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-2022-01417

December 31, 2024

P. Allen Atkins
Chief, Regulatory Branch
U.S. Army Corps of Engineers, Seattle District
4735 East Marginal Way South, Bldg.1202
Seattle, Washington 98134-2388

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Emerald Logistics Proposed Industrial Development in the headwaters of Mullen Slough, in Auburn, Washington (NWS-2021-727)

Dear Mr. Atkins:

Thank you for your letter of June 6, 2022, 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 the Emerald Logistics Proposed Industrial Development in headwaters of Mullen Slough, in Auburn, Washington.

Thank you also for your request for essential fish habitat (EFH) consultation. NMFS reviewed the proposed action for potential effects on EFH pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), implementing regulations at 50 CFR 600.920, and agency guidance for use of the ESA consultation process to complete EFH consultation. We have concluded that the action would adversely affect EFH designated under the Pacific Salmon Fishery Management Plan (PFMC 2014). EFH conservation recommendations are provided in Section 3.

After reviewing the proposed action, we have concluded that the proposed action is likely to adversely affect, but it is not likely to jeopardize the continued existence of Puget Sound (PS) Chinook Salmon *(Oncorhynchus tshawytscha),* PS steelhead *(O. mykiss),* or Southern Resident Killer Whales (SRKW) *(Orcinus orca)*. Further, we conclude that the proposed action is likely to adversely affect designated critical habitat of PS Chinook salmon, steelhead and SRKW, but is not likely to result in the destruction or adverse modification of the designated critical habitat for any listed species.

As required by section 7 of the ESA, NMFS is providing an incidental take statement with the opinion. The incidental take statement describes reasonable and prudent measures NMFS finds necessary or appropriate to minimize the impact of incidental take associated with this action. The take statement sets forth nondiscretionary terms and conditions, including reporting requirements, that the federal action agency must comply with to carry out the reasonable and prudent measures. Incidental take from actions that meet these terms and conditions will be exempt from the ESA's prohibition against the take of listed species.

This document also includes the results of our analysis of the action's likely effects on EFH pursuant to section 305(b) of the MSA), and includes four conservation recommendations to avoid, minimize, or otherwise offset potential adverse effects on EFH. Section 305(b) (4) (B) of the MSA requires Federal agencies to provide a detailed written response to NMFS within 30 days after receiving these recommendations.

Please contact Phyllis Meyers in our Lacey, Washington, office at Phyllis.Meyers@noaa.gov if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

Kathleen Wells
Assistant Regional Administrator
Oregon Washington Coastal Office

cc: Megan Ancheta, Project Manager, USACE
Martin J. Fox, Ph.D., Fisheries Biologist, Muckleshoot Tribe

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

Emerald Logistics Proposed Industrial Development
Headwaters of Mullen Slough
Auburn, Washington (NWS-2021-727)

NMFS Consultation Number: WCRO-2022-01417

Action Agency: U.S. Army Corps of Engineers

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
Puget Sound Chinook salmon (*O. tshawytscha*)	Threatened	Yes	No	Yes	No
Southern Resident Killer Whale *(Orcinus orca)*	Endangered	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:

Kathleen Wells
Assistant Regional Administrator
Oregon Washington Coastal Office

Date: December 31, 2024

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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

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.), as amended, and implementing regulations at 50 CFR part 402.

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 part 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 at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at the Lacey, Washington office.

1.2. Consultation History

- A request for consultation from the United States Corps of Engineers (COE) was received June 9, 2022. It included a letter, a Biological Assessment (BA) and a set of drawings depicting the proposed development of six parcels. The COE originally requested consultation on Puget Sound (PS) Chinook salmon, PS steelhead, designated critical habitat for PS Chinook salmon, designated critical habitat for PS steelhead and essential fish habitat for Pacific Coast salmon. In August of 2024, southern resident (SR) killer whale SRKW and their critical habitat were added to the consultation as described below.
- NMFS staff visited the site with a representative from Soundview Consultants, on September 28, 2023, who indicated that he observed coho salmon on the site.
- On September 29, 2023, NMFS requested information referenced in the BA but not provided for review. These were a mitigation plan referred to on page seven and water quality and fish protection plans referred to on page ten. Additionally, NMFS suggested the COE request formal consultation. This was based in part on text on page 28 of the BA, “Due to the potential fish presence within stream Z, potential disturbance and mortality of individuals may occur.”
- On October 3, 2023, the COE requested formal consultation by email.
- NMFS received a Mitigation Plan comprised of drawings from July and August 2023, a Stormwater Site Plan and a Water Quality Monitoring Plan for the proposal on October 4, 2023.

- On October 30, 2023 Julian Douglas, Area Habitat Biologist with Washington Department of Fish and Wildlife (WDFW), confirmed that coho salmon use the site and that it is mapped as a location for priority species.
- NMFS found several discrepancies in project documents and had a number of concerns about aquatic impacts. These were submitted to the COE on November 2, 2023. NMFS also communicated they could not yet initiate consultation.
- The COE emailed a response the same day, stating that they received our comments and had also received a 20-page comment letter from the Muckleshoot Indian Tribe.
- On January 26, 2024, the COE provided a limited response to comments, and a revised mitigation plan.
- A meeting was held with representatives of the COE, NMFS and the applicant February 20, 2024 to briefly discuss concerns.
- On February 27, 2024 the COE also provided a revised Stormwater Site Plan.
- On March 4, 2024 the COE provided three documents regarding soil contamination.
- On March 20, 2024, a meeting was held with representatives of the COE and NMFS to discuss outstanding concerns about ecological functions. The COE showed historical photographs of degraded ecological conditions.
- On March 27, 2024, the COE sent an email in which they said they had conducted an in-depth review of the project, found it to be consistent with COE guidance and suggested we proceed with informal consultation. NMFS did not agree that informal consultation was appropriate and asked if the COE would like a non-concurrence letter.
- NMFS initiated consultation on March 27, 2024.
- On March 27, 2024, the COE again requested formal consultation.
- A construction stormwater general permit coverage dated April 20 2023 and a letter and a Water Quality Monitoring Plan dated August 2022 and revised in February 2023 were provided by the Washington Department of Ecology (WDOE) on April 24, 2024.
- On May 17, 2024, NMFS sent a draft description of the proposed action to the COE for review and clarification.
- On May 29, 2024, NMFS forwarded an email to the COE from the applicant requesting information regarding the status of the project. The COE provided two documents in response. They were a copy of our draft proposed action with comments and a copy of emails between the applicant and the COE. The COE also informed us a new project manager had been assigned to the project.
- Two additional documents were provided by the COE to NMFS on May 30, 2024. These were a Construction Stormwater General Permit (revised March 9, 2024), and a grading plan set (dated February 2, 2022) approved by a professional engineer on March 13, 2024.
- NMFS provided follow-up questions to the COE on June 4, 2024.
- The applicant provided four more documents on June 12, 2024. These were: a response to June 4th questions, a demolition plan, a City of Auburn boundary line adjustment record dated March 12, 2024, and a floorplan for the proposed warehouse.
- On June 18, 2024 the applicant stated that a sixth parcel was included in all documents submitted with the application package to the COE, except for the wetland delineation report.

- The COE provided a revised set of drawings on July 19, 2024. The COE requested revised drawings to clarify text and include labels/dimensions.
- After internal review and discussion, NMFS asked the COE, on August 20, 2024, if SRKW and SRKW critical habitat should be included in the consultation.
- On August 27, 2024, the COE asked for SRKW and SRKW critical habitat to be included in the consultation.

Updates to the regulations governing interagency consultation (50 CFR part 402) were effective on May 6, 2024 (89 Fed. Reg. 24268). We are applying the updated regulations to this consultation. The 2024 regulatory changes, like those from 2019, were intended to improve and clarify the consultation process, and, with one exception from 2024 (offsetting reasonable and prudent measures), were not intended to result in changes to the Services' existing practice in implementing section 7(a)(2) of the Act. 89 Fed. Reg. at 24268; 84 Fed. Reg. at 45015. We have considered the prior rules and affirm that the substantive analysis and conclusions articulated in this biological opinion and incidental take statement would not have been any different under the 2019 regulations or pre-2019 regulations.

1.3. Proposed Federal Action

Under the ESA, "action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (see 50 CFR 402.02). Under MSA, 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 COE is proposing to permit under Section 404 of the Clean Water Act (CWA), wetland fill and stream relocation on six parcels that comprise approximately 16.04 acres for development of a large industrial warehouse on a site that is currently vacant and was farmed in the past. The total impervious surface area for the proposal is approximately 380,000 square feet or 8.72 acres, according to clarifications received on January 26, 2024. This includes the proposed warehouse, loading dock, parking lot, and drive isles to accommodate commercial truck traffic. In June of 2024 we were informed the impervious area planned is 9.24 acres.

As stated in the consultation request letter and described in the BA, the project area includes wetlands and tributaries to the Green River in Auburn, King County, Washington (47.345679 N latitude, -122.258053 W longitude). Two of the tributaries flow along the eastern (stream V) and western (stream X) project boundaries and half of their riparian areas are on the project site. A third stream flows through the central portion of the site (stream Z).

The proposed action includes the permanent placement of up to 25,000 cubic yards of fill within a 0.39-acre (15,527 square feet) area of two Category III wetlands (wetlands with a moderate level of functions that have generally have been disturbed in some ways) and 907 linear feet of a fish-accessible tributary to the Green River, to construct a warehouse and associated facilities. Proposed activities would entail placement of fill in the entirety of Wetland C (1,497 sf) and placing fill in and realigning Stream Z, a Type-F (fish-bearing) stream. The applicant also proposes to partially replace two undersized culverts with two fish passable culverts designed using the stream simulation design method as stated in section 2.3.1 of the BA.

Site Preparation

A large portion of this 16-acre site would be cleared and graded (over 14 acres would be cleared and graded according to the grading plan provided in May 2024 and as depicted in Figure 3). Wetland fill and relocating a fish-bearing stream would be part of the initial work on the site. All of the riparian areas on the site for all three streams would be completely cleared, with the exception of the SW corner, which is occupied by Wetland B, according to sheet E3 of the grading plan dated February 2, 2022. Most of the site would be subject to clearing, grading and earth movement. The applicant will also excavate a large volume of existing soil for a sub-surface stormwater treatment system.

Soils on the site are contaminated with arsenic and lead requiring excavation to remove contaminants. According to a letter dated February 10, 2023 from the WDOE, the selected cleanup method is to mix soils to a depth of at least 12 inches below ground surface in areas where contaminant levels exceeded state cleanup thresholds. For lead contamination, the WDOE requires additional sampling and testing after mixing to ensure none of the samples exceed twice the level of 250 mg/kg for lead, and that the average concentration in the samples not exceed the 250 mg/kg cleanup threshold. We anticipate that this soil mixing would be done prior to placement of fill to increase soil surface elevations and soil stability.

The BA describes the site has having a water table at the ground surface. A large volume of fill is planned to help stabilize soils and raise the elevation of the building construction area. Cement or lime soil amendments may be used to further help achieve soil stability, because soils on the site may be too wet for compaction. Roughly 27,000 cubic yards of imported material is planned for preparing the building site.

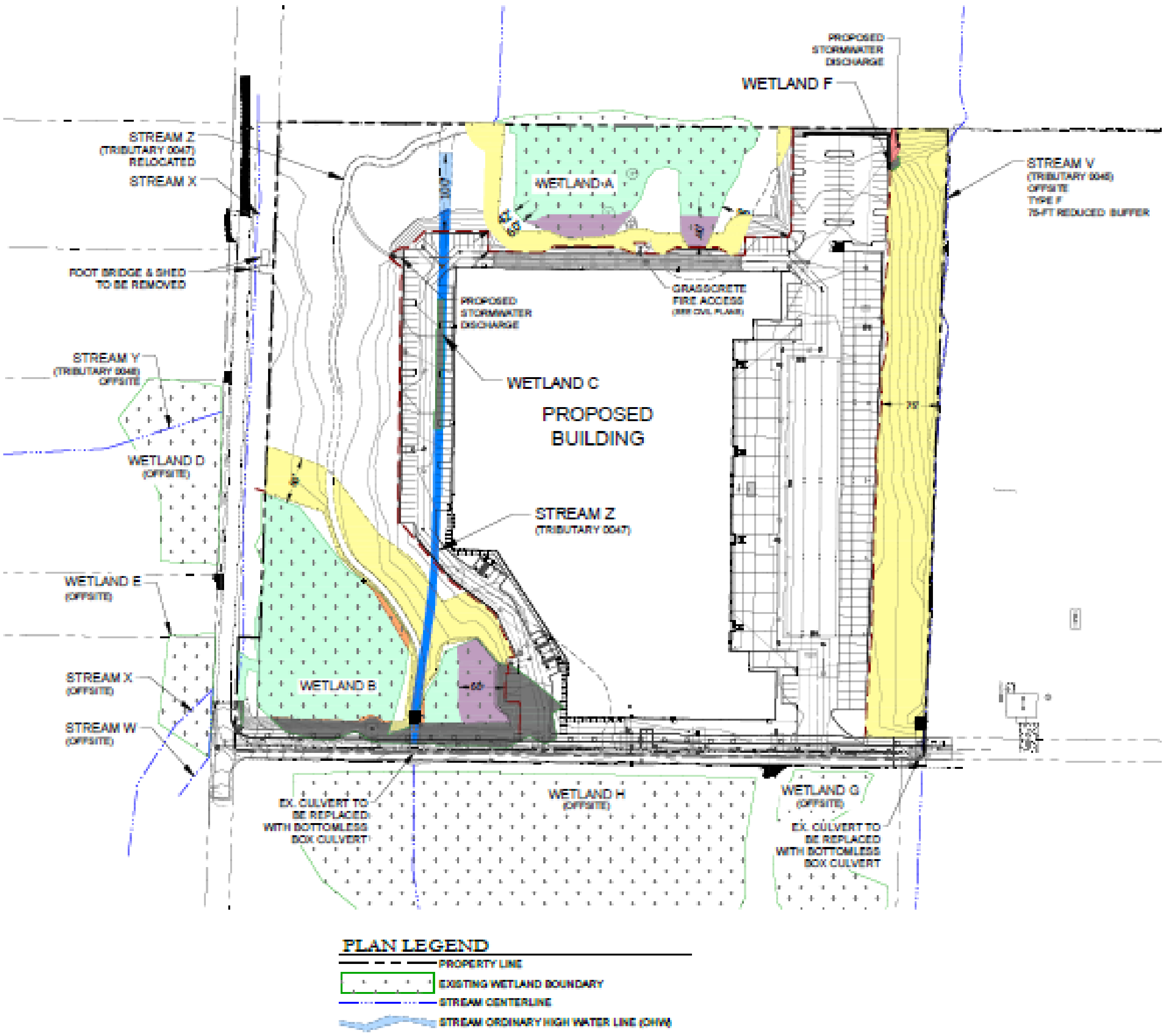

Figure 1. Site Plan depicting Stream X on the west side of the site, Stream V on the east side, and Stream Z in an almost straight line about 1/3 of the way from the western site boundary. Culverts through which Streams Z and V flow are on the south side. The proposed building is shown in the center. Wetlands are on the south, west and north sides of the building.

