UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
777 Sonoma Avenue, Room 325
Santa Rosa, California 95404-4731

September 5, 2024 **Refer to NMFS No:** WCRO-2023-02878

James Mazza
Chief, Regulatory Division
U.S. Department of the Army
San Francisco District, Corps of Engineers
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San Francisco, California 94102-3404
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Re: Endangered Species Act Section 7(a)(2) Biological and Conference Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Humboldt Bay Harbor, Conservation, and Recreation District's Humboldt Bay Water Intakes Improvement Project in Samoa, California (Corps File #: SPN-2021-00366N)

Dear Mr. Mazza:

Thank you for your letter of October 31, 2023, requesting formal consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the Humboldt Bay Harbor, Conservation, and Recreation District's (District) Humboldt Bay Water Intakes Improvement Project. Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA)(16 U.S.C. 1855(b)) for this action. This letter transmits NMFS' final biological and conference opinion and EFH response for the proposed Humboldt Bay Water Intakes Improvement Project (Project).

The enclosed biological and conference opinion describes NMFS' analysis of effects on threatened Southern Oregon/Northern California Coast (SONCC) coho salmon (*Oncorhynchus kisutch*), California Coastal (CC) Chinook salmon (*O. tshawytscha*), and Northern California (NC) steelhead (*O. mykiss*), and their designated critical habitat in accordance with section 7 of the ESA. Based on the best scientific and commercial information available, NMFS concludes that the proposed action is not likely to jeopardize the continued existence of SONCC coho salmon, CC Chinook salmon, and NC steelhead, nor is the project likely to destroy or adversely modify designated critical habitat for these species. NMFS expects the proposed action would result in incidental take of SONCC coho salmon, CC Chinook salmon, and NC steelhead. An incidental take statement with terms and conditions is included with the enclosed biological opinion. NMFS also concurs with the United States Army Corps of Engineers (Corps) that the Project would not adversely affect the Southern Distinct Population Segment of North American green sturgeon (*Acipenser mediostris*) or their designated critical habitat.

The enclosed document also provides NMFS' conference biological opinion on sunflower sea star, proposed for listing as a threatened species. *See* 88 FR 16212 (Mar. 16, 2023). The conference opinion concludes that the proposed action is not likely to jeopardize sunflower sea star and would result in take of this species. The conference opinion does not take the place of a biological opinion under section 7(a)(2) of the ESA unless and until the conference opinion is adopted as a biological opinion when the proposed listing of sunflower sea star becomes final. Adoption may occur if no significant changes to the action are made and no new information comes to light that would alter the contents, analyses, or conclusions of this opinion.

The enclosed EFH consultation was prepared pursuant to section 305(b) of the MSA. The proposed action includes areas identified as EFH for species managed under the Pacific Coast Salmon Fishery Management Plan (FMP), Pacific Coast Groundfish FMP, and Coastal Pelagic Species FMP. Based on our analysis, NMFS concludes that the project would adversely affect EFH of all three FMPs and has provided two EFH conservation recommendations.

Please contact Matt Goldsworthy, Northern California Office, Arcata, via email at Matt.Goldsworthy@noaa.gov if you have any questions concerning these consultations, or if you require additional information.

Sincerely,

Alecia Van Atta
Assistant Regional Administrator
California Coastal Office

Enclosure

cc: Kasey Sirkin, Corps of Engineers, l.k.sirkin@usace.army.mil
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FRN # 151422WCR2023AR00253

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

Humboldt Bay Water Intakes Improvement Project, Humboldt County, California

NMFS Consultation Number: WCRO-2023-02878

Action Agency: United States Army Corps of Engineers, San Francisco District

Table 1. Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species or Critical Habitat?	Is Action Likely to Jeopardize the Species?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Southern Oregon/Northern California Coast (SONCC) coho salmon	Threatened	Yes	No	No
California Coastal (CC) Chinook salmon	Threatened	Yes	No	No
Northern California (NC) steelhead	Threatened	Yes	No	No
Sunflower sea star	Candidate/ Threatened	Yes	No	N/A
Southern Distinct Population Segment (SDPS) North American Green Sturgeon	Threatened	No	No	No

Table 2. Essential Fish Habitat and NMFS' Determinations:

Fishery Management Plan with EFH in the Action Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon	Yes	Yes
Pacific Coast Groundfish	Yes	Yes
Coastal Pelagic Species	Yes	Yes

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

Issued By:

Alecia Van Atta
Assistant Regional Administrator
California Coastal Office

Date: September 5, 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

NOAA's National Marine Fisheries Service (NMFS) prepared the biological and conference 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 USC 1531 et seq.), 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 600.

The conference opinion concerning proposed listing for sunflower sea stars does not take the place of a biological opinion under section 7(a)(2) of the ESA unless and until the conference opinion is adopted as a biological opinion when the proposed critical habitat designation and/or listing becomes final. Adoption may occur if no significant changes to the action are made and no new information comes to light that would alter the contents, analyses, or conclusions of this Opinion.

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

1.2 Consultation History

On October 31, 2023, NMFS received the U. S. Army Corps of Engineers' (Corps) request for formal ESA consultation, and for EFH consultation, regarding the Project. The Corps anticipated adverse effects to Southern Oregon/Northern California Coast (SONCC) coho salmon, California Coastal (CC) Chinook salmon, Northern California (NC) steelhead, sunflower sea star, and designated critical habitats. The Corps determined the Project would not adversely affect the Southern Distinct Population Segment (SDPS) of North American green sturgeon or their designated critical habitat. The Corps determined the Project may adversely affect EFH designated by the Pacific Coast Salmon Fishery Management Plan (FMP), Pacific Coast Groundfish FMP, and Coastal Pelagic Species FMP.

On November 2, 2023, the Corps provided an email update clarifying a typographical error in their letter requesting ESA and EH consultation. On November 2, 2023, formal ESA consultation for the Project was initiated as well as consultation for EFH.

On December 21, 2023, Tenera Environmental (a consultant for the applicant, the Humboldt Bay Harbor, Recreation, and Conservation District (District) provided a memorandum via email correcting the estimated Area of Production Foregone (APF) caused by the operation of the water intakes from 34.6 acres to 28.8 acres (Tenera 2023). The correction is on the estimate of the standard error used in calculating the value at the 95th percentile of the cumulative probability curve for the final estimates of APF.

On April 8, 2024, GHD (a consultant for the District) provided an April 5, 2024, memorandum indicating that the water intake screens had been redesigned to achieve a 0.5-millimeter (mm) slot size with an approach velocity of 0.12 feet per second (GHD 2024). The redesigned screens would rely on a brush cleaning system, rather than the air burst system previously proposed. The redesigned screens were proposed to have further reduced the APF to 7.80 acres (GHD 2024). The April 5, 2024 memorandum also clarified phased mitigation obligations that correspond to the cumulative water volumes received through the water intakes.

On April 25, 2024, the California Coastal Commission (Commission) made their Staff Report available for the upcoming hearing on May 8, 2024, for the Project's Coastal Development Permit (CDP) application. The Commission's Staff Report identified several Special Conditions (Special Conditions 1-12) that would apply to the Project and would be required by the CDP. On May 7, 2024, an Addendum to the Commission's Staff Report revised the language in the Special Conditions and added a new Special Condition 13 (providing for a total of 13 Special Conditions). On May 8, 2024, the Commission approved the CDP with 13 Special Conditions. These 13 Special Conditions were incorporated, where relevant, into the Proposed Action. Special Condition 4 increased the APF from 7.80 acres to 28.5 acres.

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 (50 CFR 402.02). Under the MSA, "Federal action" means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal Agency (see 50 CFR 600.910).

The Corps proposes to issue a permit pursuant Section 10 of the Rivers and Harbors Act of 1899, as amended, 33 U.S.C. § 403 *et seq*., to the District to implement the proposed upgrades to two existing water intake facilities within Humboldt Bay and to install the associated terrestrial water pipelines and meters to supply water to tenants of the District's aquaculture business park where

the primary recipient of the water is expected to be Nordic Aquafarms California, LLC. The Project would include retrofit of the sea chests that encase the water intake systems, upgrading the water piping on docks, modernizing electrical power systems, and installation of piping (both for water intakes and industrial water) along the upland portion of the shoreline. In addition, offsite compensatory restoration (pile removal, spartina removal, restoration of the Bay Street parcel, and other unidentified actions) is proposed for potential impacts to living marine resources and longfin smelt. The Project is summarized below using information from the consultation request letter from the Corps, the Biological Assessment (HT Harvey and Associates and GHD 2023), April 5 Memo (GHD 2024), and the May 2024 Coastal Development Permit (CDP 2024).

1.3.1 Project Description

The proposed project includes two dock facilities, on two separate parcels: Redwood Marine Terminal II (RMT II) Dock and the Red Tank Dock (see Figure 1). The RMT II Dock is an approximately 16-foot wide wooden dock that extends approximately 600 feet into Humboldt Bay. The RMT II Dock includes a sea chest (i.e., water intake), which consists of a screened marine intake and pumping infrastructure, providing bay water to the RMT II facility via dock-mounted piping. The existing RMT II Dock intake structure is constructed of wood. There is some deterioration, and the wooden structure would likely need repairs to seal cracks that currently allow flow into the intake structure outside of the intake screen. The Red Tank Dock is located approximately 2,900 feet (½ mile) north of the RMT II Dock, and it is a 12-foot wide wooden dock that extends approximately 150 feet into Humboldt Bay, and also includes a water intake system encapsulated within a sea chest.

1.3.1.1 Phasing of Water Intake Volumes

The District's proposal involves withdrawing up to 11.8 million gallons of water per day (mgd) from the Bay in three phases (see Table 1). The first phase, expected to start in 2027, would withdraw up to 5.05 mgd; the second phase, starting in 2032, would withdraw an additional 4.95 mgd; and the third phase starting in 2034, would withdraw an additional 1.88 mgd.

Table 1: Phased water withdrawal volumes and associated APF (CDP 2024).

Phase Estimated Year of Operation	Volume of Water (in mgd)	Cumulative Intake Volume (mgd)	Percent of Total Volume	Cumulative APF
Phase 1 (2027)	5.05	5.05	43%	12.1 acres
Phase 2 (2032)	4.95	10.00	42%	24.0 acres
Phase 3 (2034)	1.88	11.88	15%	28.5 acres

1.3.1.2 Intake Upgrades

The Project proposes to improve and modernize the current intake structures at RMT II and Red Tank docks. The existing intake screens will be replaced with modern stainless steel wedgewire screens (WWS) designed to reduce entrainment and impingement of aquatic species. WWS can be used in flat panel screens, are alternatives to mesh, are more practical for excluding small fish, and less prone to clogging. WWS that are cylindrically shaped reduce entrainment via physical

exclusion, where the organism itself is larger than what fits through the slot width. Cylindrical WWS also reduce entrainment through hydrodynamic exclusion, whereby the rapid diffusion of flow and velocity near the screen surface allows mobile larvae to avoid entrainment, even if they are physically capable of passing through the slots. The WWS will consist of grade 316 stainless steel woven wire with 0.50 mm spacing, or smaller, between wire screen to achieve a maximum approach velocity of 0.20 feet per second at a maximum intake rate of 8,250 gallons per minute (gpm). The water intake may rely on a brush cleaning system and achieve adequate open area on the screen material with modifiers to evenly distribute velocities over the entire screen face. Both water intakes meet the criteria to avoid entrainment of juvenile salmonids, but will not avoid entrainment of planktonic lifeforms. The maximum intake rate of 8,250 gpm represents approximately 11.8 mgd withdrawn from Humboldt Bay.

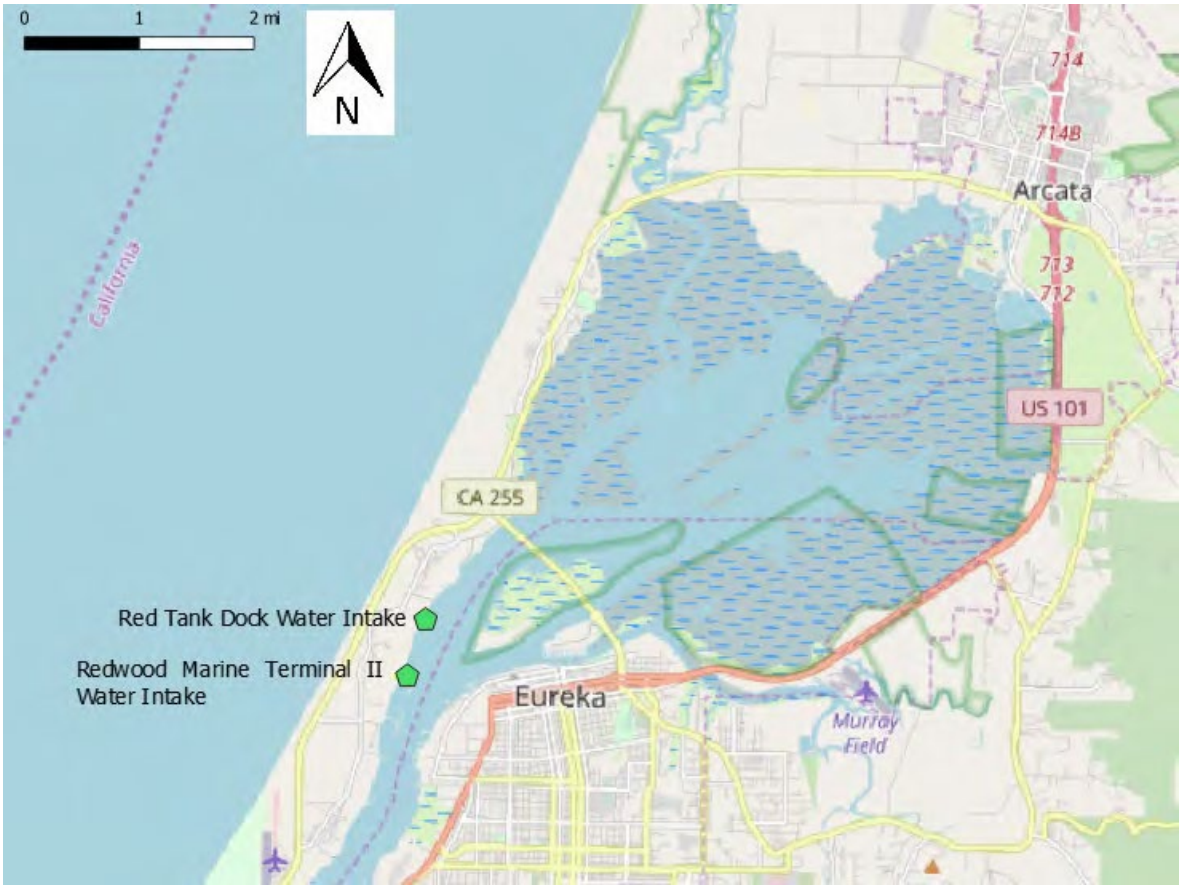

Figure 1. Location of the Red Tank Dock and Redwood Marine Terminal II water intake structures proposed for renovation and improvement.

