PACIFIC COAST GROUNDFISH FISHERY MANAGEMENT PLAN

FOR THE CALIFORNIA, OREGON, AND WASHINGTON GROUNDFISH FISHERY

APPENDIX D

NONFISHING EFFECTS ON WEST COAST GROUNDFISH ESSENTIAL FISH HABITAT AND RECOMMENDED CONSERVATION MEASURES

PACIFIC FISHERY MANAGEMENT COUNCIL
7700 NE AMBASSADOR PLACE, SUITE 200
PORTLAND, OR 97220
(503) 820-2280
(866) 806-7204
WWW.PCOUNCIL.ORG

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1. Introduction

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), the Federal law that governs U.S. marine fisheries management, requires that regional fishery management councils identify essential fish habitat (EFH) for the species they manage and to identify actions to encourage the conservation and enhancement of such habitat. EFH is defined by the MSA as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” For the purpose of interpreting this definition: “waters” include aquatic areas and their associated physical, chemical, and biological properties; “substrate” includes sediment, hard bottom, structures underlying the waters, and associated biological communities; “necessary” means the habitat required to support a sustainable fishery and the managed species’ contribution to a healthy ecosystem; and “spawning, breeding, feeding, or growth to maturity” covers a species’ full life cycle (50 CFR 600.10).

The act also requires Federal agencies to consult with the National Marine Fisheries Service (NMFS) on all actions, or proposed actions, permitted, funded, or undertaken by the agency, that may adversely affect[1] EFH. Federal agencies do this by preparing and submitting an EFH assessment to NMFS. The EFH assessment is a written assessment of the effects of the proposed Federal action on EFH. Regardless of Federal agency compliance to this directive, the act requires NMFS to recommend conservation measures to Federal once it receives information or determines from other sources that EFH may be adversely affected. These EFH conservation recommendations are provided to conserve and enhance EFH by avoiding, minimizing, mitigating, or otherwise offsetting the adverse effects to EFH. Although state agencies are not required to consult with NMFS on their actions that may adversely affect EFH, NMFS can still provide EFH conservation recommendations.

By providing EFH conservation recommendations before an activity begins, NMFS and the Councils may help prevent habitat damage before it occurs rather than restoring it after the fact, which is less efficient, unpredictable, and often more costly. This could ultimately save American taxpayers millions of dollars in habitat restoration funds and could save industries from having to remedy environmental problems down the road. Furthermore, EFH conservation will lead to more robust fisheries, providing benefits to coastal communities and commercial and recreational fishers alike (Benaka 1999).

Under the EFH implementing regulations, fishery management plans are required to identify non-fishing activities that may adversely affect EFH [50 CFR 600.815(a)(4)] and recommended options to avoid, minimize, or compensate for the adverse effects of those activities, especially in habitat areas of particular concern (HAPC) [50 CFR 600.815(a)(6)]. These options can then be used by proponents when designing a project, by Federal action agencies when preparing an EFH

[1] Adverse effect means any impact, which reduces the quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to benthic organisms, prey species, and their habitat, and other ecosystem components. Adverse effects may be site- specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions [50 CFR 600.910(a)]

assessment, by the action agency and NMFS to inform the EFH consultation, and by the Council when commenting on actions that may adversely affect EFH.

To meet these regulatory requirements, this appendix identifies a range of activities (e.g., upland and urban development, silviculture, the operation and removal of dams) that may adversely affect EFH of groundfishes managed under the Pacific Fishery Management Council's Pacific Coast Groundfish Fishery Management Plan. It also identifies broad types of potential adverse effects associated with each of those activities (e.g., loss and alteration of habitat, alteration of hydrology and geomorphology), and provides a short menu of potential conservation measures intended to avoid, minimize, or compensate for those adverse effects. Not all of the suggested measures are necessarily applicable to any one project or activity that may adversely affect EFH. More specific or different measures based on the best and most current scientific information may be developed prior to, or during, the EFH consultation process, and then communicated to the appropriate agency.

While uplands and freshwater systems are not designated as EFH for groundfishes, effects of activities in these areas may flow downhill or downstream to may adversely affect groundfish EFH in estuarine and marine waters. The regulations are clear that, if they may adversely affect EFH, such activites are subject to EFH consultation and, therefore, the potential conservation actions may also be applicable to activities in upland and freshwater habitats.

This appendix summarizes a technical document currently in preparation by the Northwest Fishery Science Center (NWFSC, Kiffney, et al. in prep). Readers are directed to that technical document for detailed descriptions of the adverse effects of the activities contained in this appendix. NMFS and the Council should consider, but are not limited to using this appendix and the NWFSC technical document as resources and guidance, in making conservation recommendations to minimize adverse impacts to EFH from non-fishing activities.

2. Upland and Urban Development

Five different types of activities associated with upland and urban development are covered here: 1) commercial and domestic water use; 2) floodplain development; 3) land clearing and impervious surfaces; 4) stormwater and urban runoff; and 5) road construction and operation.

2.1. Commercial and Domestic Water Use

The effects of commercial and domestic water use on EFH include: 1) loss and alteration of habitat; 2) altered hydrology and geomorphology; and 3) entrainment and impingement.

<u>Potential Conservation Measures for Commercial and Domestic Water Use</u>

General guidelines

- Work with water trust organizations to acquire water rights or establish water banks.
- Establish conservation guidelines for water use permits, and encourage the purchase or lease of water rights and the use of water to conserve or augment instream flows in accordance with state and Federal water laws.
- Ensure that mitigation is provided for unavoidable impacts to fish and their habitat. Mitigation can include water conservation measures that reduce the volume of water diverted or impounded.

Loss and alteration of habitat

- Maintain and restore functioning channel, floodplain, riparian, groundwater, and estuarine conditions.

Altered hydrology and geomorphology

- Conduct water availability analyses for watersheds to determine unimpaired and current baseline flows. Determine water volumes and flows (including the range of flows) needed to achieve or maintain EFH functions that support viable invertebrate and fish populations.
- Incentivize projects, practices and laws or regulations that result in water conservation and reduced water demand.
- Maintain appropriate flow velocity, water levels, and flow variability to support continued stream functions.
- Mimic the “pulsed” nature of rivers and estuaries in order to maintain their natural state as dynamic systems.
- Maintain water quality in source waterbodies necessary to support fish populations by monitoring water flows and temperature, sediment loads, and pollution levels.
- Avoid low water levels that strand juveniles and dewater redds. Incorporate juvenile and adult fish passage facilities on all water diversion projects (e.g., fish bypass systems) (CDFG and NMFS 2002).

Entrainment and impingement

- Design or modify existing water diversion and impoundment projects to create flow conditions that provide for adequate fish passage, particularly during critical life history stages.
- Install screens at water diversions in fish-bearing areas, as needed. Please see the NMFS guidelines on fish screening to protect salmonids (WDFW 2000).
- Add protective refuge at water diversions for fish where predation is an issue.
- Consolidate existing and planned diversions for facility cost savings, including fish protection facilities.