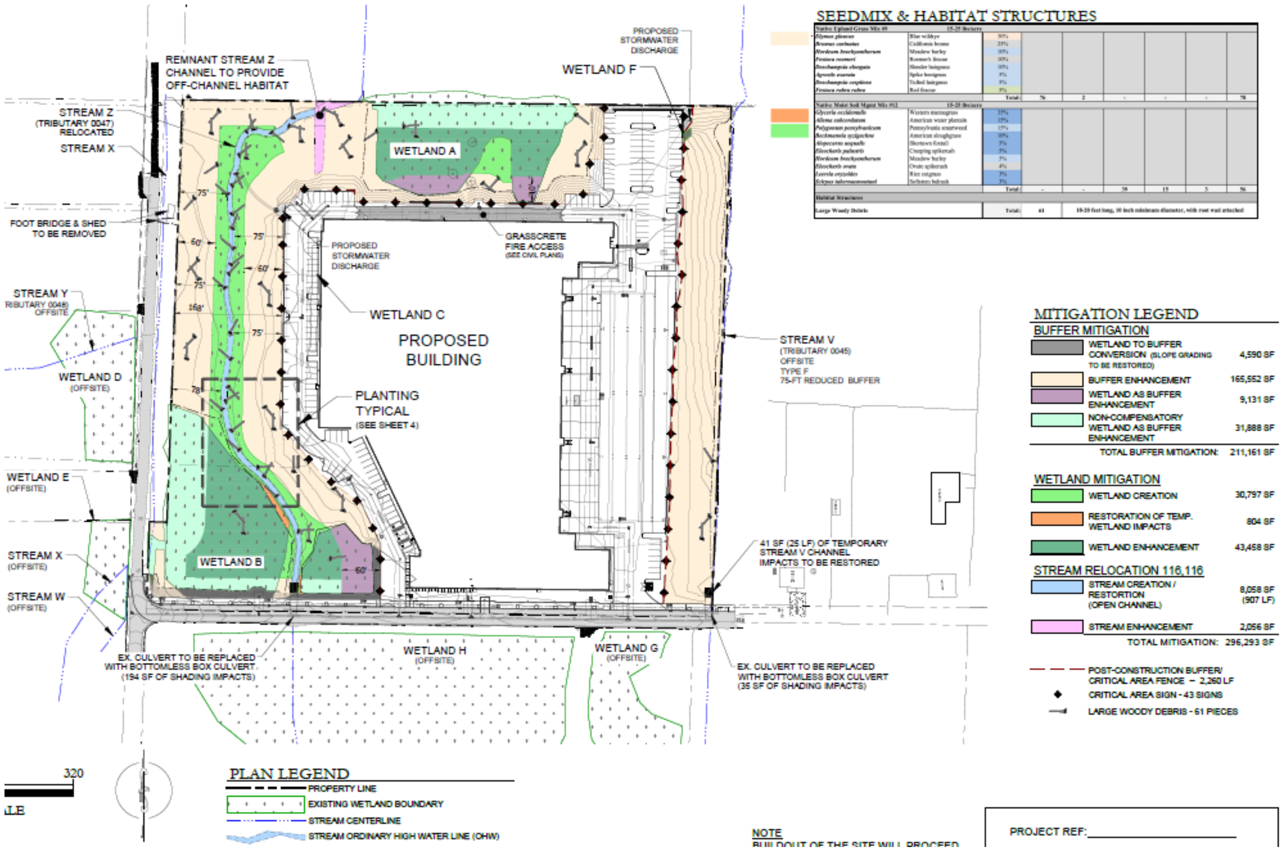

Figure 2. Site mitigation plan, from sheet 3 of a plan set received July 2024. The colored areas represent mitigation areas, indicated to be 296,293 square feet (6.8 acres).

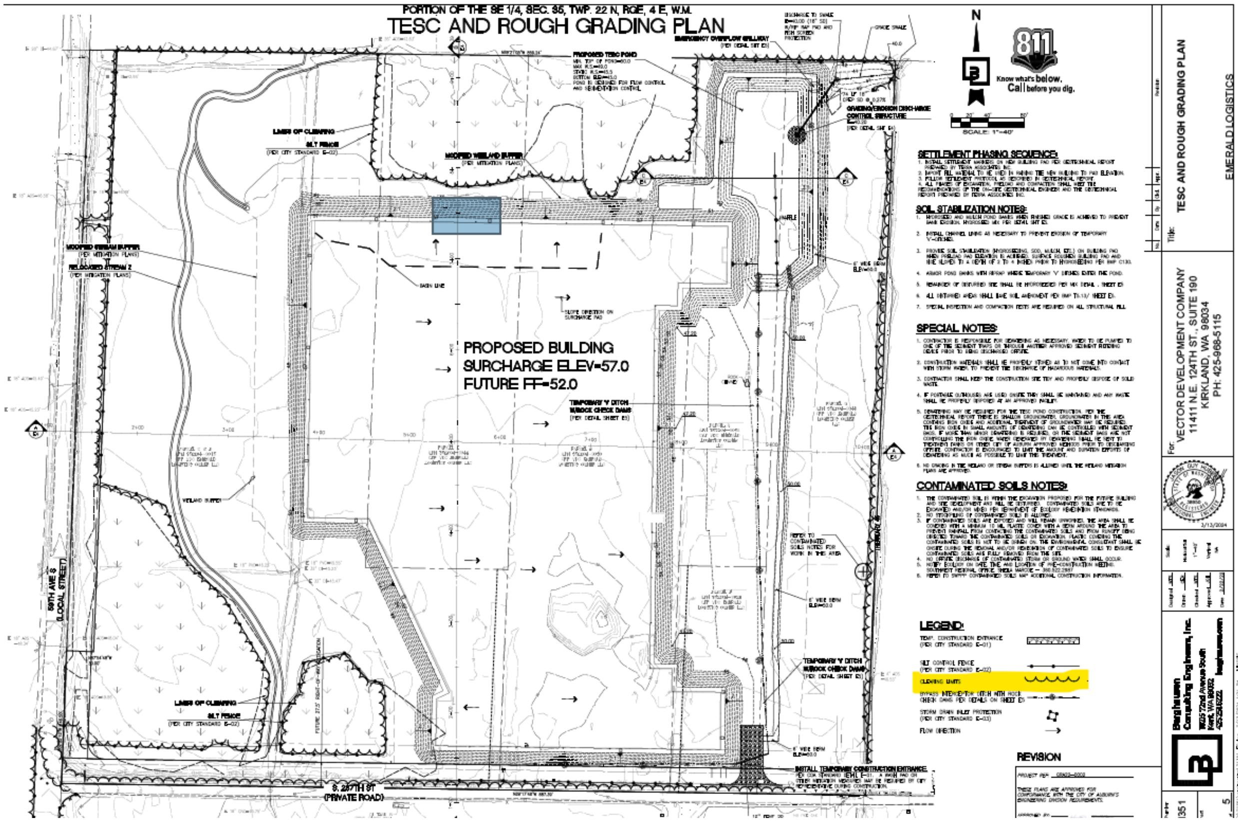

Figure 3. Proposed clearing limits are depicted with a wavy line in the Grading Plan received May 2024. Clearing only excludes wetlands A and B. The corresponding areas in Figure 2 are the darker green, the lightest green and the purple areas. They add up to 84,477 square feet or 1.94 acres. Thus, it appears grading is planned for all but 1.94 acres of the 16-acre site.

General site preparation sequence, prior to building construction:

1. Clearing over 14 acres of the 16-acre site (see Figure 3),
2. Soil mixing and testing to address arsenic and lead contamination,
3. Channel excavation and possible groundwater dewatering periods,
4. Grading and excavation for sub-grade stormwater treatment facilities,
5. Import and placement of surcharge (approximately 31,500 cubic yards) for a building pad of approximately nine and one quarter acres, and
6. Time period for surcharge to settle.

<u>Stormwater Management During Construction</u>

Because of the high groundwater table, pumps will be used to convey collected stormwater into ponds, and "[s]hallow excavations that do not extend more than 2 to 3 feet below the groundwater table can likely be dewatered by conventional sump-pumping procedures along with a system of collection trenches. Deeper excavations will require dewatering by well points or isolated deep-pump wells. The utility subcontractor should be prepared to implement excavation dewatering by well point or deep-pump wells, as needed. This will be an especially critical consideration for any deep excavations such for lift stations and sanitary sewer tie-ins."

Best Management Practices to manage stormwater during construction include:

1. Staging areas and material stockpiles located a minimum of 50 feet from realigned or preserved waters of the state to the extent practicable.
2. Machinery and equipment used during construction serviced, fueled, maintained, and parked on uplands a minimum of 50 feet, and where practical, 100 feet, from realigned or preserved waters of the state to prevent contamination to any surface water. Bypass and sump pumps will have to be located closer than 50 feet from waterbodies due to their operational constraints involving head pressure, intake length, and functionality. These pumps will all have dual containment tanks, automatic fluid pressure failure shut-offs, and be placed within separate containment pads. The sump pump will be moved outside the work area for refueling if necessary.
3. No petroleum products, fresh concrete, lime, chemicals, or other toxic or deleterious materials shall be allowed to enter realigned or preserved waters of the state.
4. Wash water containing oils, grease, or other hazardous materials resulting from wash down of equipment or working area shall not be discharged into realigned or preserved waters of the state. A separate, contained area, will be established for washing down vehicles and equipment that does not have any possibility of draining to realigned or preserved waters of the state.
5. All construction debris, concrete waste material, excess sediment, and other solid waste shall be properly managed and disposed of in an upland disposal site approved by the appropriate regulatory authority.
6. Appropriate BMPs shall be implemented to minimize track-out during construction.
7. Fuel hoses, oil drums, oil or fuel transfer valves and fittings, etc., shall be checked regularly for drips or leaks, and shall be maintained and stored properly to prevent spills into state waters.
8. A written spill prevention, control, and countermeasures (SPCC) plan will be prepared for activities that include the use of heavy equipment. The SPCC describes measures to prevent or reduce impacts due to accidental leaks or spills, as well as all hazardous materials that will be used, their proper storage and handling, and the methods that will be used to monitor their use.

Stormwater Management Post Construction

Runoff from the impervious areas would be captured by ground level catch basins and building downspouts, then routed by underground gravity piping to OldCastle Biopods, which have received a General Use Level Designation from the WDOE, will be used for treating stormwater from impervious areas. These would be installed subsurface, in the paved area on the east side of the building. The discharge point for effluent would be near the NE corner of the site and Stream V.

OldCastle indicates that Biopods provide the following removal rates based on laboratory and field testing:

- 80% of Total Suspended Solids (TSS) for influent concentrations greater than 100 mg/L
- and achieve a 20 mg/L effluent for influent concentrations less than 100 mg/L.
- 60% dissolved zinc for influent concentrations 0.02 to 0.3 mg/L.
- 30% dissolved copper for influent concentrations 0.005 to 0.02 mg/L.
- 50% or greater total phosphorus for influent concentrations 0.1 to 0.5 mg/L.

In May 2024, the applicant and the COE stated that the Biopod facilities are designed to treat 91% of all stormwater runoff, in accordance with the requirements of the City of Auburn and the WDOE. Runoff flowrates that exceed the 91% threshold would bypass treatment via a weir internal to each Biopod and discharge in the northeastern portion of the site, where Steam V flows into the floodplain. Some stormwater would be conveyed to dispersion trenches that discharge into adjacent riparian buffers.

Biopods treat influent via filtration though a proprietary media called StormMix. Maintenance of the Biopods would be performed in accordance with the manufacturer’s instructions, which are included in the Operations and Maintenance Manual for the Stormwater Drainage Facilities that was prepared for this project. Any contaminated media that is removed during maintenance would be disposed of in accordance with local requirements, which is generally the same as the disposal of material removed when cleaning catch basins. Biopods would be inspected twice per year in accordance with the Operations and Maintenance Manual.

Stream Relocation

The applicants plan for the wetland fill and the fish-bearing Stream Z realignment to be done at the same time because the wetlands are associated with Stream Z. A new stream channel would be excavated west of the existing channel prior to the stream relocation. This channel would be constructed approximately 75 feet from the western property line. Another small tributary flows near the property line. These two streams and several wetlands would have overlapping buffers and share a riparian corridor that would be approximately 150 feet wide in total. This corridor would include two streams, the riparian buffers and wetlands.

Streambed substrates, woody debris and vegetation would be installed following channel excavation. Following the connection of the new stream channel to the existing stream channel, a block net would be placed across the new channel to prevent fish from entering the new channel. Dewatering and re-watering of the existing and new stream channels would be completed using temporary dams and bypass pipes. In-water work would occur in August to comply with COE and WDFW guidance. According to supplemental information received from the applicant on May 29, 2024, fish exclusion and recovery would be completed by a qualified fish biologist and nets would be monitored daily as needed during bypass and channel relocation.

Because of the high water table, groundwater would almost certainly be encountered during channel excavation. The amount of excavation can initially be limited to shallower and depths, allowing the water table to drop as the shallow excavation is completed along a significant length of the channel. The deeper excavation to final grade would then be completed after the water table drops. Groundwater monitoring test pits may be excavated by an excavator along the length of the proposed channel. These test pits may provide information about which parts of the site are less saturated and more suitable for initial excavation. However, it is not clear how equipment access would be provided in this area. If groundwater is encountered above the planned excavation grade, then the water would be pumped to the existing Stream Z channel or pumped to upland areas adjacent to the excavated channel to infiltrate if possible. These approaches may be implemented at the discretion of the project geo-technical engineer. No monitoring wells would be installed.

Water quality monitoring is planned while dewatering and moving Stream Z. Fish exclusion from the existing Stream Z channel is anticipated to take up to two days. At that time flows will be restored to the newly created channel. The applicant confirmed the following work sequence in comments NMFS received May 29, 2024:

1. Excavate new channel while managing groundwater.
2. Install bank protection prior to relocating water flow to the new channel.
3. Use block nets to confine fish to the existing channel while pumping half the flow into the new channel while working to manage water quality. Coir logs would be installed in the new stream channel to help capture sediments flowing downstream.
4. Turbid water exceeding state standards would may be diverted to an upland area, such as a settling pond. Discharge from the upland areas shall meet water quality criteria at the point of discharge into surface waters and/or wetlands.
5. When turbidity meets background levels, route all the water into the new channel while also "completing fish recovery."
6. Fill the existing Stream Z channel and use a clay plug in the entrance to the channel.
7. Revegetate the site.

<u>Road and Culvert Modifications</u>

The City of Auburn is conditioning permit approval on modifications to South 287th Street. For this reason, culverts beneath South 287th Street would be replaced halfway through the road fill prism. A flange would connect remaining portions of the existing culverts to the new bottomless culverts planned for this project. Stream Z flows through one of these culverts. The second culvert is for Stream V, flowing along the eastern edge of the site.

The culvert replacements are anticipated to occur concurrently to the Stream Z relocation activities. If they are done later, activities would generally follow this sequence:

1. Install temporary diversion dams and bypass pipe to divert stream flow around work area
2. Install culverts
3. Perform re-grading as necessary
4. Remove temporary diversion dams and bypass pipes.

If they are done concurrently both the diversion reach for channel relocation and culvert replacement would be isolated by the bypass.

Fish Handling

Prior to dewatering, block nets would be installed at the upstream and downstream ends of the selected channel section, and fish capture and relocation efforts completed according to section 4.1.1 of the BA.

An additional net would be installed at the downstream end of the new stream channel in order to prevent fish movement upstream while the relocation effort is occurring. Following the fish capture and relocation, a bladder dam and a bypass pipe would be used to dewater the channel. Pumps may be necessary to move water from the existing stream channel to the new stream channel given the lack of a significant grade difference. As the stream channel dewatering progresses from downstream to upstream, the bypass pipe would be progressively moved up the new stream channel.

Monitoring

Monitoring is proposed for oil, grease, turbidity, pH, temperature, bacteria, and bioassessment as detailed in the Water Quality Monitoring Plan, revised February 13, 2023. For oil and grease, the monitoring would be visual observation. For turbidity, visual observation is planned, as well as well as use of a portable meter to analyze grab samples. pH monitoring is only specified in the contingency section of the plan and would be every 1 hour during work activities for one day according to the contingency monitoring schedule.

Two sample locations are for background water quality conditions: one for Stream Z and one for the stream along the eastern boundary, Stream V. Both background sample locations are where streams flow under 287th Street. A second sample location for Stream Z is at the extreme downstream end of the site. Two sample locations for Stream V are proposed a short distance downstream of 287th Street. Additional sample locations would be located immediately downstream of each discharge location.

The Water Quality Monitoring Plan states that core summer rearing habitat water temperature apply to the site and would be maintained. This standard is 16 degrees Celsius (WAC 173-201A-602).

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 to 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 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 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

This biological opinion also relies on the regulatory 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 designations of critical habitat for PS Chinook, PS steelhead, and SRKW use the term primary constituent element (PCE) or essential features. The 2016 final rule (81 FR 7414; February 11, 2016) that revised the 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 ESA Section 7 implementing regulations define effects of the action using the term "consequences" (50 CFR 402.02). As explained in the preamble to the final rule revising the definition and adding this term (84 FR 44976, 44977; August 27, 2019), that revision 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 critical 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' current "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 current 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. Major ecological realignments are already occurring in response to climate change (IPCC WGII, 2022). Long-term trends in warming have continued at global, national and regional scales. Global surface temperatures in the last decade (2010s) were estimated to be 1.09 °C higher than the 1850-1900 baseline period, with larger increases over land ~1.6 °C compared to oceans ~0.88 (IPCC WGI, 2021). The vast majority of this warming has been attributed to anthropogenic releases of greenhouse gases (IPCC WGI, 2021). Globally, 2014-2018 were the 5 warmest years on record both on land and in the ocean (2018 was the 4th warmest) (NOAA NCEI 2022). Events such as the 2013-2016 marine heatwave (Jacox et al. 2018) have been attributed directly to anthropogenic warming in the annual special issue of Bulletin of the American Meteorological Society on extreme events (Herring et al. 2018). Global warming and anthropogenic loss of biodiversity represent profound threats to ecosystem functionality (IPCC WGII 2022). These two factors are often examined in isolation, but likely have interacting effects on ecosystem function.