Water will be drafted through the screens and intake system using vertical turbine pumps. Vertical turbine pumps consist of motors that will be installed on top of the intake structures (at the level of the dock), a vertical driveline and intake pipe, and intake propellers (located next to the intake structures, beneath the surface of the water). These pumps will have a discharge pipe connecting to a distribution system for access by lessees. The RMT II Dock screen will be 42-inches in diameter with a maximum diversion rate of 5,500 gpm while the Red Tank Dock

screen will be 24-inches in diameter with a maximum diversion rate of 2,750 gpm. The pumps would operate continuously except during maintenance and cleaning activities. Power for the pumps and compressors will be supplied from the Nordic Aquafarms California facility during a power outage to ensure operation during periods of grid power outage.

1.3.1.3 Special Conditions Applied by California Coastal Commission

On May 8, 2024, the California Coastal Commission approved the Coastal Development Permit (CDP) for the Project with 13 Special Conditions, which become enforceable conditions required by the CDP (CDP 2024). The 13 Special Conditions are summarized below:

Special Condition 1: Requires evidence of all permits required from State Agencies, including the North Coast Water Quality Control Board, California Department of Fish and Wildlife (CDFW).

Special Condition 2: Requires evidence of permits and consultations required from Federal Agencies, including the Corps and NMFS.

Special Condition 3: Requires final plan for water intake system, screens, and maintenance plans and directs the screen to have a mesh size of no more than 1.0mm and an approach velocity of no more than 0.2 feet per second. This condition also requires water intake construction activities to avoid existing eelgrass beds by at least 10 meters and requires mitigation for any impacts that might occur.

Special Condition 4: Requires full compensatory mitigation for the expected 28.5 acres of annual APF. The condition establishes mitigation ratios of no more than 1:1 for the above ground surface for derelict piling removals; 1:3 for unstructured habitat; 1:4 for structured habitat; 1:1.7 or 1:3.2 for spartina removal based on vegetative cover present; and requires additional permitting for mitigation work planned to occur at the Bay Street Parcel.

Special Condition 5: Requires mitigation measures for derelict piling removals at the Kramer Dock mitigation site to ensure eelgrass resources are protected.

Special Condition 6: Requires the District to submit a Water Quality Protection Plan that identifies measures it will implement during construction and through a stormwater management plan to avoid and minimize potential water quality impacts in Humboldt Bay.

Special Condition 7: Requires the District to submit a Noise Reduction Plan that ensures noise from the project's pumps do not exceed protective thresholds established by NMFS to prevent harm to marine life.

Special Condition 8: Requires that any potential future users of the water supply provided by the project be reviewed and approved by the Executive Director as being coastal-dependent uses.

Special Condition 9: Requires the District to implement several monitoring and reporting measures meant to avoid and reduce potential disturbance or impacts to Tribal cultural resources during project construction.

Special Condition 10: Requires a 30-year term of the CDP to ensure that future changes or increased hazards at the project site could be re-evaluated if the District wishes to continue operations for a longer period.

Special Condition 11 and 12: provides that the District assumes liability for site hazards and attorney fees brought by third parties.

Special Condition 13: Requires a final site characterization plan for pipeline installation work onshore.

1.3.2 Construction

The in-water work required to improve and modernize the water intakes will occur at lower tides, which will support access to the sea chests. The new WWS at Red Tank Dock will be placed approximately one foot above the existing bay bottom to minimize the intake of sediment into the sea chest or intake system. The RMT II intake will be placed three feet above the bottom to ensure enough clearance for sediment accumulation and to minimize drawing sediment into the sea chest.

The installation of new intake screens will be done from a boat, with divers to bolt metal guide channels to the existing structures. The screens will be lowered from above into place. Before the installation of the new screens, small quantities of sediment will be removed from the bottom of the existing sea chest structures. There will be a total of 11.6 cubic yards of sediment removed from RMT II and Red Tank Docks. The openings in the sea chests will be sealed, and the water decanted to accommodate the removing of sediment using a vacuum truck or other mechanical method.

1.3.3 Compensatory Mitigation

The compensatory mitigation being proposed is intended to offset the reduction in the biological productivity within Humboldt Bay that is expected to result from entrainment of embryonic (egg), larval, or planktonic life stages of marine organisms and for larval life stages of longfin smelt. The compensatory habitat mitigation projects will occur with the phased withdrawal of water through the two intakes. The volume of water withdrawn, proposed compensatory mitigation, and timing associated with each of the phases are summarized below. The Commission deemed the District's approach to mitigation as being insufficient and required additional mitigation through their Special Condition 4. Phase 1 is expected to begin in 2027 with an estimated mitigation implementation of 2025. Phase 2 is expected to begin in 2032 with estimated mitigation implementation of 2031. Phase 3 is expected to begin in 2034 with estimated mitigation implementation of 2033.

1.3.3.1 Pile Removal at Kramer Dock

The proposed pile removal compensatory mitigation efforts will result in the removal and disposal of 1,139 structures (988 piles and 151 cross beams) that were formerly part of Kramer Dock. This removal results in a total volume of 23,650 square feet, weight of 308 tons, and surface area of 96,530 square feet. The District expects that the removal of pilings would

improve natural processes and ecosystem functions that support EFH and ESA-listed species' critical habitat and expand and improve eelgrass parameters in the action area.

Pile removal will be conducted from shore or a barge. Pilings will be removed using various methods including a vibratory hammer or excavator with a timber clamp. Piles that break off above the bottom are to be reattached to the vibratory hammer and removed. If a pile cannot be fully extracted, it may be cut off below the mudline using a saw. Pilings will be cutoff at a minimum of 1 foot below the bed elevation. Pilings closer to shore will likely be removed using equipment operated from land during low tide. Piles further from the coastline may be removed by equipment operating on a barge. For pile removal from a barge, the excavator would operate from a barge and require the use of a small support boat. After being placed on the barge, these piles are transferred to land and disposed. Within the 2.69 acres of mitigation area, there are two, 150-foot areas to be used for barge access.

The District proposed a 1:4 mitigation ratio for the Kramer Dock actions that was based on the 2.69-acre total area, which the District asserts would compensate for 10.76 acres of the calculated 28.5-acre APF. However, the Commission identified Special Condition 4, which established that piling removals at Kramer Dock would create mitigation credits at a ratio of no more than 1:1 for the above-ground surface area directly occupied by the material removed. Therefore, the total mitigation credit gained by actions at the Kramer Dock would count towards 0.79 acres of APF mitigation credit.

1.3.3.1.1 Minimization Measures for Pile Removal at Kramer Dock

Minimization measures for pile removal will be employed specifically to avoid impacts to eelgrass and mobilization of contaminants during pile removal activities. District staff or designated representative will be present to ensure that the following BMPs are adhered to, in addition to those contained within Special Condition 5:

- Neither the barge nor the tug will anchor during the project. The barge may attach to existing piles to maintain its position;
- During the barge method, piles will be removed at a tide of sufficient elevation to float the barge and tugboat adjacent to the piles being removed without scarring the mudflats or injuring eelgrass (Special Condition 4 requires a minimum of two feet above seafloor);
- Grounding of the barge will not be permitted;
- Floating and submerged containment booms will surround the work area to collect any debris. If debris sinks to the bottom, then it will be removed by a diver;
- All equipment will be checked before use to minimize risk of petroleum product releasing to the bay. A spill response kit, including oil absorbent pads will be onsite to collect any petroleum product that is accidently released;
- The crane and tug operators will be experienced with vibratory pile removal; and will break the soil/pile bond prior to pulling to limit pile breakage and sediment adhesion;
- Piles will be removed slowly to limit sediment disturbance;
- Piles will not be hosed off, scraped, or otherwise cleaned once they are removed from the sediment and immediately placed in a containment area lined with plastic sheeting to not allow sediment or residual water to reenter the bay;

- Sawdust or woody debris generated from pilings that are cut 1 foot below the mudline using a saw are to be retrieved and placed in the containment area;
- Holes left in the sediment by the pilings will not be filled and are expected to fill naturally;
- All removed piles or portions of piles will be disposed of at an authorized facility. No piles or portions of piles will be re-used in Humboldt Bay or along shoreline areas; and
- Land operations will not be conducted in wetlands in proximity to the staging site.

1.3.3.2 Spartina Removal

The District has also proposed conducting removal of an invasive species both at a tidal marsh site in Eureka at the end of Bay Street as well as, potentially, other locations around Humboldt Bay. The District proposes a 1:3 mitigation ratio for any Spartina eradication effort (3 acres of credit for each acre of habitat restored) at its Bay Street mitigation site and various other unidentified salt marsh sites around the bay. Special Condition 4 requires the District to site any Spartina eradication efforts where they would be complete over a discrete area and where the ongoing threat of reinvasion is manageable. It caps the allowable APF acreage credited through Spartina eradication alone at 15% (or 4.275 acres). To ensure that the ecological benefits of Spartina removal are fully realized, eradication must also be sustained into the future.

1.3.3.3 Bay Street Tidal Restoration and Enhancement

The District acquired two properties on the north end of Bay Street, near the confluence of Second Slough and Eureka Slough, to support compensatory mitigation for the Project. Deed restrictions are also proposed over both parcels at Bay Street, which removes development rights, but allows for future habitat restoration (see Figure 2). Special Condition 4 provides additional requirements for mitigation ratios and design parameters for Bay Street. The Commission estimates, by applying mitigation ratios required as part of Special Condition 4, there could be between 7-11 acres of APF credits depending on the final site designs at the Bay Street site.

In addition to providing for mitigation credit opportunities for APF, the Bay Street parcel actions will also provide for longfin smelt mitigation credits. The longfin smelt is a species listed as threatened under California's Endangered Species Act (CESA), and CESA requires that any listed species that perish during any project to be fully mitigated for. The CDFW concluded that the intake system's estimated annual entrainment of longfin smelt larvae would be approximately 11,205-15,881 longfin smelt larvae, which would require 4.16-5.89 acres of highly productive mitigation habitat in order to offset. Bay Street is intended to provide for longfin smelt mitigation credits, and actions planned to occur at Bay Street were specifically intended for longfin smelt habitat creation. However, the actions at Bay Street would also serve as appropriate mitigation for APF, and the species the APF was calculated from, so mitigation actions at Bay Street would count towards both APF and for CESA longfin smelt mitigation.

1.3.3.3.1 Bay Street Intertidal Slough Channel Creation

To create aquatic habitat and a dendritic tidal channel network, new meandering intertidal slough channels will be excavated (see Figure 2). The excavated channels would reoccupy the original

tidal channel alignments and be enlarged from existing conditions. The exact dimensions of the intertidal channels are still being determined by the final design, and will also vary depending on the tidal prism, existing elevations, and historical indicators. Generally, the channel width and depth will decrease with increased distance from Second Slough, and have an average depth of 4 feet (ft) and top width of 8 ft. The bottom elevations will be similar where the enhanced channels connect to Second Slough to provide a range of sub- and intertidal habitat at the confluences. The top marsh sod layer that is not infested with Spartina will be excavated, stockpiled and transplanted as the top vegetation layer of the drainage ditch filling. The intertidal channels are located near the existing drainage ditches, and the ditch backfilling can be minimized to avoid marsh impacts.