2.2. Floodplain Development

The effects of floodplain development on EFH include: 1) loss and alteration of habitat; and 2) altered hydrology and geomorphology.

Potential Conservation Measures for Floodplain Development

General guidelines

- Work with water trust organizations to acquire water rights or establish water banks
- Minimize adverse effects on floodplains and wetlands from water-dependent uses.
- Complete compensation mitigation for unavoidable floodplain or wetland loss prior to conducting activities that may adversely affect floodplains or wetlands, and perform such mitigation only in areas that have been identified as having long term viability and functionality.
- Design floodplain and wetland mitigation to meet specific performance objectives for function and value, and monitor to assure achievement of these objectives. Use mitigation and enhancement ratios that are sufficient to attain a net gain in acreage as well as function and value.
- Focus resources on conservation and restoration of upland or urban habitats on private and public lands (Burnett et al. 2007).

Loss and alteration of habitat

- Determine cumulative effects of all past and current floodplain and wetland alterations before planning activities that further alter wetlands and floodplains.
- Promote awareness and use of the United States Department of Agriculture’s wetland and conservation reserve programs (also any local conservation programs) to conserve and restore wetland and floodplain habitat.
- Incentivize restoration of degraded floodplains and wetlands, including reconnecting rivers with their associated floodplains and wetlands, and invasive species management.

Altered hydrology and geomorphology

- Avoid floodplain development, and mitigate for unavoidable floodplain losses to existing floodplain functions and processes, including water quality, water storage capacity and lateral channel movement.
- Minimize alteration of floodplains and wetlands for non-water dependent uses.

2.3. Land Clearing and Impervious Surfaces

The effects of land clearing and impervious surfaces on EFH include: 1) loss and alteration of habitat; 2) altered hydrology and geomorphology; 3) sedimentation, siltation, and turbidity; and 4) release of contaminants;

<u>Potential Conservation Measures for Land Clearing and Impervious Surfaces</u>

General guidelines

- Work with water trust organizations to acquire water rights or establish water banks
- Implement comprehensive planning for watershed protection, and avoid or minimize filling and building in coastal and riparian areas affecting EFH. Development sites should be planned to minimize clearing and grading, cut-and-fill, and new impervious surfaces.
- Focus resources on conservation and restoration of upland or urban habitats on private and public lands (Burnett et al. 2007).
- Implement widespread application of innovative approaches to drainage design (Walsh et al. 2005).

Loss and alteration of habitat

- Protect and restore vegetated buffer zones of appropriate width along streams, lakes, and wetlands that include or influence EFH (Wang et al. 2001).

Altered hydrology and geomorphology

- Remove obsolete impervious surfaces such as abandoned parking lots and buildings from riparian and shoreline areas, and reestablish water regime, wetlands, and native vegetation.
- Minimize the amount of impervious surfaces by using pervious instead of impervious materials

Sedimentation, siltation, and turbidity

- Implement best management practices (BMPs) for sediment control during construction and maintenance operations. These can include, but are not limited to: avoiding ground-disturbing activities during the wet season; minimizing exposure time of disturbed lands; using erosion prevention and sediment control methods; minimizing the spatial extent of vegetation disturbance; maintaining buffers of vegetation around wetlands, streams, and drainage ways; and avoiding building activities in areas with steep slopes and areas prone to mass wasting events with highly erodible soils. Use of structural BMPs such as sediment ponds, sediment traps, vegetated swales, or other facilities designed to slow water runoff and trap sediment and nutrients is recommended.

Release of contaminants

- Increase requirements or incentives for use of biofiltration features to reduce stormwater impacts to fish (e.g., coho salmon). These must increasingly be installed along roads and road drainage systems (Spromberg et al. 2015). Possible features include permeable pavers, bioretention swales, silt fencing, impervious containment areas, stormwater wetponds, raingardens, and check dams among others (WDOE 2012).
- Allow zero net increase in annual loading of stormwater pollutants into EFH (i.e. total suspended solids [TSS], total and dissolved copper [Cu] and zinc [Zn]). Zero net increase can be accomplished by infiltrating or dispersing the majority of the treated stormwater such that the volume and frequency of discharges affects only a few feet of in-water habitat in the vicinity of the point of discharge. This can be demonstrated via dilution analysis utilizing flow and discharge assumptions that are conservative for fishes. Pollutant concentrations below the biological effects thresholds:
    - Dissolved Cu: 2.0 micrograms per liter (µg/L), (Sandahl et al. 2007) over background levels of 3.0 µg/L or less (Baldwin et al. 2003).
    - Dissolved Zn: 5.6 µg/L over background zinc concentrations between 3.0 µg/L and 13 µg/L (Sprague 1968).

2.4. Stormwater and Urban Runoff

The effects of stormwater and urban runoff on EFH include: 1) altered hydrology and geomorphology; and 2) release of contaminants;

<u>Potential Conservation Measures for Stormwater and Urban Runoff</u>

General guidelines

- Incentivize allocation of resources to conservation and restoration of upland or urban habitats on private and public lands (Burnett et al. 2007).
- Implement widespread application of innovative approaches to drainage design (Walsh et al. 2005).

Altered hydrology and geomorphology

- Monitor water quality discharges following National Pollutant Discharge Elimination System requirements from all discharge points (including municipal stormwater systems, desalinization plants, and irrigation ditches).
- Establish conservation guidelines for water use permits, encourage the purchase or lease of water rights and the use of water to conserve or augment instream flows in accordance with state and Federal water law.

- Manage stormwater to replicate the natural hydrologic cycle, maintaining natural infiltration and runoff rates to the maximum extent practicable.

Release of contaminants

- Bioinfiltration features reduce the adverse effects to fishes from stormwater runoff and should be installed along roads and road drainage systems (Spromberg et al. 2015). Possible features include permeable pavers, bioretention swales, silt fencing, impervious containment areas, stormwater wetponds, raingardens, and check dams among others (WDOE 2012).
- Allow zero net increase in annual loading of stormwater pollutants into EFH (i.e. TSS, total and dissolved Cu and Zn). This can be accomplished by infiltrating or dispersing the majority of the treated stormwater such that the volume and frequency of discharges affects only a few feet of in-water habitat in the vicinity of the point of discharge. This should be demonstrated via dilution analysis utilizing flow and discharge assumptions that are conservative for listed fish. Pollutant concentrations below the biological effects thresholds:
    - Dissolved Cu: 2.0 micrograms per liter (µg/L), (Sandahl et al. 2007) over background levels of 3.0 µg/L or less (Baldwin et al. 2003).
    - Dissolved Zn: 5.6 µg/L over background zinc concentrations between 3.0 µg/L and 13 µg/L (Sprague 1968).
- Establish total maximum daily loads and develop appropriate management plans to attain management goals.
- Allocate increasing amounts of resources to complete existing and future total maximum daily loads (TMDL) established on waterbodies within, or draining to, EFH that are designated as water quality limited.
- Establish and update pollution prevention plans, spill control practices, and spill control equipment for the handling or transporting toxic substances in EFH. Consider bonds or other damage compensation mechanisms to cover clean-up, restoration, and mitigation costs.
- Actively reduce the size of mixing zones that discharge to coastal areas and watersheds.
- Utilize biological effects thresholds, for example those recently established for dissolved copper, for transportation facilities that discharge to EFH habitat.
- Use the best available technologies in upgrading wastewater systems to avoid combined sewer overflow problems and chlorinated sewage discharges into rivers, estuaries, and the ocean.
- Design and install proper wastewater treatment systems. Locate them away from open waters, wetlands, and floodplains.
- Where vegetated swales are not feasible, install oil/water separators to treat runoff from impervious surfaces in areas adjacent to EFH. Ensure that oil/water separators are regularly maintained such that they do not become clogged and function properly on a continuing basis.