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

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

Forests

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

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

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

Freshwater Environments

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

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

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

As cited in Siegel and Crozier (2019), Isaak et al. (2018), examined recent trends in stream temperature across the Western U.S. using a large regional dataset. Stream warming trends paralleled changes in air temperature and were pervasive during the low-water warm seasons of 1996-2015 (0.18-0.35°C/decade) and 1976-2015 (0.14-0.27°C/decade). Their results show how continued warming will likely affect the cumulative temperature exposure of migrating sockeye salmon *O. nerka* and the availability of suitable habitat for brown trout *Salmo trutta* and rainbow trout *O. mykiss*. Isaak et al. (2018) concluded that most stream habitats will likely remain suitable for salmonids in the near future, with some becoming too warm. However, in cases where habitat access is currently restricted by dams and other barriers salmon and steelhead will be confined to downstream reaches typically most at risk of rising temperatures unless passage is restored (FitzGerald et al. 2020, Myers et al. 2018).

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

Marine and Estuarine Environments

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

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

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

Climate change effects on salmon and steelhead

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

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

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

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

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

2.2.1 Status of the Species

For Pacific salmon, steelhead, and certain other species, we commonly use the four "viable salmonid population" (VSP) criteria (McElhany et al. 2000) to assess the viability of the populations that, together, constitute the species. These four criteria (spatial structure, diversity, abundance, and productivity) encompass the species' "reproduction, numbers, or distribution" as described in 50 CFR 402.02. When these parameters are collectively at appropriate levels, they maintain a population's capacity to adapt to various environmental conditions and allow it to sustain itself in the natural environment.

"Spatial structure" refers both to the spatial distributions of individuals in the population and the processes that generate that distribution. A population's spatial structure depends on habitat quality and spatial configuration, and the dynamics and dispersal characteristics of individuals in the population.

"Diversity" refers to the distribution of traits within and among populations. These range in scale from DNA sequence variation in single genes to complex life history traits (McElhany et al. 2000).

"Abundance" generally refers to the number of naturally-produced adults (i.e., the progeny of naturally-spawning parents) in the natural environment (e.g., on spawning grounds).

"Productivity," as applied to viability factors, refers to the entire life cycle (i.e., the number of naturally-spawning adults produced per parent). When progeny replace or exceed the number of parents, a population is stable or increasing. When progeny fail to replace the number of parents, the population is declining. McElhany et al. (2000) use the terms "population growth rate" and "productivity" interchangeably when referring to production over the entire life cycle. They also refer to "trend in abundance," which is the manifestation of long-term population growth rate.

For species with multiple populations, once the biological status of a species' populations has been determined, we assess the status of the entire species using criteria for groups of populations, as described in recovery plans and guidance documents from technical recovery teams. Considerations for species viability include having multiple populations that are viable, ensuring that populations with unique life histories and phenotypes are viable, and that some viable populations are both widespread to avoid concurrent extinctions from mass catastrophes and spatially close to allow functioning as metapopulations (McElhany et al. 2000).

Table 1, below provides a summary of listing and recovery plan information, status summaries and limiting factors for the species addressed in this opinion. More information can be found in recovery plans and status reviews for these species. Acronyms appearing in the table include DPS (Distinct Population Segment), ESU (Evolutionarily Significant Unit), MPG (Multiple Population Grouping), NWFSC (Northwest Fisheries Science Center), TRT (Technical Recovery Team), and VSP (Viable Salmonid Population).

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

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Puget Sound Chinook salmon	Threatened 6/28/05 (70 FR 37159)	Shared Strategy for Puget Sound 2007 NMFS 2006	NMFS 2016; Ford 2022	This ESU comprises 22 populations distributed over five geographic areas. All Puget Sound Chinook salmon populations continue to remain well below the TRT planning ranges for recovery escapement levels. Most populations also remain consistently below the spawner–recruit levels identified by the TRT as necessary for recovery. Across the ESU, most populations have increased somewhat in abundance since the last status review in 2016, but have small negative trends over the past 15 years. Productivity remains low in most populations. Overall, the Puget Sound Chinook salmon ESU remains at "moderate" risk of extinction.	• Degraded floodplain and in-river channel structure • Degraded estuarine conditions and loss of estuarine habitat • Degraded riparian areas and loss of in-river large woody debris • Excessive fine-grained sediment in spawning gravel • Degraded water quality and temperature • Degraded nearshore conditions • Impaired passage for migrating fish • Severely altered flow regime
Puget Sound steelhead	Threatened 5/11/07	NMFS 2019	NMFS 2016; Ford 2022	This DPS comprises 32 populations. Viability of has improved somewhat since the PSTRT concluded that the DPS was at very low viability, as were all three of its constituent MPGs, and many of its 32 DIPs (Hard et al. 2015). Increases in spawner abundance were observed in a number of populations over the last five years within the Central & South Puget Sound and the Hood Canal & Strait of Juan de Fuca MPGs, primarily among smaller populations. There were also declines for summer- and winter-run populations in the Snohomish River basin. In fact, all summer-run steelhead populations in the Northern Cascades MPG are likely at a very high demographic risk.	• 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 • Dikes, hardening of banks with riprap, and channelization
Southern resident killer whale	Endangered 11/18/05	NMFS 2008	NMFS 2022k	The Southern Resident killer whale DPS is composed of a single population that ranges as far south as central California and as far north as southeast Alaska. While some of the downlisting and delisting criteria have been met, the biological downlisting and delisting 63 criteria, including sustained growth over 14 and 28 years, respectively, have not been met. The SRKW DPS has not grown; the overall status of the population is not consistent with a healthy, recovered population. Considering the status and continuing threats, the Southern Resident killer whales remain in danger of extinction.	• Quantity and quality of prey • Exposure to toxic chemicals • Disturbance from sound and vessels • Risk from oil spills

2.2.2 Status of the 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 (PBF) 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.

A summary of the status of critical habitats, considered in this opinion, is provided in Table 2, below.

Table 1. Critical habitat, designation date, federal register citation, and status summary for critical habitat considered in this opinion

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Puget Sound Chinook salmon	9/02/05 70 FR 52630	Critical habitat for Puget Sound Chinook salmon includes 1,683 miles of streams, 41 square mile of lakes, and 2,182 miles of nearshore marine habitat in Puget Sounds. The Puget Sound Chinook salmon ESU has 61 freshwater and 19 marine areas within its range. Of the freshwater watersheds, 41 are rated high conservation value, 12 low conservation value, and eight received a medium rating. Of the marine areas, all 19 are ranked with high conservation value.
Puget Sound steelhead	2/24/16 81 FR 9252	Critical habitat for Puget Sound steelhead 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.
Southern resident killer whale	08/02/21 86 FR 41668	Critical habitat includes approximately 2,560 square miles of marine inland waters of Washington: 1) the Summer Core Area in Haro Strait and waters around the San Juan Islands; 2) Puget Sound; and 3) the Strait of Juan de Fuca. Six additional areas include 15,910 square miles of marine waters between the 20-feet (ft) (6.1-meter (m)) depth contour and the 656.2-ft (200-m) depth contour from the U.S. international border with Canada south to Point Sur, California. We have excluded the Quinault Range Site. Based on the natural history of the Southern Residents and their habitat needs, NMFS identified three PCEs, or physical or biological features, essential for the conservation of Southern Residents: 1) Water quality to support growth and development; 2) prey species of sufficient quantity, quality, and availability to support individual growth, reproduction and development, as well as overall population growth; and 3) passage conditions to allow for migration, resting, and foraging Water quality in Puget Sound, in general, is degraded. Some pollutants in Puget Sound persist and build up in marine organisms including Southern Residents and their prey resources, despite bans in the 1970s of some harmful substances and cleanup efforts. The primary concern for direct effects on whales from water quality is oil spills, although oil spills can also have long-lasting impacts on other habitat features In regards to passage, human activities can interfere with movements of the whales and impact their passage. In particular, vessels may present obstacles to whales' passage, causing the whales to swim further and change direction more often, which can increase energy expenditure for whales and impacts foraging behavior. Reduced prey abundance, particularly Chinook salmon, is also a concern for critical habitat.

The physical or biological features (PBF) of freshwater spawning and incubation sites, include water flow, quality and temperature conditions and suitable substrate for spawning and incubation, as well as migratory access for adults and juveniles (Table 3). These features are essential to conservation because without them the species cannot successfully spawn and produce offspring. The physical or biological features of freshwater migration corridors associated with spawning and incubation sites include water flow, quality and temperature conditions supporting larval and adult mobility, abundant prey items supporting larval feeding after yolk sac depletion, and free passage (no obstructions) for adults and juveniles. These features are essential to conservation because they allow adult fish to swim upstream to reach spawning areas and they allow larval fish to proceed downstream and reach the ocean.

Table 3. Primary constituent elements (PCEs) or PBFs of critical habitats designated for ESA-listed salmon and steelhead species considered in the opinion and corresponding species life history events.

Primary Constituent Elements Site Type	Primary Constituent Elements Site Attribute	Species Life History Event
Freshwater spawning	Substrate Water quality Water quantity	Adult spawning Embryo incubation Alevin growth and development
Freshwater rearing	Floodplain connectivity Forage Natural cover Water quality Water quantity	Fry emergence from gravel Fry/parr/smolt growth and development
Freshwater migration	Free of artificial obstruction Natural cover Water quality Water quantity	Adult sexual maturation Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration
Estuarine areas	Forage Free of artificial obstruction Natural cover Salinity Water quality Water quantity	Adult sexual maturation and "reverse smoltification" Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration
Nearshore marine areas	Forage Free of artificial obstruction Natural cover Water quantity Water quality	Adult growth and sexual maturation Adult spawning migration Nearshore juvenile rearing

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 site for the proposal is slightly larger than 16 acres at the northeast corner of the intersection of 59th Avenue South and South 287th Street in Auburn, Washington. Tributaries flow down the west side of the Green River Valley and then north, eventually to the Green River. Three of these streams are associated with the site. They are labeled streams X, Z, and V in Figure 1 and are part of the Mullen Slough stream system. The site has been farmed but most recently has been fallow. Coho salmon have been observed in the streams on-site. The site also has several wetlands, a high water-table, and is on the perimeter of mapped floodway and floodplain.

The action area for this proposal includes the project site and the aquatic habitat downstream to Elliott Bay.

Critical habitat has been designated within the action area for both PS Chinook salmon and PS steelhead in the Green/Duwamish River and in Mullen Slough. For PS steelhead, critical habitat extends from Elliott Bay to South 277th Street, a short distance downstream of the site for the proposal. Critical habitat for PS Chinook salmon is also designated in the Green/Duwamish river and in the downstream portion of Mullen Slough. The action area also includes designated critical habitat for SRKW due to prey reduction.

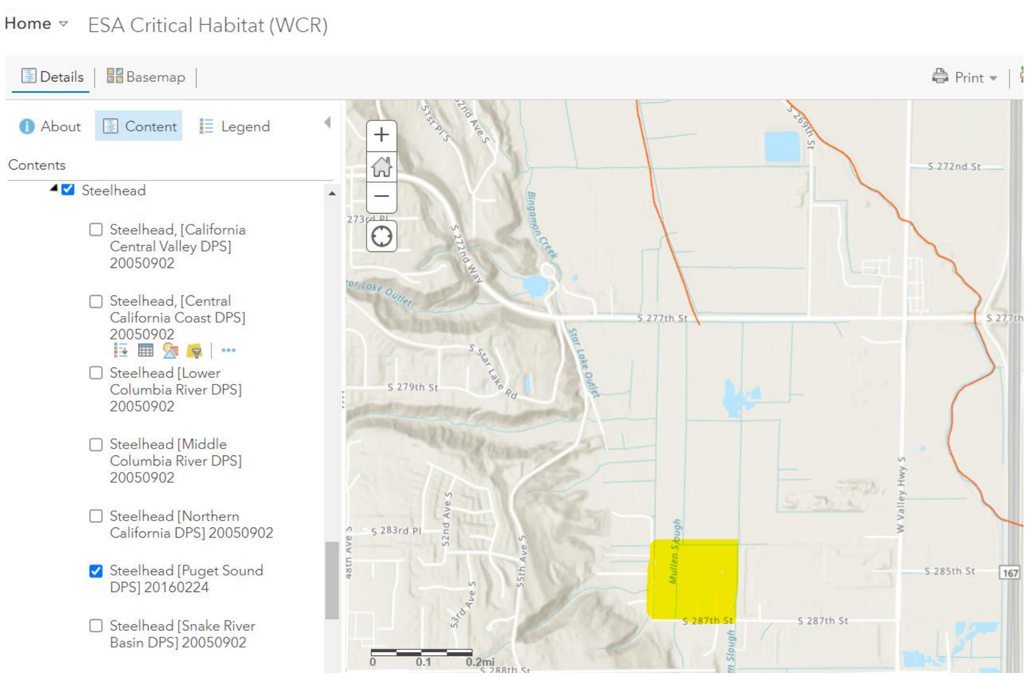

Figure 4. Designated critical habitat for PS steelhead, depicted with a red line, is a short distance downstream of the site for the proposed action (indicated in yellow).

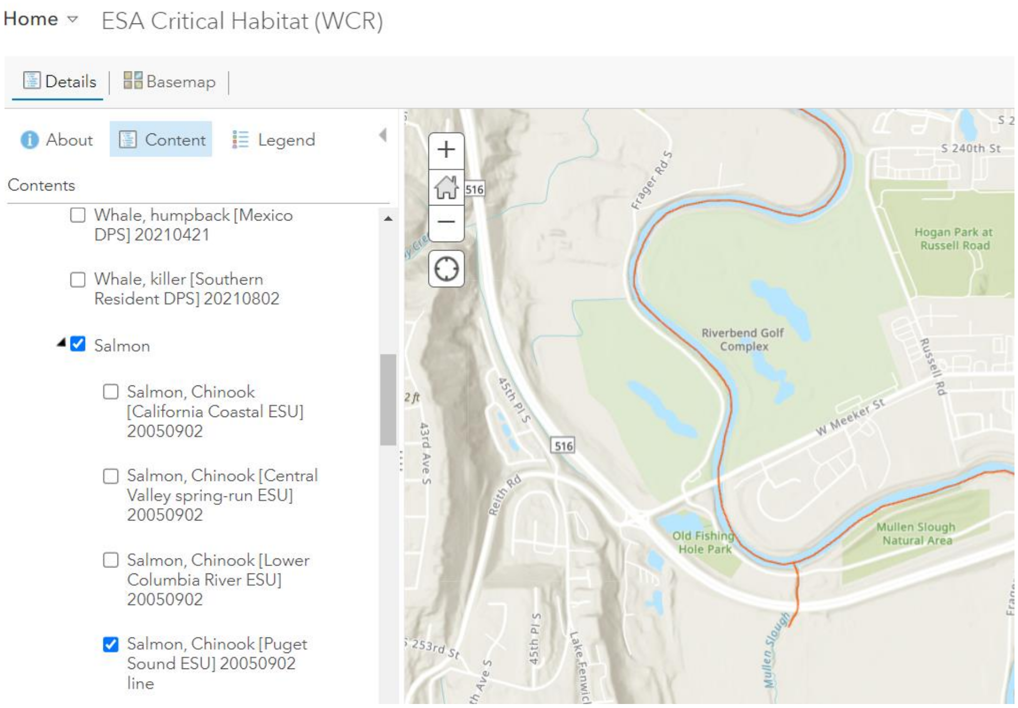

Figure 5. Designated critical habitat for PS Chinook salmon, depicted with a red line, is in the downstream reach of Mullen Slough and in the Green River.

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 first Euro-American settlers claimed land along the Duwamish River in 1851 (Washington State Department of Transportation 2007). In the following decades, agriculture spread in the Green River Valley. Dredging, filling, and flood control projects followed and resulted in loss of habitat for salmonids. Now urbanization poses threats to remaining streams, wetlands and riparian areas.

The site for the proposal is in the Lower Green River sub-watershed. The Lower Green River is important for juvenile salmon rearing. Levees, water diversions, and urbanization have reduced the amount of habitat available to salmon in the Lower Green River, particularly off-channel refuge habitats (WRIA 9 2021). Habitat area was already diminished by the alterations that reduced the water flow volume in the Green/Duwamish River described earlier. Mullen Slough is one of only three major tributaries to the Lower Green River.

