

# DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

## Draft Supplemental Environmental Impact Statement for 10 Salmon and Steelhead Hatchery Programs in the Duwamish-Green River Basin



Prepared by the  
National Marine Fisheries Service, West Coast Region



In Cooperation with the  
Bureau of Indian Affairs, Northwest Regional Office

November 2018

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

November 26, 2018

Dear Recipient:

In accordance with provisions of the National Environmental Policy Act (NEPA), we announce the availability for review of the *Draft Supplemental Environmental Impact Statement for 10 Salmon and Steelhead Hatchery Programs in the Duwamish-Green River Basin*.

This draft supplemental environmental impact statement (DSEIS) supplements the draft environmental impact statement (DEIS) that analyzes the environmental impacts associated with the National Marine Fisheries Service's (NMFS) review and approval of 10 hatchery and genetic management plans (HGMPs) for hatchery programs in the Duwamish-Green River Basin in Puget Sound. The HGMPs were submitted jointly by the fishery co-managers for approval as resource management plans under Limit 6 of the Endangered Species Act 4(d) rules for listed salmon and steelhead.

The DSEIS analyzes the effects of an increased production alternative that was not analyzed in the DEIS.

The document is accessible electronically through the National Marine Fisheries Service (NMFS) West Coast Region's website at:

[https://www.westcoast.fisheries.noaa.gov/hatcheries/salmon\\_and\\_steelhead\\_hatcheries.html](https://www.westcoast.fisheries.noaa.gov/hatcheries/salmon_and_steelhead_hatcheries.html). Hard copies or CD copies of the document may be obtained from the comment coordinator, Allyson Purcell, at the contact information provided below.

Written comments may be submitted to NMFS via electronic mail, physical mail, or fax to the comment coordinator during the 45-day public-comment period (the closing date for the public comment period is noted at the above website). When submitting fax or email comments, include the following document identifier in the comment subject line: **Green Hatcheries EIS**.

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Thank you in advance for your input and assistance in finalizing the *Draft Supplemental Environmental Impact Statement for 10 Salmon and Steelhead Hatchery Programs in the Duwamish-Green River Basin*.

Sincerely,

Barry A. Thom  
Regional Administrator



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## Cover Sheet

**Title of Environmental Review:** Draft Supplemental Environmental Impact Statement for 10 Salmon and Steelhead Hatchery Programs in the Duwamish-Green River Basin

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**Location of Proposed Activities:** The Duwamish-Green River Basin in Puget Sound, Washington State

**Proposed Action:** The National Marine Fisheries Service (NMFS) would make a determination that the 10 hatchery and genetic management plans (HGMPs) submitted as resource management plans (RMP) by the co-managers, meet the requirements under Limit 6 of the 4(d) Rule under the Endangered Species Act (ESA) for listed Puget Sound Chinook salmon and steelhead.

**Abstract:** The Washington Department of Fish and Wildlife and the Puget Sound treaty tribes jointly submitted 10 HGMPs for salmon and steelhead hatchery programs in the Duwamish-Green River Basin in Puget Sound, as an RMP. These plans describe each hatchery program in detail, including fish life stages produced and potential measures to minimize risks of negative impacts that may affect listed fish. NMFS' determination of whether the plans achieve the conservation standards of the ESA, as set forth in Limit 6 of the 4(d) Rule for listed salmon and steelhead, is the Federal action requiring National Environmental Policy Act (NEPA) compliance. The analyses within the environmental impact statement (EIS), including the supplemental EIS, inform NMFS, hatchery operators, and the public about the current and anticipated direct, indirect, and cumulative environmental effects of operating the 10 salmon and steelhead hatchery programs under the full range of alternatives.

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# Summary

## **Draft Supplemental Environmental Impact Statement for 10 Salmon and Steelhead Hatchery Programs in the Duwamish-Green River Basin**

### **Introduction**

Pursuant to the National Environmental Policy Act (NEPA), the National Marine Fisheries Service (NMFS) prepared this Draft Supplemental Environmental Impact Statement (draft SEIS) to supplement information in the Draft Environmental Impact Statement (draft EIS) for 10 Hatchery and Genetic Management Plans (HGMPs) for salmon and steelhead hatchery programs jointly submitted by the Washington Department of Fish and Wildlife (WDFW) with the Muckleshoot Indian Tribe and the Suquamish Tribe (referred to as the co-managers), for NMFS' evaluation and determination under Limit 6 of the Endangered Species Act (ESA) 4(d) Rule for threatened salmon and steelhead (NMFS 2017 [hereafter referred to as the draft EIS]). That draft EIS was released for public comment in November 2017 (82 Fed. Reg. 51237, November 3, 2017). NMFS' action of determining that implementation of the co-managers' HGMPs would not appreciably reduce the likelihood of survival and recovery of affected threatened evolutionarily significant units (ESUs) under Limit 6 of the 4(d) Rule for salmon and steelhead promulgated under the ESA, is a major Federal action subject to environmental review under NEPA.

The draft SEIS analyzes a new alternative (Alternative 5, Increased Production) and provides the public with the opportunity to comment on that alternative. The alternative is informed by the applicants' interest in increased production of juvenile fall-run Chinook salmon, and NMFS' analysis of endangered Southern Resident killer whales and the importance of Chinook salmon prey to their food base. Collectively, the draft SEIS and the draft EIS evaluate the proposed action under a full range of alternatives. Public comments and responses on the draft SEIS and responses to previous comments on the draft EIS will be provided in the final EIS.

The draft EIS includes the context (including the purpose and need and description of the action area) and much of the analysis for meeting the requirements of NEPA. The draft EIS can be found at [http://www.westcoast.fisheries.noaa.gov/hatcheries/salmon\\_and\\_steelhead\\_hatcheries.html](http://www.westcoast.fisheries.noaa.gov/hatcheries/salmon_and_steelhead_hatcheries.html). Where methodologies, the affected environment, and environmental consequences under the new alternative are the same as those discussed previously, this draft SEIS will refer to the draft EIS for further information. Where circumstances differ from the draft EIS, this draft SEIS provides further information and analysis.

### **Alternative 5 (Increased Production)**

Under this alternative, the applicants would use existing facility capacity to increase the number of fall-run Chinook salmon subyearlings produced by the Soos Creek fall-run Chinook salmon hatchery program. The number of Soos Creek fall-run Chinook salmon subyearlings produced would be 6,200,000 fish, 2,000,000 more subyearlings than under Alternative 1 and Alternative 2 as described in the draft EIS. Furthermore, the 2,000,000 subyearlings would be released from Palmer Ponds, in addition to the 1,000,000 subyearlings that would be released there under Alternative 1 and Alternative 2 as described in the draft EIS.

Maximum annual release levels under Alternative 5 (Increased Production) would be:

Fall-run Chinook salmon	7,100,000
Late winter-run steelhead	405,000 <sup>1</sup>
Summer-run steelhead	100,000
Coho salmon	3,410,000
Chum salmon	5,000,000
<b>Total</b>	<b>16,015,000<sup>1</sup></b>

### **Summary of Effects**

Table S-1 provides a summary of the predicted resource effects under Alternative 5 that reflects the more detailed resource discussions in this draft SEIS.

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<sup>1</sup> The total number of late winter-run steelhead releases in the draft EIS is 383,000. During the public comment period, a revised HGMP for the Green River late winter-run steelhead program was submitted, proposing to release an additional 33,000 yearling steelhead. This draft SEIS analyzes this higher number.