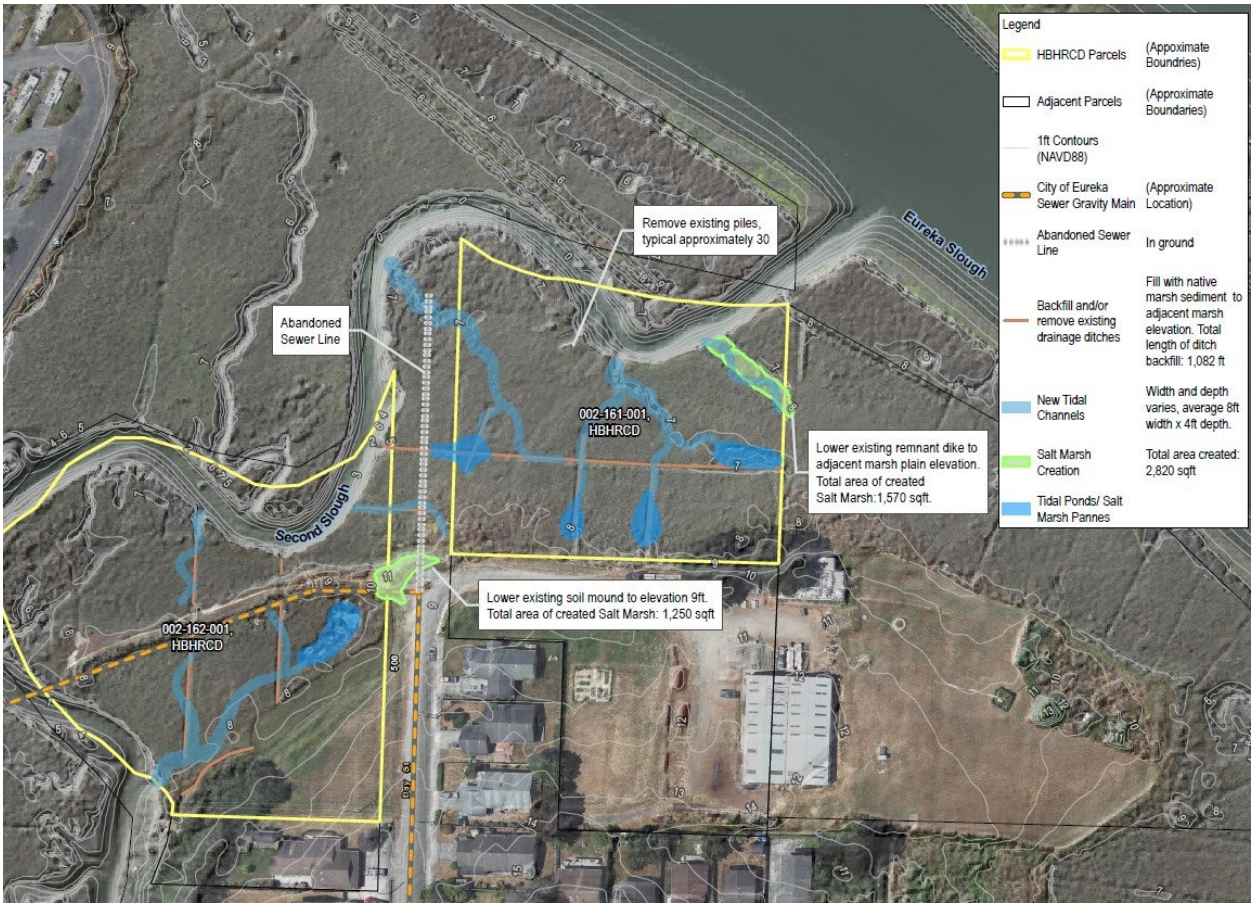

Figure 2: Conceptual design plans for the Bay Street Tidal Restoration and Enhancement action proposed to provide compensatory mitigation.

1.3.3.3.2 Bay Street Tidal Pond and Salt Marsh Creation

Tidal ponds and salt marsh pannes will be created at the end of the intertidal channels. They will be designed to inundate and exchange tidal water during high tides, while retaining water during low tides. This is to provide a diversity in habitat type and salinity stratification relative to the intertidal channels, and to avoid potential entrapment of aquatic organisms. The final pond and panne area and depths will be developed during the final design and may vary based on tidal prism, existing elevations, and historical indicators.

1.3.3.3.3 Bay Street Drainage Ditch Amelioration

The existing linear drainage ditches are unnatural features that have changed tidal circulation and sediment distribution processes around the salt marsh and can create fish entrapment issues. The ditches are up to 1.5 ft wide and 4 ft deep. Approximately 1,082 ft of existing linear drainage ditches will be removed as part of the new enhanced channel excavation or filled with native marsh soil that is excavated from constructing the intertidal channels. The backfilled soil will be compacted to density of the soil within the marsh. The upper layer of native marsh vegetative sod removed from intertidal channel excavation will be transplanted to adjacent marsh elevation to provide immediate native vegetative cover over the backfilled remnant ditch.

1.3.3.4 Other Future Compensatory Mitigation Projects

The District intends to identify additional compensatory mitigation projects in the future to fulfill the mitigation required to offset reductions in biological productivity within Humboldt Bay caused by entrainment and removal of larval and planktonic organisms from the bay. The District anticipates the additional compensatory mitigation projects would be similar to those actions proposed at Kramer Dock and Bay Street, and additionally may include living shorelines or stormwater treatment type actions. These compensatory mitigation actions, once identified, would likely need additional permits from the Corps and consultations from NMFS. These mitigation offsets for APF will be identified once the actions have been developed and permitted in the future.

1.3.4 Other Activities

We considered whether the proposed action would cause any other activities and determined that the proposed Project will accommodate the development of the District's aquaculture business park, where Nordic Aquafarms California, LLC (NAFC) is expected to construct and operate a land-based finfish aquaculture facility. NAFC proposes to use most of the volume of seawater being pumped from Humboldt Bay, in addition to freshwater being provided by the Humboldt Bay Municipal Water District (HBMWD). The HBMWD operates in accordance with an existing Habitat Conservation Plan (HCP), and the HCP has contemplated the effects associated with the diversion of water from the Mad River and required any effects to be fully mitigated for. The HCP provides regulatory coverage under Section 10(a)(1)(B) of the ESA for the HBMWD diversions. NAFC has secured a National Pollutant Discharge Elimination System (NPDES) permit to discharge effluent from the facility and into the Pacific Ocean. The NAFC discharge would rely on an existing outfall pipe, which extends as far as approximately 1.5 miles offshore of Samoa, California. NAFC intends to rear large volumes of yellowtail kingfish at the land-based aquaculture facility.

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

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, each Federal agency must ensure that its actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with

NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provides 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.

The Corps determined the proposed action is not likely to adversely affect SDPS green sturgeon or its critical habitat. Our concurrence is documented in the "Not Likely to Adversely Affect" Determinations section (Section 2.12).

2.1 Analytical Approach

This biological and conference opinion includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "to jeopardize the continued existence of" a listed species, which is "to engage in an action that 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 and conference 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 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 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 is likely to be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' "reproduction, numbers, or distribution" for the jeopardy analysis. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the function of the PBFs that are essential for the species' conservation.

2.2.1 Species Description and General Life History

2.2.1.1 SONCC Coho Salmon

Coho salmon have a generally simple 3-year life history. The adults typically migrate from the ocean and into bays and estuaries towards their freshwater spawning grounds in late summer and fall, and spawn by mid-winter. Adults die after spawning. The eggs are buried in nests, called redds, in the rivers and streams where the adults spawn. The eggs incubate in the gravel until fish hatch and emerge from the gravel the following spring as fry. These 0+ age fish typically rear in freshwater for about 15 months before migrating to the ocean. The juveniles go through a physiological change during the transition from fresh to salt water called smoltification. Coho salmon smolts typically outmigrate between March and July (Ricker *et al.* 2014). Coho salmon typically rear in the ocean for two growing seasons, returning to their natal streams as 3-year-old fish to renew the cycle.

2.2.1.2 CC Chinook Salmon

CC Chinook salmon are typically fall spawners, returning to bays and estuaries before entering their natal streams in the early fall. The adults tend to spawn in the mainstem or larger tributaries of rivers. As with the other anadromous salmon, the eggs are deposited in redds for incubation. When the 0+ age fish emerge from the gravel in the spring, they typically migrate to saltwater shortly after emergence. Therefore, Chinook salmon typically enter the estuary as smaller fish compared to coho salmon. Chinook salmon are typically present in the stream-estuary ecotone, which is located in the downstream portions of major tributaries to estuaries like Humboldt Bay, from early May to early September, with peak abundance in June/July (Wallace and Allen 2007). Similar to coho salmon, prey resources during out-migration are critical to Chinook salmon survival as they grow and move out to the open ocean.

2.2.1.3 NC Steelhead

Steelhead are the anadromous form of *O. mykiss*, spending time in both fresh and saltwater. Steelhead generally return to freshwater to spawn as 4 or 5-year-old adults. Unlike other Pacific salmonids, steelhead can survive spawning and return to the ocean only to return to spawn in a future year. It is rare for steelhead to survive more than two spawning cycles. Steelhead typically spawn between December and May. Like other Pacific salmonids, the steelhead female deposits her eggs in a redd for incubation. The 0+ age fish emerge from the gravel to begin their freshwater life stage and can rear in their natal stream for 1 to 4 years before migrating to the ocean.

Steelhead have a similar life history as noted above for coho salmon, in the sense that they rear in freshwater for an extended period before migrating to saltwater. As such, they enter the estuary as larger fish (mean size of about 170 to 180 mm or 6.5 to 7.0 inches) and are, therefore, more oriented to deeper water channels. CDFW data indicate that steelhead smolts generally migrate downstream toward the estuary between March 1 and July 1 each year, although they have been observed as late as September (Ricker *et al.* 2014). The peak of the outmigration timing varies from year to year within this range, and generally falls between early April and mid-May.

2.2.1.4 Sunflower Sea Star

The sunflower sea star occupies nearshore intertidal and subtidal marine waters from Adak Island, Alaska, to Bahia Asunción, Baja California Sur, Mexico. They are occasionally found in the deep parts of tide pools. The species is a habitat generalist, occurring over sand, mud, and rock bottoms both with and without appreciable vegetation. Prey include a variety of epibenthic and infaunal invertebrates, and the species also excavates clams from soft substrates. It is a well-known urchin predator and plays a key ecological role in controlling urchin populations. More information about sea star biology, ecology, and their life history cycle is found in the proposed listing (88 FR 2023).

2.2.2 Status of Species and Critical Habitat

In this biological and conference opinion, NMFS assesses four population viability parameters to help us understand the status of each species and their ability to survive and recover. These population viability parameters are: abundance, population productivity, spatial structure, and diversity (McElhaney *et al.* 2000). While there is insufficient information to evaluate these population viability parameters in a thorough quantitative sense, NMFS has used existing information, including the Recovery Plan for SONCC Coho Salmon (NMFS 2014) and Coastal Multispecies Recovery Plan (NMFS 2016), to determine the general condition of each population and factors responsible for the current status of each Evolutionarily Significant Unit (ESU). We use these population viability parameters as surrogates for numbers, reproduction, and distribution, the criteria found within the regulatory definition of jeopardy (50 CFR 402.02).

2.2.2.1 Status of SONCC Coho Salmon

SONCC Coho Salmon Abundance and Productivity: Although long-term data on coho salmon abundance are scarce, the available evidence from short-term research and monitoring efforts indicate that spawner abundance has declined since the last status review for populations in this ESU (Williams *et al.* 2016). In fact, 24 of the 31 independent populations in the ESU are at high

risk of extinction because they are below or likely below their depensation threshold, which can be thought of as the minimum number of adults needed for survival of a population. No populations are at a low risk of extinction and all core populations are thousands short of the numbers needed for recovery (Williams *et al.* 2016). The latest viability assessment (Williams 2022) determined the extinction risk category is still moderate, but the trend in extinction risk is declining (i.e., less viable) since the previous assessment.

SONCC Coho Salmon Spatial Structure and Diversity: The distribution of SONCC coho salmon within the ESU is reduced and fragmented, as evidenced by an increasing number of previously occupied streams from which SONCC coho salmon are now absent (NMFS 2001, Good *et al*. 2005, Williams *et al.* 2011, Williams *et al*. 2016, NMFS SWFSC 2023). Extant populations can still be found in all major river basins within the ESU (70 FR 37160; June 28, 2005). However, extirpations, loss of brood years, and sharp declines in abundance (in some cases to zero) of SONCC coho salmon in several streams throughout the ESU indicate that the SONCC coho salmon's spatial structure is more fragmented at the population-level than at the ESU scale. The genetic and life history diversity of populations of SONCC coho salmon is likely very low. The latest viability assessment (NMFS SWFSC 2023) determined the extinction risk category is still moderate, but the trend in extinction risk is declining (i.e., less viable) since the previous assessment.

2.2.2.2 Status of CC Chinook Salmon

CC Chinook Salmon Abundance and Productivity: Low abundance, generally negative trends in abundance, reduced distribution, and profound uncertainty as to risk related to the relative lack of population monitoring in California have contributed to NMFS' conclusion that CC Chinook salmon are likely to become an endangered species within the foreseeable future throughout all or a significant portion of their range. Where monitoring has occurred, Good *et al.* (2005) found that historical and current information indicates that CC Chinook salmon populations are depressed. Uncertainty about abundance and natural productivity, and reduced distribution are among the risks facing this ESU. Concerns regarding the lack of population-level estimates of abundance, the loss of populations from one diversity stratum[1], as well as poor ocean survival contributed to the conclusion that CC Chinook salmon are likely to become an endangered species in the foreseeable future (Good *et al.* 2005, Williams *et al.* 2011, Williams *et al.* 2016, NMFS SWFSC 2023). The new information available since 2016 indicates that recent trends across the ESU have been mixed and that overall extinction risk for the ESU is moderate and has not changed appreciably since the previous viability assessment (NMFS SWFSC 2023).

CC Chinook Salmon Spatial Structure and Diversity: Williams *et al.* (2011) found that the loss of representation from one diversity stratum, the loss of the spring-run history type in two diversity substrata, and the diminished connectivity between populations in the northern and southern half of the ESU pose a concern regarding viability for this ESU. Based on consideration of this updated information, Williams *et al*. (2016) concluded the extinction risk of the CC Chinook salmon ESU has not changed since the last status review. The genetic and life history diversity of populations of CC Chinook salmon is likely very low and is inadequate to contribute to a viable ESU, given the significant reductions in abundance and distribution.

[1] A diversity stratum is a grouping of populations that share similar genetic features and live in similar ecological conditions.

2.2.2.3 Status of NC Steelhead

NC Steelhead Spatial Structure and Diversity: NC steelhead remain broadly distributed throughout their range, with the exception of habitat upstream of dams on both the Mad River and Eel River, which has reduced the extent of available habitat. Extant summer-run steelhead populations exist in Redwood Creek and the Mad, Eel (Middle Fork, Van Duzen), and Mattole rivers. The abundance of summer-run steelhead was considered "very low" in 1996 (Good *et al.* 2005), indicating that an important component of life history diversity in this DPS is at risk. Hatchery practices in this DPS have exposed the wild population to genetic introgression and the potential for deleterious interactions between native stock and introduced steelhead. However, abundance and productivity in this DPS are of most concern, relative to NC steelhead spatial structure and diversity (Williams *et al*. 2011).