2.5. Road Construction and Operation

The adverse effects of road construction and operation on EFH include: 1) loss and alteration of habitat; 2) altered hydrology and geomorphology; 3) sedimentation, siltation, and turbidity; 4) invasive organisms; and 5) impaired fish passage.

<u>Potential Conservation Measures for Road Construction and Operation</u>

General guidelines

- Plan and design roads to minimize damage to, and loss of EFH (Newman et al. 2012).
- Use seasonal work restrictions to avoid impacts to habitat during species critical life history stages (e.g., spawning and egg development periods). Recommended seasonal work windows are generally specific to regional or watershed-level environmental conditions and species requirements.
- Properly maintain roadway ditches and associated stormwater collection systems.
- Address the cumulative impacts of past, present and foreseeable future development activities on aquatic habitats by considering them in the review process for road construction projects.
- Plan road and infrastructure development within the context of climate change.
- Provide estimates for how development will impact stream hydrology (e.g., magnitude and frequency of floods).
- Conduct road maintenance using practices according to the requirements of existing NMFS rules, such as the July 2000 ESA 4(d) rule (Protective Regulations) for listed West Coast salmon and steelhead (65 FR 42422; July 10, 2000), Limit 10, covering road maintenance. Implementing maintenance under these programs avoids exacerbation of existing impacts, and protects EFH to the extent that it contributes to the conservation of the species.

Loss and alteration of habitat

- Design bridge abutments to minimize disturbances to EFH, and place abutments outside of the current and predicted floodplain habitat when built in streams and rivers.
- Reduce and eliminate riparian corridor damage during construction of roads (and bridges, culverts, and other crossings) and avoid locating roads in floodplains.
- Mitigate on-site for all losses in aquatic EFH and the surrounding riparian zone.
- Ensure road crossings allow for the free movement of organisms, sediment and water.

Altered hydrology and geomorphology

- Design roadways to minimize the length of inboard ditches.
- Outslope roads for drainage or use frequent rolling dips, waterbars or ditch relief culverts so they do not concentrate flows and cause erosion.

- Use pipe extenders to bring flows from ditch relief culverts to grade before discharge, use T-spreaders to diffuse flows at the discharge points or energy dissipaters to slow the initial flows at the discharge point.

Sedimentation, siltation, and turbidity

- Specify erosion control measures in road construction plans.
- Do not side cast road materials into streams or places where they may make their way to aquatic habitats.
- Limit roadway sanding during the winter to minimize sedimentation of nearby aquatic habitats. Snow-melt disposal areas should be silt-fenced and include a collection basin. Roads should be swept after break up to reduce sediment loading in streams and wetlands.
- Revegetate cut banks, road fills, bare shoulders, disturbed streambanks, etc. after construction to prevent erosion and increase nutrient assimilation and adsorption. Check and maintain sediment control and retention structures throughout the rainy season.

Release of contaminants

- Biofiltration features prevent lethal stormwater impacts to fish (e.g., coho salmon), and must be installed along roads and road drainage systems (Spromberg et al. 2015). Possible features include permeable pavers, bioretention swales, silt fencing, impervious containment areas, stormwater wetponds, raingardens, and check dams among others (WDOE 2012).
- Limit the use of deicing chemicals during the winter to minimize the introduction of contaminants into nearby aquatic habitats. Snow-melt disposal areas should be silt-fenced and include a collection basin.

Invasive organisms

- Use only native vegetation in re-plantings.

Impaired fish passage

- Consult NMFS guidelines for stream crossings. Because these guidelines are periodically updated, ensure that the most recent version is used.
- Design all road crossings for ecological connectivity.
- Build bridges for crossing aquatic environments rather than utilizing culverts.
- If culverts must be used, they should be sized, constructed, and maintained to match the gradient, flow characteristics, and width of the stream so as to accommodate flood events.
- All new road crossing structures should accommodate future increased flows. Climate change will alter hydraulic flow regimes and corresponding debris flows.
- Use state or Federal culvert design guidelines for improved design and installations of culverts (e.g., NMFS 2001; Bates et al. 2003; Barnard et al. 2014; Gillespie et al. 2014).

At a minimum, culvert diameter should be at least as wide as bankfull width (Nislow 2014).

Increased surface erosion and mass wasting

- Implement compaction techniques to reduce erosion (FAO 1998).
- Site roads to avoid sensitive areas such as streams, wetlands and steep slopes.
- Abandon and remove road crossings when other existing road crossings are available, and on decommissioned roads.

3. Silviculture

Potential Conservation Measures for Silviculture

General guidelines

- Incorporate watershed assessment into forestry projects (Beechie et al. 1994) to evaluate the effects of past, present, and future timber sales on organic matter and sediment fluxes, and hydrologic and geomorphologic processes within the watershed.

Loss and alteration of habitat

- Ensure that the width of riparian buffers is at least 30 m. However, depending on the location, a wider buffer may be necessary.
- Mitigate for logging impacts by increasing habitat heterogeneity via enhancement and restoration of watershed processes.
- Create a mixture of successional trajectories of riparian vegetation to reestablish and sustain natural disturbance processes.

Altered hydrology and geomorphology

- Keep overall harvest percentages low (including through the use of buffers) to control impacts of timber harvest on hydrology and stream flow (see Bosch and Hewlett 1982; Stednick 1996).
- Evaluate the potential for logging to induce changes in stream flow through the use of process-based runoff models (e.g., DHSVM http://www.hydro.washington.edu/Lettenmaier/Models/DHSVM/).

Release of contaminants

- Avoid fueling near streams and include contingencies to avoid and contain spills.
- Ensure that all forestry operations incorporate conservation plans that include control of nonpoint source pollution, avoidance of sensitive habitats, maintaining riparian corridors, and monitoring and controlling pesticide use.
- Develop a fuel transport, storage, and spill contingency plan.
- Complete staging, cleaning, maintenance, refueling, and fuel storage for wheeled and tracked machinery in staging area placed 50 m or more from any stream or stream-associated wetland, or in areas that are hydrologically disconnected from streams and wetlands.
- Inspect all wheeled and tracked machinery that will be operated within 50 m of any stream, waterbody, or wetland daily for fluid leaks before leaving the vehicle staging area. Repair any leaks detected in the vehicle staging area before resuming operation.