In both the 2007 listing document (72 FR 26722) and again in the 2013 federal recovery outline (NMFS 2013), guiding and documenting the recovery planning process currently underway for the PS steelhead DPS[127], NMFS noted that the habitat factors leading to the decline of PS steelhead were also the factors limiting species recovery. These include:

- Reduced habitat quality through changes in river hydrology, temperature profile, downstream gravel recruitment, and reduced movement of LWD.
- Continued urban development in the lower reaches of many Puget Sound rivers and tributaries causing increased flood frequency and peak flows during storms, and reduced groundwater-driven summer flows.
- Altered stream hydrology resulting in gravel scour, bank erosion, and sediment deposition.
- Dikes, hardening of banks with riprap, and channelization, reduced river braiding and sinuosity, and increased the likelihood of gravel scour and dislocation of rearing juveniles because of dikes, hardening of banks with riprap, and channelization. (NMFS 2016a).

Limiting factors for the recovery of PS Chinook salmon have been listed for the Lower Green River and its tributaries (Kerwin and Nelson 2000). For the Lower Green River mainstem they are: Urbanization, water diversions, and revetments that are:

- Lowering the floodplain and disconnecting off-channel habitats such as sloughs and adjacent wetlands;
- Reducing large woody debris and associated instream complexity, such as pools and riffles;
- Creating some adult salmon migration problems due to low flows;
- Causing chronic water quality problems; and
- Severely reducing riparian habitats and associated functions.

For the Lower Green River tributaries, limiting factors are intense urbanization and infrastructure that are:

- Reducing forest cover and increasing impervious surfaces leading to hydrologic disruptions to stream flow, channel degradation, increased sedimentation, and decreased water quality;
- Channelizing streams to facilitate land use practices;
- Creating barriers to fish passage; and
- Introducing non-native plant and animal species.

In the Lower Green River Valley, according to the Salmon Recovery Plan (Green/Duwamish and Central Puget Sound Watershed Water Resource Inventory Area 9 Steering Committee. August 2005), about 40% of the wetlands have been filled, and about 87% of the floodplain forest has been lost. Goals include restoring spawning habitat to about 45% of historical levels and *restoring hydrologic connection to floodplain, tributaries and historical off-channel habitat to achieve access to about 45% of historical habitat area*. The plan calls for the following actions to reduce impacts:

- Establish and enforce riparian buffers along rivers, streams, estuaries and the marine shoreline.
- Minimize impervious surfaces and forest cover removal in Rural Areas.
- Promote low impact development including natural filtration systems, grassy buffer strips, and other methods to manage runoff from paved areas, clustered development and narrower roads, and porous concrete where soils allow.
- Establish specific instream habitat goals for lowland streams.
- Reduce or eliminate industrial discharges and combined sewer overflows into waterways.
- Actively manage riparian buffers to ensure a long-range goal of at least 70% of the stream corridor as mature, coniferous-dominated forest. Strive to achieve and maintain a near-continuous riparian corridor.

In Mullen Slough, several parameters in the Washington State Water Quality Assessment 303(d)/305(b) list are rated as Category 5 (polluted). These are dissolved oxygen (DO), fecal coliform bacteria, and benthic macroinvertebrates. Water temperature are rated as Category 4 (impaired). In the Green River, several additional parameters are on the list as Category 2: water of concern. These include Bis (2-ethylhexyl) phthalate, Polychlorinated Biphenyls (PCBs), mercury, toxaphene, and Endrin (WDOE 2024).

DEPARTMENT OF ECOLOGY State of Washington — Washington State Water Quality Assessment 303(d)/305(b) List

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New Search | Modify Search | Export

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Search Results - 6 Matched Listings

Listing ID	AU ID	Medium	Parameter	Category	Waterbody Name	WRIA	WQ Improvement Project	WQ Atlas Map Link
50846	17110013000158_001_001	Water	pH	3	MULLEN SLOUGH	9-Duwamish-Green		50846
71757	17110013000158_001_001	Water	Ammonia-N	3	MULLEN SLOUGH	9-Duwamish-Green		71757
15828	17110013000158_001_001	Water	Temperature	4A	MULLEN SLOUGH	9-Duwamish-Green	Green River Temperature Watershed TMDL	15828
15767	17110013000158_001_001	Water	Bacteria - Fecal coliform	5	MULLEN SLOUGH	9-Duwamish-Green		15767
15825	17110013000158_001_001	Water	Dissolved Oxygen	5	MULLEN SLOUGH	9-Duwamish-Green		15825
70164	17110013000158_001_001	Other	Benthic Macroinvertebrates Bioassessments	5	MULLEN SLOUGH	9-Duwamish-Green		70164

Showing 1 to 6 of 6 entries — Previous 1 Next

Figure 6. Washington State 303(d) list search results for Mullen Slough, showing that temperature, bacteria, DO and benthic macroinvertebrate parameters are identified water quality problems.

Juvenile Chinook salmon rear in the lower Green River subwatershed from mid-December through mid-July. Analysis of juvenile life history success in adult Green River Chinook salmon found parr outmigrants, as opposed to fry, disproportionately contribute to adult returns relative to their abundance. A 2019 study on the use of small tributaries by juvenile Chinook salmon helped to illustrate that it is important for Chinook salmon to have places to rear and grow before leaving the Green River system (Gregersen 2019). Smaller fry are less likely to return as adults (Water Resource Inventory Area 9 2021).

Juvenile natural origin PS Chinook salmon have recently been found in Mullen slough (Gregersen 2022). Adult PS Chinook salmon have also been observed as far upstream as South 277th Street (C. Gregersen March 28, 2024 email communication[1]).

Adult PS Chinook salmon have have been observed a short distance downstream of the site for the proposal. No culvert, slope or water velocity barriers preclude Chinook salmon and steelhead from using the aquatic areas of the action area for rearing. In October of 2010, several adult Chinook were observed in the pool below the South 277th Street culvert by biologists working form King County (Personal communication Chris Gregersen, March 28, 2024), approximately 2300 feet (0.44 miles) downstream of the site for the proposal.

Figures below include a site map from a Critical Areas Report for the proposal, depicting streams and wetlands in the project area, a floodplain map, and a National Wetlands Inventory Map. During high water events, such as the 2006 flood event, the small streams and wetlands on the site provide backwater rearing habitat for salmon.

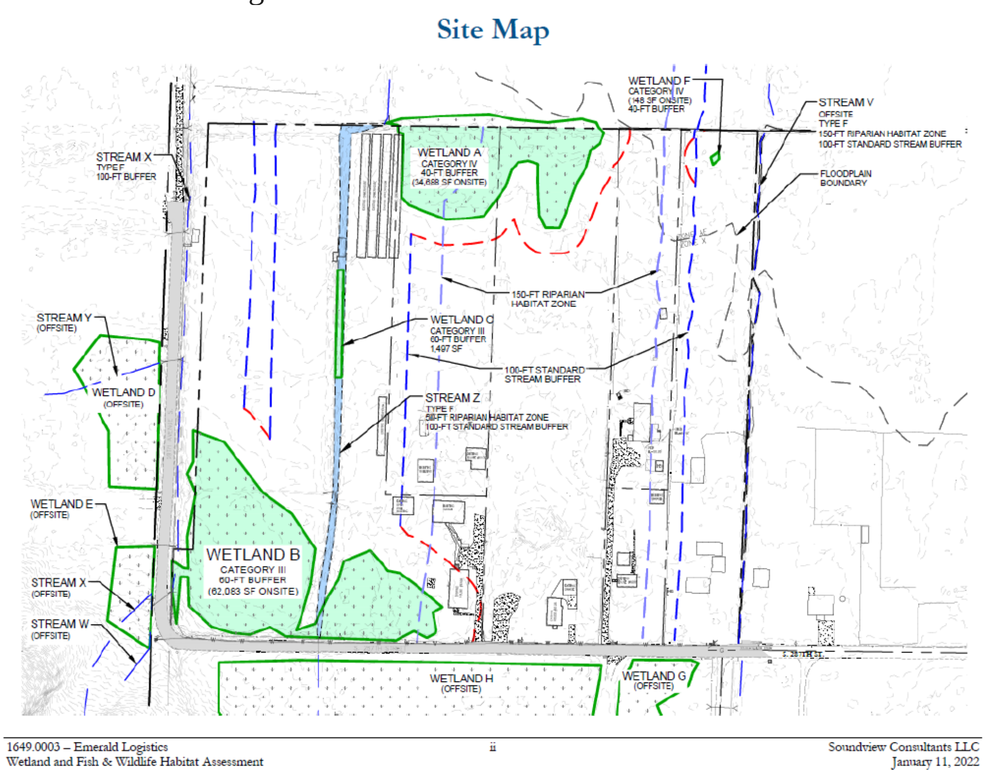

Figure 7. Site Map depicting streams, wetlands, floodplain and standard buffers.

[1] C. Gregersen, King County Department of Natural Resources, Water & Land Resources Division, 201 South Jackson, Suite 5600, Seattle, WA 98104

The proposed action is to convert 9.24 acres of the site to impervious industrial land use which has higher impact that lower intensity land uses, in a location that is important to listed species, with less than standard water quality and habitat protection. Based on information provided by the applicant, the site has over nine acres of stream, wetland and associated riparian buffer detailed in the table below. The riparian buffer widths are from information provided by the applicant as noted (Table 4).

Table 4. Environmentally Sensitive Areas on the site of the proposal add up to at least 9 acres according to the information provided in section 2 of the BA and the mitigation plan as noted. These documents refer to the City of Auburn's buffers.

	Area on-site, acres[2]	**Buffer Area on-site, square feet-acres[3]**	**Acres used to calculate sensitive areas**
Wetland A	0.8	34,668-0.80	1.6
Wetland B	1.51	62,776-1.44	Mostly within buffers of Streams X and Z
Wetland C	0.03	1497-0.034	Within Stream Z buffer
Wetland F	0.003	148-0.003	Within Stream V buffer
Stream Z	0.12	175,100-4.02	4.14
Stream X	0	56,154-1.29	1.29
Stream V	0	87,500-2.01	2.01
Approximate Total			At least 9.04 acres

We noted text on page 105 of Washington State Wetland Rating System for Western Washington 2014 Update (Hruby 2014) states that wetlands are assigned a high value for habitat if wetlands on a site provide habitat for either state or federal threatened or endangered species or are mapped as a location for an individual WDFW priority species. Wetland B is connected to Stream Z. Coho use stream Z according to the WDFW area habitat biologist, the project proponent and Salmonscape (WDFW 2024) (Figure 8). Coho is a WDFW priority species. Wetland ratings are sometimes used to determine mitigation ratios and riparian functions. The amount of area protected from development in the form of aquatic habitat or for riparian functions affects the quality of salmon habitat on-site and downstream.

Using the wetland classifications and normally-required buffer widths provided by the applicant in the mitigation plan, 9 acres of the site could not be developed (even without consideration for listed species). Also, normally, when fill is placed in wetland and buffers are reduced, compensatory mitigation is required. Typically, wetland that is artificially created provides less ecological value than natural wetlands and for this reason, mitigation ratios that larger than the fill area. The COE described the proposed action to include placing fill in 0.39 acres of wetland. The mitigation ration for Wetland B as a category III wetland would be 8 to one, or over 3 acres of wetland creation.

If the COE chose to require buffers recommended in Wetland Mitigation in Washington State (WDOE, USACE and USEPA 2021) for wetland that provide habitat for state or federal

[2] From Table 4 Final Mitigation Plan except, the area of Stream z is estimated to 4 times the area of Wetland C.
[3] From Sheet 1 of the Final Mitigation Plan for wetland buffers. Stream buffers were estimated using the measuring tool in iMap. The distance from the south to north boundary lines is approximately 875 feet. Buffer widths for streams are depicted as 100 feet wide on Sheet 1.

threatened or endangered species and/or are mapped as a location for an individual WDFW priority species, and adjacent to high intensity land use, buffer widths would 150 to 200 feet. This would be consistent with Kiffney et al. (2003 and 2004) and the salmon recovery planning documents that call for off-channel habitat protection and enhancement in the Lower Green River valley.

If the standard compensatory wetland mitigation and buffers were required, the site is not large enough for the proposed warehouse and surrounding pavement. With the wider buffer widths recommended in Wetland Mitigation in Washington State (WDOE, USACE and USEPA 2021) were used, even less area would be considered developable. Therefore, the proposed action is at odds with standards for protecting aquatic habitats.

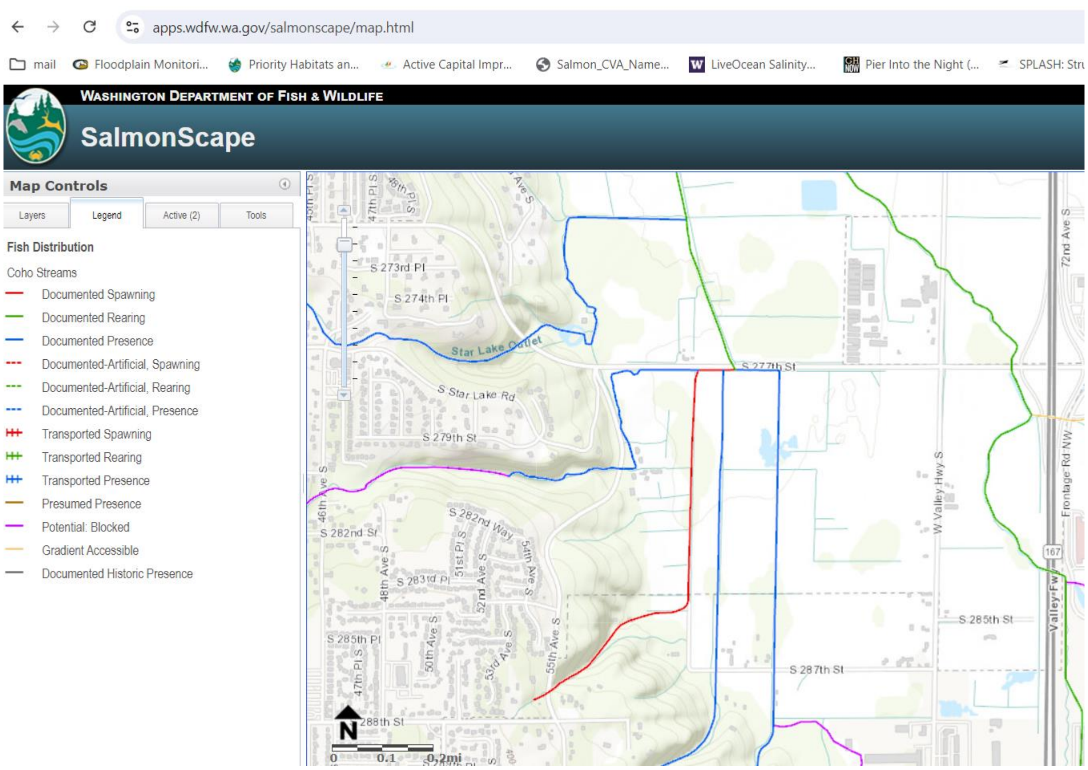

Figure 8. Salmonscape (https://apps.wdfw.wa.gov/salmonscape/) depiction of coho use of Streams X, Z and V.

In recent decades, the site was almost certainly part of a complex and dynamic floodplain consisting of wetlands, oxbows, side channels, sloughs and beaver ponds, which provided valuable habitat for numerous Pacific salmonid species. In the 1900s agriculture waxed and later waned in the valley. Fish habitat was reduced by construction of the current system of levees and the completion of Howard Hanson Dam in 1962. Areas still accessible to salmon are very important for sustaining and recovering listed populations of PS Chinook salmon and steelhead.

The Green/Duwamish and Central Puget Sound Watershed Salmon Habitat Plan 2021 Update (WRIA 9, 2021) calls for restoring floodplain habitat, increasing the length of tributaries and side channels, increasing backwater acreage and wetland acreage and increasing riparian forest in the lower Green River. It also calls for protecting and restoring riparian tree canopy and promoting hyporheic exchange of shallow groundwater and surface waters to build ecological resilience to rising temperatures and moderate the impacts of climate change. Predicted temperature increases, lower summer flows and altered precipitation patterns are likely to worsen temperature stress for Chinook salmon and steelhead in the Green River.