Table S-1. Summary of environmental consequences under Alternative 5 by resource.

Resource	Alternative 5 (Increased Production)
Water Quantity and Quality	<p>The hatchery programs would have a low negative effect on water quantity, primarily because water use would generally be non-consumptive and limited by water right permits, and because all surface water diverted would be returned near the points of withdrawal after it circulates through the hatchery facilities, which would be the same as under Alternative 1.</p> <p>The hatchery programs would have a negligible negative effect on water quality, primarily because hatchery operations are limited by National Pollutant Discharge Elimination System (NPDES) permits and would not be expected to contribute substantially to water quality impairments in the river basin, which would be the same as under Alternative 1.</p>
Salmon and Steelhead	<p>The hatchery programs would generally have negligible to high negative genetics, competition, predation, facility operations, masking, incidental fishing, and disease transfer effects; and negligible to moderate positive population viability and nutrient cycling effects, depending on the affected species, which would be the same as under Alternative 1.</p> <p>The genetic effect (high negative) on natural-origin fall-run Chinook salmon would be greater than under Alternative 1 (moderate negative).</p>
Other Fish Species	<p>The hatchery programs would have negligible negative or negligible positive effects on other fish species, depending on whether the hatchery-origin fish compete with or prey on the species, which would be the same as under Alternative 1.</p>
Wildlife – Southern Resident killer whale	<p>The hatchery programs would have a moderate positive effect by providing a source of prey for Southern Resident killer whales, which would be greater than under Alternative 1 (low positive).</p>
Socioeconomics	<p>The hatchery programs would have a low positive effect on socioeconomics because personal income and jobs from tribal commercial and non-tribal recreational fisheries, income associated with hatchery operations, and contributions to the local and regional economies, would accrue, but primarily in King County in the South Puget Sound subregion. In addition, the economic activity and fisheries effects from the hatchery programs would have a relatively small impact on the overall economy of King County and in the broader Puget Sound region. In some of the more remote areas of the river basin and the South Puget Sound subregion more economically dependent on income derived the hatchery programs, effects would likely be greater.</p>
Environmental Justice	<p>The hatchery programs would have a moderate positive effect on environmental justice effects, primarily because of the economic impact on communities of concern (King County and the South Puget Sound subregion) and benefits to Native American tribes of concern from fishing for ceremonial and subsistence and commercial purposes, which would be the same as under Alternative 1.</p>
Human Health	<p>The hatchery programs would have a negligible negative effect on human health, primarily because the hatchery programs would comply with worker safety programs, rules, and regulations; the use of therapeutics would be minimal and in compliance with label requirements; and personal protective equipment would be used that limits the spread of pathogens, which would be the same as under Alternative 1.</p>

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## **1 PURPOSE OF AND NEED FOR THE PROPOSED ACTION**

The draft EIS includes a description of the purpose of and need for the proposed action, the proposed action, and NMFS' authorities under the ESA and NEPA in Chapter 1. The new alternative analyzed in this draft SEIS does not affect the purpose and need for the action, or the hatchery facilities and activities that are described in the draft EIS.

## **2 ALTERNATIVES INCLUDING THE PROPOSED ACTION**

The draft EIS includes a description of the alternatives analyzed in detail and alternatives considered but not analyzed in detail. The alternatives analyzed in the draft EIS are: Alternative 1 (No Action), Alternative 2 (Proposed Action), Alternative 3 (Termination), and Alternative 4 (Reduced Production).

### **2.1 Alternative 5 (Increased Production)**

Under this alternative, the applicants would increase the number of salmon released from the Soos Creek fall-run Chinook salmon hatchery program, a revised HGMP would be submitted for the program, and NMFS would make a determination that the 10 HGMPs meet the requirements of the 4(d) Rule.

Under this alternative, using existing facility capacity, the number of Soos Creek fall-run Chinook salmon subyearlings produced would be 6,200,000 fish, 2,000,000 more subyearlings than under Alternative 1 and Alternative 2 as described in the draft EIS. Furthermore, those 2,000,000 subyearlings would be released from Palmer Ponds, in addition to the 1,000,000 subyearlings that would be released there under Alternative 1 and Alternative 2 as described in the draft EIS. All aspects of the other salmon and steelhead hatchery programs would be as described in the draft EIS.

Under Alternative 5, the total annual maximum release level would be 16,015,000 hatchery-origin salmon and steelhead as shown in Table 1.

Table 1. Maximum annual hatchery releases of juvenile salmon and steelhead under existing conditions and the alternatives by species.

Species	Existing Conditions	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3 (Termination)	Alternative 4 (Reduced Production)	Alternative 5 (Increased Production)
Fall-run Chinook salmon	4,500,000	5,100,000	5,100,000	0	2,550,000	7,100,000
Late winter-run steelhead	55,000	405,000	405,000 <sup>1</sup>	0	202,500	405,000
Summer-run steelhead	100,000	100,000	100,000	0	50,000	100,000
Coho salmon	2,810,000	3,410,000	3,410,000	0	1,705,000	3,410,000
Chum salmon	5,000,000	5,000,000	5,000,000	0	2,500,000	5,000,000
<b>Total</b>	<b>12,465,000</b>	<b>14,015,000</b>	<b>14,015,000</b>	<b>0</b>	<b>7,007,500</b>	<b>16,015,000</b>

<sup>1</sup> The total number of late winter-run steelhead releases in the draft EIS is 383,000. During the public comment period, a revised HGMP for the Green River late winter-run steelhead program was submitted, proposing to release an additional 33,000 yearling steelhead. This draft SEIS analyzes this higher number.

### 3 AFFECTED ENVIRONMENT

The draft EIS includes a description of existing conditions and the analysis areas for the resources that may be affected by the alternatives. These resources are Water Quantity and Quality, Salmon and Steelhead, Other Fish Species, Wildlife (Southern Resident Killer Whale), Socioeconomics, Environmental Justice, and Human Health. The descriptions in the draft EIS for all of these resources are adequate to evaluate potential impacts associated with Alternative 5 (Increased Production) described in this draft SEIS.

### 4 ENVIRONMENTAL CONSEQUENCES

The environmental consequences of Alternative 5 (Increased Production) described below are in addition to the impacts of the alternatives as described in the draft EIS.

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## 4.1 Water Quantity and Quality

### *Water Quantity*

Under Alternative 5, the salmon and steelhead hatchery programs would have a low negative effect on water quantity, which would be the same as under all of the other alternatives, because water use would be non-consumptive, all water diverted (except that lost to evaporation) would be returned near the points of withdrawal after it circulates through the hatchery facilities, and all water use would be limited by water right permits. Surface water quantity would only be affected between the water intake and discharge structures (the bypass reach). No stream reaches would be dewatered to the extent that migration and rearing of listed natural-origin fish would be impaired, and there would be no net loss of river or tributary flow volume.

### *Water Quality*

Under Alternative 5, the salmon and steelhead hatchery programs overall would have a negligible negative effect on water quality in the Duwamish-Green River Basin, primarily because hatchery operations would limit their pollutant discharges in accordance with their National Pollutant Discharge Elimination System (NPDES) permits and would not be expected to contribute substantially to water quality impairments in the basin, which would be the same as under Alternative 1, Alternative 2, and Alternative 4. In comparison to Alternative 3 (negligible positive), water quality effects under Alternative 5 would be increased because the hatchery programs would be terminated under Alternative 3, thereby eliminating the potential for water quality effects.