Impacts to water quality

- Ensure that the width of riparian buffers is at least 30 m. However, depending on the location, a wider buffer may be necessary.
- Ensure that nearby streams are not temperature compromised prior to harvest.
- Design monitoring studies to assess forest harvest activities on stream temperature and EFH habitat (e.g., Smith 2013).
- Use alternative harvesting methods, such as selective harvest or thinning as opposed to clear-cutting to reduce impacts to nutrient cycling (Dahlgren 1998).

Impaired fish passage

- Ensure that new, reconstructed, and existing roads will not impair hydrological connections between stream channels, ground water, and wetlands; will not increase sedimentation to aquatic systems; will have adequate drainage and surfacing; and will not discharge drainage water into streams or onto potentially unstable land forms (e.g., concave hollows or headwalls on steep hills).
- Require stream crossings to provide adequate fish passage for both adults and juveniles, accommodate a 100-year flood without over-topping the road, and pass adequate sediment and organic material including large woody debris (LWD).

Increase in surface erosion and mass wasting

- Avoid logging activities near streams and wetlands, and on steep or unstable slopes.
- Restrict building of crossing structures during periods where fish are vulnerable (e.g., embryo, larval, and spawning stages).
- Ensure that all logging roads do not increase fine sediments in EFH.
- Apply BMPs for log hauling, recreational use, and seasonal closure to minimize erosion and sediment generation.
- Require stream crossings to provide adequate fish passage for both adults and juveniles, accommodate a 100-year flood without over-topping the road, and pass adequate woody material.
- Use temporary roads and stream crossings where practicable.
- Mitigate for riparian functions altered by new road segments.
- Ensure that all logging roads have adequate drainage and surfacing, and will not discharge drainage water into EFH or onto potentially unstable land forms.
    - Design monitoring studies to assess forest harvest activities on fine sediment inputs and EFH habitat using BACI design (before-after-control-impact, Smith 2013).
    - Decommission roads once they are no longer necessary and restore the roadway to pre-project conditions, including revegetation disturbed areas and restoring natural drainage.

4. Log Transfer Facilities/In-water Log Storage

The potential adverse effects of log transfer facilities (LTF) and in-water log storage include: 1) loss and alteration of habitat; and 2) release of contaminants.

Potential Conservation Measures for LTF and in-water log storage

General guidelines

- Store logs on land rather than in the water.
- If in-water log storage or LTFs are necessary, site them in areas with good currents and tidal exchanges.

Loss and alteration of habitat

- Minimize potential impacts of log storage by employing effective bark and wood debris controls, collection, and disposal methods at log dumps, raft building areas, and mill-side handling zones; avoiding the free-fall dumping of logs; using easy let-down devices for placing logs in the water; and bundling logs prior to water storage (bundles should not be broken except on land and at millside).
- Storage of logs should not take place where they will ground at any time or shade aquatic vegetation.
- Avoid siting in-water log storage areas and LTFs in sensitive habitat (e.g., habitat areas of particular concern [HAPC]).

Release of contaminants

- Storage and handling of logs should be restricted or eliminated from waters where state and Federal water quality standards cannot be met at all times.

5. Dam Operations and Removal

5.1. Dam Operations

The adverse effects of dam operation on EFH include: 1) loss and alteration of habitat: 2) altered hydrology and geomorphology; 3) impaired fish passage; and 4) impacts to water quality.

Potential Conservation Measures for Dam Operations

General guidelines

- Avoid construction new dams by finding alternate means of addressing the need that have fewer adverse effects on EFH.
- Address the cumulative impacts of past, present, and foreseeable future development activities of the dam on aquatic habitats. Consider these impacts in the review process for dam construction and operation.

- Use seasonal restrictions for construction, maintenance, and operations of dams to avoid impacts to habitat during critical life-history stages. Recommended seasonal work windows are generally specific to regional or watershed-level environmental conditions and species requirements.
- Develop water and energy conservation guidelines for integration into dam operations and into regional and watershed-based water resource plans.
- Coordinate maintenance and operations that require drawdown of the impoundment with state and Federal resource agencies to minimize impacts to aquatic resources.

Loss and alteration of habitat

- Develop a sediment transport and geomorphic maintenance plan to allow for peak flows that will result in sediment pulses through the reservoir/dam system and allow for geomorphic processes determined by high-flow events. If natural sediment and wood transport is not possible, consider sediment and wood additions below the dam.

Altered hydrology and geomorphology

- Operate dams within the natural rates and timing of flow fluctuations. Mimic the natural hydrograph and allow for sediment and wood transport. Run-of-river dam operation is optimal, such that the volume of water entering an impoundment exits the impoundment with minimal change in storage, and is the preferred mode of operation for fishery and aquatic resource interests. Install water flow monitoring equipment upstream and downstream of the facility. Monitor reservoir-levels and fluctuations during critical life history events of fish populations.
- Operate facilities to create flow conditions that provide for fish passage, pre-dam water quality, proper timing of life-history stages, and properly functioning channel conditions.
- Avoid drawdowns that may result in stranding of fishes and redd (i.e., spawning nest) dewatering (Connor and Pflug 2004).
- If a dam is deemed necessary, construct dam facilities with the lowest hydraulic head practicable for the project purpose.

Impaired fish passage

- Design and construct new facilities with efficient and functional upstream and downstream adult and juvenile fish passage that ensure safe, effective, and timely passage.
- Consider all available upstream-passage mechanisms, including natural-like bypass channels, fish ladders, fishlifts, etc. In general, volitional passage is preferable to trap and truck methods.
- Retrofit existing dams with efficient and functional upstream and downstream fish passage structures.
- Provide downstream passage to prevent adults and juveniles from passing through the turbines, to minimize delays, and to provide sufficient water downstream for safe passage.

Impacts to water quality

- Use a selective depth outlet structure so that released water more closely matches the natural water temperature regime of adjacent downstream habitat (Stanford and Hauer 1992).

5.2. Dam Removal

The adverse effects of dam removal on EFH include: 1) sedimentation, siltation, and turbidity; 2) release of contaminants; and 3) invasive species.

<u>Potential Conservation Measures for Dam Removal</u>

General guidelines

- Consider the history of the project, geomorphology of the watershed, and location in the river system, among other factors, as these will dictate the types of environmental issues dam removal will present.
- Conduct an assessment of the biotic component of the impacted area, particularly if anadromous fish restoration is one of the objectives of the dam removal. For example, the assessment may include characterization of the historic distribution and abundance of fish species, their various life-history habitat requirements, and their limiting environmental factors. The assessment should also evaluate the predicted physical and chemical conditions following dam removal to determine if additional restoration may be necessary.
- Provide downstream movement of LWD past dam sites rather than removing it from the system.
- Establish a monitoring protocol to evaluate success of the restoration for fish passage and utilization.