Appendix B10 – FEMA Floodplain Map

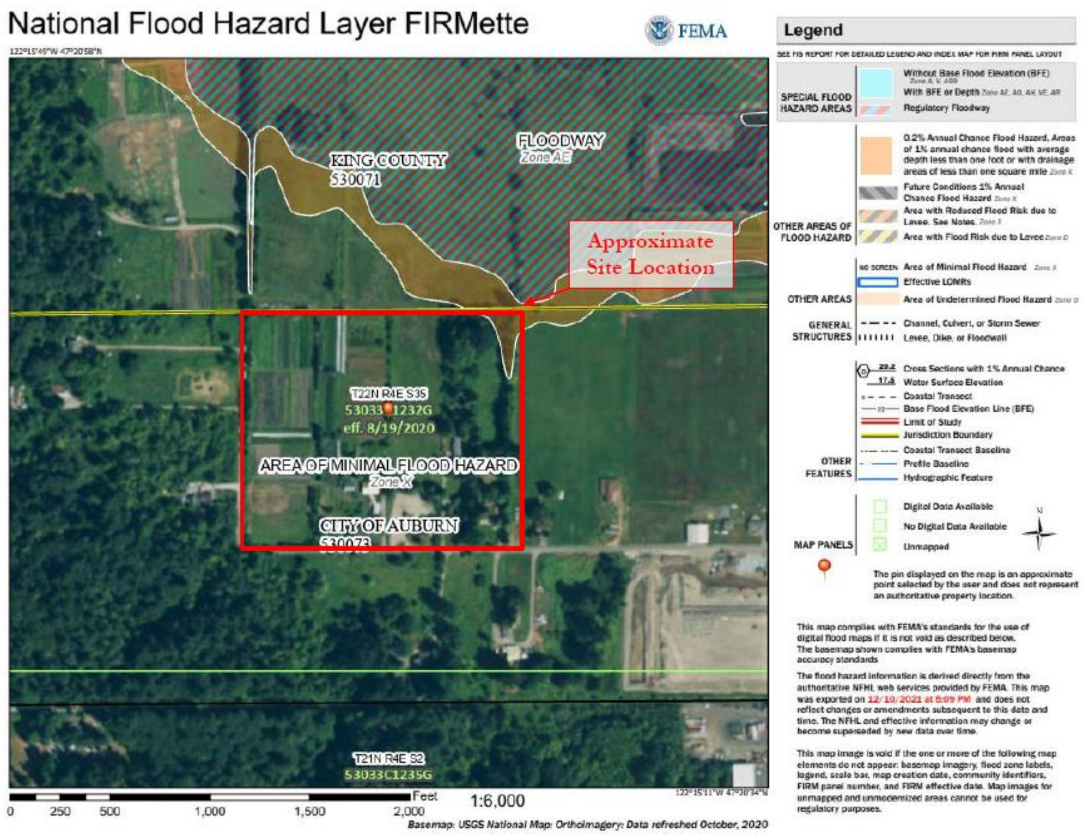

Figure 9. FEMA floodplain map depicting floodway on parcels adjacent to the project (https://msc.fema.gov/portal/search?AddressQuery=6214%20south%20287%20Street%2C%20Auburn%20WA)

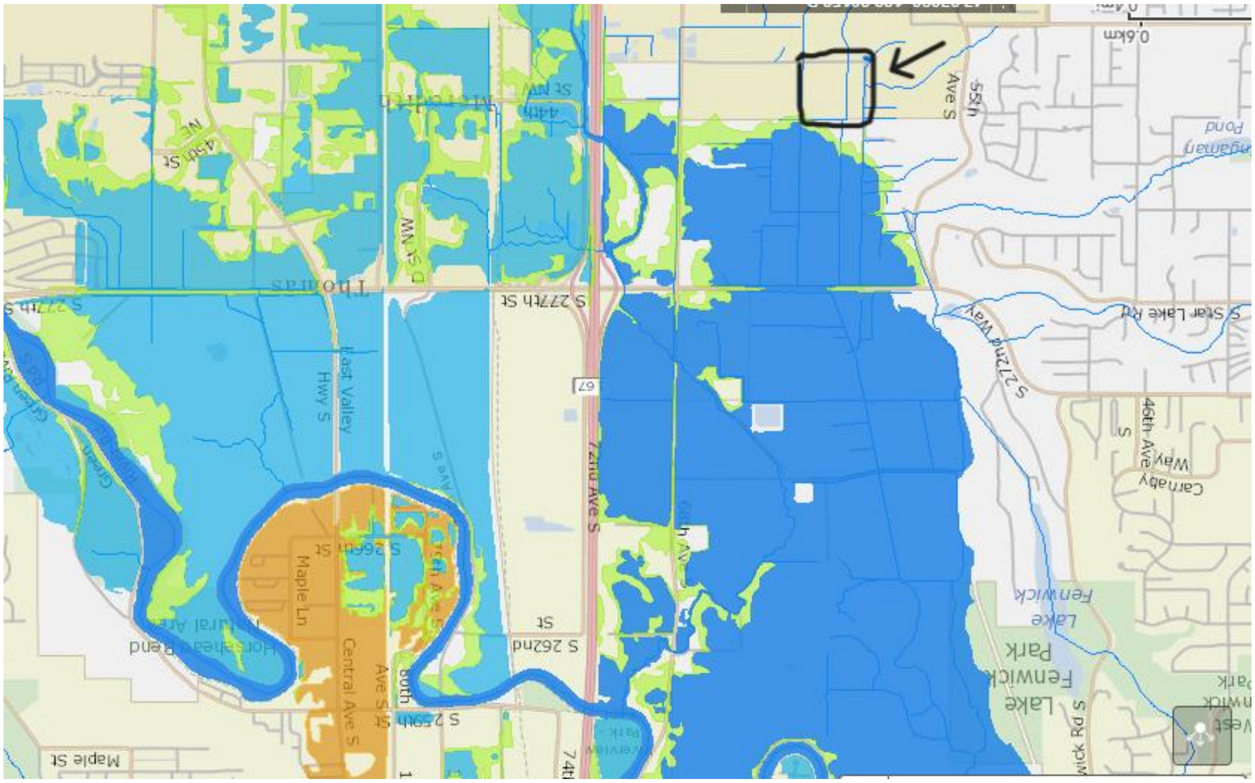

Figure 10. FEMA floodplain features in the Green River Valley showing that the project site is part of a larger fluvial floodplain network. Darker blue is floodway. From King County IMAP (https://kingcounty.gov/en/dept/kcit/data-information-services/gis-center/maps-apps/imap).

Figure 11. Photograph depicting the same area, the upper reaches of Mullen Slough, that is depicted in Figure 14 during a flood event in 2006.

Mullen Slough has been identified as likely playing an important role in the productivity of salmonids in the Green River Basin (Shannon & Wilson 2002). Shannon and Wilson (2002) found that five major factors limit anadromous and resident salmonid spawning in the Mullen Slough system: (1) altered hydrology and land use activities, (2) degraded riparian zones, (3) hydromodification, (4) passage barriers, and (5) poor water quality. Many factors also limit juvenile salmonid rearing in this system. These include urbanization, physical barriers to juvenile passage, change in channel morphology, lack of large woody debris (LWD), and lack of native riparian areas. Adult holding and adult upstream migrations are limited by land use activities (agriculture and stream straightening), alteration of the natural hydrological regime of Mullen Slough, physical barriers, and water quality.

Tributaries throughout the lower Green River accounted for one-third of the total area of available habitat and drained an extensive network of floodplains and depressional areas throughout the valley. These areas likely served as salmon flood forage, flow refuge and rearing habitat. Much of this habitat is no longer available to salmon. Habitat that remains is heavily impacted by human actions throughout the lower Green subbasin (Gregersen 2019).

The Mullen Slough basin is 3264 acres. As of 2019, 20.5 percent of the basin was impervious and 55 percent was urbanized (Gregersen 2019). Yet Mullen Slough and Midway Creek had the highest densities of juvenile Chinook salmon in lower Green River during a three-month sampling period in 2018. Based on the relatively good riparian habitat on public land in the lower reaches of Mullen Slough, the absence of barriers, and relatively high juvenile Chinook salmon abundance, it is likely that Mullen Slough currently provides the highest potential for rearing habitat of the streams sampled in the lower Green River tributaries (Gregersen 2019).

Mullen slough drains a mixture of forested open space, agricultural, and urban land uses. The riparian canopy in the lower portion of Mullen slough is in relatively good condition. However, much of the stream has been straightened and lacks needed riparian functions. Chris Gregersen (2019) documented high densities of non-natal juvenile Chinook salmon (fry and parr) using Mullen slough. In a second study Gregersen (2022) confirmed juvenile Chinook salmon use the lower Green River for rearing. Findings included:

- Juvenile Chinook salmon spent up to two months in the mainstem lower Green River, which is longer than previously known.
- Non-natal tributaries proved to be valuable habitat for juvenile rearing.

The Green/Duwamish and Central Puget Sound Watershed Salmon Habitat Plan 2021 Update calls for restoring floodplain habitat, increasing the length of tributaries and side channels, increasing backwater acreage and wetland acreage and increasing riparian forest in the lower Green River. It also calls for protecting and restoring riparian tree canopy and promoting hyporheic exchange of shallow groundwater and surface waters to build ecological resilience to rising temperatures and moderate the impacts of climate change. Predicted temperature increases, lower summer flows and altered precipitation patterns are likely to worsen temperature stress for Chinook salmon in the Green River.

The widespread removal of tall native trees in riparian corridors of the lower Green River valley allows solar-atmospheric radiation to warm waters. As a result, large stretches of the Green River and its tributaries regularly exceed established water quality standards for temperature. In 2011, the WDOE calculated total maximum daily load (TMDL) for the Green River and detailed the need for buffers 32-meters wide. In response to widespread high water-temperatures in 2015, a riparian revegetation strategy titled Regreen the Green was adopted as an addendum to the 2005 Salmon Habitat Plan.

Mullen Slough is on the Washington State 303d list of polluted waters. Four water quality standards have been violated. In addition to temperature, fecal coliform bacteria, DO and benthic macroinvertebrate populations are impaired. Water quality improvements are required for all these parameters. Specifically, in Mullen Slough the latter three parameters are rated as Category 5, the highest rating. This means water quality improvement projects are required for fecal coliform bacteria, DO and benthic macroinvertebrates.

The site was formerly farmed and is now fallow. Some of the site was not accessible during a site visit in September of 2023 because of fencing, standing water and thick vegetation. Many young cottonwood trees are scattered over the formerly farmed area. Pacific tree frogs, song birds and a garter snake were observed during the site visit. Although it was still dry season, water overtopped ankle boots while walking the site.

Figure 12. September 2023 site visit photograph. The taller plants all over the previously-farmed area are cottonwood tree seedlings.

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 but that are not part of the 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 402.02).

Temporary effects associated with construction activities include fish exclusion including potential handling and possible electrofishing; degraded water quality from suspended sediment reaching the stream during upland earthmoving and stream relocation; and reduced access to rearing areas during worksite isolation.

Longer term effects from the site development include degraded water quality from urban runoff/stormwater and temperature increases due to reduced riparian vegetation; reduced prey base and natural cover due to reduced riparian vegetation, and modified site hydrology; reduced floodplain connectivity and reduce rearing area due to compaction and fill.

2.5.1. Effects on Critical Habitat

Five of the six of effects listed above are habitat effects but cover and floodplain connectivity are features of critical habitat, and the project site where these impacts will occur is not within designated critical habitat. Those two effects, plus fish handling, will be presented exclusively in the analysis of species exposure and response. To the degree that the project effects affect PS Chinook salmon, this is an effect on the forage PBF of SRKW critical habitat.

Effects on PS Steelhead and PS Chinook salmon Critical Habitat

The habitat effects modify freshwater rearing and migration values for PS steelhead and PS Chinook salmon by PBFs, specifically water quality and forage.

Reduced access to rearing habitat

Worksite isolation involves removing fish from the area where work occur or where the immediate effects of work are so intense that exposure of fish will be injurious or lethal. We will discuss the effects of fish handling in the section on species, but the effect of worksite isolation is a restriction from certain habitat areas normally suitable for rearing. While fish are constrained to upstream and downstream areas, access to rearing habitat is temporarily degraded. To the degree that some areas currently used for rearing fish are filled (e.g. wetlands, and the current alignment of one stream), together with fill being added to the site in order to place buildings and parking, surface connection between wetlands and streams during high water becomes less likely, ensuring the loss of that rearing habitat is permanent.

Reduced water quality

New impervious conditions will alter physical habitat processes; for example, the hydrologic effects of stormwater runoff increase erosion and streambank scouring, downstream sedimentation and flooding, and channel simplifications (Jorgensen et al. 2013; Jonsson et al. 2017). And, as listed above, water quality is both temporarily and persistently impaired by the proposed construction and increase in impervious conditions.

Turbidity is primarily a construction impact, but temperature and stormwater contamination are persistent. Turbid conditions/suspended sediment reduce water clarity and can impair spawning values when sediment settles into spawning substrates.

Reduced riparian condition and increased impervious contribute to the heat island effects, that increase water temperature. The site is at the edge of the urbanizing City and also at the edge of the floodway. It is at the intersection of a landscape characterized by floodplain fluvial ecological processes and an urban heat island, as descripted by the Environmental Protection Agency (EPA 2024). Somers et al. (2016) found that heat pulses from urban stormwater extended beyond one kilometer downstream.

Impervious surfaces, such as roads and parking lots, alter the natural infiltration of vegetation and soil, and accumulate many diverse pollutants. During heavy rainfall or snowmelt events, accumulated pollutants are mobilized and transported in runoff from roads and other impervious surfaces. Treatment is proposed for 91 percent of the stormwater from the proposed industrial development. Proposed water quality treatment for pollution-generating impervious area is expected to reduce the magnitude of these adverse effects. However, a portion of the contaminated stormwater from the pollution generating impervious surface (PGIS) would be discharged without treatment. PGIS is considered to be a significant source of pollutants in stormwater runoff. Such surfaces are regularly subject to vehicular use or industrial activities.

The proposal is expected to increase traffic on South 287th Street as well. Therefore, the proposed action is likely to result in the introduction of contaminants into fish habitat on-site and downstream. Motor vehicles are a primary source of transportation-related pollutants from impervious surfaces. Other known toxicants include those derived from tire wear (e.g., 6PPD-quinone), brake pads (e.g., copper and other metals), and exhaust (e.g., phenanthrene and other polycyclic aromatic hydrocarbons, or PAHs). Stormwater may also include additional contaminants depending on the surrounding land use and proximity to industrial facilities. Stormwater can discharge at any time of year. However, first-flush rain events after long dry periods typically occur in September in western Washington. As with stormwater runoff globally, the leading edge of hydrographs (the first flush) in Puget Sound have proportionally higher contractions of contaminants, including those long known to resource managers (as evidenced by existing aquatic life criteria under the Clean Water Act), as well as many chemicals of emerging concern, so-called because they were largely unknown a decade ago (Peter et al. 2020). Higher concentrations of pollutants occur less frequently between March and October as longer dry periods exist between storm events. In western Washington, most stormwater discharge occurs between October and March, when the region receives the most rain.

These contaminants may have additive or synergistic effects, and effects may be aggravated by warmer temperatures. The reductions in water quality reduce the habitat value for spawning and rearing directly, and indirectly by reducing the quantity and quality of forage communities.

Reduced forage due to upstream loss of riparian vegetation and reduced floodplain connectivity.

In addition to forage impacts from water quality reductions, altered hydrology and reduced riparian conditions can impair salmonid prey. In the publication Wetland Mitigation in Washington State (WDOE, USACE and USEPA 2021) wider buffers are specified for habitats important to sustain threatened species and/or species listed as a WDFW Priority Species. Buffers for Category III wetlands with a moderate to high level of function for habitat, and a high level of adjacent land use should be 150 to 200 feet wide according to Table 6C-2 in that guidance document. Typically, 100 feet is considered a minimum to protect riparian functions (Kiffney et al. 2003; Kiffney et al. 2004). This amount of buffer will not be maintained along any of the streams at the project site. Loss of riparian vegetation at the project site would persist for several years in some locations and where vegetation is removed and replaced with buildings or pavement, riparian functions would be permanently lost.

The proposed action would clear riparian vegetation on the site which would adversely affect on-site and downstream in-water habitat. Many prey organisms depend on riparian vegetation and have life histories that include both terrestrial and aquatic phases. Riparian areas with abundant and diverse native species generate food needed for foraging young fish. Allochthonous material is an integral part of riparian systems that sustain rearing salmon (Bridcut 2000, Eberle & Stanford, 2010, Wipfli & Baxter 2011). In one study, (Eberle and Stanford 2010) 68 percent of coho salmon diet was of terrestrial origin. Rundio and Lindley (2019) found stream-dwelling steelhead to be opportunistic feeders that took advantage of diverse aquatic and terrestrial prey available. Terrestrial invertebrates were 15 to 60 percent of the energy consumed by steelhead in this study.

Removing riparian trees reduced the biotic integrity of water bodies (Kiffney et a. 2003, 2004). Degraded biotic integrity is an existing water quality impairment in Mullen Slough (WDOE 2024). In a two-year study Merz (2002) examined the stomach contents of juvenile steelhead and found the major portions of their diets, in order of relative importance, were hydropsychid caddisfly larvae, chironomid pupae, baetid mayfly nymphs and subimago, and zooplankton (primarily daphniids). Caddisflies, chironomids and mayflies all have terrestrial life stages and illustrate the interaction between aquatic and terrestrial organisms in riparian ecosystems.