NC Steelhead Abundance and Productivity: With few exceptions, NC steelhead are present wherever streams are accessible to anadromous fish and have sufficient flows. The most recent status review by Williams *et al.* (2016) reports that available information for winter-run and summer-run populations of NC steelhead do not suggest an appreciable increase or decrease in extinction risk since publication of the last viability assessment (Williams *et al.* 2011). Williams *et al.* (2016) found that population abundance was very low relative to historical estimates, and recent trends are downwards in most stocks. The new information for NC steelhead available since the previous viability assessment indicates that overall extinction risk is moderate and has not changed appreciably since the prior assessment (NMFS SWFSC 2023). Based on the 2024 status review, NMFS concluded that NC steelhead should remain threatened (NMFS 2024).

2.2.2.4 Status of Sunflower Sea Star

From 2013 to 2017, the sunflower sea star experienced a range-wide epidemic of sea star wasting syndrome (SSWS) (Gravem *et al.* 2021, Hamilton *et al.* 2021, Lowry *et al.* 2022). Sunflower sea stars have no life history variation, morphological characters, genetic traits, or other attributes to delineate specific populations, and therefore is likely a single population throughout its range (panmictic population) While the cause of this disease remains unknown, prevalence of the outbreak has been linked to a variety of environmental factors, including temperature change, sustained elevated temperature, low dissolved oxygen, and decreased pH (Hewson *et al.* 2018; Aquino *et al.* 2021; Heady *et al.* 2022, Oulhen *et al.* 2022). As noted above, changes in physiochemical attributes of nearshore waters are expected to change in coming decades as a consequence of anthropogenic climate change, but the specific consequences of such changes on SSWS prevalence and severity are currently impossible to accurately predict.

2.2.2.5 Status of Critical Habitats

No designation of critical habitat for the sunflower sea star is currently proposed. The condition of SONCC coho salmon, CC Chinook salmon, and NC steelhead critical habitat, specifically their ability to provide for conservation of the species, have been degraded from conditions known to support viable salmonid populations. Critical habitat for SONCC coho salmon (64 FR 24049) was designated in 1999 and critical habitat for both CC Chinook and NC steelhead (70 FR 52488) was designated in 2005. In terms of their status, NMFS has determined that currently depressed population conditions are, in part, the result of the following human induced factors

affecting both SONCC coho salmon as well as CC Chinook and NC steelhead critical habitat: logging, agriculture, mining, urbanization, stream channelization, dams, wetland loss, and water withdrawals (including unscreened diversions for irrigation). Impacts of concern include altered stream bank and channel morphology, elevated water temperature, lost spawning and rearing habitat, habitat fragmentation, impaired gravel and wood recruitment from upstream sources, degraded water quality, lost riparian vegetation, and increased erosion into streams from upland areas (Williams *et al.* 2016, Weitkamp *et al.* 1995). Diversion and storage of river and stream flow has dramatically altered the natural hydrologic cycle in many of the streams within the ESU's and DPS. Altered flow regimes can delay or preclude migration, dewater aquatic habitat, and strand fish in disconnected pools, while unscreened diversions can entrain juvenile fish.

2.2.3 Factors Responsible for the Decline of Species and Critical Habitat

The factors that caused declines of species and degradation of salmonid critical habitat include hatchery practices, ocean conditions, habitat loss due to dam building, degradation of freshwater habitats due to a variety of agricultural and forestry practices, water diversions, urbanization, over-fishing, mining, climate change, and severe flood events exacerbated by land use practices (Good *et al*. 2005, Williams *et al.* 2016). Sedimentation and loss of spawning gravels associated with poor forestry practices and road building are particularly chronic problems that can reduce the productivity of salmonid populations. Late 1980s and early 1990s droughts and unfavorable ocean conditions were identified as further likely causes of decreased abundance (Good *et al.* 2005). From 2014 through 2016, drought conditions in California reduced stream flows and increased temperatures, further exacerbating stress and disease. Ocean conditions have been unfavorable in past years due to the El Niño in 2015 and 2016 and other anomalously warm waters in the Gulf of Alaska. Reduced flows can cause increases in water temperature, resulting in increased heat stress to fish and thermal barriers to migration.

Another factor affecting the range wide status of SONCC coho salmon, CC Chinook salmon, and NC steelhead and their aquatic habitat at large is climate change. Recent work by the NMFS Science Centers ranked the relative vulnerability of west-coast salmon and steelhead to climate change. In California, listed coho and Chinook salmon are generally at greater risk (high to very high risk) than listed steelhead (moderate to high risk) (Crozier *et al* 2019).

Impacts from global climate change are already occurring in California. For example, average annual air temperatures, heat extremes, and sea level increased in California over the last century (Kadir *et al.* 2013). Snowmelt from the Sierra Nevada has declined (Kadir *et al*. 2013). Although SONCC coho salmon, CC Chinook salmon and NC steelhead are not dependent on snowmelt driven streams, they have likely already experienced some detrimental impacts from climate change through lower and more variable stream flows, warmer stream temperatures, and changes in ocean conditions. California experienced well below average precipitation during the 2012-2016 drought, as well as record high surface air temperatures in 2014 and 2015, and record low snowpack in 2015 (Williams *et al*. 2016). Paleoclimate reconstructions suggest the 2012-2016 drought was the most extreme in the past 500 to 1000 years (Williams *et al.* 2016, Williams *et al*. 2020, Williams *et al.* 2022). Anomalously high surface temperatures substantially amplified annual water deficits during 2012-2016. California entered another period of drought in 2020. These drought periods are now likely part of a larger drought event (Williams *et al.* 2022). This recent long-term drought, as well as the increased incidence and magnitude of wildfires in

California, have likely been exacerbated by climate change (Williams *et al.* 2019, Williams *et al.* 2020, Williams et al. 2022,).

The threat to SONCC coho salmon, CC Chinook salmon, and NC steelhead from global climate change is expected to increase in the future. Modeling of climate change impacts in California suggests that average summer air temperatures are expected to continue to increase (Lindley *et al.* 2007, Moser *et al*. 2012). Heat waves are expected to occur more often, and heat wave temperatures are likely to be higher (Hayhoe *et al.* 2004, Moser *et al.* 2012, Kadir *et al.* 2013). Total precipitation in California may decline and the magnitude and frequency of dry years may increase (Lindley *et al.* 2007, Schneider 2007, Moser *et al.* 2012). Similarly, wildfires are expected to increase in frequency and magnitude (Westerling *et al.* 2011, Moser *et al.* 2012). Increases in wide year-to- year variation in precipitation amounts (droughts and floods) are projected to occur (Swain *et al*. 2018). Estuarine productivity is likely to change based on changes in freshwater flows, nutrient cycling, and sediment amounts (Scavia *et al.* 2002, Ruggiero *et al.* 2010).

In marine environments, ecosystems and habitats that are important to salmonids are likely to experience changes in temperatures, circulation, water chemistry, and food supplies (Brewer and Barry 2008, Feely 2004, Osgood 2008, Turley 2008, Abdul-Aziz *et al.* 2011, Doney *et al.* 2012). Some of these changes, including an increased incidence of marine heat waves, are likely already occurring, and are expected to increase. In fall 2014, and again in 2019, a marine heatwave, known as "The Blob"[2], formed throughout the northeast Pacific Ocean, which greatly affected water temperature and upwelling from the Bering Sea off Alaska, south to the coastline of Mexico. The marine waters in this region of the ocean are utilized by salmonids for foraging as they mature (Beamish 2018). Although the implications of these events on salmonid populations are not fully understood, they are having considerable adverse consequences to the productivity of these ecosystems and presumably contributing to poor marine survival of salmonids.

With respect to sunflower sea star, the causative agent of SSWS is currently unknown and various hypotheses regarding transmission dynamics and the lethality of SSWS under diverse physiochemical circumstances exist. Ocean warming and other environmental stressors have been linked to SSWS outbreaks, hastening disease progression and severity (Harvell *et al.* 2019; Aalto *et al.* 2020). Warming ocean temperatures, extreme fluctuations in ocean temperature, harmful algal blooms, ocean acidification, and low dissolved oxygen events were identified as factors that could increase the vulnerability of sunflower sea stars. The largest concern identified by the Status Review Team was increasing sea surface temperatures (Lowry *et al.* 2022).

Overall, climate change is believed to represent a growing threat, and will challenge the resilience of SONCC coho salmon, CC Chinook salmon, NC steelhead, and potentially sunflower sea star.

2.3 Action Area

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

[2] https://www.fisheries.noaa.gov/feature-story/new-marine-heatwave-emerges-west-coast-resembles-blob

proposed action includes the entirety of Humboldt Bay which was defined as the source water population for the entrainment study and the area where reductions in productivity are expected to occur. The action area also includes the Pacific Ocean in the vicinity of the outfall pipe, where water from the Project will be discharged as described in the Other Activities section.

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 impacts to listed species or designated critical habitat from federal agency activities or existing federal agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

In the action area, the threats to SONCC coho salmon, CC Chinook salmon, NC steelhead, and, potentially sunflower sea star from climate change are likely to be similar to those described above in the Species Status section. For example, the action area is likely to experience increases in average summer air temperatures; more extreme heat waves; and an increased frequency of drought (Lindley *et al.* 2007). These are conditions that may increase the prevalence of SSWS, which has already nearly extirpated sunflower sea stars in the action area. In addition to the increased frequency of drought, high intensity rainfall events are also expected to become more common, leading to increased erosion and flooding. In future years and decades, many of these changes are likely to further degrade habitat throughout Humboldt Bay by, for example, reducing streamflow entering the bay during the summer and raising summer water temperatures.

Coho salmon in the action area belong to the Humboldt Bay Tributaries population of SONCC coho salmon, which is currently at a moderate risk of extinction (NMFS 2014). Chinook salmon in the action area belong to the Humboldt Bay Tributaries population of CC Chinook salmon (NMFS 2016), which is well below the number needed to be at a low risk of extinction. Steelhead in the action area belong to the Humboldt Bay Tributaries population of NC steelhead, which is likely below the number needed to be at a low risk of extinction. All of the listed salmonid populations have the same name and encompass all of the tributaries draining into Humboldt Bay. The spatial extent of these populations indicates that fish born in Freshwater Creek (a Humboldt Bay tributary) may return to Humboldt Bay as adults and spawn in any of the Humboldt Bay tributaries, as the entire network of tributaries draining into the bay constitute one population area.

The highest rated threats identified in the recovery plan for SONCC coho salmon include roads, channelization/diking, and agricultural practices (NMFS 2014). The highest rated threats identified in the recovery plan for CC Chinook salmon include roads/railroads and channel modifications such as levees (NMFS 2016). High priority recovery actions in the SONCC Coho Salmon Recovery Plan and the Coastal Multi-Species Recovery Plan (Chinook salmon) are to increase instream structure; construct off channel habitats and oxbows; remove or set back

levees; improve grazing practices; and restore tidally influenced areas (NMFS 2014, 2016).

2.4.1 Status of Listed Species and Critical Habitat in the Action Area

Freshwater Creek is one of the major tributaries draining into Humboldt Bay and is likely to represent about half of the anadromous habitat within the Bay. Counts of adult salmonids, including SONCC coho salmon and CC Chinook salmon, at the Freshwater Creek weir from 1994 through 2014 indicates that both wild populations have declined (Ricker *et al.* 2014). Ricker *et al*. (2014) characterized the decline in CC Chinook salmon in Freshwater Creek as dramatic, and raised concerns over depensatory population effects. Once the augmentation of hatchery reared Chinook salmon ceased in 2004, weir captures declined rapidly into the single digits and ultimately reached an all-time low of no returning adults in 2013 (Ricker *et al.* 2014). Freshwater Creek adult abundance estimates for SONCC coho salmon also indicates that adult escapement has declined, ranging from a high of 1,807 in 2002-03 to a low of 89 in 2009-10 (Moore and Ricker 2012). Information on abundance of winter steelhead in Humboldt Bay is limited, but adult steelhead returning to Freshwater Creek from 2000 to 2014 have ranged from a low of 51 to a high of 432 adults (Ricker *et al.* 2014).

Salmonids occurring in estuaries are highly mobile and in Humboldt Bay, low numbers of fish are spread over a large area, which can complicate scientific observations or captures intended to understand their habitat preferences (Garwood *et al.* 2013 and Pinnix *et al.* 2005). Garwood *et al.* (2013) studied fish assemblages in Humboldt Bay by conducting monthly sampling over several years and only captured one listed salmonid. Pinnix *et al.* (2005) sampled Humboldt Bay over a 2-year period using fyke nets, shrimp trawls, beach seines, purse seines, cast nets, and minnow traps. Pinnix *et al.* (2005) identified a diverse and abundant fish community in Humboldt Bay, including a total of 49 species from 22 families of fishes. However, over the two years of sampling, no salmonid species were captured in any of the six different types of sampling gear. No listed salmonids were captured during regular trawling conducted by the Corps from March through October at five paired locations in and just outside of the federal channels in Humboldt Bay in 2019 and 2020 (Novotny *et al.* 2020a, b).

Pinnix *et al.* (2013) used acoustic transmitters surgically implanted into out-migrating coho salmon smolts in Humboldt Bay. Coho salmon smolts spent more time in the stream-estuary ecotone, which is located in the downstream portions of major tributaries to Humboldt Bay. During their residency in Humboldt Bay, coho smolts primarily used deep channels and channel margins and were present in the estuary an average of 10 to 12 days.

Sunflower sea stars are habitat generalists with large variations in their seasonal depth distribution. All life stages of sunflower sea star are expected to be present in the action area at various times throughout the year. Juvenile sunflower sea stars are commonly observed in nearby areas, such as Trinidad, California (Tyburczy 2016), and adult sunflower sea star have been captured outside of Humboldt Bay in the Dungeness crab and sablefish fisheries in recent years (pers. Comm. Marc Schmidt, 2024).