## 4.2 Salmon and Steelhead

### 4.2.2 Genetics

#### *Fall-run Chinook Salmon*

Under Alternative 5, the two fall-run Chinook salmon hatchery programs would operate as under Alternative 1 and Alternative 2, except that an additional 2,000,000 subyearlings would be released at Palmer Ponds from the Soos Creek fall-run Chinook salmon hatchery program. Overall, the anticipated proportionate natural influence (PNI) value (0.16) would be lower than under Alternative 1 and Alternative 2, because more hatchery-origin broodstock would need to be used, at least until the number of available natural-origin fish increases. In addition, returns of larger numbers of hatchery-origin spawners would increase the proportion of naturally spawning hatchery-origin spawners (pHOS) to about 90 percent compared to Alternative 1 and Alternative 2. Therefore, the substantial number of fall-run

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Chinook salmon that would be released under Alternative 5 (7,100,000 fall-run Chinook salmon juveniles) under this alternative would increase genetic effects (e.g., hatchery-influenced selection) on natural-origin fall-run Chinook salmon in the Duwamish-Green River Basin, which would have a high negative genetic effect, and would be greater than the moderate negative genetic effect under Alternative 1 and Alternative 2. In comparison to Alternative 3 (moderate positive), negative genetic effects on natural-origin fall-run Chinook salmon under Alternative 5 would be increased because the hatchery programs would be terminated under Alternative 3, thereby eliminating the potential for genetic effects.

#### *Steelhead, Coho Salmon, and Chum Salmon*

There would be no additional steelhead, coho salmon, or chum salmon produced under Alternative 5; therefore, under Alternative 5 the genetic impacts to these species would be the same as under Alternative 1 and Alternative 2.

#### **4.2.3 Competition and Predation**

##### *Fall-run Chinook Salmon*

Under Alternative 5, the risk of competition impacts on natural-origin fall-run Chinook salmon in the Duwamish-Green River Basin would be increased because of the substantial number of additional hatchery-origin fall-run Chinook salmon subyearlings that would be released at similar times and would occupy similar freshwater areas as similarly sized natural-origin fall-run Chinook salmon during outmigration. The competition effect under Alternative 5 would be high negative (the highest effect level), which would be the same as under Alternative 1 and Alternative 2. Under Alternative 5, the high negative competition effects on fall-run Chinook salmon would be increased compared to Alternative 3 (moderate positive), under which the hatchery programs would be terminated and would present no competition effects.

Under Alternative 5, the risk of predation impacts on natural-origin fall-run Chinook salmon in the Duwamish-Green River Basin would be the same as under Alternative 1 and Alternative 2 (moderate negative<sup>2</sup>), because releases of relatively large-sized yearling fall-run Chinook salmon would be the same. Although under Alternative 5 considerably more fall-run Chinook salmon subyearlings would be released than under Alternative 1 and Alternative 2, the size of the fish would be relatively small and therefore

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<sup>2</sup> The predation effect ratings for fall-run Chinook salmon in the draft EIS were high negative under Alternative 1 and Alternative 2. However, to better reflect available information on the effects of predation on natural-origin fall-run Chinook salmon juveniles the ratings are changed to moderate negative under Alternative 1 and Alternative 2.

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they would not be expected to prey on natural-origin fall-run Chinook salmon during outmigration. Under Alternative 5, the moderate negative predation effects on natural-origin fall-run Chinook salmon would be increased compared to Alternative 3 (moderate positive), under which the hatchery programs would be terminated and would present no predation effects.

#### *Steelhead and Coho Salmon*

Under Alternative 5, the risk of competition impacts on natural-origin steelhead and coho salmon in the Duwamish-Green River Basin would be the same as under Alternative 1 and Alternative 2 (high negative), because releases of similarly large-sized yearling fall-run Chinook salmon would be the same. Although under Alternative 5 considerably more fall-run Chinook salmon subyearlings would be released than under Alternative 1 and Alternative 2, the size of the fish would be relatively small and therefore they would not be expected to prey on natural-origin steelhead and coho salmon during outmigration. Under Alternative 5, the high negative competition effects on steelhead and coho salmon would be increased compared to Alternative 3 (high positive), under which the hatchery programs would be terminated and would present no competition effects.

Under Alternative 5, the risk of predation impacts on natural-origin steelhead and coho salmon in the Duwamish-Green River Basin would be the same as under Alternative 1 and Alternative 2 (negligible negative), because although substantial in number, the additional hatchery-origin fall-run Chinook salmon subyearlings would be too small in size to prey on natural-origin steelhead and coho salmon during outmigration. Under Alternative 5, the high negative predation effects on steelhead and coho salmon would be increased compared to Alternative 3 (high positive), under which the hatchery programs would be terminated and would present no predation effects.

#### *Chum Salmon and Pink Salmon*

Under Alternative 5, the risk of competition impacts on natural-origin chum salmon and pink salmon in the Duwamish-Green River Basin would be the same as under Alternative 1 and Alternative 2 (negligible negative for chum salmon and low negative for pink salmon), because hatchery-origin fall-run Chinook salmon would be unlikely to compete substantially for food and space with natural-origin chum salmon and pink salmon in fresh water or marine water (NMFS 2017). Natural-origin chum salmon and pink salmon fry hatch and then out-migrate promptly to marine waters, spending relatively little time in fresh water. Under Alternative 5, the negative competition effects on natural-origin chum salmon and pink salmon (negligible negative for chum salmon and low negative for pink salmon) would be increased compared to Alternative 3 (negligible positive for chum salmon and low positive for pink salmon), under which the hatchery programs would be terminated and would present no competition effects.

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Under Alternative 5, the risk of predation impacts on natural-origin chum salmon and pink salmon in the Duwamish-Green River Basin would be the same as under Alternative 1 and Alternative 2 (moderate negative), because although substantial in number, the additional hatchery-origin fall-run Chinook salmon subyearlings would be too small in size to prey on natural-origin chum salmon and pink salmon in fresh water or marine water. Under Alternative 5, the moderate negative predation effects on natural-origin chum salmon and pink salmon would be increased compared to Alternative 3 (moderate positive), under which the hatchery programs would be terminated and would present no predation effects.

#### **4.2.4 Facility Operations**

Under Alternative 5, the salmon and steelhead hatchery programs overall would have a low negative facility operations effect on natural-origin salmon and steelhead in the Duwamish-Green River Basin, which would be the same as under Alternative 1, Alternative 2, and Alternative 4, primarily because the abundance and distribution of fish would be affected by two of the facilities that would not comply with current water intake screening criteria (Soos Creek Hatchery and Keta Creek Complex) and one facility that would not meet current fish passage criteria (Soos Creek Hatchery). The operators of these facilities intend to meet these guidelines given future funding. In comparison to Alternative 3 (low positive), negative facility operations effects under Alternative 5 would be increased because the hatchery programs would be terminated under Alternative 3, thereby eliminating the potential for facility operations effects.