Sedimentation, siltation and turbidity

- Use a watershed-scale analysis that evaluates past, existing, and future hydrology and sediment transport regimes.
- Consider the relative benefits of rapid dam removal and ‘sluicing’ the impounded sediments downstream versus removal of the dam in stages to meter the release of sediments. Plan dam-removal timing according to which approach is most ecologically sound.
- Revegetate the newly exposed stream bank with local native vegetation.
- Establish a contingency plan in the event that the stream channel needs modification following dam removal (addition of riffle-and-pool complex, added features to create habitat complexity, meanders, etc.) to facilitate fish passage and achieve habitat function goals.

Release of contaminants

- Conduct sufficient testing to evaluate the type, extent, and level of contamination in accumulated sediment while planning and assessing alternatives for dam removal (Bednarek 2001). If the presence of contaminated sediments is extensive, mechanical or hydraulic removal might be required prior to the removal of the dam.

Invasive species

Consider construction of artificial barriers to impede the dispersal of invasive species (Fausch et al. 2009; for comprehensive review of installations see Rahel 2013).

6. Mineral Mining

Two types of mining are covered here: 1) mineral mining in upland in freshwater habitats; and 2) marine mining.

6.1. Mineral Mining in Upland or Freshwater Habitats

The adverse effects of mineral mining on EFH include: 1) loss and alteration of habitat; 2) altered hydrology and geomorphology; 3) sedimentation, siltation, and turbidity; 4) release of contaminants; 5) catastrophic mine failures; and 6) abandoned sites and legacy effects of mining.

<u>Potential Conservation Measures for Mineral Mining in Upland or Freshwater Habitats</u>

General guidelines

- Implement integrated environmental assessments and monitoring programs. For example, long-term sequential sampling should be implemented in water bodies connected to the mine site to determine the impacts of mine operations on EFH. Such a program could involve collection of baseline trophic food web data (i.e., water quality, invertebrates, and fish). Pre-development data should be collected over time frame such that temporal variability in physical and biological responses can be accounted for.
- Schedule all maintenance and construction activities when the fewest aquatic species and least vulnerable life stages will be present. This is especially important where listed species are present in the vicinity of, or could be affected by, the operation.
- Obtain a plan of operation from dredge miners before dredging begins. An operating plan provides an opportunity for dialog with the miner concerning potential EFH impacts. An operating plan might include the following:
    - projected dates of operation
    - description of the types of equipment that will be used
    - ingress/egress locations
    - map or sketch showing locations where dredging will occur and locations of sensitive areas that should be avoided (such as spawning gravels, debris jams, etc.).
- For specific guidelines for sand and gravel extraction, see NMFS's National Gravel Extraction Policy and Sediment Removal Guidelines (Packer et al. 2005).
- Develop a plan for closing the mine after operations cease. The plan should include measures to ensure that the mine does not contaminate ground or surface waters that flow into designated EFH in perpetuity and to restore disturbed areas to pre-project conditions.

Loss and alteration of habitat

- Do not mine in waters, near water sources, in riparian areas, near hyporheic zones, or in floodplains. Maximize the distance from waterways to minimize all impacts.

- Place suction mine tailings piles in instream locations that will not interfere with important fish life history events (Harvey and Lisle 1999).
- Restore natural contours and plant native vegetation on site after use to restore habitat function. Monitor the site for an appropriate time to evaluate performance and implement additional corrective measures if necessary.
- Do not remove or disturb instream roughness elements during mining activities. Preserve and enhance recruitment of LWD, and replace or restore that which is disturbed.
- Do not dredge in locations where the activity could undermine stream banks or widen the stream channel.

Altered hydrology and geomorphology

- Conduct hydrologic, hydraulic, and geomorphologic modeling in conjunction with sub-basin-specific riparian, fish, and invertebrate data to estimate impacts of development and operation on natural resources, including the acid generating potential associated with the proposed activities. Modelers must clearly articulate how data were collected, clearly report inputs, outputs, governing equations, and be able to successfully defend assumptions using vetted sensitivity analyses.

Siltation, sedimentation and turbidity

- Do not allow mine-generated sediments to directly enter or affect EFH. Reduce the aerial extent of ground disturbance (e.g., through phasing of operations), and stabilize disturbed lands to reduce erosion and downstream impacts. Employ methods such as contouring, mulching, and construction of settling ponds to control sediment transport.
- Do not dredge in locations with fine-textured substrates (predominately sands, fines, or silt).

Release of contaminants

- Conduct contaminant modeling in conjunction with hydrologic, geomorphologic, riparian, fish, and invertebrate information to estimate impacts of development and operation on natural resources, including the acid generating potential associated with the proposed activities. Modelers must clearly articulate how data were collected, clearly report inputs, outputs, governing equations, and be able to successfully defend assumptions using vetted sensitivity analyses.
- Eliminate possible spillage of dirt, fuel, oil, toxic materials, and other contaminants directly or indirectly into EFH. Monitor and report turbidity in real-time during operations. Prepare a HAZMAT-type spill prevention plan and maintain spill containment and water repellent/oil absorbent clean-up materials on hand.
- Treat wastewater (acid neutralization, sulfide precipitation, reverse osmosis, electrochemical, or biological treatments) and recycle on site to minimize discharge or infiltration into surface- and groundwater systems near EFH. Test wastewater before discharge for compliance with the Federal and state clean water standards.

- If mercury collects in sluice boxes or other equipment during dredging or other activities, the mercury must be transferred into a vapor-proof, sturdy, unbreakable container to be safely stored and disposed of or recycled (www.deq.idaho.gov/media/638458-mercury_BMP_dredging_fs_0411.pdf).

Catastrophic Mine Failures

- Monitor environmental conditions using real-time water quality data, for example, turbidity, conductivity, or pH. Employ empirical, vetted regressions between in-situ instantaneous variables at the site (e.g., conductivity) and trace metals, and transmit to online databases to alert subscribers (operators) when metal concentrations or other 'site failure' indicators become elevated.

Abandoned sites and legacy effects of mining

- Improve monitoring of development or abandoned site impacts by enabling access to contemporary and historical data (Kuipers et al. 2006).
- Reclaim areas of mine waste that contain heavy metals, acid materials, or other toxic compounds that might impacts EFH.
- Monitor environmental conditions using real-time water quality data, for example, turbidity, conductivity, or pH. Laboratory-verified regressions between in-situ instantaneous variables at the site (e.g., conductivity) and trace metals could then be transmitted to online databases to alert subscribers when metal concentrations or other indicators become elevated.

6.2. Marine Mining

The potential adverse effects on EFH from marine mining include: 1) loss and alteration of habitat; 2) sedimentation, siltation, and turbidity; and 3) release of contaminants.