The condition of SONCC coho salmon, CC Chinook salmon, and NC steelhead critical habitat in the action area, specifically its ability to provide for their conservation, is degraded from conditions known to support viable populations. The action area and nearby areas have been subjected to a high degree of historic anthropogenic disturbance and manipulation, starting in the

1880s after the construction of the jetties and subsequent designation and maintenance of the Federal Navigation Channels. These changes have contributed to changes in the widths, depths, and velocities at the Entrance Channel and action area. The Entrance Channel is flanked by the North and South Jetties on either side, where artificial substrates (concrete, boulders, and concrete dolos) have been installed, which create habitat favored by predators of juvenile salmonids. Humboldt Bay is a major deep-water port, where there is frequent vessel activity and other projects under construction. These conditions and obstructions likely increase the number of days required for SONCC coho salmon, CC Chinook salmon, and NC steelhead to navigate their way through the migratory corridor of Humboldt Bay and into the open ocean.

2.4.2 Previous ESA Section 7 Consultations in the Action Area

NMFS' ESA Section 10(a)(1)(A) research and enhancement permits and research projects in the annual California Department of Fish and Wildlife ESA Section 4(d) rule research program could potentially occur in Humboldt Bay or within nearby estuarine portions of tributaries, including the reaches within the action area. In general, these activities are closely monitored and require measures to minimize take of juveniles during the research activities. NMFS determined the small loss of juveniles associated with these research projects are unlikely to affect future adult returns. The United States Environmental Protection Agency consulted with NMFS pursuant to the expansion of Humboldt Open Ocean Disposal Site (HOODS), allowing dredged materials from dredging projects along the Northern California coast to continue to deposit clean dredge spoils at HOODS. NMFS evaluated effects to EFH and ESA listed species and their designated critical habitats from disposals at HOODS and found that they are not likely to adversely affect SONCC coho salmon, CC Chinook salmon, NC steelhead, and SDPS green sturgeon (NMFS ECO#: WCRO-2019-03626). The Corps expects to routinely dredge the entrance and interior Federal Navigation Channels, which NMFS found would result in the loss of small numbers of juvenile salmonids, but would not jeopardize the survival and recovery of these species (NMFS ECO#: WCRO-2022-00817). The United States Coast Guard (USCG) consulted with NMFS on the removal of the Marine Railway from Station Humboldt Bay, and NMFS concurred with the USCG that species would not be adversely affected (NMFS ECO#: WCRO-2020-03286). The USCG consulted with NMFS on their Station Humboldt Bay Maintenance Dredging activities (2023-2032) and NMFS found that the species and critical habitats would be adversely affected but would be unlikely to jeopardize the survival or recovery of those species because the losses of juvenile salmonids or green sturgeon were small (NMFS ECO#: WCRO-2023-00135). Other activities which have been previously consulted on and expected to routinely occur within or nearby the action area include: dredging of marinas, docks, and boat launches; maintenance and replacement of docks and pilings; maintenance and reconstruction of the North and South Jetties; restoration projects; oyster and macro-algae mariculture; and placement of utility lines.

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).

NMFS expects both adult and juvenile (smolt) stages of SONCC coho salmon, CC Chinook salmon, and NC steelhead to be present in the action area, as well as all life stages of sunflower sea star (larval through adult) at various times throughout the 30-year expected lifespan of the Project structures.

2.5.1 Effects to Critical Habitat

The action area is designated critical habitat for SONCC coho salmon, CC Chinook salmon, and NC steelhead. The PBFs for designated CC Chinook salmon and NC steelhead critical habitats in the action area include[3]: estuarine areas free of obstruction with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation. These features are essential to conservation because without them juveniles cannot reach the ocean in a timely manner and use the variety of habitats that allow them to avoid predators, compete successfully, and complete the behavioral and physiological changes needed for life in the ocean. Similarly, these features are essential to the conservation of adults because they provide a final source of abundant forage that will provide the energy stores needed to make the physiological transition to fresh water, migrate upstream, avoid predators, and develop to maturity upon reaching spawning areas.

Within the range of the SONCC coho salmon, the life cycle of the species can be separated into five PBFs or essential habitat types: (1) juvenile summer and winter rearing areas, (2) juvenile migration corridors, (3) areas for growth and development to adulthood, (4) adult migration corridors, and (5) spawning areas. Within these areas, essential features of coho salmon critical habitat include adequate substrate, water quality, water quantity, water temperature, water velocity, cover/shelter, food, riparian vegetation, space, and safe passage conditions (NMFS 1999). The PBFs of coho salmon critical habitat associated with this Project relate to all PBFs with the exception of: (5) spawning areas. The essential features that may be affected by the proposed action include water quality, food, cover/shelter, and safe passage.

2.5.1.1 Entrainment

The primary adverse effect to designated critical habitat for SONCC coho salmon, CC Chinook salmon, and NC steelhead will be caused by entrainment of prey and reductions in productivity within the action area. Entrainment occurs when small planktonic organisms such as eggs and fish larvae (i.e., ichthyoplankton) and invertebrates, pass through intake screens (Steinbeck *et al.* 2007). Impingement occurs when larger organisms are trapped against screening systems, thus blocking material from entering (Steinbeck *et al.* 2007). The water intake screens are designed to exceed NMFS criteria to avoid entrainment or impingement of juvenile salmonids. Entrainment of smaller organisms, such as ichthyoplankton and invertebrates are expected from the source water, which will result in reductions in available prey for juvenile and adult life stages of ESA-listed salmonids occurring in the action area. The design specifications and cleaning system are expected to avoid impingement of most organisms.

[3] The PBF's for SONCC coho salmon are similar, but stated generally to include juvenile migration corridors, adult migration corridors, and areas for growth.

2.5.1.2 Empirical Transport Model and Area of Production Foregone

To evaluate entrainment impacts to fish (ichthyoplankton), invertebrate larvae, and marine organisms from the water intakes at RMT II and Red Tank Docks, a field assessment and an empirical transport model (ETM) of potential effects on ichthyoplankton was completed by Tenera Environmental (Tenera 2023). The ETM provides an estimate of the proportion (or percentage) of a source water population of larvae that is entrained and assumed lost to the population annually. ETM relies on an estimate of the ratio of the number of larvae likely to be withdrawn from the intakes to the number available or at risk of entrainment (known as P_M or proportional mortality). ETM estimates of P_M are typically used on large water intake projects in California to provide a basis for calculating mitigation using the Area of Production Foregone (APF), such as desalination plants or for cooling nuclear facilities (Raimondi 2010). APF estimates (in terms of acreage) are specifically used to calculate appropriate mitigation measures for project impacts by representing the amount of habitat required to replace losses due to entrainment.

The APF calculated for the two water intakes for this Project reveal that the reductions in productivity caused by the removal of planktonic life forms from Humboldt Bay would require 28.5 acres of restoration or mitigation around Humboldt Bay in order to offset impacts to productivity of Humboldt Bay (CDP 2024). The 28.5-acre APF can also be viewed as what level of impact to productivity the action area/Humboldt Bay would experience (the effects of the water withdrawn to productivity are analogous to 28.5 acres of habitat being removed from the action area). The District intends to achieve 28.5 acres of mitigation to offset the 28.5 acres of APF and is relying on compensatory mitigation at Kramer Dock, Bay Street, and future actions that have yet to be identified.

NMFS views the ETM and corresponding APF estimates as the best available science for evaluating impacts caused by entrainment of multiple species. The ETM and APF methodologies are consistent with, and recommended by, the water quality standards set forth by the California State Water Resources Control Board for desalination or for once-through-cooling systems. These standards are designed for achieving preservation and enhancement of areas of special biological significance, including rare and endangered species, marine habitat, and fish migration and spawning.[4] These estimates are prescribed for use in California to evaluate impacts and identify appropriate mitigation for large water intakes. The 28.5 acres of mitigation is expected to offset the impacts if appropriate mitigation ratios are used for elements of each mitigation action being proposed.

2.5.1.2.1 Adverse Effects to Prey Resources

Many of the species of ichthyoplankton expected to be entrained include high value prey items, such as Pacific herring, northern anchovy, and ichthyoplankton in general. Most of the species expected to have the highest P_M are those who are either endemic to Humboldt Bay (gobies, etc) or are seasonal visitors who spawn inside Humboldt Bay (Pacific herring). Incoming source water from the Pacific Ocean is not expected to include meaningful numbers of these species' larvae to replace the individuals who are entrained by the Project. The P_M for the species

[4] *See* California State Water Resources Control Board, Water Quality Control Plan, Ocean Waters of California (California Ocean Plan) (2019), *available at* https://www.waterboards.ca.gov/water_issues/programs/ocean/

endemic to Humboldt Bay indicates that these populations are expected to persist at reduced abundance levels. Invertebrate species (such as copepods or krill) were not part of the ETM evaluation and are also expected to be entrained and removed as potential sources of prey for both juvenile and adult salmonids.

The reductions in available prey will impact all life stages who migrate through, or rear inside Humboldt Bay and cause adverse effects to the quality and quantity of available food/prey resources of designated SONCC coho salmon, CC Chinook salmon, and NC steelhead critical habitat. The ability of critical habitat to provide for rapid growth prior to ocean entry, or for key energy reserves prior to upstream spawning migrations, will be reduced by the Project.

2.5.1.3 Adverse Effects to Migratory Corridor PBF

The improvements to the underwater sea chests, water intake structures, and associated terrestrial pipelines are expected to extend the lifespan of these structures into the future. Both the water intake structures and sea chests, as well as the docks that these structures are connected to, will impede the unction and quality of migratory or safe passage PBFs of designated critical habitats. Recent studies in Humboldt Bay that relied on the use of eDNA found that the highest concentrations of SONCC coho salmon eDNA were detected at the Samoa sampling stations, which are in close proximity to the water intakes (Kinziger *et al.* 2022). The continued existence of the sea chest structures will cause shade and avoidance behavior by all life stages of salmonids, ultimately reducing the function and quality of the migratory habitat available in Humboldt Bay.

2.5.1.4 Improvements to Critical Habitat Through Compensatory Mitigation

The compensatory mitigation planned to offset the APF impacts include: removal of derelict pilings at Kramer Dock; reconnection and enhancement of tidal habitats at Bay Street; and additional actions that have not yet been identified. The removal of pilings at Kramer Dock is expected to increase eelgrass parameters and reduce the amount of structures in the bay. The Kramer Dock location is within designated critical habitat for SONCC coho salmon, CC Chinook salmon, and NC steelhead, and eelgrass is key habitat type which provides both natural shelter or cover, as well as prey resources which grow on, or depend upon eelgrass. Increasing eelgrass parameters and reducing the numbers of structures are expected to improve the value of designated critical habitats. NMFS is supportive of a 1:1 mitigation ratio for piling removals at Kramer Dock and agrees that actions at Kramer Dock will account for 0.79 acres towards APF mitigation.

Currently, the Bay Street parcel is largely disconnected from tidal waters due to levees and a channel network which has been mostly buried by human activities. During higher tides water only inundates the Bay Street parcel in small volumes resulting in shallow and mostly inadequate depths with poor water quality. Removing levees and restoring or constructing a channel network will improve depths, tidal circulation, and water quality parameters onsite. The improved conditions and restored access to the parcel will accommodate the future use of the Bay Street by all listed salmonids. The Bay Street parcel is within the lateral extent of designated critical habitat for SONCC coho salmon, as well as CC Chinook and NC steelhead. The reconnection of

the Bay Street parcel to tidal inundation will increase the amount of critical habitat available in the action area and improve the quality of the critical habitats. NMFS is supportive of the cap on the amount of mitigation resulting from Spartina control and agrees with the maximum of 11 acres of APF mitigation for the Bay Street.

Future compensatory actions are expected to have similar benefits to critical habitats, but the locations, timing, and mitigation elements are unknown. Therefore, NMFS is not yet crediting the District for the actions which have not yet been identified. NMFS is crediting both the Kramer Dock piling removal (0.79 acres credit) and Bay Street enhancements (11.0 acres mitigation credit) as mitigation towards the APF mitigation needed. These anticipated credits total 11.79 acres, leaving 16.71 acres of APF impacts remaining to be mitigated or offset for.

2.5.2 Effects to Individuals

2.5.2.1 Entrainment of Individuals

The design specifications for the water intake screens are expected to preclude the entrainment and impingement of juvenile salmonids. However, larval or planktonic life stages of sunflower sea stars are expected to be entrained, as these animals would be small enough to pass through the 0.50 mm to 1.00 mm slot openings. Because the water intakes are located in an environment where sunflower sea star larvae are likely to occur, we expect some larvae will be entrained. While sunflower sea star adults and juveniles are very uncommon at this time, one adult can produce millions of larvae, thus larvae in the water column are likely to be more plentiful than benthic adults and juveniles. Adult sunflower sea stars have been captured in commercial fisheries outside of Humboldt Bay in recent years (personal communication Marc Schmidt, January 26, 2024). While sunflower sea star adults are rarely encountered in the bay in recent years, some larvae produced within the bay or adjacent open ocean waters would likely be entrained and result in the death of sunflower sea star larvae.

2.5.2.2 Reduced Growth and Survival

The 28.5 acres of production foregone and associated reduction in prey availability is expected to result in a proportion of each cohort of juvenile SONCC coho salmon, CC Chinook salmon, and NC steelhead being smaller upon entry into the ocean because of decreased critical growth inside of the Humboldt Bay. Smaller size upon entering the ocean may adversely impact subsequent survivorship in marine waters (MacFarlane 2010, Norrie *et al*. 2022), ultimately leading to reduced survival and escapement for generations of cohorts. Chinook salmon and steelhead in particular are dependent on growth during extended summer rearing to provide for ocean survival and adult abundance (Riemers 1973, Bond 2008, Hayes 2008). Bond *et al.* 2008 found that steelhead from Scott Creek, a coastal watershed in Central California, showed strong size-dependent mortality at sea, with large estuary-reared steelhead versus smaller stream-reared steelhead showing a large survival advantage. NMFS expects a small number of juvenile SONCC coho salmon, CC Chinook salmon, and NC steelhead to perish upon ocean-entry because of their exposure to diminished prey resources and smaller size.