#### **4.2.5 Masking**

Under Alternative 5, the salmon and steelhead hatchery programs overall would have a negligible negative masking effect on natural-origin salmon and steelhead in the Duwamish-Green River Basin, which would be the same as under Alternative 1, Alternative 2, and Alternative 4, primarily because a large percentage of the releases from the hatchery programs would be mass-marked to allow for hatchery-origin fish to be accounted for in abundance estimates of natural-origin fish. In comparison to Alternative 3 (negligible positive), negative masking effects under Alternative 5 would be increased because the hatchery programs would be terminated under Alternative 3, thereby eliminating the potential for masking effects.

#### **4.2.6 Incidental Fishing**

Under Alternative 5, the salmon and steelhead hatchery programs overall would have a negligible negative incidental fishing effect on natural-origin salmon and steelhead in the Duwamish-Green River Basin, which would be the same as under Alternative 1, Alternative 2, and Alternative 4, primarily because relatively few natural-origin fish would be caught incidentally in fisheries, and NMFS would

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ensure that the impacts of planned harvest would not appreciably reduce the likelihood of survival and recovery of listed salmon and steelhead in Puget Sound. In comparison to Alternative 3 (negligible positive), negative incidental fishing effects under Alternative 5 would be increased because the hatchery programs would be terminated under Alternative 3, thereby eliminating the potential for incidental fishing effects.

#### **4.2.7 Disease**

Under Alternative 5, the salmon and steelhead hatchery programs overall would have a negligible negative effect on the transfer of diseases to natural-origin salmon and steelhead in the Duwamish-Green River Basin, which would be the same as under Alternative 1, Alternative 2, and Alternative 4, primarily because all of the programs would be operated in compliance with all fish health protection guidelines and monitoring. In comparison to Alternative 3 (negligible positive), negative disease effects under Alternative 5 would be increased because the hatchery programs would be terminated under Alternative 3, thereby eliminating the potential for disease transfer effects.

#### **4.2.8 Population Viability Benefits**

##### *Fall-run Chinook Salmon*

Adults returning from the Soos Creek and Fish Restoration Program integrated fall-run Chinook salmon hatchery programs have the potential to benefit the viability of the listed Green River Chinook salmon population in terms of abundance, diversity, and spatial structure. Hatchery-origin adults returning from the programs would be expected to bolster the total abundance of fish spawning naturally in the river basin but would be well below the minimum viable abundance target of 17,000 fish described in the draft EIS. Spatial structure would be benefited, especially if the returning adults spawn in habitat above Howard Hanson Dam that has not been used by fall-run Chinook salmon since the dam was constructed. The potential contribution of the integrated hatchery programs to the productivity of natural-origin fall-run Chinook salmon is unknown.

Under Alternative 5, the two integrated fall-run Chinook salmon hatchery programs would operate as under Alternative 1 and Alternative 2, except that an additional 2,000,000 subyearlings would be released at Palmer Ponds from the Soos Creek fall-run Chinook salmon hatchery program. Under Alternative 5, although the increased production associated with the additional fall-run Chinook salmon program would increase some population viability benefits, the hatchery programs overall would have a moderate positive population viability benefit to natural-origin fall-run Chinook salmon in the Duwamish-Green River Basin, which would be the same as under Alternative 1 and Alternative 2. This is primarily because

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although the programs would help increase overall abundance and have a similar level of genetic diversity as the natural-origin fall-run Chinook salmon population, the extent to which other aspects of viability (spatial structure, productivity) would be benefited is uncertain. Natural spawning by hatchery-origin fall-run Chinook salmon would bolster use of available habitat and potentially contribute to spatial structure, especially above Howard Hanson Dam. In comparison to Alternative 3 (moderate negative), population viability benefits under Alternative 5 would be increased because the hatchery programs would be terminated under Alternative 3, thereby eliminating the potential for population viability benefits to natural-origin fall-run Chinook salmon.

#### *Steelhead, Coho Salmon, and Chum Salmon*

There would be no additional steelhead, coho salmon, or chum salmon produced under Alternative 5; therefore, under Alternative 5 the population viability benefits to these species would be the same as under Alternative 1 and Alternative 2.

#### **4.2.9 Nutrient Cycling**

Under Alternative 5, the salmon and steelhead hatchery programs overall would have a low positive nutrient cycling effect, which would be the same as under Alternative 1, Alternative 2, and Alternative 4, primarily because the annual escapement of hatchery-origin coho salmon, steelhead, and fall-run Chinook salmon spawners and distribution of carcasses from hatchery operations in the Duwamish-Green River Basin would contribute over 28 percent of the total number of carcasses and associated marine-derived nutrients to the river basin. The additional fall-run Chinook salmon that would be produced under Alternative 5 may lead to increased numbers of natural spawners and carcasses from hatchery operations, which would contribute to the low positive effect. Relative to Alternative 3 (low negative), nutrient cycling benefits under Alternative 5 would be increased because the hatchery programs would be terminated under Alternative 3, thereby eliminating the potential for nutrient cycling benefits.

#### **4.3 Other Fish Species**

Under Alternative 5, the salmon and steelhead hatchery programs overall would have a negligible negative or positive effect on other fish species (e.g., negative if the hatchery-origin fish compete with or prey on other fish species and positive for other fish species that consume hatchery-origin salmon and steelhead). This would be the same as under the other alternatives, primarily because (1) the analysis area is only a small portion of each species' range, and (2) hatchery-origin salmon and steelhead are not exclusive predators or prey for any of the other fish species (including bull trout). Under Alternative 5,

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the hatchery programs would have a greater positive effect on bull trout compared to Alternative 1 and Alternative 2, because there would be more hatchery-origin fall-run Chinook salmon for bull trout to eat.

#### **4.4 Wildlife – Southern Resident Killer Whale**

Under Alternative 5, the salmon and steelhead hatchery programs would operate as under Alternative 1 and Alternative 2, except that an additional 2,000,000 subyearlings would be released at Palmer Ponds from the Soos Creek fall-run Chinook salmon hatchery program. These subyearlings would be expected to produce an average of 8,750 hatchery-origin adults that would be available for harvest, hatchery broodstock, and as prey for Southern Resident killer whales, compared to an estimated 4,375 adults that would be available from the release of 1,000,000 subyearlings at Palmer Ponds under Alternative 1, Alternative 2, and existing conditions.

Under Alternative 5, the salmon and steelhead hatchery programs would have a moderate positive effect on the diet, survival, distribution, and listing status of Southern Resident killer whales, which would be greater than under Alternative 1 and Alternative 2 (low positive<sup>3</sup>). This is because the adults returning from the hatchery programs (especially Chinook salmon) would represent a small but meaningful part of the Southern Resident killer whale food base provided by the total number of hatchery-origin and natural-origin salmon and steelhead available from throughout the greater Puget Sound, the Strait of Georgia, and Pacific Coast area, particularly in south Puget Sound during the fall months. As described in the draft EIS, the estimated total annual abundance of adult Chinook salmon from Washington State and British Columbia waters that would be available as food for Southern Resident killer whales would average about 1,000,000 fish. In comparison to Alternative 3 (low negative<sup>4</sup>), positive effects on Southern Resident killer whales under Alternative 5 would be decreased because the hatchery programs would be terminated under Alternative 3, thereby eliminating their potential for beneficial effects on Southern Resident killer whales.