<u>Potential Conservation Measures for marine mining.</u>

Loss and Alteration of Habitat

- Avoid mining in waters containing EFH.
- Minimize the areal extent and depth of extraction to minimize recolonization times.
- Limit sand mining and beach nourishment in areas with EFH.
- Monitor the number of individual mining operations to avoid and minimize cumulative impacts. For instance, three mining operations in an intertidal area could impact EFH, whereas one may not. Also, disturbance of previously contaminated mining areas threaten an additional loss of EFH.

Sedimentation, Siltation, and Turbidity

- Monitor turbidity during operations and cease operations if turbidity exceeds predetermined threshold levels.

- Use sediment or turbidity curtains to limit the spread of suspended sediments and minimize the area affected.

Release of Contaminants

- Avoid the use of materials that are toxic to marine life.
- Mine operators should develop a disposal and spill response plan for potential sources of contaminants are used in, or produced by, the operation.
- Mine operators should survey the area for evidence of contamination from previous operations. If found, a plan should be developed to prevent those contaminants from entering surface and groundwaters.

7. Oil Extraction, Shipping, and Production

The potential adverse effects of oil extraction, shipping, and production include: 1) loss and alteration of habitat; and 2) release of contaminants.

Potential Conservation Measures for oil extraction, shipping, and production

Loss and alteration of habitat

- Remove residual oil from sediments if oil will persist in sediment and continue to impact recovery of benthic organisms and vegetation (Iverson and Esler 2010).

Release of contaminants

- Utilize systems that detect spills and leaks as rapidly as technologically possible so that action can be taken to avoid or reduce the effect to EFH.
- Conduct compensatory mitigation when spills occur.
- Develop a comprehensive oil spill response plan that includes staging of spill-response equipment.

Noise

- Pile driving noise: see conservation measures in Section 17.1 Pile Driving.
- Vessel noise: see conservation measures in Section 11.3 Operation and Maintenance of Vessels.
- Exclude vessels or limit specific vessel activities such as high intensity, low-frequency sonar, to known sensitive EFH if evidence indicates that these activities could have an effect on aquatic organisms.

8. Other Energy-Related Activities

Four different types of activities associated with other energy related activities are covered here: 1) wave and tidal energy facilities; 2) cables and pipelines; 3) offshore wind facilities; and 4) liquefied natural gas.

8.1. Wave and Tidal Energy Facilities

The potential adverse effects on EFH from wave and tidal energy facilities include: 1) loss and alteration of habitat; 2) altered hydrology; 3) sedimentation, siltation, and turbidity; 4) release of contaminants; 5) entrainment and impingement; and 6) alteration of electromagnetic field.

<u>Potential Conservation Measures for Wave and Tidal Energy Facilities</u>

General guidelines

- Address the cumulative impacts of past, present, and foreseeable future development activities on aquatic habitats in the review process for wave and tidal facility construction and operations.
- Do not site projects in areas that may result in adverse effects to sensitive marine and estuarine resources and habitats.

Loss and alteration of habitat

- Characterize pre-construction habitat and associated biological community with consideration for temporal variability, and monitor post-installation change to the community in response to habitat alteration.
- Prior to construction, identify adaptive management thresholds and response actions to be implemented in the event adverse effects to marine species occur as a result of loss or alteration of habitat. Consider cumulative effects from other developments within the species range.

Altered hydrology

- Monitor project components installed on the seafloor for indications of scour, deposition, or other changes to sediment characteristics.
- Monitor water quality parameters after installation of shallow water or estuarine project components.

Sedimentation, siltation, and turbidity

- Conduct pre-construction contaminant surveys of the sediment in excavation or scour areas.
- Site facilities on the coarsest substrate possible to reduce siltation and turbidity.

Release of contaminants

- Do not permit the construction of barrage-type tidal energy facilities because of the potential for large impacts to the ecosystem and migratory fishery resources.
- Include impacts associated with the decommissioning and/or dismantling of wave or tidal energy facility as part of the environmental analyses. Contingency for removal of structures should be required as part of any permits or licenses.
- Require preconstruction assessments for analysis of potential impacts to fishery resources for all projects. Assessments should include comprehensive monitoring of the timing, duration, and utilization of the area by migratory, diadromous, and resident fish stock species. Compare assessments to potential impacts from the project, and develop contingency planning using avoidance measures and/or adaptive management.
- Time construction of facilities to avoid impacts to sensitive life stages and species. Recommended seasonal work windows are generally tailored to specific project areas as appropriate to regional or watershed-level environmental conditions and species requirements.
- Develop a comprehensive oil spill response plan that includes staging of spill-response equipment.

Entrainment and impingement

- Engineer sluices, water intakes, and turbines to reduce fish entrainment. Rotary turbines should be used when applicable.
- Apply the National Oceanic and Atmospheric Administration (NOAA) Fisheries screening criteria to minimize or avoid entrainment.
- Identify any moving parts and determine if animal exclusion devices can be engineered to minimize impingement.

Noise

- Pile driving noise: see conservation measures in Section 17.1 Pile Driving.
- Vessel noise: see conservation measures in Section 11.3 Operation and Maintenance of Vessels.
- Implement technologies that minimize the levels of underwater sound.

Alteration of electromagnetic fields

- Conduct studies that measure pre-construction on-site ambient EMFs and post-installation EMF's generated from wave and tidal energy facilities and identify how they may impact aquatic organisms and EFH.
- Require pre-construction analysis of anticipated EMFs generated by proposed project facilities based on best available science from energized cables and components elsewhere.

8.2. Cables and Pipelines

The potential adverse effects of cables and pipelines on EFH include: 1) loss and alteration of habitat; 2) sedimentation, siltation, and turbidity; 3) impacts to organisms; 4) release of contaminants; 5) altered electromagnetic field; and 4) noise.

Potential Conservation Measures for Cables and Pipelines

General guidelines

- Plan access routes and staging areas for equipment to avoid passage through sensitive resources such as HAPC.
- Address the cumulative impacts of past, present, and foreseeable future development activities on aquatic habitats in the review process for cable and pipeline construction and operations.

Loss and alteration of habitat

- Align cable and pipeline crossings along the least environmentally damaging route. Sensitive habitats such as hard-bottom (e.g., rocky reefs), submerged aquatic vegetation (SAV), oyster reefs, emergent marsh, and mud flats should be avoided.
- Use existing rights-of-way whenever possible to lessen overall encroachment and disturbance of wetlands or other sensitive aquatic habitats.
- Use horizontal directional drilling where cables or pipelines would cross sensitive habitats, such as intertidal mudflats and vegetated intertidal zones, to avoid surface disturbances.
- Avoid the use of open trenching for installation in freshwater and shoreline habitats. If trenching is necessary, immediately backfill the trench to reduce the impact duration.
- During the permitting phase, require evaluation of impacts to EFH that may occur during the decommissioning phase, including impacts during the demolition phase and impacts resulting from short- and ling-term habitat loss.
- Prescribe fish passage guidance to ensure fish access to suitable habitat and minimize loss of EFH during migration.