2.5.2.3 Acoustics and Noise

Acoustics and noise are expected to be produced by the removal of pilings at Kramer Dock, operation of large underwater water pumps, and general construction noise during the water intake infrastructure upgrade. Pilings will be removed with an excavator or vibratory hammer,

both of which are expected to produce sound levels that would not disrupt normal behavioral activities or cause harm to individuals. The continuous operations of the water intake pumps are expected to produce sound levels of 120 decibels at 45-meter distances from the water intake pumps. These sound levels are below those expected to cause injury but may cause changes in behavior. Changes in behavior that result from exposure to acoustic noise are not expected to influence feeding or migration, as the locations of the pumps are in areas generally avoided by salmonids due to the overwater structures and unnatural shoreline. Acoustics and noise are not expected to injure any life stages of sunflower sea star.

2.5.2.4 Turbidity and Contaminants

Suspended sediments and turbidity are expected to be caused during the water intake upgrade work, piling removal work at Kramer Dock, and the enhancement activities at Bay Street. The turbidity is expected to be brief and during work windows that will minimize exposure of individuals. NMFS expects the effects of turbidity to be temporary and minimal and not disrupt routine behaviors of any individual SONCC coho salmon, CC Chinook salmon, NC steelhead, or sunflower sea stars.

2.5.3 Other Activities

As described in the Proposed Action section, a primary consequence of the water being diverted from Humboldt Bay is the operation of the NAFC land-based aquaculture facility, which is already permitted to discharge up to 12.5 mgd into the Pacific Ocean. The discharge will rely on an existing outfall pipe structure with diffuser ports where treated wastewater would be released near the bottom in approximately 80-feet of water depth. Although the wastewater will be treated to reduce pollutants and nutrients, because of the scale, there will be measurable amounts of nitrates discharged into the Pacific Ocean.

2.5.3.1 Harmful Algal Blooms

Nitrogen is the primary nutrient limiting phytoplankton production in coastal waters (Booth 2015, Howard *et al.* 2014) and additions of nitrogen cause phytoplankton production to increase, potentially reaching levels so high that they become harmful algal blooms (HABs). The most prevalent species that cause HABs are diatoms and dinoflagellates. The diatom species (primarily *Pseudo-nitzschia australis* and *P. multiseries)* produce domoic acid, which is responsible for well documented toxic events to marine mammals and birds and amnesiac shellfish poisoning in humans. The dinoflagellates (*Alexandrium tamarense* complex) can produce saxitoxin, which is responsible for paralytic shellfish poisoning and fish kill determinations (Backer and Miller 2016, Gosselin *et al.* 1989, Kudela *et al.* 2010, Lefebvre *et al.* 2004, Trainer *et al.* 2010). Domoic acid and saxitoxins are responsible for the shellfish consumption warnings frequently posted in coastal counties including Humboldt county. The razor clam fishery in Humboldt County has been closed since November of 2023 due to high levels of domoic acid in clams sampled from Clam Beach (California Department of Public Health (CDPH) 2024).

The discharge will supply nutrients year-round into the photic zone outside of Humboldt Bay. The discharge may have the effect of fertilizing or kick-starting HABs by sustaining or even

increasing the duration or population size of HAB species at the surface or in subsurface water "lenses" associated with the effluent plume during periods of stratification (Cochlan *et al.* 2008, Kudela *et al.* 2010, Nezlin *et al.* 2012, Seeyave *et al.* 2009, Seegers *et al.* 2015, Trainer *et al.* 2007) and by providing nitrogen to the upper water column. In the shallow receiving waters of the outfall, which are always in the photic zone, populations of HABs brought into the near shore area by upwelling or from Humboldt Bay could become entrenched by the year-round availability of nitrogen and establish a year-round presence.

The discharge of nitrogen into the shallow photic zone will likely contribute to the magnitude or duration of HAB events in the vicinity of the outfall. Adult, sub-adult, or juvenile life stages of SONCC coho salmon, CC Chinook, and NC steelhead will likely be exposed to HAB events and experience short term reductions in their ability to feed normally. The exposure to HAB events is expected to be temporary and isolated to only a small portion of the nearshore environment of the Pacific Ocean. SONCC coho salmon, CC Chinook, and NC steelhead are expected to resume normal feeding activities and not suffer from any fitness consequences due to exposure of HABs if they were to occur.

2.6 Cumulative Effects

"Cumulative effects" are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation [50 CFR 402.02 and 402.17(a)]. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline *vs.* cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the environmental baseline (Section 2.4).

SONCC coho salmon, CC Chinook salmon, NC steelhead, and sunflower sea star in the action area are likely to be affected by future, ongoing non-federal activities like marine commerce and recreational activities such as fishing. Future marine commerce (vessel traffic, shipments of raw goods, etc) or fishing are not expected are not expected to have negative consequences for these species. Effects in the action area originating from activities upstream of the action area will also contribute to diminished water quality or quantity, such as agriculture, water diversion, urban development, and timber harvest. Water diversions contribute to diminished stream flows and warmer water temperatures, while agriculture may increase nutrients and degrade dissolved oxygen or water clarity. The future effects of timber harvest include continued land disturbance, road construction and maintenance, and higher rates of erosion and sedimentation.

2.7 Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we

add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's biological and conference 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 for the conservation of the species.

SONCC coho salmon, CC Chinook salmon, and NC steelhead have declined to a large degree from historic numbers. The small loss of SONCC coho salmon, CC Chinook salmon, and NC steelhead juveniles caused by the Project is not expected to affect future returns. Estimates for a portion of the Humboldt Bay Tributaries population of SONCC coho salmon indicates as many as 35,000 juvenile coho salmon emigrate from Freshwater Creek each year (Freshwater Creek is approximately one third of the population area). Marine survival of juveniles is known to be very low, and the loss of juveniles from their respective populations is less impactful than the loss of adults. The brief periods of turbidity will be temporary; while the reductions in prey, underwater noise, and discharge of treated wastewater into the Pacific Ocean are expected to occur for 30 years. Reductions in prey are expected to have a negative impact on designated salmonid critical habitats and likely result in reduced size at ocean entry for a subset of the individuals in the populations. The improvements to the sea chests are expected to increase the lifespan of the adjacent overwater structures and continue to adversely affect the migratory or safe passage PBF of critical habitats. The 28.5-acre APF represents the portion, or area, of critical habitat that would essentially be lost due to reductions in productivity (28.5-acre reduction). The area of designated critical habitat for SONCC coho salmon and for CC Chinook and NC steelhead in Humboldt Bay is approximately 16,000 acres, so a 28.5-acre reduction would represent a small percentage of the overall area of critical habitat.

Furthermore, the compensatory mitigation proposed at Kramer Dock and Bay Street is expected to offset adverse effects to critical habitats and contribute as much as 11.79 acres of the 28.5 acres of APF mitigation proposed. The actions at Kramer Dock are expected to reduce the amount of the action area occupied by structures and offset adverse effects of the Project on the migratory or safe passage PBFs. The Kramer Dock actions will also improve and increase eelgrass parameters, expanding natural shelter and prey resources in the action area, which also offset the migratory/safe passage effects of the Project as well as adverse effects to the prey or food resources PBFs. The Bay Street actions are expected to reconnect former tidelands that had been disconnected and increase the amount of habitat available in the action area. Removing infrastructure (levees) at Bay Street is expected to immediately improve access to and species usage of the site. These actions will improve the value of designated critical habitats and offset adverse effects to the prey and food resources PBFs caused by the Project. The compensatory mitigation actions are expected to offset most of the adverse impacts to critical habitat and contribute to ensuring that designated critical habitats would not be adversely modified.

These effects are not expected to appreciably diminish the value of the designated salmonid critical habitats as a whole for the conservation of these species. In addition, the loss of juveniles due to these impacts would not be sufficient to influence future adult returns or contribute to population level effects that could affect either of the ESUs or DPS.

Sunflower sea stars have declined to a large degree from historic numbers, and in some portions of their range, are nearly functionally extirpated. The loss of larval sunflower sea star is not expected to change population dynamics of the species, given its broad range and likely panmictic population structure. Survival of larvae from broadcast spawning species such as sunflower sea star is very low, and the loss of larvae is less impactful to the overall population than the loss of adult life stages would be. Adults have survived all life stage transitions and are more valuable to the resiliency of the population.

The action area and ranges of these species are likely to be subject to higher average summer air temperatures and lower total precipitation levels due to climate change. Although the total precipitation levels may decrease, the average rainfall intensity has increased and is expected to continue to increase in the future. Higher air temperatures would likely warm stream and estuary temperatures. Reductions in the amount of precipitation would reduce stream flow levels and estuaries may also experience changes in productivity due to changes in freshwater flows, nutrient cycling, and sediment amounts. For this project, all Project activities would be completed by 2034 and the likely long-term effects of climate change described above are unlikely to be detected within that time frame. The short-term effects of project construction would have completely elapsed prior to these climate change effects. Overall, the project is unlikely to appreciably reduce the likelihood of survival and recovery of SONCC coho salmon, CC Chinook salmon, NC steelhead, and sunflower sea star and the project is unlikely to appreciably diminish the value of designated critical habitat for the conservation of these species.

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, any effects of interrelated and interdependent activities, and cumulative effects, it is NMFS' biological and conference opinion that the proposed action is not likely to jeopardize the continued existence of SONCC coho salmon, CC Chinook salmon, NC steelhead, or destroy or adversely modify their designated critical habitats; and is not likely to jeopardize the continued existence of sunflower sea star.

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

In the biological opinion and conference opinion, NMFS determined that incidental take is reasonably certain to occur to sunflower sea stars as a result of entrainment by water intakes of larval and planktonic individuals. Incidental take of salmonids is anticipated as a result of entrainment of planktonic prey species, resulting in mortality of juvenile salmonids that perish upon ocean-entry because of their smaller size from exposure to diminished prey resources. NMFS expects the loss of small numbers of juvenile SONCC coho salmon, juvenile CC Chinook salmon, juvenile NC steelhead, and larval sunflower sea star during most years of operation throughout the expected 30-year term of this Project. The future abundance of juvenile salmonids and larval sunflower sea stars is expected to be variable and difficult to predict. The volume of water being removed from the action area is the primary impact producing mechanism of the Project that is causally linked to take because it will affect individual sunflower sea star larvae through entrainment, and will impact individual salmonids by entraining planktonic prey items which reduce the amount of available prey for those individuals.

The abundance of juvenile salmonids in the action area would depend on future adult returns to the population area (all of the Humboldt Bay tributaries), and the corresponding survival rates of their offspring through various life stages until their outmigration into the ocean. There is considerable variability associated with the survival of each life stage depending on environmental factors, which are hard to predict (such as droughts or floods). Currently, only limited information is available on salmonid abundance from one portion of the population area (Freshwater Creek), which further complicates estimates for the action area given the extent of the area without available data. The number of individual juvenile salmonids who experience reduced feeding and enter the ocean at smaller sizes is also expected to be variable and depend on multiple factors. The abundance of sunflower sea stars is currently severely depressed and nearby spawning events may not always produce planktonic larvae that would be carried into Humboldt Bay from the Pacific Ocean. Very little information exists on the distribution or abundance of planktonic larval life stage of sunflower sea star because the ability to identify them during their planktonic larval stage is very difficult. For these reasons, as well as the difficulty of directly monitoring or observing entrainment of very small individuals, it is not practical to express the amount or extent of take of larval sunflower sea stars in terms of individuals of the species. For similar reasons, it is difficult to directly monitor or observe the loss of planktonic prey of salmonids, and furthermore not practical to directly monitor how many individuals would be lost due to a resulting reduction in the available planktonic prey in the action area. If and when the sunflower sea star population recovers, we would expect more larvae would be produced and entrained in future years. Therefore, NMFS relies on the anticipated volumes of water being drafted as a surrogate for the amount of take. Thus, the cumulative volumes of water proposed to be drafted during each phase of the project (phase 1 is 5.05 mgd; phase 2 is 10.0 mgd; and phase 3 is 11.88mgd, see Table 1) serve as thresholds for determining when the anticipated level of take has been exceeded.

2.9.2 Effect of the Take

In the biological and conference 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" refer to those actions the Director considers necessary or appropriate to minimize the impact of the incidental take on the species (50 CFR 402.02). NMFS believes the following reasonable and prudent measures are necessary and appropriate to minimize take of SONCC coho salmon, CC Chinook salmon, NC steelhead and sunflower sea star:

1. The District shall monitor the take of listed species.

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 Corps 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:
    a. The District shall provide a written report to NMFS by December 31 of each year summarizing the volumes of water being removed at each water intake and the status of APF mitigation projects, including which actions have been taken, which actions are planned, or which are remaining to be identified.
    b. The District shall submit the annual report, by December 31, to Matt.Goldsworthy@noaa.gov. This point of contact may be updated by NMFS if needed through written notice to the District.

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). NMFS has no conservation recommendations to suggest other than those within the MSA EFH consultation.

2.11 Reinitiation of Consultation

This concludes formal consultation for the Humboldt Bay Water Intakes Improvement Project. Under 50 CFR 402.16(a): "Reinitiation of consultation is required and shall be requested by the federal agency, where discretionary federal 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[5] 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."

2.12 Not Likely to Adversely Affect Determinations

2.12.1 Southern Distinct Population Segment Green Sturgeon

Subadult and adult green sturgeon move between coastal waters and estuaries. Lindley *et al.* (2011) report multiple rivers and estuaries are visited by aggregations of green sturgeon in summer months, and larger estuaries (e.g., the action area in Humboldt Bay) appear to be particularly important habitat. During the winter months, green sturgeon generally reside in the coastal ocean. Subadult green sturgeon spend several years at sea before reaching reproductive maturity and returning to freshwater to spawn for the first time (Nakamoto *et al.* 1995).

Juvenile SDPS green sturgeon rear in their natal streams in California's Central Valley, so only sub-adult and adult Southern DPS green sturgeon are present in the marine environment offshore of, and inside of, Humboldt Bay and are the only life stages of SDPS green sturgeon that could be present. Sub-adults range from 65-150 centimeters (cm) total length from first ocean entry to size at sexual maturity. Sexually mature adults range from 150-250 cm total length.