#### **4.5 Socioeconomics**

Under Alternative 5, the salmon and steelhead hatchery programs would operate as under Alternative 1 and Alternative 2, except that an additional 2,000,000 subyearlings would be released at Palmer Ponds from the Soos Creek fall-run Chinook salmon hatchery program. The release scenarios for fish produced by the Fish Restoration Facility (FRF) hatchery programs would not change or be affected under

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<sup>3</sup> The effect ratings on Southern Resident killer whales in the draft EIS were negligible positive under Alternative 1 and Alternative 2, and negligible negative under Alternative 3. However, to better reflect available information on the effects of the alternatives on Southern Resident killer whales, the ratings under Alternative 1 and Alternative 2 are changed to low positive, and to low negative under Alternative 3.

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Alternative 5. Appendix A of this draft SEIS contains quantitative information on the socioeconomic effects of Alternative 5 that are described in this subsection.

#### **4.5.1 Fisheries Affected by the Hatchery Programs**

##### *Commercial Fisheries*

Under Alternative 5, the contributions from the hatchery programs to the number of fish harvested in salmon and steelhead commercial fisheries and their ex-vessel values would increase compared to existing conditions and all of the other alternatives, because more fall-run Chinook salmon would be produced and harvested. Under Alternative 5, there would be 2,308 more Chinook salmon harvested and ex-vessel values would increase \$60,820 compared to Alternative 1 and Alternative 2. More than 92 percent of the increases in commercial harvest and the ex-vessel value under Alternative 5 would occur in the South Puget Sound subregion and would mostly affect tribal fisheries (Appendix A), which is similar to Alternative 1 and Alternative 2. Compared to Alternative 3, under which the hatchery programs would be terminated, commercial fisheries harvest would increase by 145,793 fish if there is fish passage at the dam, and by 158,422 fish without fish passage. Similarly, compared to Alternative 3, ex-vessel value would increase \$976,478 if there is fish passage, and \$1,066,243 without fish passage.

##### *Recreational Fisheries*

Under Alternative 5, the contributions from the hatchery programs to recreational fishing (recreational fishing trips and related expenditures) would increase compared to existing conditions and all of the other alternatives, because more fall-run Chinook salmon would be produced and available for harvest. Under Alternative 5, there would be 3,280 more fishing trips and \$576,869 more in trip-related expenditures compared to Alternative 1 and Alternative 2. Of the increases in recreational fishing trips, 54 percent of the trips would occur in the South Puget Sound subregion, 29 percent in the North Puget Sound subregion, and 17 percent in the Strait of Juan de Fuca subregion, regardless of release scenario (Appendix A), which is similar to Alternative 1 and Alternative 2. Under Alternative 5, the effects on subregions of trip-related expenditures from recreational fishing would be proportionately similar to those described above for recreational fishing trips. Compared to Alternative 3, under which the hatchery programs would be terminated, recreational fishing trips would increase by 60,009 trips if there is fish passage at the dam, and by 68,583 trips without fish passage. Similarly, compared to Alternative 3, trip-related expenditures would increase \$10,550,854 if there is fish passage, and \$12,058,344 without fish passage.

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#### **4.5.2 Hatchery Operations**

Under Alternative 5, direct jobs and personal income associated with the hatchery programs would be the same as under the other alternatives, which would entail 15.1 direct jobs and \$657,310 in personal income.

Under Alternative 5, hatchery operating expenditures would increase by \$97,500 compared to the other alternatives and would generate slightly greater indirect and induced effects. Under Alternative 5, the indirect and induced effects would additionally contribute 0.7 full-time equivalent (FTE) and \$43,117 in personal income compared to the other alternatives. The total effect under Alternative 5 (direct, indirect, and induced) would be 22.9 FTEs and \$1,105,728 in personal income from hatchery operations (Appendix A).

#### **4.5.3 Regional and Local Economies**

Under Alternative 5, the direct and indirect contributions of the hatchery programs to regional and local economies from commercial (harvest and ex-vessel value) and recreational fishing (personal income and jobs) would be greater than under existing conditions and the other alternatives, because more fall-run Chinook salmon would be produced and available for harvest.

Puget Sound-wide, under Alternative 5, 2,308 more Chinook salmon would be commercially harvested with an ex-vessel value of \$60,280, and personal income and jobs associated with commercial fisheries would increase about by \$100,800 and by 1 job compared to Alternative 1 and Alternative 2. In addition, there would be an additional 3,280 recreational fishing trips and \$576,800 in trip-related expenditures Puget Sound-wide, and personal income and jobs associated with recreational fisheries would increase about by \$611,500 and by 11 jobs compared to Alternative 1 and Alternative 2. None of these increases would be substantial in the context of regional values described in Subsection 3.5.3, Regional and Local Economies in the draft EIS (i.e., commercial harvest of 4,414,951 fish, ex-vessel value of \$21,010,062, \$31,933,084 in personal income, and 599 jobs associated with commercial fisheries; and 1,502,267 recreational trips, \$265,830,434 in trip-related expenditures, \$215,075,942 in personal income, and 3,536 jobs associated with recreational fishing).

Overall, under Alternative 5, the salmon and steelhead hatchery programs would have a low positive socioeconomic effect, which would be the same as under Alternative 1 and Alternative 2. Although the socioeconomic values would increase relative to the other alternatives, particularly in King County and the South Puget Sound subregion, the increases would be insufficient to increase the effect level for the socioeconomic analysis area. As under Alternative 1 and Alternative 2, the economic activity from the hatchery programs and associated effects on fisheries under Alternative 5 would have a relatively small

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impact on the overall economy of King County, the South Puget Sound subregion, and the broader Puget Sound region. However, in some of the more remote areas and communities of the Duwamish-Green River Basin in the South Puget Sound subregion, the effect would be greater because some local economies are more economically dependent on the direct and indirect economic effects of the hatchery programs.

#### **4.6 Environmental Justice**

Under Alternative 5, the salmon and steelhead hatchery programs would operate as under Alternative 1 and Alternative 2, except that an additional 2,000,000 subyearlings would be released at Palmer Ponds from the Soos Creek fall-run Chinook salmon hatchery program. The release scenarios for fish produced by the FRF hatchery programs would not change or be affected under Alternative 5.

##### *Communities of Concern*

Under Alternative 5, the contributions from the hatchery programs to communities of concern to commercial harvest, recreational fishing trips and related expenditures, and jobs and personal income would increase compared to Alternative 1, Alternative 2, and Alternative 4, and most of those increases would occur in King County and the South Puget Sound subregion.

##### *Non-tribal User Groups of Concern*

Under Alternative 5, contributions from the hatchery programs to landings by non-tribal commercial fishermen at three ports in the North Puget Sound and South Puget Sound subregions (representing non-tribal user groups of concern) would increase catch and ex-vessel values compared to Alternative 1, Alternative 2, and Alternative 4; most of those increases would occur in King County.

##### *Native American Tribes of Concern*

Under Alternative 5, contributions from the hatchery programs to tribal ceremonial and subsistence uses and tribal commercial fisheries in terms of the number of fish and ex-vessel values would increase compared to Alternative 1, Alternative 2, and Alternative 4. Income and jobs from tribal hatchery operations would not be affected under Alternative 5.