Sedimentation, siltation, and turbidity

- Use silt curtains or other types of sediment control in order to protect sensitive freshwater habitats and resources.
- Avoid construction of permanent access channels in freshwater or intertidal habitats since they disrupt natural drainage patterns and destroy wetlands through excavation, filling, and bank erosion.
- Minimize riparian clearing and immediately restore areas that are unavoidably disturbed upon completion of pipeline construction to minimize potential erosion in streams.

- Avoid conducting activities that increase turbidity during periods of the year when eelgrass is growing rapidly and is most sensitive to reductions in light (generally starting in July in the Pacific Northwest; Phillips 1984).

Impacts to organisms

- Bury pipelines and submerged cables. Unburied pipelines or pipelines buried in areas where scouring or wave activity eventually exposes them can result in impacts to EFH.
- Conduct construction during the time of year that will have the least impact on sensitive habitats and species and life stages. Appropriate work windows can be established based on pre-construction biological sampling spanning multiple seasons and years. Recommended seasonal work windows are generally specific to regional or watershed-level environmental conditions and species requirements.

Release of contaminants

- Ensure that oil and gas pipeline systems include leak detection capabilities to minimize potential impacts from spills.
- Stream crossing plans involving HDD should include risk assessment for frac-out based on geotechnical analysis, and contingency planning to address frac-out if it occurs (construction stoppage, cleanup, and remediation). Measures should be employed to avoid/minimize impacts to sensitive fishery habitats from potential frac-outs, including:
    - Use only nonpolluting, water-based lubricants.
    - Implement monitoring of drill stem pressures so that potential frac-outs can be identified.
    - If frac-outs are suspected, cease drilling operations immediately.
    - Implement above ground monitoring to identify potential frac-outs.
    - Develop spill clean-up plan and protocols, and on-site availability of clean-up equipment to quickly respond to frac-outs.

Alteration of electromagnetic fields

- Measure natural on-site electromagnetic frequencies (EMFs) prior to construction for comparison to post-installation monitoring.
- Conduct studies that identify how EMFs generated from pipes and cables impact aquatic organisms and EFH. Cable orientation relative to the geomagnetic field can increase the intensity of the local magnetic field (Normandeau et al. 2011) and should be studied in-situ for each project.

Noise effects

- Conduct studies that identify how noise generated from pipes and cables impacts aquatic organisms and EFH.

- Prescribe acoustic monitoring for the operational phase of marine energy installations. Where sound levels exceed accepted acoustic thresholds, implement measures to minimize those sounds.
- Avoid in-water blasting when possible. However, if blasting is necessary, conduct such activities only when sensitive MSA-managed species and life stages are not present in the affected area.

8.3. Offshore Wind Facilities

The potential adverse effects on EFH from offshore wind facilities include: 1) loss and alteration of habitat; 2) sedimentation, siltation, and turbidity; 3) direct impacts to organism; 4) alteration of electromagnetic field; and 5) noise.

<u>Potential Conservation Measures for Offshore Wind Facilities</u>

General guidelines

- Address the cumulative impacts of past, present, and foreseeable future development activities on aquatic habitats in the review process for offshore wind energy facilities construction and operations.

Loss and alteration of habitat

- Avoid placing cables associated with offshore wind facilities near HAPC and sensitive benthic habitats, such as SAV.
- Monitor fish attraction to anchors, mooring lines, and facility components on the seafloor and in the water column and identify any negative community change effects that occur as a result of habitat conversion.
- Design mooring and anchoring systems to the minimum necessary for device stability in order to minimize scour and avoid unnecessary alteration and conversion of benthic habitat.
- Plan construction procedures to occur as quickly and efficiently as possible to minimize the duration of disruption on the seafloor.

Sedimentation, siltation, and turbidity

- Use scour protection for turbines and associated structures and cables to the minimum practicable in order to avoid alteration and conversion of benthic habitat.
- Bury cables to an adequate depth in order to minimize the need for maintenance activities and to reduce conflicts with other ocean uses.

Direct Impacts to organisms

- Conduct preconstruction biological surveys in consultation with resource agencies to determine the extent and composition of biological populations or habitat in the proposed impact area.

- Time construction of facilities to avoid impacts on sensitive life stages and species. Construction in the Pacific Ocean may be technically constrained to the summer season, but may be tailored as necessary based on recommended seasonal work windows specific to regional environmental conditions and species requirements.
- Make contingency plans and response equipment available at the offshore wind facility to respond to spills associated with maintenance activities.

Alteration of electromagnetic fields

- Measure natural EMF for each proposed project site prior to construction.
- Conduct studies that identify how EMFs generated from offshore wind facilities impact aquatic organisms and EFH.

Noise effects

- Define the area of potential effect, which may vary by project location and affected species.
- Conduct studies that document pre-construction ambient sound of the project area in various sea states. Determine appropriate thresholds above ambient conditions at which marine species could be negatively affected.
- Conduct studies to characterize noise generated from offshore wind facilities and identify how it may impact aquatic organisms and EFH.

8.4. Liquefied Natural Gas

The potential adverse effects on EFH from liquefied natural gas (LNG) facilities include: 1) loss and alteration of habitat; 2) altered hydrology; 3) impacts to water quality; 4) sedimentation, siltation, and turbidity; 5) release of contaminants; 6) discharge of debris; 7) entrainment and impingement; 8) noise; and 9) introduction of invasive species.

<u>Potential Conservation Measures for Liquefied Natural Gas</u>

General guidelines

- Address cumulative impacts of past, present and foreseeable future development projects on aquatic habitats by considering them in the project review process of LNG facility construction and operation. Based on predicted impacts to EFH, a determination can be made regarding the most suitable location and operational procedures for LNG facilities. Ideally, such an analysis would be done at the regional or national level based on natural gas usage and need. However, such analysis is not the case for all activities.
- Require analysis of potential adverse effects to all EFH listed species including native, pelagic, salmonid, and non-salmonid (e.g. eulachon) Endangered Species Act-listed species potentially present. Impacts on all life stages present (e.g. rockfish juveniles) must be considered.

Loss and alteration of habitat

- Conduct preconstruction biological surveys in consultation with resource agencies to determine the extent and composition of biological populations or habitat in the proposed impact area.
- Off-site mitigation, if proposed, should be located in habitat similar to that altered by the project, with similar species assemblages.
- Provide detailed monitoring plans should be developed for mitigation activities to evaluate native condition, alteration from project activities, and successful recovery of ecological function and processes.
- Monitor stream crossing restoration to ensure the trench or otherwise disturbed area does not scour or result in diversion of flow.
- Provide a thorough analysis of lighting needs during project construction and operation, and assess the potential biological effects of such lighting on EFH species. Develop measures to minimize potential effects (e.g. alter light intensity, color, or direction).
- Perform dredging or other estuarine construction activities during the appropriate in water work window to mitigate impacts to less than significant levels.