The site has a high water table, wetlands, and three small unnamed streams. Filling aquatic areas and raising the ground surface elevation of more than half of the site, would reduce floodplain connectivity on more than half the site, and the soil compaction will reduce water in the soil. These would impede hydraulic conductivity and flow patterns in the stygoscape. Contemporaneously, invertebrate densities and taxon richness would likely be altered (Stanford and Ward 1993, Ward 2002), particularly with altered pH or other water quality parameters and because reductions in floodplain connectivity would also reduce prey that an unconstrained network of streams and wetlands in an alluvial valley would otherwise provide.

To summarize, a shift in how water moves, and reductions in water quality from stormwater and increased temperature is likely to change the in-stream fauna and reduce forage for salmonids normally provided by micro and macroinvertebrates (Haldar et al. 2016). Together with the loss of forage-generating riparian area during both the short and long term would adversely affect the forage PBF of freshwater rearing for salmon and steelhead. Having forage habitat in sheltered, low velocity areas with abundant food is extremely important for juvenile salmonids in the Green River watershed because this type of habitat is in very short supply. The Puget Sound Chinook Recovery Plan calls for increasing backwater acreage and wetland acreage and increasing riparian forest in the lower Green River Watershed.

Critical Habitat for SRKW

The 2006 final rule designating critical habitat for SRKW identified three habitat features (PBFs) essential to the conservation of the DPS: (1) Water quality to support growth and development; (2) prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth; and (3) passage conditions to allow for migration, resting, and foraging.

This proposal would impact the second PBF, regarding prey. For SRKW, a reduction in fitness or survival of salmon and steelhead would reduce quality and quantity of prey. Direct and indirect impacts to salmon survival are addressed below. In the instance of contaminated runoff, PS Chinook salmon, PS Steelhead and coho's repeated/chronic exposure to contaminants in successive cohorts, directly through diminished water quality, and via contaminated prey, both described below, results in a diminishment of the forage PBF of SRKW critical habitat. For coho salmon, exposed to 6PPDq in stormwater discharge is expected to be lethal. French et al. (2022) found that mixtures containing 5% stormwater were lethal to coho. Both quantity and quality of prey would decline as a result of impacts to water quality, as these effects are likely to cause latent health effects on salmon that slightly reduce adult abundance, and also reduce the quality of adult salmon that do return and serve as SRKW prey, due to bioaccumulated contaminants.

Southern Resident killer whales need to maintain their energy balance all year long to support daily activities (foraging, traveling, resting, socializing) as well as gestation, lactation, and growth. Maintaining their energy balance and body condition is also important because when stored fat is metabolized, lipophilic contaminants may become more mobilized in the bloodstream, with potentially harmful health effects (Mongillo *et al.* 2016). SRKWs are top predators that show a strong preference for salmonids in inland waters, particularly larger, older age class Chinook salmon (age class of 3 years or older) (Ford & Ellis 2006, Hanson *et al.* 2010). According to NMFS (2022) steelhead, chum, and Pacific halibut have also been detected as prey organisms. Foraging on chum and coho salmon, steelhead, Big skate and lingcod was also detected in recent fecal samples (Hanson et al. 2021). These data indicate that the whale diet diversifies when Chinook salmon is less abundant (Hilborn et al. 2012; Ford et al. 2016; Hanson et al. 2021). Warlick et al. (2020) continued to find that Chinook is the primary prey for all pods in the summer months, followed by coho and then other salmonids. Habitat conditions should support the successful growth, recruitment, and sustainability of abundant prey to support the individual growth, reproduction, and development of SRKW.

Age, size, and caloric content all affect the quality of prey, as do contaminants and pollution. The availability of key prey is also essential to the whales' conservation. Availability of prey along the coast is likely limited at particular times of year due to the small run sizes of some important Chinook salmon stocks, as well as the distribution of preferred adult Chinook salmon that may be relatively spread out prior to their aggregation when returning to their natal rivers (FR 8/2/21 etc.).

Additionally, the critical habitat feature related to prey includes prey quantity, quality, and availability and this analysis also draws on the analysis of the effects on prey to the whales themselves. The proposed action has the potential to affect quantity and therefore availability of prey, and through stormwater contamination and bioaccumulation in salmon, may affect prey quality.

Given the total quantity of prey available to SRKWs throughout their range numbers in the millions, the reduction in prey related to short-term construction effects from the proposed action is extremely small. Therefore, NMFS anticipates that the short-term reduction of Chinook salmon, coho salmon and steelhead from temporary effects would have little effect on SRKWs. However, episodic and enduring declines of SRKW’s prey as a result of the proposed action is also expected. Sufficient quantity, quality, and availability of prey are an essential feature of the critical habitat designated for SRKW. Therefore, we expect a permanent though slight, incremental reduction in the quantity and availability of prey, which is adverse to critical habitat.

2.5.2. Effects on Listed Species

As previously stated, the temporary effects associated with construction activities include: 1) fish exclusion including potential handling and possible electrofishing, 2) degraded water quality from suspended sediment reaching the stream during upland earthmoving and stream relocation, and 3) reduced access to rearing areas during worksite isolation.

Longer term effects from the site development include 1) degraded water quality from urban runoff/stormwater and temperature increases due to reduced riparian vegetation 2) reduced prey base due to reduced riparian vegetation, and 3) modified hydrology and reduce rearing area.

Salmonid Exposure and Response

Fish Exclusion

The proponent will need to remove fish from the site to avoid accidental injury or death of fish during site preparation and development, particularly filling of wetlands and stream relocation. While "herding" is proposed as removal a preliminary method that does not trap fish, secondary steps such as netting, or electrofishing, may be employed to remove as many fish as possible; these secondary steps, while intended to avoid injury and death of fish can also stress, stun, injure or kill some of the fish so handled. Exclusion from some rearing habitat is a persistent effect of the proposed action. Reduced rearing habitat decreases available resting and foraging area, and increases competition with the remaining suitable area which can result in reduced growth or fitness of some individuals in the exposed cohorts (Ayllon, et al. 2012; Young, 2004).

Water Quality Reductions

Even if fish are relocated to downstream locations, during clearing, filling, grading, and stream relocation, turbid conditions are likely to occur in areas where fish may be present in the action area. Salmonids can detect areas of high turbidity and if stream conditions are suitable, respond with avoidance behavior by relocating to areas of lower turbidity. If exposure is minimized through this response, only slight physical response of individual fish, such as stress and cough, are likely. These are typically temporary effects that do not reduce fitness or cause acute injury, but prolonged exposure can result in harmful response (Bash et al. 2001).

Stormwater adversely impacts ESA-listed fish and indirectly when fish are exposed to contaminants in stormwater, which can be transported far downstream to estuaries and the ocean, dissolved in surface waters, attached to suspended sediments, or via aquatic food webs (e.g., bioaccumulation). ESA-listed fish and may take up contaminants from their surrounding environments by direct contact with water and sediments, or ingestion of contaminated plankton, invertebrates, detritus, or sediment. The response to such an exposure depends on the chemical, its concentration, frequency of exposure, and duration of exposure. When exposed to pollutants in singularity or in complex mixtures, individual organisms may experience a range of effects (e.g., avoidance of aquatic habitat areas, reduced growth, or death). In many (if not most) cases, the magnitude of impact would be strongly influenced by the presence or absence of other habitat co-stressor stressors, such as increasing surface water temperatures as a consequence of climate change.

6PPD-Quinone

Laboratory studies have demonstrated that juvenile coho salmon (Chow et al. 2019), juvenile steelhead, and juvenile Chinook salmon (J. McIntyre and N. Scholz, unpublished results, 2020) are also susceptible to varying degrees of mortality when exposed to urban stormwater. A few of the key findings to date include:

- Following exposure, the onset of mortality is more delayed in steelhead and Chinook salmon (NWFSC unpublished data) than in coho.
- The mechanisms underlying mortality in salmonids is under investigation, but are likely to involve cardiorespiratory disruption, consistent with symptomology. Therefore, special consideration should be given to parallel habitat stressors that also affect the salmon gill and heart, and nearly always co-occur with 6PPD such as temperature (as a proxy for climate change impacts at the salmon population-scale) and PAHs.
- The long-term viability of salmon and other Puget Sound aquatic species is the foremost conservation management concern for NOAA, and thus it will be important to incorporate effectiveness monitoring into future mitigation efforts – i.e., evaluating proposed stormwater treatments not only on chemical loading reductions, but also the environmental health of salmon and other species in receiving waters (Scholz 2011).
- Chinook salmon and steelhead are also physically harmed by 6PPD-Q when exposed. Reductions in prey for SRKW, described in section 2.5.1, can also reduce the growth, survival and productivity of SRKW.

The highest concentration levels are expected to occur at the points of discharge and would begin to dilute as the stormwater moves downstream. Captured and treated stormwater effluent would be discharged 75 feet from the Stream V channel in the NE part of the site. This is also the part of the site that is mapped floodplain by FEMA. The effects of the dilution would be such that concentrations of metals, PAHs, PCBs and 6PPDs and the chemical mixtures in the discharge would be indistinguishable from background levels because there are additional contributions of stormwater downstream of the project site, for example, from roads crossing Mullen Slough.

First- flush rain events after long antecedent dry periods (periods of no rain) that most typically occur in September are also expected to have extremely high levels of copper, lead, zinc, and tire particles. Higher concentrations are also expected to occur between March and October in any given year—as there would be longer dry periods between storm events. However, the occurrence of these events would occur with less frequency. Most discharge would occur between October and March, concurrent with when the region would receive the most rain. However, year-round toxicity would increase with the additional PGIS and at least 9 percent of untreated stormwater being discharged from the site. The effect of these contaminants on rearing salmonids is to reduce fitness and survival of multiple juvenile salmonid cohorts for the foreseeable future; reduced abundance over time may impact productivity.

Temperature

After clearing and grading, the restoration of 75-foot wide buffers is planned for streams X, Z and V and 40 to 60-foot-wide buffers are planned for the two larger wetlands, according to

Figure 2 above, from the mitigation plan for the proposal. Loss of riparian area and function is anticipated. By removing riparian vegetation and adding impervious area, without measures to address or reduce urban heat island effects, the proposed action would increase water temperatures. Specifically, in the Green River, temperature increases would add to a compromised baseline condition in which water temperatures already occasionally exceed lethal thresholds. This is even more likely when vegetated areas are replaced with impervious surfaces because the loss of groundwater recharge also exacerbates summer low flow conditions. Reduced surface and ground water interaction would also increase water temperature impacts. The high ground water level on-site, as described in the Geotechnical Report, and the anticipated de-watering proposed during construction would reduce hyporheic exchange of water in the project vicinity. The hyporheic exchange of water can exert a significant cooling effect (NOAA 2022). With reduced hyporheic exchange as a result of soil compaction, this cooling effect would be reduced. In other words, reduced groundwater connectivity also increases water temperatures. Warm water temperatures can impair growth and survival of eggs and fry (Del Rio et al. 2021) e expect poor growth, decreased fitness, and reduced survival of juvenile salmonids in particular, as a result of increased water temperatures from both reduced riparian conditions and reduced groundwater connectivity.

Forage reductions

The loss of this vegetation would decrease prey that salmonid species would experience throughout the action area, at the project site, and downstream. Similarly, the proposed action's wetland fill, soil compaction, stream relocation, and new impervious surfaces will alter function of the hyporheic zone, which connects the small streams and wetlands on the site to each other and the larger floodplain ecosystem by subsurface connection. Invertebrates found in the hyporheic zone (Stubbington, 2012) are a component of salmon prey.

An additional pathway of forage reduction is the loss of riparian vegetation. The proponents primary plan for revegetation is to hydroseed the disturbed areas with only small areas of replanting using native vegetation. Riparian vegetation, in addition to providing cover for juvenile fish and cooling of stream water, is a source of detrital prey as insects fall and drift into the water.

Bioenergetic and foraging models developed for salmonids can be used to convert the effects of habitat and prey abundance to estimates of energy intake, expenditure and, ultimately, growth (Rosenfeld & Taylor 2009). Experiments and modelling demonstrated that physical habitat and prey abundance jointly limit growth. Changes in prey concentration can therefore be expected to simultaneously influence capacity (Rosenfeld & Taylor 2009. Reducing both habitat area and prey abundance inevitably results in fewer fish. Reductions in prey reduce carrying capacity, increase competition, and are likely to reduce growth in some of the juvenile fish in each cohort for the foreseeable future. Smaller fish are more vulnerable to predation because capture success decreases rapidly as prey size approaches a limit set by the mouth gape of the predator (Willette, 2001). Increased juvenile salmonid mortality is a likely outcome of the proposed action.

Loss of rearing habitat

During high water events, the three streams and several wetlands on or surrounding the site provide velocity refuge and foraging areas for salmon. The site, consistent with the larger Green River watershed landscape, has a complex and interactive stygoscape, or three subsurface saturated zones beneath and lateral to river channels: the hyporheic, parafluvial and riparian zones, differentiated on the basis of hydrological, biological and chemical conditions, and the degree of interaction with the channel surface, riparian systems, geomorphic features, and of course biological features (Datry et al. 2008).

Because compaction of soils, filling of wetlands, relocation of the stream and addition of fill, and the addition of impervious surfaces, this hydrology and the availability of rearing habitat will be reduced. Reduction in rearing habitat will affect all future cohorts of rearing salmonid and is likely to result in reductions in growth, fitness, and survival of fry and parr, in part because for salmon, being in higher velocity water requires greater energy. Lack of refuge from high flows can increase the need for food while concurrently making it more difficult to successfully forage for food. These factors contribute to reduced growth and development and ultimately lower rates of survival, as we detail here.

Filling aquatic area and raising the ground surface elevation of more than half of the site, the proposal would reduce floodplain connectivity on more than half the site. The purpose of the soil compaction is to reduce water in the soil. This would impede hydraulic conductivity and flow patterns in the stygoscape. Invertebrate densities and taxon richness would likely be altered (Stanford and Ward 1993, Ward 2002), particularly with altered pH or other water quality parameters. In addition, the beneficial cooling, flow attenuation, and water quality cleansing functions of hyporheic zones would be reduced.

Because of soil compaction, fill placement, and adding impervious area, the proposed action would affect water quantity, particularly during summer low flow and high temperature periods. Soil compaction, as proposed, would reduce groundwater storage. When soil is compacted as proposed, by heavy machinery and the proposed surcharge, it hardens and squeezes air out from between soil particles. This increases the soil's density and strength, but decreases its porosity. These changes make it harder for water to move through the soil, which can lead to higher rates of surface runoff and reduced groundwater recharge (Chen et al. (2014), Das et al. (2023). In addition to soil compaction, active dewatering is planned. Therefore, we expect less ground water to be available to maintain flows during the dry season. Groundwater and wetlands function to store water and moderate stream flows. Extreme high and extreme low flows both present problems for salmonids. Overall, we expect the hydrology of the site would be altered in ways that worsen baseline conditions. Less storage, higher high flows and lower low flows are likely to result from the proposed action.

Increased impervious area in watersheds has been well-documented to result in higher high stream flows and lower low flows (Booth 2005). The proposed action would not only increase impervious area but would do so in a side channel aquatic area that is providing PBFs that are called out for restoration in the salmon recovery planning documents. At the same time that impervious area in increased, flood water storage and habitat area is decreased. Higher stream flows, are more likely to occur as a result of the proposed action because the project effectively reduces total stream habitat and concentrates them in a single area. We expect that small fish will not be as able to escape high velocity, and may flush from their rearing habitats before they are physiologically mature. This is likely contributing to the emigration of parr from the Green River. WDFW has found evidence of a density-dependent relationship between adult spawner abundance and the number of juveniles that leave the river as parr; the ones that live in the river longer before outmigrating to the ocean. This suggests that production is limited to the carrying capacity of the current available habitat (Anderson and Topping 2017). This is an important finding because parr contribute to adult returns at rates that are disproportionate to their abundance.

Specifically, roughly half of the juvenile Chinook salmon that leave the Green River do so as parr; more than nine out of ten returning adults originate from parr. For example, WDFW (WDFW 2018a) found that although Chinook salmon that had outmigrated as fry only made up 1–5% of the total adult return from 2015 to 2017, those same fish (outmigrating fry between 2010 and 2014) made up an average of 52% of the total Chinook salmon subyearling outmigration (WDFW 2018b). This research indicates that Chinook salmon parr, which made up an average of 48% of the Chinook subyearling outmigration between 2010 and 2014, produced 93 to 95% of the adult returns between 2015 and 2017. This research suggests that increasing rearing habitat in the Green River basin would allow more juvenile Chinook salmon to grow larger, and therefore more adult Chinook salmon would return to spawn. Conversely, the loss of rearing habitat as occurs with the proposed action reduces abundance and productivity of the affected population.