Overall, under Alternative 5, the salmon and steelhead hatchery programs would have a moderate positive environmental justice effect, which would be the same as under Alternative 1 and Alternative 2. Although the number of adult fish available to communities of concern, non-tribal user groups of concern, and Native American tribes of concern would increase relative to the other alternatives, the increase would be

insufficient to increase the effect level for the analysis area. However, the greatest increases in effects would be the substantial economic values from commercial and recreational fishing to communities of concern (especially King County and the South Puget Sound subregion), and substantial benefits to Native American tribes of concern (especially the Muckleshoot Indian Tribe and Suquamish Tribe) from fishing for ceremonial and subsistence and commercial purposes. In comparison to Alternative 3 (moderate negative), environmental justice effects under Alternative 5 would be increased because the hatchery programs would be terminated under Alternative 3.

#### 4.7 Human Health

Under Alternative 5, the salmon and steelhead hatchery programs overall would have a negligible negative effect on human health in the Duwamish-Green River Basin, which would be the same as under Alternative 1, Alternative 2, and Alternative 4, primarily because hatchery operations would comply with worker safety programs, rules, and regulations; the use of therapeutics would be minimal and in compliance with label requirements; and personal protective equipment would be used that limits the spread of pathogens. In comparison to Alternative 3 (negligible positive), negative human health effects under Alternative 5 would be increased because the hatchery programs would be terminated under Alternative 3, thereby eliminating the potential for human health effects.

#### 4.8 Summary of Resource Effects

Table 2 summarizes predicted effects under Alternative 5 from the resource discussions in Subsection 4.1, Water Quantity and Quality, through Subsection 4.7, Human Health.

Table 2. Summary of environmental consequences under Alternative 5 by resource.

Resource	Alternative 5 (Increased Production)
Water Quantity and Quality	The hatchery programs would have a low negative effect on water quantity, primarily because water use would generally be non-consumptive and limited by water right permits, and because all surface water diverted would be returned near the points of withdrawal after it circulates through the hatchery facilities, which would be the same as under Alternative 1.
	The hatchery programs would have a negligible negative effect on water quality primarily because hatchery operations are limited by NPDES permits and would not be expected to contribute substantially to water quality impairments in the river basin, which would be the same as under Alternative 1.

Table 2. Summary of environmental consequences under Alternative 5 by resource (continued).

<b>Resource</b>	<b>Alternative 5 (Increased Production)</b>
Salmon and Steelhead	<p>The hatchery programs would generally have negligible to high negative genetics, competition, predation, facility operations, masking, incidental fishing, and disease transfer effects; and negligible to moderate positive population viability and nutrient cycling effects, depending on the affected species, which would be the same as under Alternative 1.</p> <p>The genetic effect (high negative) on natural-origin fall-run Chinook salmon would be greater than under Alternative 1 (moderate negative).</p>
Other Fish Species	<p>The hatchery programs would have negligible negative or negligible positive effects on other fish species, depending on whether the hatchery-origin fish compete with or prey on the species, which would be the same as under Alternative 1.</p>
Wildlife – Southern Resident killer whale	<p>The hatchery programs would have a moderate positive effect by providing a source of prey for Southern Resident killer whales, which would be greater than under Alternative 1 (low positive).</p>
Socioeconomics	<p>The hatchery programs would have a low positive effect on socioeconomics because personal income and jobs from tribal commercial and non-tribal recreational fisheries, income associated with hatchery operations, and contributions to the local and regional economies, would accrue, but primarily in King County in the South Puget Sound subregion, but would be unsubstantial compared to Alternative 1. In addition, the economic activity and fisheries effects from the hatchery programs would have a relatively small impact on the overall economy of King County and in the broader Puget Sound region. In some of the more remote areas of the river basin and the South Puget Sound subregion more economically dependent on income derived the hatchery programs, effects would likely be greater.</p>
Environmental Justice	<p>The hatchery programs would have a moderate positive effect on environmental justice effects, primarily because of the economic impact on communities of concern (King County and the South Puget Sound subregion) and benefits to Native American tribes of concern from fishing for ceremonial and subsistence and commercial purposes, which would be the same as under Alternative 1.</p>
Human Health	<p>The hatchery programs would have a negligible negative effect on human health, primarily because the hatchery programs would comply with worker safety programs, rules, and regulations; the use of therapeutics would be minimal and in compliance with label requirements; and personal protective equipment would be used that limits the spread of pathogens, which would be the same as under Alternative 1.</p>

## 5 CUMULATIVE EFFECTS

The draft EIS discusses past, present, and reasonably foreseeable future actions and the incremental effects of the alternatives on the resources analyzed. The descriptions in the draft EIS for all of these resources in the context of climate change, development, habitat restoration, hatchery production, and

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fisheries in the cumulative effects analysis area are adequate to evaluate the incremental effects of Alternative 5 (Increased Production) as described in this draft SEIS. Below is an analysis of the cumulative effects under Alternative 5 for each resource analyzed in the draft EIS.

### **5.1 Water Quantity and Quality**

Under Alternative 5, as under the other alternatives, it is likely that cumulative effects from climate change, development, habitat restoration, and hatchery production would impact water quantity (increased demand on limited water supplies) and water quality (particularly changes in water temperature) in the cumulative effects analysis area. Alternative 5 would not affect the overall trend in cumulative effects on water quantity and quality.

### **5.2 Salmon and Steelhead**

Under Alternative 5, as under the other alternatives, it is likely that cumulative effects from climate change and development would continue to degrade aquatic habitat over time, and abundance and productivity of natural-origin salmon and steelhead populations may be reduced. Hatchery-origin salmon and steelhead may be similarly affected. Habitat restoration and associated (mostly localized) benefits to salmon and steelhead would be expected to continue, but not fully mitigate for all habitat degradation. Effects on abundance and productivity of natural-origin salmon and steelhead from changes in hatchery production and fisheries would be expected to continue. Alternative 5 would not affect the overall trend in cumulative effects on salmon and steelhead, although it may increase the adverse cumulative effect on the genetics of natural-origin fall-run Chinook salmon. However, this cumulative impact would not substantially add to the cumulative impacts compared to the other alternatives because the increase in production would represent a small component of the total abundance of fall-run Chinook salmon in the cumulative effects analysis area.

### **5.3 Other Fish Species**

Under Alternative 5, as under the other alternatives, it is likely that cumulative effects from climate change, development, habitat restoration, hatchery production, and fisheries would impact other fish species, including bull trout, in the cumulative effects analysis area. Under Alternative 5, cumulative effects on other fish species that compete with, prey on, or are prey items for salmon and steelhead may be greater. However, Alternative 5 would not affect the overall trend in cumulative effects on other fish species, because the production would be a small component of the total abundance of salmon and steelhead in the cumulative effects analysis area.

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#### **5.4 Wildlife – Southern Resident Killer Whale**

Under Alternative 5, as under the other alternatives, climate change and development in the cumulative effects analysis area may reduce the abundance and productivity of natural-origin salmon and steelhead populations. Hatchery-origin salmon and steelhead may be similarly affected. Consequently, the total number of salmon and steelhead available as prey to wildlife may decrease. The potential benefits of habitat restoration actions within the cumulative effects analysis area are difficult to quantify. These actions may not fully, or even partially, mitigate for the effects of climate change and development on salmon and steelhead abundances. Changes in hatchery programs and fisheries may occur over time and may affect wildlife species that have a relationship to salmon and steelhead, including Southern Resident killer whales. It is likely that cumulative effects from climate change, development, habitat restoration, hatchery production, and fisheries would impact Southern Resident killer whales in the cumulative effects analysis area. Alternative 5 would not affect the overall trend in cumulative effects on Southern Resident killer whales, although it may benefit the whales by increasing the number of fall-run Chinook salmon available for the whales to eat. However, although important, the increase would comprise a small component of the overall salmon prey base for Southern Resident killer whales in the analysis area, and the cumulative impact would not substantially add to the cumulative impacts compared to the other alternatives.

