive effects of temperature, salinity, and atmospheric p CO2. *Environmental Science & Technology*, 46(19): 10651-10659

Tague, C. L., Choate, J. S., & Grant, G. 2013. Parameterizing sub-surface drainage with geology to improve modeling streamflow responses to climate in data limited environments. *Hydrology and Earth System Sciences*, 17(1): 341-354

Tillmann, P., and D. Siemann. 2011. Climate Change Effects and Adaptation Approaches in Marine and Coastal Ecosystems of the North Pacific Landscape Conservation Cooperative Region. National Wildlife Federation.

TRT (Technical Recovery Team). 2007. Dawgz 'N the Hood: The Hood Canal Summer Chum Salmon ESU. Puget Sound Technical Recovery Team.

Tschaekofske, H., D.Lantz and B. Peck. 2004. Fish Passage Inventory and Barrier Assessment on U.S. Fish and Wildlife Service Lands: Watershed Resource Inventory Areas 1-23. U.S. Fish and Wildlife Service. Lacey, Washington.

Tynan, T. 1997. Life History Characterization of Summer Chum Salmon Populations in the Hood Canal and Eastern Strait of Juan de Fuca Regions. Report # H97-06. Washington State Department of Fish Wildlife, Olympia, WA.

USFS (U.S. Forest Service). 1994. Big Quilcene Watershed Analysis; An Ecological Report at the Watershed Level. Quilcene Ranger District, Quilcene, Washington.

USFWS. 2012. Recommended Fish Exclusion, Capture, Handling, and Electroshocking Protocols and Standards. Prepared by Nancy Brennan-Dubbs, U.S. Fish and Wildlife Service, Washington Fish and Wildlife Office, Lacey, WA. June 19, 2012. Information available at http://www.fws.gov/wafwo/pdf/FishExclusionProtocolsandStandards6222012%20DR.pdf.

WDFW (Washington Department of Fish and Wildlife) and PNPTT (Point-No-Point Treaty Tribes). 2000. Summer Chum Salmon Conservation Initiative (An Implementation Plan to Recover Summer Chum in the Hood Canal and Strait of Juan de Fuca Region). Olympia, Washington.

WDFW. 2020. SalmonScape. Website: https://apps.wdfw.wa.gov/salmonscape/. Accessed January 22, 2020.

WDOE (Washington Department of Ecology). 2004. Lower Skagit River tributaries temperature Total Maximum Daily Load study. Publication No. 04-03-001. January 2004.

Winder, M. and D. E. Schindler. 2004. Climate change uncouples trophic interactions in an aquatic ecosystem. Ecology 85: 2100–2106

Zabel, R.W., M.D. Scheuerell, M.M. McClure, and J.G. Williams. 2006. The interplay between climate variability and density dependence in the population viability of Chinook salmon. Conservation Biology 20(1):190-200

Zajac, Dave. 2002. An Assessment of Anadromous Fish Habitat Use Above Quilcene National Fish Hatchery in the Big Quilcene River. U.S. Fish and Wildlife Service, Western Washington Office, Lacey, Washington.