For PS Chinook salmon in the lower Green River, this loss of tributary rearing habitat has been studied. Monitoring work has helped connect Chinook salmon life histories and limiting factors for the middle Green River (Gregersen 2022). WDFW found that Chinook salmon fry made up an average of 52% of the total Chinook salmon subyearling outmigration from 2010-2014. Subsequent returning adults that left as fry only made up 1-5% of the total returns from 2015-2017 (WDFW 2018a and 2018b). This research indicates that Chinook salmon parr (juveniles >45mm), which made up an average of 48% of the Chinook salmon subyearling outmigration between 2010 and 2014, produced 93 to 95% of the adult returns between 2015 and 2017. Based on these findings we know that Chinook salmon that are not able to find rearing habitat to grow to parr size in the river and instead enter the estuary as fry have a very low survival rate to adulthood. Compounding this, Anderson and Topping (2017) found that the production of Chinook salmon parr in the Green River is density dependent, being limited by the amount of rearing habitat available. In other words, loss of rearing habitat results in fewer fish.

Temporary and enduring reductions in forage base, whether benthic prey communities or forage fish, would occur from the proposed clearing, grading, soil compaction and stream relocation, reduced prey production, increased solar radiation, decreased groundwater interaction and introduction stormwater contamination.

Reduced riparian vegetation/natural cover

Natural cover includes shade, submerged and overhanging large wood, log jams and beaver dams, large rocks and boulders, side channels and undercut banks. The small streams on the site of the proposal are floodplain *side channels*. They provide fry and parr with feeding area and refuge from both larger predators and high flows. In spite of historical agricultural activities, there is habitat complexity on the site and even though the area has been farmed, some mature trees are present, thick vegetation exists around the wetlands, and the site is covered with sapling cottonwood trees.

In this particular basin, where water temperature is unfavorably high, making shade particularly important. Here the proposed action involves extensive clearing and grading and the relocation of a stream without a significant replanting plan. To maximize cover, vegetated riparian areas need to be large enough to provide shade, wood input, leaf litter inputs, sediment and nutrient control, and bank stabilization functions" (PFMC 2014). Because the proposed action does not provide full tree replanting, and because the buffers are narrower than a site potential tree-height, we expect more solar radiation in cleared areas to add heat and worsen water temperature problems already present at the site. Natural cover is also thought to afford small fish ability to hide, reducing their vulnerability to predators. Lack of riparian cover then, not only increases stream temperatures and reduces prey, but also increases juvenile salmonid risk of predation.

Effects on SRKW

When prey is scarce, as stated in Section 2.2.1, SRKW likely spend more time foraging than when prey is plentiful. Increased energy expenditure and prey limitation can cause poor body condition and nutritional stress. Nutritional stress is the condition of being unable to acquire adequate energy and nutrients from prey resources and as a chronic condition, can lead to reduced body size of individuals and to lower reproductive or survival rates in a population (Trites and Donnelly 2003). During periods of nutritional stress and poor body condition, cetaceans lose adipose tissue behind the cranium, displaying a condition known as "peanut-head" in extreme cases (Pettis et al. 2004; Bradford et al. 2012; Joblon et al. 2014). This individual stress and diminished body condition of individuals would lead to an overall decline in the fitness of the species, while accounting for age and sex (Stewart et al. 2021). NMFS qualitatively evaluated long-term effects on the SRKW from the anticipated reduction in PS Chinook salmon. We assessed the likelihood for localized depletions, and long-term implications for SRKW survival and recovery, resulting from the proposed action presenting risks to the continued existence of PS Chinook salmon and reducing the ability for the ESU to expand and increase in abundance. In this way, NMFS can determine whether the reduced likelihood for survival and recovery of prey species is also likely to appreciably reduce the likelihood of survival and recovery of SRKW. Viability at the population level is a foundational necessity for PS Chinook salmon persistence and recovery.

The reduction of PS Chinook salmon, coho salmon and PS steelhead is likely to lead to nutritional stress in the SRKW. Nutritional stress can lead to reduced body size and condition of individuals and can also lower reproductive and survival rates. Prey sharing would distribute more evenly the effects of prey limitation across individuals of the population than would otherwise be the case. Therefore, poor nutrition from the reduction of prey could contribute to reduced fitness in this population. Food scarcity could also cause whales to draw on fat stores, mobilizing contaminants stored in their fat and affecting reproduction and immune function.

Because SRKWs are already stressed due to the cumulative effects of multiple stressors, and the stressors can interact additively or synergistically, any additional stress such as reduced prey abundance likely have a greater physiological effect than they would for a healthy population. This may have negative implications for SRKW vital rates (mortality and fecundity) and population viability (e.g., NAS 2017

SRKW Exposure and Response

Puget Sound Chinook salmon are a preferred prey species of SRKW, though they consume other salmonid species and other fish species as well. Because, as outlined in the sections above, there will be reductions in the fitness and survival of juvenile salmon (Chinook and steelhead) this component of forage, a biological feature of SRKW designated critical habitat, will also have some incremental decline. Here we evaluate the exposure and response of SRKW to this reduction in the PBF.

The prey base of SRKW is adult salmon, however fish impacted by the proposed action are juveniles, and the impacts include reduced growth, fitness, and survival. Salmon have r-reproductive strategy, laying thousands of eggs, but the rate of survival to maturity is low. While NMFS is certain that the proposed action will decrease the rate of survival for juveniles, it is uncertain if the level of injury and death that occurs will be discernible at the adult lifestage as a reduction in any given year. However, such a reduction repeated annually can compound over time, with a latent reduction in productivity overall. In other words, reductions in juveniles at a sufficient level, over time will translate to fewer adult fish.

The reduction in the number of adult salmonids available as prey for SRKW over the long-term would result in incremental additional stress for individual whales, with the SRKW likely needing to increase foraging effort/ abandon some feeding areas in search of more abundant prey. Decreased foraging efficiency would increase the likelihood of physiological responses of individual whales, such as poorer fitness. While we ultimately (over a period of years) anticipate incremental reduction in prey abundance, it is unlikely that the reduction of adult fish will be at a level that, when the population is exposed, notably alters fitness, fecundity, or survival in any individual member of the population.

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]. 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.

When we consider a generic design life of structures in the proposed action, we can anticipate that they are reasonably certain to remain in the environment for roughly 50 years. Thus, to gauge the cumulative effects accurately, we consider the non-federal activities that would occur in the action area within that same timeframe. 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, much of the relevant future climate-related environmental conditions in the action area are described earlier in the discussion of environmental baseline (Section 2.4). We do expect that climate change over the life of this project will include more frequent extreme temperatures in air and water, such as occurred with the "heat dome" events (NOAA 2022) and that more variability in stream conditions, with more frequent low flows and more abrupt flood conditions will occur.

Other changes in the action area from non-federal activities are likely to occur with intensifying land use. The human population in the Puget Sound region increased from about 1.29 million people in 1950 to about 3.84 million in 2014, and is expected to reach nearly 5 million by 2040 (Puget Sound Regional Council 2020). Land use changes and development of the built environment that are detrimental to salmonid habitats are reasonably certain to continue, and these are likely to be additional water quality and prey diminishments, primarily in the form of nonpoint pollution and heat island effects. Though the existing regulations may minimize future potential adverse effects on salmon habitat, as currently constructed and implemented, they still allow systemic, incremental, additive degradation to occur. To the extent that non-federal recovery actions are implemented and offset ongoing development actions, adverse cumulative effects may be minimized, but would probably not be completely avoided.

2.7. Integration and Synthesis

The Integration and Synthesis section is the final step in assessing the risk that the proposed action poses to species and critical habitat. 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.

<u>Puget Sound Salmonids</u>

The status of both Puget Sound salmonid species is threatened. Both species are listed due to declines in abundance and productivity, reduced genetic diversity, and reduced spatial structure. Systemic factors contributing to reduced abundance and productivity, and reduced spatial structure are largely anthropogenic changes to habitat quantity and quality, derived from, among other things, levees, diking, draining, and filling that simplify riverine habitat, and upland land conversion that reduces riparian values and increases water pollution. The baseline in the action area currently reflects several of these habitat modifications. To this status and baseline we add the effects of the proposed action and determine their influence on the populations of salmonids that are exposed to those effects.

As described in section 2.5 of the document, at least on cohort of listed PS salmonid species will be handled, excluded from preferred habitat temporarily and will experience turbid conditions during construction, and for the foreseeable future all cohorts of the listed Green River populations of PS Chinook salmon and steelhead will experience reduced habitat connectivity/refugia, less rearing habitat, less riparian cover, less prey, increased water temperatures, and greater exposure to stormwater contaminants. Response of some of the individuals in each of the cohorts to each of these effects is likely to be reduced growth, reduced fitness and greater likelihood of mortality.

Effects on Salmonid Population Viability

We assess the importance of effects in the action area to the ESUs/ DPS by examining the relevance of those effects to the characteristics of Viable Salmon Populations (VSPs). The characteristics of VSPs are sufficient abundance, population growth rate (productivity), spatial structure, and diversity. While these characteristics are described as unique components of population dynamics, each characteristic exerts significant influence on the others. For example, declining abundance can reduce spatial structure of a population when habitats are less varied diversity among the population declines. We expect a persistent, chronic, negative effect from the proposed action. 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).

PS Steelhead

The population of steelhead exposed to the proposed action is Green River steelhead. This population is a priority winter-run population in this MPG The population is intended to achieve viable status to support MPG viability. Target abundance for this population is ~18,700 for low productivity conditions (NMFS 2019). in 2022 abundance was 1,282 (Ford 2022).

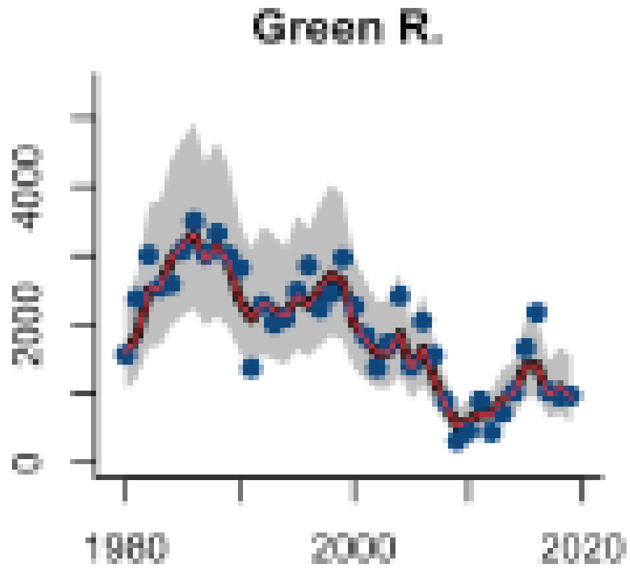

Figure 13. Green River winter steelhead abundance trend

PS Chinook salmon

The population of PS Chinook exposed to the proposed action is Green fall Chinook. The Puget Sound Chinook recovery plan in 2007 proposed 5,800 returning adults as a target whereas the technical recovery team (TRT) indicated the minimum population abundance would be 17,000 with 4,900 returning spawners per year. In 2022, abundance was 1,822 (Ford 2022).

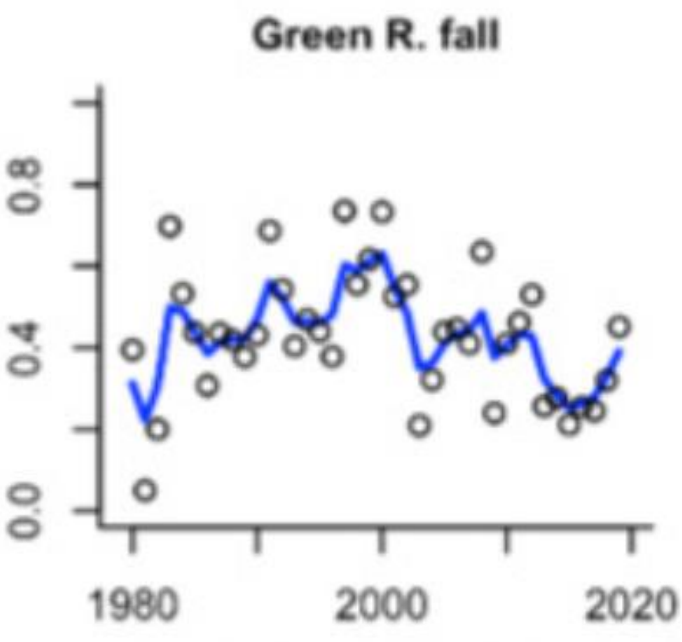

Figure 14. Green River fall Chinook population trend

Abundance. While numbers cannot be ascertained, it is certain that there would be temporary, episodic and enduring effects that diminish water quality and forage base, accessibility of rearing habitat, and cover, affecting both steelhead and Chinook salmon. Because these effects have the potential to reduce fitness and survival among individuals from the Green River population of both species that use the action area, we find it likely that a small number of individual fish would from the populations will experience reduced survival on an annual basis.

Productivity and spatial structure: Because of the chronic nature of these reductions in survival, we expect that over a period of decades, productivity and spatial structure would also be incrementally diminished.

Diversity. The impacts are expected to be greatest on juvenile PS steelhead because they typically spend over a year rearing in freshwater, when freshwater rearing habitats are available to them. Over time, selective pressure on one component of a life-history strategy tends to eliminate that divergent element from the population, reducing diversity in successive generations and the ability of the population to adapt to new environmental changes (McElhany et al. 2000). Any specific populations that experience increased mortality from the proposed action would have their life-history strategy selected against. The long-term effects of the proposal would likely result in a slight decline in PS steelhead diversity as the impacts are exclusively on the Green River population.

When we consider the effects of the proposed action on this population, we expect that the reduction in fitness and survival in the Green River population for each species is incremental and will occur among a subset of the exposed cohorts of both populations, but the low rate of this reduction is unlikely to be discernible in terms of the productivity of the population within timeframes that are able to be causally linked to the proposed action. When we include cumulative effects, climate impacts are likely to have a more obvious negative effect on the populations over time, irrespective of the proposed action.

<u>Salmonid Critical Habitat</u>

Critical habitat range-wide for both PS Chinook salmon and PS steelhead has degraded conditions from water quality diminishments and reduced prey abundance and quality, as well as spatial constraint with former areas being in accessible due to blocking culverts, levees eliminating floodplain access, and filling and dredging to create simplified channel systems. While the proposed action largely occurs above designated critical habitat, the water quality effects will flow downstream, adding more pollutants and increasing temperatures in areas of designated critical habitat. When added to the baseline, the project incrementally contributes to the degraded conditions seen in the action area and freshwater areas of critical habitat rangewide. The degree of this degradation, while adverse, is however, insufficient to impair the conservation role of the critical habitat for either species. When we consider cumulative effects, the effects of intensifying land use, plus those associated with climate change, are expected to have a greater effect on the condition of critical habitat, irrespective of the proposed action.

Southern Resident Killer Whales

Southern Resident Killer Whales are listed as endangered, with very limited population size, poor productivity, and low genetic diversity. There were multiple factors for decline, including historical hunting and capturing, and habitat degradation with multiple contaminants reducing water quality, continuing prey reduction, and increasing vessel traffic/noise. These habitat conditions persist as limiting factors.

As described above in the effects section, SRKW will experience an incremental/slight reduction in prey quality and abundance as a result of the proposed action. We expect that the reduction in prey will be at so small a scale (single digits) so that in the near term no specific individuals will be notably affected by increased energy expenditure, reduced fitness, growth or fecundity as a result of the project. However, given the rate of expected population growth in the Puget Sound area and increasing climatic changes, cumulative effects are expected to result in mostly adverse impacts on SRKW through reduced habitat quality. While habitat restoration and advances in best management practices for activities that affect critical habitat could lead to some improvement of PBFs, adverse impacts created by the intense demand for future development is likely to outpace any improvements. Current state and local regulations do not prevent some of the activities degrading the quality of critical habitats. There is no indication these regulations are reasonably certain to change in the foreseeable future.

Southern Resident Killer Whale Critical Habitat

As identified above, critical habitat for SRKW is systemically degraded by poor water quality, diminished prey base, and the presence of vessels, and noise. The proposed action incrementally adds, over time a further slight reduction in prey base and water quality degradation. These effects are estimated to be at a low enough scale that the conservation role of the critical habitat is not altered. When cumulative effects are considered, we anticipate increasing human use of the Puget Sound, and climate change, will have a more discernible effect on the critical habitat of this species than the project, and these effects will occur irrespective of the proposed action.

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, an effects of interrelated and interdependent activities, and cumulative effects, it is NMFS' biological opinion that the proposed action is likely to adversely affect but is not likely to jeopardize the continued existence of PS Chinook salmon, PS steelhead or SRKW and would not adversely modify or destroy designated critical habitat for these three species.