The PBFs of green sturgeon critical habitat relevant to the action area are those limited to the estuarine area with: (1) abundant food items and substrates for juvenile, subadult and adult life stages; (2) water flow necessary for orientation and attraction flows to spawning areas in the Sacramento River; (3) water quality necessary for normal behavior, growth, and viability of all life stages; (4) a migratory pathway necessary for the safe and timely passage within estuarine habitats and between estuarine and riverine or marine habitats; (5) a diversity of depths necessary for shelter, foraging and migration of juvenile, subadult, and adult life stages; and (6) sediment quality necessary for normal behavior, growth, and viability of all life stages (NMFS 2006). The PBF for water flow necessary only pertains to the Sacramento River and does not apply in the action area.

SDPS green sturgeon are known to use an area of the North Bay heavily (Goldsworthy *et al.* 2016, Pinnix 2008) and have been detected in most portions of the action area. SDPS green sturgeon are expected to be exposed to stressors such as: turbidity, acoustic noise, reduced prey, and vessel traffic throughout the Project. However, turbidity and vessel traffic are expected to be temporary and minor and have an insignificant effect upon individuals or their designated critical habitat. Noise created during the removal of pilings is expected have an insignificant effect on individuals given the episodic and temporary nature of the work, and the low levels of sound produced by vibratory hammers or excavators. The noise caused by the continuous operation of the water intake pumps is expected to produce sound as high as 120 decibels at a distance of 45-

[5] This includes all components of the Project, including the compensatory mitigation components included in the Project and required by the Special Conditions of the California Coastal Commission's Coastal Development Permit.

meter from the intakes. This level of sound is not expected to interrupt normal feeding or migratory behaviors and have an insignificant effect.

Reductions in prey caused by the 28.5-acre APF impact is expected to have an insignificant effect on SDPS green sturgeon and their critical habitat. Given the age and size of SDPS green sturgeon in Humboldt Bay, the removal of planktonic organisms from the action area is not expected to influence the fitness or feeding opportunities, nor the conservation value of designated critical habitat. Organisms subject to being entrained are those with head capsule sizes less than 0.5 mm, while most prey consumed by SDPS green sturgeon are older life stages of fish or invertebrates that are much larger given the size of the sturgeon's mouth and energetic demands. SDPS green sturgeon have a wide range of prey resources, both infaunal and pelagic, and therefore are not expected to have reduced feeding opportunities.

NMFS concurs with the Corps that the Project is not likely to adversely affect the SDPS green sturgeon nor their designated critical habitat.

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." 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 [50 CFR 600.905(b)].

Habitat Areas of Particular Concern (HAPC) are described in the regulations as subsets of EFH that are identified based on one or more of the following considerations: the importance of the ecological function provided by the habitat; the extent to which the habitat is sensitive to human-induced environmental degradation; whether, and to what extent, development activities are, or will be stressing the habitat type; and the rarity of the habitat type (50 CFR 600.815(a)(8)). Designated HAPC are not afforded any additional regulatory protection under MSA; however, federal projects with potential adverse impacts to HAPC are more carefully scrutinized during the consultation process. The EFH consultation mandate applies to all species managed under a Fishery Management Plan (FMP) that may be present in the action area.

3.1 Essential Fish Habitat Affected by the Project

This analysis is based, in part, on the EFH assessment provided by the Corps and descriptions of EFH for the following fishery management plans (FMPs): Pacific Coast Salmon (Pacific Fishery Management Council (PFMC) 2016), coastal pelagic species (PFMC 2019a), and Pacific Coast Groundfish (PFMC 2019b). The Pacific Coast Groundfish EFH includes all waters from the mean high water line, and the upriver extent of saltwater intrusion in river mouths, along the coasts of Washington, Oregon, and California seaward to the boundary of the EEZ (PFMC 2019b). The east-west geographic boundary of Coastal Pelagic EFH is defined to be all marine and estuarine waters from the shoreline along the coasts of California, Oregon, and Washington offshore to the limits of the EEZ and above the thermocline where sea surface temperatures range between 10ºC and 26ºC. The southern extent of EFH for Coastal Pelagics is the United States-Mexico maritime boundary. The northern boundary of the range of Coastal Pelagics is the position of the 10ºC isotherm, which varies both seasonally and annually (PFMC 2019a). In estuarine and marine areas, Pacific Coast Salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the full extent (200 miles) of the U.S. Exclusive Economic Zone (EEZ) offshore of Washington, Oregon, and California north of Point Conception to the Canadian border (PFMC 2016). Thus, the proposed Project occurs within EFH for various Federally-managed species in the Pacific Coast Salmon, Pacific Coast Groundfish, and Coastal Pelagic Species FMPs. Furthermore, the action area is designated as a HAPC for Pacific Coast Salmon (estuary), and Pacific Coast Groundfish (estuary).

3.2 Adverse Effects on Essential Fish Habitat

Most of the adverse effects to EFH for the Pacific Salmon Fishery Management Plan (FMP) were previously described in the ESA portion of this document. NMFS also expects the action to adversely affect the Estuary HAPC designated for the Pacific Coast Salmon FMP. Adverse effects to the Estuary HAPC for the Pacific Coast Salmon FMP are expected to include the reductions in productivity of Humboldt Bay, including the direct removal of prey for juveniles and adults within the action area.

Adverse effects to EFH for the Pacific Coast Groundfish FMP, Coastal Pelagic Species FMP, and to Estuary HAPC for Pacific Coast Groundfish includes the reduction in productivity of the action area; entrainment of prey for numerous managed species; individuals from the Coastal Pelagic Species FMP and Pacific Coast Groundfish FMP are expected to be entrained in large numbers (Tenera 2023); brief periods of turbidity; loss of habitat; and increased risk of HABs in the Pacific Ocean.

3.3 Essential Fish Habitat Conservation Recommendations

Most of the adverse effects from the proposed action are related to the reduction in productivity of Humboldt Bay, removals of prey, and removals of managed species themselves via entrainment in the water intakes. Therefore, NMFS suggests the following Conservation Recommendations to offset or otherwise compensate for the significant adverse effects to the Pacific Coast Salmon, Pacific Coast Groundfish, and Coastal Pelagic Species FMPs:

1. The Corps and District should ensure that compensatory mitigation actions taken at

Bay Street maximize tidal prism, or the volume of tidewater allowed to inundate the parcel. Water control structures (levee, tidegates culverts, etc.) should be fully removed and the size and depth of the terminal tidal ponds and channels should be maximized.

2. To maximize the benefits that would accrue from compensatory mitigation actions, NMFS suggests a lower cap for the amount of spartina control that can be applied as compensatory mitigation to offset APF impacts. Special Condition 4 caps the amount of spartina control to 15% of the total 28.5-acre APF (or 4.275 acres of spartina control). After many years of spartina control in Humboldt Bay, NMFS is not aware of any success nor any areas where spartina has been eradicated. Typically, spartina control actions generally continue ad infinitum. The productivity gains expected from spartina control are not likely to be achieved, and the control work would continue to cause a high level of disturbance for only minimal short-term gains. NMFS suggests the cap on the amount of spartina control be reduced from 15% to 5% of the total 28.5-acre APF (or 1.5 acres of spartina control).

Fully implementing this EFH conservation recommendation would protect EFH and HAPC, by avoiding or minimizing the adverse effects described in section 3.2 above.

3.4 Statutory Response Requirement

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

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

3.5 Supplemental Consultation

The Corps 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 U.S. Army Corps of Engineers. Other interested users could include the California Department of Fish and Wildlife, California Coastal Commission, and tenants of the District's Aquaculture Business Park. A copy of this opinion was provided to the Corps. 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 600.

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

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

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

5 REFERENCES

Abdul-Aziz, O.I., N.J. Mantua, and K.W. Myers. 2011. Potential climate change impacts on thermal habitats of Pacific salmon (*Oncorhynchus spp.)* in the North Pacific Ocean and adjacent seas. Canadian Journal of Fisheries and Aquatic Sciences 68(9):1660-1680.

Aquino, C. A., Besemer, R. M., DeRito, C. M., Kocian, J., Porter, I. R., Raimondi, P. T., Rede, J. E., Schiebelhut, L. M., Sparks, J. P., Wares, J. P., and I. Hewson. 2021. Evidence that microorganisms at the animal-water interface drive sea star wasting disease. Frontiers in Microbiology. 11(3278).

Backer, L.C., and M. Miller. 2016. Sentinel animals in a one health approach to harmful cyanobacterial and algal blooms. Veterinary Sciences 3(2), 8; doi:10.3390/vetsci30200008

Beamish, R.J., Editor. 2018. The ocean ecology of Pacific salmon and trout. American Fisheries Society, Bethesda, Maryland.

Bond, M. H., S. A. Hayes, C. V. Hanson, and R. B. MacFarlane. 2008. Marine survival of steelhead (*Oncorhynchus mykiss*) enhanced by a seasonally closed estuary. Canadian Journal of Fisheries and Aquatic Sciences. 65:2242–2252.

Booth, A. 2015. State of the Bay Report. "Looking Ahead: Nutrients and Hypoxia". Urban Coast 5(1):190-193. Available online: http://urbancoast.org/

Brewer, P.G., and J. Barry. 2008. Rising Acidity in the Ocean: The Other CO2 Problem. Scientific American. October 7, 2008.

California Department of Public Health (CDPH). 2024. Razor Clam Domoic Acid Monitoring for Del Norte and Humboldt County. https://cdphdata.maps.arcgis.com/sharing/rest/content/items/f349952bae944a17abb685669ff33be1/data

Coastal Development Permit. 2024. Notice of Intent to Issue Permit for Humboldt Bay Water Intakes Improvement Project. Permit Application Number 1-21-0653. California Coastal Commission. Arcata, California. May 14, 2024.

Cochlan, W.P., J. Herndon and R.M. Kudela. 2008. Inorganic and organic nitrogen uptake by the toxigenic diatom Pseudo-nitzschia australis (Bacillariophyceae). Harmful Algae 8:111-118.

Crozier, L.G., M.M. McClure, T. Beechie, S.J. Bograd, D.A. Boughton, and M. Carr. 2019. Climate vulnerability assessment for Pacific salmon and steelhead in the California Current Large Marine Ecosystem. PLoS ONE 14(7): e0217711. https://doi.org/10.1371/journal.pone.0217711

Doney, S.C., M. Ruckelshaus, J. E. Duffy, J. P. Barry, F. Chan, C. A. English, H. M. Galindo, J. M. Grebmeier, A. B. Hollowed, N. Knowlton, J. Polovina, N. N. Rabalais, W. Sydeman, J., and L. D. Talley. 2012. Climate Change Impacts on Marine Ecosystems. Annual Review of Marine Science 4:11-37.

Feely, R.A., C.L. Sabine, K. Lee, W. Berelson, J. Kleypas, V.J. Fabry, F.J. Millero. 2004. Impact of anthropogenic CO2 on the CaCO3 system in the oceans. Science 305:362-366.

Garwood, R., T.J. Mulligan, and E. Bjorkstedt. 2013. Ichthyological Assemblage and Variation in a Northern California Zostera marina Eelgrass Bed. Northwestern Naturalist 94(1):35-50.

GHD. 2024. Summary of APF and Longfin Smelt Mitigation Adjustments Resulting from Mesaures to Reduce Impacts and Updated APF and LFS Mitigation Calculations Based on the Redesign of the Intake Screens. GHD, Eureka, California. April 5, 2024.

Goldsworthy, M., B. Pinnix, M. Barker, L. Perkins, A, David, and J. Jahn. 2016. Green Sturgeon Feeding Observations in Humboldt Bay, California. Field Note from August 19, 2016. National Marine Fisheries Service, United States Fish and Wildlife Service, Arcata, California.

Good, T. P., R. S. Waples, and P. Adams (editors). 2005. Updated status of federally listed ESUs of West Coast salmon and steelhead. U.S. Department of Commerce, NOAA Tech. Memo. NMFS-NWFSC-66. 597 pp.

Gosselin, S., L. Fortier, and J.A. Gagne. 1989. Vulnerability of Marine Fish Larvae to the Toxic Dinoflagellate Protogonyaulax tamarensis. Marine Ecology Progress Series 57:1-10

Gravem, S.A., Heady, W.N., Saccomanno, V.R., Alvstad, K.F., Gehman, A.L.M., Frierson, T.N., Hamilton, S.L. 2021. Pycnopodia helianthoides. IUCN Red List of Threatened Species 2021. 43.

Hamilton, S.L., Saccomanno, V.R., Heady, W.N., Gehman, A.L., Lonhart, S.I., Beas-Luna, R., Francis, F.T., Lee, L., Rogers-Bennett ,L., Salomon, A.K., and Gravem, S.A. 2021. Disease-driven mass mortality event leads to widespread extirpation and variable recovery potential of a marine predator across the eastern pacific. Proceedings of the Royal Society B. 288(1957): 20211195.

Hayhoe, K., D. Cayan, C.B. Field, P. C. Frumhoff, E.P. Maurer, N.L. Miller, S.C. Moser, S.H. Schneider, K.N. Cahill, E.E. Cleland, L. Dale, R. Drapek, R.M. Hanemann, L.S. Kalkstein, J. Lenihan, C.K. Lunch, R.P. Neilson, S.C. Sheridan, and J.H. Verville. 2004. Emissions pathways, climate change, and impacts on California. Proceedings of the National Academy of Sciences of the United States of America, 101(34):12422-12427.

Hayes, S. A., Bond, M. H., Hanson, C. V., Freund, E. V., Smith, J. J., Anderson, E. C. MacFarlane, R. B. (2008). Steelhead Growth in a Small Central California Watershed:

Upstream and Estuarine Rearing Patterns. Transactions of the American Fisheries Society, 137(1), 114–128. https://doi.org/10.1577/T07-043.1

Heady, W., Beas-Luna, R., Dawson, M., Eddy, N., Elsmore, K., Francis, F., Frierson, T., Gehman, A.L., Gotthard,t T., Gravem, S.A., Hamilton, S.L., Hannah, L., Harvell, C.D., Hodin, J., Kelmartin, I., Krenz, C., Lee, L., Lorda, J., Lowry, D., Mastrup, S., Meyer, E., Raimondi, P.T., Rumrill, S.S., Saccomanno, V.R., Schiebelhut, L.M., and Siddon, C. 2022. Roadmap to recovery for the sunflower sea star (*Pycnopodia helianthoides*) along the west coast of North America. Sacramento, California: The Nature Conservancy. 44 pp.