#### **5.5 Socioeconomics**

Under Alternative 5, as under the other alternatives, it is likely that cumulative effects from climate change, development, habitat restoration, hatchery production, and fisheries would decrease the number of fish available for harvest and reduce expenditures and economic values in the cumulative effects analysis area. Under Alternative 5, the overall trend in cumulative effects associated with socioeconomics may be positively affected because more fall-run Chinook salmon would be available to catch. However, these changes would comprise a small component of the overall economic activity associated with salmon and steelhead production, harvest, and socioeconomic activity in the analysis area.

#### **5.6 Environmental Justice**

Under Alternative 5, as under the other alternatives, it is likely that cumulative effects from climate change, development, habitat restoration, hatchery production, and fisheries would decrease the number of fish available for harvest in the cumulative effects analysis area. Under Alternative 5, the overall trend in cumulative effects associated with environmental justice may be positively affected because more fall-run Chinook salmon would be available to catch. However, this change would comprise a small

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percentage of the total number of harvestable salmon and steelhead in the cumulative effects analysis area available to environmental justice populations and communities.

## **5.7 Human Health**

Under Alternative 5, as under the other alternatives, it is likely that cumulative effects from climate change, development, habitat restoration, and hatchery production would impact human health in the cumulative effects analysis area. Alternative 5 would not be expected to affect the overall trend in cumulative effects associated with the use of hatchery chemicals, the transfer of toxic contaminants from fish to humans, or the transmission of diseases from fish to humans.

## **6 REFERENCES**

The draft EIS includes a list of references, and additional references used in this supplemental EIS are listed below.

National Marine Fisheries Service (NMFS) 2017. Draft environmental impact statement for 10 salmon and steelhead hatchery programs in the Duwamish-Green River Basin. National Marine Fisheries Service, Sustainable Fisheries Division, West Coast Region, Lacey, WA. 435 pages.

## **7 DISTRIBUTION LIST**

The draft EIS includes a distribution list.

## **8 LIST OF PREPARERS**

The draft EIS includes a list of preparers. No other preparers were involved in preparation of this supplemental EIS.

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**Appendix A**  
**Socioeconomics**

This appendix to the Duwamish-Green River Basin hatcheries draft SEIS contains quantitative information on the socioeconomic effects under Alternative 5 (Increased Production) described in Subsection 4.2, Socioeconomics. Socioeconomic information on the other alternatives is presented in Subsection 4.5, Socioeconomics, in the draft EIS.

Table A-1 Contribution of salmon and steelhead hatchery programs in the Duwamish-Green River Basin to commercial harvests and ex-vessel values in Puget Sound by subregion under Alternative 5.

Subregion / County of Landings <sup>1</sup>	Existing Conditions Number	Alternative 5					
		Without Fish Passage at Howard Hanson Dam			With Fish Passage at Howard Hanson Dam		
		Number	Change from Existing Conditions	Change from Alt. 1 and 2	Number	Change from Existing Conditions	Change from Alt. 1 and 2
<b>North Puget Sound</b>							
Non-tribal							
Harvest (number)	426	452	26	0	433	7	0
Ex-vessel value	\$2,248	\$2,413	\$165	0	\$2,292	\$44	0
Tribal							
Harvest (number)	446	460	14	2	440	-6	2
Ex-vessel value	\$2,495	\$2,624	\$129	\$53	\$2,497	\$2	\$53
Total							
Harvest (number)	872	912	40	2	873	1	2
Ex-vessel value	\$4,743	\$5,036	\$293	\$52	\$4,789	\$46	\$53
<b>South Puget Sound</b>							
Non-tribal							
Harvest (number)	12,229	12,482	253	2	12,293	64	2
Ex-vessel value	\$61,981	\$63,631	\$1,650	\$39	\$62,427	\$446	\$53
Tribal							
Harvest (number)	124,663	143,084	18,421	2,131	130,864	6,201	2,129
Ex-vessel value	\$802,295	\$973,641	\$171,346	\$56,143	\$887,201	\$85,906	\$56,103
Total							
Harvest (number)	136,892	155,565	18,673	2,132	143,157	6,265	2,131
Ex-vessel value	\$864,276	\$1,037,272	\$172,996	\$56,182	\$949,628	\$85,352	\$56,156

Table A-1 Contribution of salmon and steelhead hatchery programs in the Duwamish-Green River Basin to commercial harvests and ex-vessel values in Puget Sound by subregion under Alternative 5 (continued).

Subregion / County of Landings <sup>1</sup>	Existing Conditions Number	Alternative 5					
		Without Fish Passage at Howard Hanson Dam			With Fish Passage at Howard Hanson Dam		
		Number	Change from Existing Conditions	Change from Alt. 1 and 2	Number	Change from Existing Conditions	Change from Alt. 1 and 2
<b>Strait of Juan de Fuca</b>							
Non-Tribal							
Harvest (number)	0	0	0	0	0	0	0
Ex-vessel value	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Tribal							
Harvest (number)	1,528	1,945	417	174	1,763	235	175
Ex-vessel value	\$16,849	\$23,935	\$7,086	\$4,585	\$22,061	\$5,212	\$4,611
Total							
Harvest (number)	1,528	1,945	417	174	1,763	235	175
Ex-vessel value	\$16,849	\$23,935	\$7,086	\$4,585	\$22,061	\$5,212	\$4,611
<b>Puget Sound Total</b>							
Non-tribal							
Harvest (number)	12,655	12,934	279	2	12,726	71	2
Ex-vessel value	\$64,229	\$66,044	\$1,815	\$40	\$64,719	\$490	\$53
Tribal							
Harvest (number)	126,637	145,489	18,852	2,307	133,067	6,430	2,306
Ex-vessel value	\$821,639	\$1,000,199	\$178,560	\$60,820	\$911,759	\$90,120	\$60,768
Total							
Harvest (number)	139,292	158,422	19,130	2,308	145,793	6,501	2,308
Ex-vessel value	\$885,868	\$1,066,243	\$180,375	\$60,820	\$976,478	\$90,610	\$60,820

Source: Values are derived based on estimates of recreational fishing effort provided by NMFS and by simulating the Puget Sound economic impact spreadsheet model developed by TCW Economics (Appendix B, Socioeconomics, of the draft EIS).

<sup>1</sup> Landings represent harvested fish, typically brought to shore at locations that include ports, marinas, and boat launches. This SEIS generally refers to "harvest" rather than "landings."

Notes:

Values include hatchery operations at FRF hatchery facilities to be constructed.

Values include harvest associated with all hatcheries to be operating in the Duwamish-Green River Basin, including the FRF hatchery facilities to be constructed.

All dollar values are reported in 2015 dollars.

Values for existing conditions, and Alternatives 1 and 2 (used to calculated changes compared to Alternative 5), are from the draft EIS.

Table A-2. Contribution of salmon and steelhead hatchery programs in the Duwamish-Green River Basin to recreational fishing effort and expenditures in Puget Sound by subregion under Alternative 5.