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). “Harass” is further defined by guidance as to “create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering.” “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

When take is in the form of harm from habitat degradation, it is often impossible to enumerate the take that would occur because the number of fish likely to be exposed to harmful habitat conditions is highly variable over time, influenced by environmental conditions that do not have a reliably predictable pattern, and the individuals exposed may not all respond in the same manner or degree. Where NMFS cannot quantify take in terms of numbers of affected individuals, we instead consider the likely extent of changes in habitat quantity and quality to indicate the extent of take as surrogates. The best available indicators for the extent of take caused by the proposed action are as follows.

In the biological opinion, NMFS determined that incidental take of PS Chinook salmon and PS steelhead is reasonably certain to occur as follows:

- Construction-based
    - harm from fish exclusion (worksite isolation),
    - injury or death during fish salvage, and
    - fish injury or death during dewatering or contact with large equipment (juveniles)
- Habitat-based
    - harm from water quality reduction and
    - harm from prey reductions

  both caused by loss of riparian vegetation, and increased stormwater runoff (adults and juveniles)

In the biological opinion, NMFS determined that incidental take SRKW is reasonably expected in the form of harm from reduced prey quality and quantity associated with short and long-term effects on salmon.

For the proposed action, the *amount of take* during construction activities is:

> From dewatering or contact with large equipment: up to 5 juvenile PS Chinook salmon and up to 5 PS steelhead.
>
> And

From fish exclusion, handling and relocation (salvage): up to 10 juvenile PS Chinook salmon and up to 10 PS steelhead.

If the number of juvenile PS Chinook salmon or PS steelhead killed 15 individuals from either species, then the amount of take would be exceeded, and the reinitiation provisions of this opinion would be triggered.

Because of the highly variable abundance and duration of presence of listed fish in the action area at any given time, we cannot estimate the number of listed fish that would be exposed to degraded water quality or harmed by fish exclusion, salvage or stranding, nor can we estimate the number of fish or SRKW that would experience adverse effects from reduced prey base with any meaningful level of accuracy. In such circumstances, NMFS provides an "extent of take" which is based on an observable aspect of the proposed action causally related to the harm.

In this case, *the extent of take* for both salmonids, and SRKW:

1. From water quality reductions from stormwater runoff is 9.24 acres of new impervious surface from the drive aisles, parking areas, and warehouse. This extent is easily observable, and is causally related to the source of harm, as a larger impervious area would contribute more stormwater runoff and that increased volume would increase the area affected and increase load of contaminants, exposing more individuals of the listed species and their prey. Reinitiation shall be triggered if additional impervious is constructed.

2. From water quality and prey reductions from reduced riparian vegetation caused by clearing vegetation and grading of the site is 10 acres. This extent is easily observable, and is causally related to the source of harm as removing vegetation in riparian areas reduces prey resources and water quality as a result of soil instability and increased solar radiation.

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

The COE shall require Vector Development to:

1. Minimize incidental take of juvenile PS Chinook salmon and PS steelhead associated construction activities, worksite isolation, and fish handling.

2. Minimize incidental take of adult and juvenile PS Chinook salmon and PS steelhead by limiting the extent of riparian habitat disturbance and degradation, and reestablishing riparian buffers.
3. Minimize incidental take of adult and juvenile PS Chinook salmon and PS steelhead from stormwater inputs.
4. Minimize incidental take of SRKW in the form of harm by limiting adverse effects to their prey species, as articulated in items 1-3 above.
5. Ensure completion of monitoring and reporting of incidental take to ensure take identified in the ITS is not exceeded.

2.9.4. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Federal action agency must comply (or must ensure that any applicant complies) with the following terms and conditions. The COE or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

1. The following terms and conditions implement reasonable and prudent measure 1 (construction related take):
   a. Ensure that all passive methods of fish removal (herding of fish first, then netting with prompt placement in adjacent water) occurs prior to employing electrofishing.
   b. Ensure that isolation and fish handling to remove fish from worksite is performed by or supervised by a biologist trained in electrofishing.

2. The following terms and conditions implement reasonable and prudent measure 2 (water quality and prey reductions from riparian loss):
   a. Do not clear the 75-foot riparian buffers on the eastern (Stream v) and western (Stream x) sides of the site where development is not planned.
   b. Preserve native plants in-situ within all areas that are not planned to be developed.
   c. Replant native species to establish a new 75-foot buffer on the east side of Stream z at the new location. Plant no fewer than 100 fast growing canopy forming trees with a mix of black cottonwood (*Populus trichocarpa*), willow (*Salix lasiandra*), and western red cedars (*Thuja plicata).* Trees are to be spaced at least 15 feet apart, with cottonwoods being preferably placed nearer to the stream, in order to restore shade and other riparian functions as quickly as possible, planting to occur in the first October and November following construction and allow them to grow to maturity. An 85% survival rate is required five years after construction of the warehouse.

3. The following terms and conditions implement reasonable and prudent measure 3 (stormwater): The applicant/permittee shall:
   a. Annually perform “street” sweeping of the parking areas and drive aisles annually in late August to remove 6ppd particles prior to “first flush” rainfall events.

b. Ensure that all inspection and maintenance of the stormwater treatment system occurs on schedule and that if any inspection shows degradation of the stormwater system, prompt correction of the deficiency occurs.

4. The following terms and conditions implement reasonable and prudent measure 4 (SRKW prey impacts):
Meet all terms and conditions and their sub-elements as described above to fully reduce prey impacts for SRKW.

5. The following terms and conditions implement reasonable and prudent measure 5 (monitoring):
   a. In addition to the monitoring described in Section 1.3 (Proposed Federal Action), monitor the following water quality conditions: The applicant/permitee shall
      i. Use data loggers to sample before construction begins the water temperature at the two culvert locations in Stream Z, near the northern property boundary, and at the proposed stormwater discharge location near the northeastern corner of the site to establish baseline temperature conditions. Sample again at the same location post construction in the season of the following year using a 7 day maximum over at least a three month period, to indicate if any temperature changes within the streams have occurred that may be associated with the construction.
      ii. One year post construction, collect one water sample at a location downstream of the stormwater discharge and have the sample analyzed for total solids, PAHs and 6PPD-Q (measured in accordance with EPA's adopted method at https://www.epa.gov/cwa-methods).
      iii. Monitoring locations shall be indicated on a map, equipment shall be specified and results provided in two reports with monitoring data. The water quality monitoring report 1 year after construction is complete. Reports must also include photographs depicting on-site riparian conditions for Streams X, Z, and V.
   b. Provide within 60 days of project completion a report which documents: the dates, locations and extents, and the methods used for channel isolation, and fish removal and relocation, clearing, and replanting. The document should include the species, number of individuals, and relative condition of fish handled/relocated.
      a. Report any injuries or mortalities observed.
         i. The total number of days and dates of in-water work (below the OHWM).
      b. Site conditions at project completion, including:
         i. The type, location and total area of all impervious surfaces.
         ii. Stormwater treatment systems.
         iii. The stream channel relocation location and conditions, including the stream and buffer areas.
         iv. The size, location and condition of all riparian buffer areas, including maintained and replanted areas. Photographs should be provided to substantiate the narrative.

c. The report shall be provided to*:* [*projectreports.wcr@noaa.gov*](mailto:projectreports.wcr@noaa.gov) and copy Phyllis.meyers@noaa.gov including "Attn: WCRO-2022-01417" within the subject line, within 60 days of completion of the warehouse construction.

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 improve the habitat conditions for rearing salmonids in the streams on the site and downstream, the applicant should construct a "green roof" for the warehouse. Critical habitat for them is designated a short distance (approximately 0.4 mile) downstream and has already been placed on the Washington State list of impaired water bodies for temperature and for biotic integrity. A green roof would help minimize the adverse impact of converting a large portion of this site to impervious area.

2. To help reduce water temperature impacts on salmon and salmon habitat on the site and downstream, where a green roof is not used, the applicant should apply reflective white paint to increase the albedo of the warehouse (see Oleson et al. 2010), and incorporate heat reflective asphalt for the parking areas (see Zheng et al. 2015).

3. NMFS also seeks to have greater protection of aquatic habitats for upstream parcels in the event of additional redevelopment proposals. Having the COE, the City of Auburn, and/or State agencies require greater protection of riparian functions, particularly in areas adjacent to fish-bearing streams, floodplains and wetlands in such a way that effectively achieves stated goals in the recovery plan is strongly recommended. Side channel rearing habitat is a priority in the Puget Sound Salmon Recovery Plan. The plan has the specific goal (on page 256) for the Lower Green River sub-watershed to restore 45% of historical off-channel habitat (Shared Strategy for Puget Sound 2007). Wetland fill, stream relocation and buffer reductions will not achieve this goal.

2.11. Reinitiation of Consultation

This concludes formal consultation for the Emerald Logistics Proposed Industrial Development in headwaters of Mullen Slough, in Auburn, WA.

Under 50 CFR 402.16(a): "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: (1) If the amount or extent of taking specified in the incidental take statement is exceeded; (2) If new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) If 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 written concurrence; or (4) If a new species is listed or critical habitat designated that may be affected by the identified 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. Under the MSA, this consultation is intended to promote the conservation of EFH as necessary to support sustainable fisheries and the managed species' contribution to a healthy ecosystem. For the purposes of the MSA, EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and includes the physical, biological, and chemical properties that are used by fish (50 CFR 600.10). 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) of the MSA also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH. Such recommendations may include measures to avoid, minimize, mitigate, or otherwise offset the adverse effects of the action on EFH [CFR 600.905(b)].

This analysis is based, in part, on the EFH assessment provided by the COE and descriptions of EFH for Pacific Coast salmon (PFMC 2024) 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 Section 1 of to this document. The action area includes areas designated as EFH for Pacific Coast salmon, including various life history stages of Chinook coho, and pink (*O. gorbuscha*) salmon (PFMC 2024). The effects of the proposed action on EFH are the same as those habitat effects described above in the ESA portion of this document (Section 2.5.

Chinook salmon and steelhead are known to rear in and migrate through portions of the action area downstream of the project area. Pink salmon are in the Green River. Coho salmon are known to rear in aquatic areas downstream as well as on the site of the proposed project. Jon Pickett said he has seen coho on-site. This is consistent with Salmonscape information depicted in Figure 15. A WDFW Area Habitat Biologist also confirmed coho used of the site (Julian Douglas, pers. comm10-30-23).

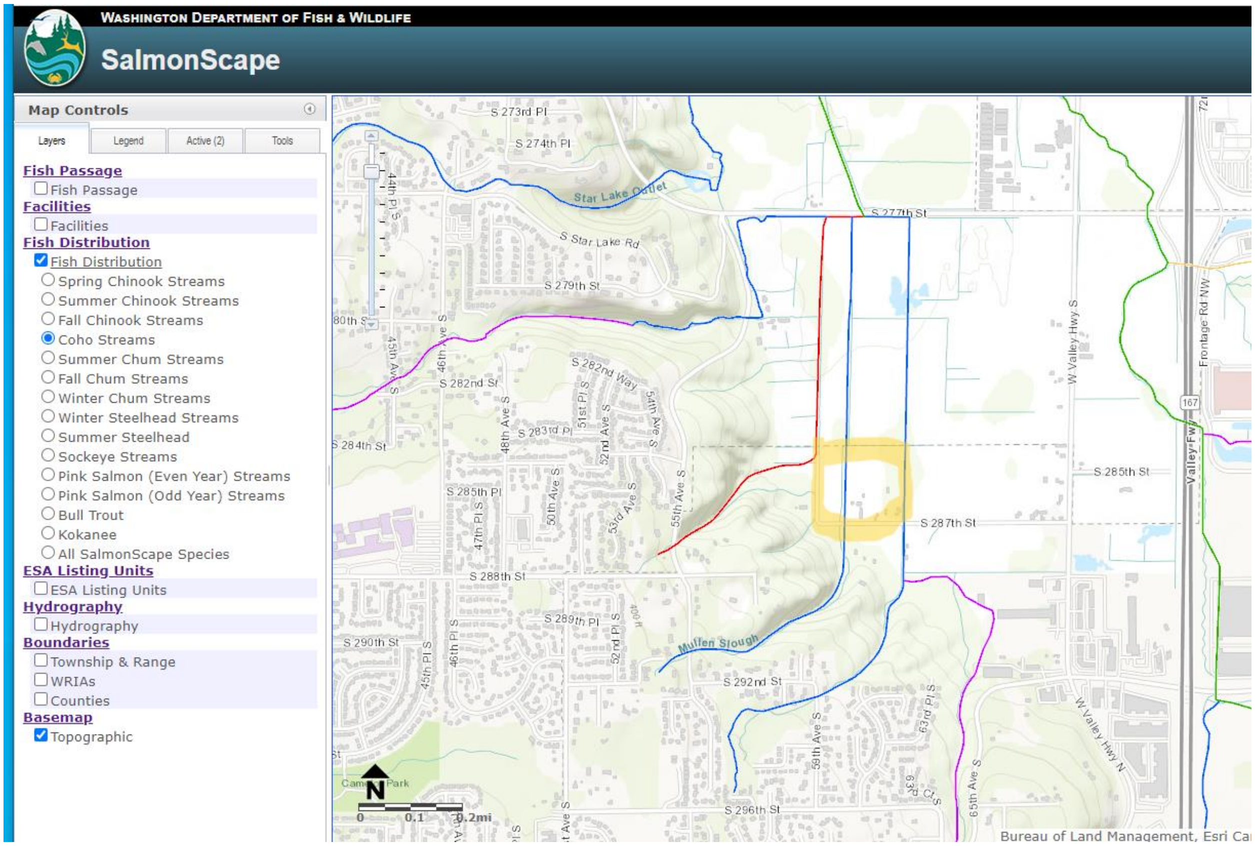

Figure 15. Map depicting coho salmon use of the site (blue and red lines). Site boundaries are approximately indicated with yellow highlighting.

3.2. Adverse Effects on Essential Fish Habitat

Based on information provided by the action agency and the analysis of effects presented in the ESA portion of this document, we conclude that the proposed action would have adverse effects on EFH designated for Pacific Coast salmon, concurring with the COE determination. The effects of the proposed action on EFH are the same as those described above in the ESA portion of this document, with the exception that stormwater effects would be even more adverse. The effects of untreated stormwater discharge would be worse for coho. French et al. (2022) found that water mixtures with only 5% untreated stormwater were lethal to coho.

After years of forensic investigation, the urban runoff coho mortality syndrome has now been directly linked to motor vehicle tires, which deposit the compound 6PPD and its abiotic transformation product 6PPD-quinone (6PPD-q) onto roads. 6PPD or [(N-(1, 3-dimethylbutyl)-N'-phenyl-p-phenylenediamine] is used to preserve the elasticity of tires. 6PPD can transform in the presence of ozone (O3) to 6PPD-q. 6PPD-q is ubiquitous to roadways (Sutton et al. 2019) and was identified by Tian et al. (2020) as the primary cause of urban runoff coho mortality syndrome described by Scholz et al. (2011).

Polluted stormwater would be discharged to receiving waters on-site from 9% of the PGIS that would not occur but for the proposed action. Coho salmon, documented to use the site and to be important SRKW prey, are particularly sensitive to 6PPD-Q.

Additional adverse effects of the proposed action include a reduction in rearing habitat area as wetlands will be filled, low-lying land will also be filled, disconnecting functional floodplain, the amount of stream habitat will be reduced, riparian vegetation providing cover and shade will be reduced, and prey will be reduced.

3.3 Essential Fish Habitat Conservation Recommendations

NMFS determined that the following conservation recommendations are necessary to avoid, minimize, mitigate, or otherwise offset the impact of the proposed action on EFH.

1. The COE should require the applicant to include information on coho salmon within the reporting required for PS steelhead and PS Chinook salmon, provided per the terms and conditions in the ESA section of this document. The report should include counts of coho salmon observed on-site during stream re-location operations, dates of observation and photographs of work at the site. Photographs should include images of the newly constructed channel before, during and after water is directed into it.

2. The COE should require the applicant to have 50 percent of the tree planting (see ESA terms and conditions) be comprised of black cottonwood

3. The COE should require the applicant to treat all of the stormwater on the site to remove a larger percentage of contaminants, rather than treating only 91% as described in the original proposal.

Fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in Section 3.2, above, for Pacific Coast salmon.

3.4. Statutory Response Requirement

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

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

3.5. Supplemental Consultation

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

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

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

4.1. Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended user of this opinion is the COE. Other interested users could include Vector Development and the Muckleshoot Tribe. Individual copies of this opinion were provided to the COE, Vector Development and the Muckleshoot Tribe. The document will be available at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adhere 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 part 600.

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

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

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

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