Hewson, I., Bistolas, K.S.I., Quijano Cardé E.M., Button, J.B., Foster, P.J., Flanzenbaum, J.M., Kocian, J., Lewis, C. K. 2018. Investigating the complex association between viral ecology, environment, and Northeast Pacific sea star wasting. Frontiers in Marine Science. 5.

H.T. Harvey and Associates, and GHD. 2023. Humboldt Bay Water Intakes Improvement Project Biological Assessment. HT Harvey and Associates and GHD. Los Gatos, California. October 17, 2023.

Kadir, T., L. Mazur, C. Milanes, K. Randles, and (editors). 2013. Indicators of Climate Change in California. California Environmental Protection Agency, Office of Environmental Health Hazard Assessment.

Kinziger, A. P., D. Coyne, and S. Novotny. 2022. Comparison of environmental DNA and bottom trawling for detection of rare marine fishes in Humboldt Bay, California. Annual report to USACE-San Francisco. Cal Poly Humboldt, Arcata. 20pp.

Kudela, R.M., S. Seeyave, and W.P. Cochlan. 2010. The role of nutrients in regulation and promotion of harmful algal blooms in upwelling systems. Progress in Oceanography 85:122-135.

Lefebvre, K.A., V.L. Trainer, and N.L. Scholz. 2004. Morphological abnormalities and sensorimotor deficits in larval fish exposed to dissolved saxitoxin. Aquatic Toxicology 66:159-170.

Lindley, S. T., R. S. Schick, E. Mora, P. B. Adams, J. J. Anderson, S. Greene, C. Hanson, B. May, D. McEwan, R. B. MacFarlane, C. Swanson, and J. G. Williams. 2007. Framework for assessing viability of threatened and endangered Chinook salmon and steelhead in the Sacramento-San Joaquin Basin. San Francisco Estuary and Watershed Science 5:4.

Lowry, D., Pacunski, R., Hennings, A., Blaine, J., Tsou, T., Hillier, L., Beam, J., and E. Wright. 2022. Assessing bottomfish and select invertebrate occurrence, abundance, and habitat associations in the U.S. Salish Sea with a small, remotely operated vehicle: results of the Page 249 of 292 2012-13 systematic survey. Olympia, WA: Washington Department of Fish and Wildlife. FPT 22-03. 67 pp.

MacFarlane, R.B. 2010. Energy dynamics and growth of Chinook salmon (*Oncorhynchus tshawytscha*) from the Central Valley of California during the estuarine phase and first ocean year. Canadian Journal of Fisheries and Aquatic Sciences 67(10):1549-1565.

McElhany, P., M. H. Ruckelshaus, M. J. Ford, T. C. Wainwright, and E. P. Bjorkstedt. 2000. Viable salmonid populations and the recovery of evolutionarily significant units. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-42. 156 pp.

Moore, T.L., Anderson, C.W., Ricker, S.J. 2012. Escapement, spawning, distribution and migration patterns of adult salmonids in Freshwater Creek 2010-2011 [scientific report]. Sacramento (CA): California Department of Fish and Wildlife.

Nakamoto, R. J., T. T. Kisanuki, and G. H. Goldsmith. 1995. Age and Growth of Klamath River Green Sturgeon (*Acipenser medirostris*). United States Fish and Wildlife Service Project 93-FP-13, Yreka, California.

Nezlin, N.P., M.A. Sutula, R.P. Stumpf, and A. Sengupta. 2012. Phytoplankton Blooms Detected by SeaWiFS along the Central and Southern California Coast. J. of Geophysical Research 117, C07004, doi:10.1029/2011JC007773.

NMFS (National Marine Fisheries Service). 2001. Status review update for coho salmon (Oncorhynchus kisutch) from the Central California Coast and the California portion of the Southern Oregon/Northern California Coast Evolutionarily Significant Units. National Marine Fisheries Service, Southwest Fisheries Science Center, Santa Cruz, California. April 12. 43 pp.

NMFS. 2014. Final recovery plan for the Southern Oregon/Northern California Coast Evolutionarily Significant Unit of Coho Salmon (Oncorhynchus kisutch). September 2014. Arcata, California.

NMFS. 2016. Final Multispecies Recovery Plan. California Coast Chinook Salmon, Northern California Steelhead, Central California Coast Steelhead. Santa Rosa, California.

NMFS 2024. 2024 5-Year Review: Summary & Evaluation of Northern California Steelhead. National Marine Fisheries Service, West Coast Region. 97 pages.

NMFS SWFSC. 2023 Viability assessment for Pacific salmon and steelhead listed under the Endangered Species Act: Southwest. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-686. https://doi.org/10.25923/039q-q707

Norrie, C. R., C. A. Morgan, B. J. Burke, L. A. Weitkamp, and J. A. Miller. 2022. Freshwater growth can provide a survival advantage to Interior Columbia River spring Chinook salmon after ocean entry. Marine Ecology Progress Series 691:131-149.

Novotny, S., J. Staton, R. Reed, and E. Campbell. 2020a. Benthic fish and invertebrate trawl surveys of sub-tidal habitat reaches inside and outside of the federally maintained Humboldt Bay navigation channels – 2019. January 2020. Report prepared for the U.S. Army Corps of Engineers. 44 pp plus appendices.

Novotny, S., J. Staton, R. Reed, and E. Campbell. 2020b. Benthic fish and invertebrate trawl surveys of sub-tidal habitat reaches inside and outside of the federally maintained Humboldt Bay navigation channels – 2020. December 2020. Report prepared for the U.S. Army Corps of Engineers. 57 pp plus appendices.

Osgood, K.E. 2008. Climate Impacts on U.S. Living Marine Resources: National Marine Fisheries Service Concerns, Activities and Needs. National Oceanic and Atmospheric Administration, National Marine Fisheries Service. NOAA Technical Memorandum NMFS-F/SPO-89.

Oulhen, N., Byrne, M., Duffin, P., Gomez-Chiam, M., Hewson, I., Hodin, J., Konar, B., Lipp, E., Miner, B., Newton, A., Schiebelhu,t L.M., Smolowitz, R., Wahltinez, S.J., Wessel, G.M., Work, T.M., Zaki, H.A., and Wares, J. P. 2022. A review of asteroid biology in the context of sea star wasting: Possible causes and consequences. The Biological Bulletin. 243(1): 50-75.

PFMC (Pacific Management Fishery Council). 2016. The Fishery Management Plan for U.S. West Coast Commercial and Recreational Salmon Fisheries off the Coast of Washington, Oregon, and California. PFMC, Portland. As Amended through Amendment 19, March 2016.

PFMC. 2019a. Coastal Pelagic Species Fishery Management Plan. Portland, Oregon. As Amended through Amendment 17, June.

PFMC. 2019b. Pacific Coast Ground Fish Fishery Management Plan for California, Oregon, and Washington Groundfish Fishery. Portland, Oregon. As Amended through Amendment 28, December.

Pinnix, W. D. 2008. Letter from William Pinnix documenting acoustic detections of green sturgeon in Humboldt Bay. U.S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, Arcata, California. 21 p.

Pinnix, W. D., T. A. Shaw, K. C. Acker, and N. J. Hetrick. 2005. Fish communities in eelgrass, oyster culture, and mudflat habitats of North Humboldt Bay, California Final Report. U.S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, Arcata Fisheries Program Technical Report Number TR2005-02, Arcata, California.

Pinnix, W. D., P. A. Nelson, G. Stutzer, and K. A. Wright. 2013. Residence time and habitat use of coho n in Humboldt Bay, California: An acoustic telemetry study. Environmental Biology of Fish 96:315-323.

Raimondi, P. 2010. Variation in entrainment impact estimation based on different measures of acceptable uncertainty. August 2011. CEC-500-2011-020. California Energy Commission, Public Interest Energy Research Program.

Ricker, S.J., D. Ward, C.W. Anderson, and M. Reneski. 2014. Results of Freshwater Creek salmonid life cycle monitoring station 2010-2013. California Department of Fish and Wildlife, Anadromous Fisheries Resource Assessment and Monitoring Program, Fisheries Restoration Grant P0910513.

Riemers. 1973. The Length of Residence of Juvenile Fall Chinook Salmon in Sixes River, Oregon. Research Report of the Fish Commission of Oregon, v4 n2 p3-43 Jun 73. Technical Report 197406.

Ruggiero, P., C.A. Brown, P.D. Komar, J.C. Allan, D.A. Reusser, H. Lee, S.S. Rumrill, P. Corcoran, H. Baron, H. Moritz, and J. Saarinen. 2010. Impacts of climate change on Oregon's coasts and estuaries. Pages 241-256 in K. D. Dellow, and P. W. Mote, editors. Oregon Climate Assessment Report, College of Oceanic and Atmospheric Sciences, Oregon State University, Corvallis, Oregon.

Scavia, D., J. C. Field, D. F. Boesch, R. W. Buddemeier, V. Burkett, D. R. Cayan, M. Fogarty, M. A. Harwell, R. W. Howarth, C. Mason, D. J. Reed, T. C. Royer, A. H. Sallenger, and J. G. Titus. 2002. Climate change impacts on U.S. coastal and marine ecosystems. Estuaries 25(2):149-164.

Schmidt, M. Verbal communications regarding captures of sunflower sea stars in Dungeness crab traps and sablefish longlines. January 26, 2024.

Schneider, S.H. 2007. The unique risks to California from human-induced climate change. May 22, 2007. Environmental Protection Agency.

Seegers, B.N., J.M. Birch, R. Martin III, C.A. Scholin, D.A. Caron, E.L. Seubert, M.D. A. Howard, G.L. Robertson, and B.H. Jones, 2015. Subsurface Seeding of Surface Harmful Algal Blooms Observed through the Integration of Autonomous Gliders, moored environmental sample processors, and satellite remote sensing in Southern California. Limnology and Oceanography 60:754-764.

Seeyave, S., T.A. Probyn, G.C. Pitcher, M.I. Lucas, and D.A. Purdie. 2009. Nitrogen nutrition in assemblages dominated by Pseudo-nitzschia spp., Alexandrium catenella and Dinophysis acuminata off the west coast of South Africa. Marine Ecology Progress Series 379:91-107.

Steinbeck, J., J. Hedgepeth, P. Raimondi, G. Cailliet, and D. Mayer. 2007. Assessing power plant cooling water intake systems entrainment impacts. October 2007. CEC-700-2007-010. San Luis Obispo, California. California Energy Commission. Prepared by Tenera Environmental Inc.

Swain, D.L., Langenbrunner, B., Neelin, J.D. et al. Increasing precipitation volatility in twenty-first-century California. Nature Climate Change 8, 427–433 (2018). https://doi.org/10.1038/s41558-018-0140-y

Tenera Environmental. 2023. Correction to APF Estimates for Humboldt Bay Water Intakes. Tenera Environmental, San Luis Obispo, California. December 7, 2023 Memo.

Trainer, V.L., G.C. Pitcher, B. Reguera, and T.J. Smayda. 2010. The distribution and impacts of armful algal bloom species in Eastern Boundary upwelling systems. Progress in Oceanography 85:33-52.

Trainer, V.L., W.P. Cochlan, A. Erickson, B.D. Bill, F.H. Cox, J.A. Borchert, and K.A. Lefebvre. 2007. Recent domoic acid closures of shellfish harvest areas in Washington State inland waterways. Harmful Algae 6:449-459.

Tyburczy, J. 2016. Sea star babies return in droves in amid die-off. News article published in the Times Standard newspaper. Eureka, California. May 7, 2016.

Wallace, M., and S. Allen. 2007. Juvenile salmonid use of the tidal portions of selected tributaries to Humboldt Bay, California. California Department of Fish and Wildlife, Fisheries Restoration Grants Program Grant P0410504.

Weitkamp, L. A., T. C. Wainwright, G. J. Bryant, G. B. Milner, D. J. Teel, R. G. Kope, and R. S. Waples. 1995. Status review of coho salmon from Washington, Oregon, and California. NOAA Technical Memorandum NMFS-NWFSC-24. U.S. Department of Commerce, NOAA, Northwest Fisheries Science Center, Seattle, Washington. 258 pp.

Westerling, A.L., B.P. Bryant, H. K. Preisler, T.P. Holmes, H.G. Hidalgo, T. Das, and S.R. Shrestha. 2011. Climate change and growth scenarios for California wildfire. Climatic Change 109 (Suppl 1):S445–S463.

Williams, T. H., S. T. Lindley, B. C. Spence, and D. A. Boughton. 2011. Status review for Pacific salmon and trout listed under the Endangered Species Act: Southwest. National Marine Fisheries Service, Southwest Fisheries Science Center, Santa Cruz, California.

Williams, T. H., B. C. Spence, D. A. Boughton, R. C. Johnson, L. Crozier, N. Mantua, M. O'Farrell, and S. T. Lindley. 2016. Viability assessment for Pacific salmon and steelhead listed under the Endangered Species Act: Southwest. 2 February 2016 Report to National Marine Fisheries Service – West Coast Region from Southwest Fisheries Science Center, Fisheries Ecology Division, Santa Cruz, California.

Williams, T.H. 2022. Southern Oregon/Northern California Coast Recovery Domain. Pages 25-54 in Southwest Fisheries Science Center. 2022. Viability assessment for Pacific salmon and steelhead listed under the Endangered Species Act: Southwest. 11 July 2022. Report to National Marine Fisheries Service – West Coast Region from Southwest Fisheries Science Center, Fisheries Ecology Division 110 McAllister Way, Santa Cruz, California 95060.