Subregion / County of Landings <sup>1</sup>	Existing Conditions Number	Alternative 5					
		Without Fish Passage at Howard Hanson Dam			With Fish Passage at Howard Hanson Dam		
		Number	Change from Existing Conditions	Change from Alt. 1 and 2	Number	Change from Existing Conditions	Change from Alt. 1 and 2
<b>North Puget Sound<sup>2</sup></b>							
Trips <sup>3</sup>	10,204	13,466	3,262	946	11,740	591	1,536
Trip-related Expenditures	\$1,794,079	\$2,367,608	\$573,529	\$166,327	\$2,064,141	\$103,910	\$270,062
<b>South Puget Sound<sup>4</sup></b>							
Trips	28,684	35,873	7,189	1,766	31,805	1,356	3,121
Trip-related Expenditures	\$5,043,255	\$6,307,233	\$1,263,978	\$310,500	\$5,591,993	\$238,414	\$548,738
<b>Strait of Juan de Fuca<sup>5</sup></b>							
Trips	14,968	19,244	4,276	569	16,464	927	1,496
Trip-related Expenditures	\$2,631,692	\$3,383,503	\$751,811	\$100,042	\$2,894,720	\$162,986	\$263,028
<b>Puget Sound Total</b>							
Trips	53,856	68,583	14,727	3,281	60,009	2,874	6,153
Trip-related Expenditures	\$9,469,026	\$12,058,344	\$2,589,318	\$576,869	\$10,550,854	\$505,310	\$1,081,828

<sup>1</sup> Landings represent harvested fish, typically brought to shore at locations that include ports, marinas, and boat launches. This SEIS generally refers to “harvest” rather than “landings.”

<sup>2</sup> North Puget Sound subregion includes Whatcom and Snohomish Counties (no effects in Skagit County).

<sup>3</sup> Trips are an indicator of recreational fishing effort.

<sup>4</sup> South Puget Sound subregion includes King, Pierce, Thurston, and Kitsap Counties.

<sup>5</sup> Strait of Juan de Fuca subregion includes Clallam and Jefferson Counties.

Notes:

Under Alternative 5, it is assumed that there would be no change in annual operating costs at the three existing hatchery facilities, and that the annual operating costs for the three new FRF programs would generate the same proportionate numbers of FTEs and personal income as those associated with the three existing facilities (Appendix B, Socioeconomics, of the draft EIS).

All dollar values are reported in 2015 dollars.

Values for existing conditions, and Alternatives 1 and 2 (used to calculated changes compared to Alternative 5), are from the draft EIS.

Table A-3. Personal income and jobs resulting from hatchery operations and commercial and recreational fisheries supported by salmon and steelhead hatchery programs in the Duwamish-Green River Basin under Alternative 5.

Subregion / County of Landings <sup>1</sup>	Existing Conditions Number	Alternative 5					
		Without Fish Passage at Howard Hanson Dam			With Fish Passage at Howard Hanson Dam		
		Number	Change from Existing Conditions	Change from Alt. 1 and 2	Number	Change from Existing Conditions	Change from Alt. 1 and 2
<b>North Puget Sound Subregion<sup>2</sup></b>							
Commercial Fisheries							
Personal Income	\$7,860	\$8,346	\$486	\$87	\$7,937	\$77	\$87
Jobs	0.2	0.2	0.0	0	0.2	0.0	0.0
Recreational Fisheries							
Personal Income	\$1,901,829	\$2,509,803	\$607,974	\$176,316	\$2,188,110	\$286,281	\$176,130
Jobs	32.0	42.4	10.4	3.2	37.1	5.1	3.3
<b>South Puget Sound Subregion<sup>3</sup></b>							
Hatchery Operations							
Personal Income	\$868,856	\$1,105,728	\$236,872	\$43,117	\$1,105,728	\$236,872	\$43,117
Jobs	18.1	22.9	4.8	0.7	22.9	4.8	0.7
Commercial Fisheries							
Personal Income	\$1,432,349	\$1,719,052	\$286,703	\$93,110	\$1,573,801	\$141,452	\$93,066
Jobs	18.1	21.7	3.6	1.1	19.9	1.8	1.2
Recreational Fisheries							
Personal Income	\$5,346,144	\$6,686,035	\$1,339,891	\$329,148	\$5,927,839	\$581,695	\$328,962
Jobs	72.1	90.8	18.7	4.9	80.5	8.4	4.9
<b>Strait of Juan de Fuca Subregion<sup>4</sup></b>							
Commercial Fisheries							
Personal Income	\$27,924	\$39,667	\$11,743	\$7,599	\$36,562	\$8,638	\$7,643
Jobs	0.7	1.0	0.3	0.2	0.9	0.2	0.2
Recreational Fisheries							
Personal Income	\$2,789,747	\$3,586,710	\$796,963	\$106,050	\$3,068,572	\$278,825	\$106,051
Jobs	67.0	86.2	19.2	2.6	73.8	6.8	2.6

Table A-3. Personal income and jobs resulting from hatchery operations and commercial and recreational fisheries supported by salmon and steelhead hatchery programs in the Duwamish-Green River Basin under Alternative 5 (continued).

Subregion / County of Landings <sup>1</sup>	Existing Conditions Number	Alternative 5					
		Without Fish Passage at Howard Hanson Dam			With Fish Passage at Howard Hanson Dam		
		Number	Change from Existing Conditions	Change from Alt. 1 and 2	Number	Change from Existing Conditions	Change from Alt. 1 and 2
<b>Puget Sound Total</b>							
Hatchery Operations							
Personal Income	\$868,856	\$1,105,728	\$236,872	\$43,117	\$1,105,728	\$236,872	\$43,117
Jobs	18.1	22.9	4.8	0.7	22.9	4.8	0.7
Commercial Fisheries							
Personal Income	\$1,468,133	\$1,767,066	\$298,933	\$100,797	\$1,618,300	\$150,167	\$100,797
Jobs	18.9	22.9	4.0	1.4	20.9	2.0	1.3
Recreational Fisheries							
Personal Income	\$10,037,720	\$12,782,548	\$2,744,828	\$611,515	\$11,184,520	\$1,146,800	\$611,142
Jobs	171.2	219.4	48.2	10.8	191.3	20.1	10.7

Source: Derived by simulating the Puget Sound economic impact spreadsheet model developed by TCW Economics. Refer to Appendix B, Socioeconomics, in the draft EIS for details.

<sup>1</sup> Landings represent harvested fish, typically brought to shore at locations that include ports, marinas, and boat launches. This SEIS generally refers to “harvest” rather than “landings.”

<sup>2</sup> North Puget Sound subregion includes Whatcom and Snohomish Counties (no effects in Skagit County).

<sup>3</sup> South Puget Sound subregion includes King, Pierce, Thurston, and Kitsap Counties.

<sup>4</sup> Strait of Juan de Fuca subregion includes Clallam and Jefferson Counties.

Notes:

Under Alternative 5, it is assumed that there would be no change in annual operating costs at the three existing hatchery facilities, and that the annual operating costs for the three new programs at the FRF would generate the same proportionate numbers of FTEs and personal income as those associated with the three existing facilities. Refer to Appendix B, Socioeconomics, of the draft EIS for additional details.

All dollar values are reported in 2015 dollars.

Values for existing conditions, and Alternatives 1 and 2 (used to calculated changes compared to Alternative 5), are from the draft EIS, updated in some cases to correct unsubstantial errors in the draft EIS.

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