Altered hydrology

- Require applicant to ensure natural gas pipelines are sufficiently deep along the entirety of the route so as not to interfere with restoration activities such as placement of large woody debris or reestablishment of channel function, tidal processes, or floodplain connectivity.

Impacts to water quality

- Locate facilities that use surface waters for regasification and engine cooling purposes away from areas of high biological productivity (e.g., estuaries).
- Regulate discharge temperatures (both heated and cooled effluent) such that they do not appreciably alter the temperature regimes of the receiving waters. Strategies should be implemented to diffuse the heated effluent.
- Use regasification and liquification systems that neither rely on surface waters no affect water temperature in the surrounding waters. If a water-sourced system is necessary, use a closed-loop rather than an open-loop system.

Sedimentation, siltation, and turbidity

- Schedule dredging and excavation activities when the fewest species and least vulnerable life stages are present. Appropriate work windows can be established based on the multiple season biological sampling. Recommended seasonal work windows are generally specific to regional or watershed-level environmental conditions and species requirements.

- Do not conduct activities that increase turbidity during periods of the year when eelgrass is growing rapidly and is most sensitive to reductions in light (generally starting in July in the Pacific Northwest; Phillips 1984).

Release of contaminants

- Do not use biocides (e.g., aluminum, copper, chlorine compounds) to prevent fouling where possible. The least damaging antifouling alternatives should be implemented.
- Provide real-time monitoring and leak detection systems at natural gas production and transportation facilities that preclude gas from entering the environment.
- Ensure that gas production and transportation facilities have developed and implemented adequate gas spill response plans. Assist government agencies responsible for gas spills (e.g., U.S. Coast Guard, state and local resource agencies) in developing response plans and protocols, including identification of sensitive marine habitats and development and implementation of appropriate gas spill-response measures.
- Require a plan for notification of unintentional spills that includes alerts to state and Federal fish and wildlife agencies.
- Require that hydrostatic test water be analyzed for relevant water quality parameters prior to being discharged back to the source waterbody.

Discharge of debris

- Implement operational monitoring plans to analyze impacts resulting from intake and discharge structures and link them to a plan for adaptive management.

Entrainment and impingement

- Design intakes that do not impinge or entrain aquatic organisms. Use vaporization systems that do not rely on surface waters as a heat source (e.g., ambient air systems). If a water- sourced system must be used, use "closed loop" systems that minimize the volume of water utilized for regasification. Do not use "open loop" systems.
- Install fish screening systems at all ballast and cooling water intakes and all surface water points of diversion. Screen intakes should comply with the most recent fish screening guidelines from http://www.habitat.noaa.gov/pdf/salmon_passage_facility_design.pdf.
- Acquire written verification of screen inspection and approval by state and Federal fish screen experts prior to the withdrawal of any water.
- Require site-specific waterbody crossing plans with fish passage plans for review and approval prior to any construction activity.

- *Noise effects*
- Conduct construction and maintenance activities during periods when noises from activities won't impact organisms inhabiting EFH (e.g., van Staveren et al. 2010).
- Pile driving noise – see conservation measures in Section 17.1 Pile Driving.

- Vessel noise: see conservation measures in Section 11.3 Operation and Maintenance of Vessels.

Introduction of invasive species

- Develop and adhere to ballast water management guidelines as a first line of defense to prevent introduction of invasive species.
- Monitor newly disturbed areas (e.g. vessel slips) for colonization by invasive species.
- Develop a plan for elimination or control of invasive species if detected. Prescribe changes to project operations that may be implemented to prevent further introduction.

9. Agriculture and Grazing

The potential adverse effects on EFH from agriculture and grazing include: 1) loss and alteration of habitat; 2) altered hydrology; 3) release of contaminants; and 4) impacts to water quality.

<u>Potential Conservation Measures for Agriculture and Grazing</u>

General guidelines

- Promote and incentivize acquisition of agricultural lands, when available, to prevent urban, rural, and upland development, which leads to permanent loss of aquatic habitats.
- Include private landowner, and public and private land manager input when developing and implementing BMPs (Thompson et al. 2006).
- Collect control and treatment data in the vicinity of agricultural restoration sites prior to restoration activities to evaluate effectiveness of restoration efforts (Cooperman et al. 2007).
- Incentivize protection and restoration of rangelands using practices such as rotational grazing systems or livestock distribution controls, exclusion of livestock from sensitive riparian and aquatic areas, dry residual matter monitoring, the use of off-stream attractants such as water sources and salt or nutrient licks, livestock-specific erosion controls, reestablishment and protection of vegetation to promote growth of desirable native species, or extensive brush management correction.
- Incentivize conservation programs, especially those in the Food, Conservation, and Energy Act of 2008 (i.e., Farm Bill).
- Incentivize the Conservation of Private Grazing Land Program (CPGL), and the Conservation Reserve Enhancement Program (CREP), voluntary programs that help owners and managers of private grazing land address natural resource concerns while enhancing the economic and social stability of grazing land enterprises and the rural communities that depend on them. Technical assistance is provided by the Natural Resource Conservation Service.

Loss and alteration of habitat

- Roads for agricultural lands must be sited in locations to avoid sensitive areas such as streams, wetlands, and steep slopes. Decommission and relocate all roads that impact vulnerable and sensitive areas.
- In actively grazed areas, reconstruct riparian buffers and implement monitoring, management, and grazing regimes. In degraded grazed areas in or near streams, wetlands, and the riparian zone, implement mitigation to reconstruct riparian buffers with the goal of restoring riparian-aquatic functionality.
- Construct, manage and mitigate riparian and stream corridors to improve terrestrial invertebrate production (Saunders and Fausch 2007), streamside shading, LWD and leaf litter inputs, and sediment and nutrient routing control (Lowrance et al. 2002). The width of the buffers is dependent upon site characteristics, various methods, such as riparian

forest planting, alley cropping, filter strips, field borders, etc. can be implemented (Fischer and Fischenich 2000).

- Do not plant crops in areas with steep slopes and erodible soils, and do not disturb or drain wetlands and marshes.
- Design restoration projects that provide durable structures used to increase cover, improve geomorphologic functionality, and reduce erosion (e.g., timber and log check dams, Allan 2004).
- Implement rotational grazing, livestock exclusion, manure storage, and off-stream watering and feeding sites to reduce impacts of grazing on riparian and stream habitat and benthic communities (Platts 1991; Lyons et al. 2000; McInnis and McIver 2001; Scrimgeour and Kendall 2003; Yates et al. 2007).
- Implement no-till crop management to reduce impacts of crop management on riparian and stream habitat (Yates et al. 2006)

Altered hydrology

- Redesign and operate water diversion systems to ensure that flow conditions provide for passage and proper timing of life history stages of aquatic organisms.
- Monitor diversion facility operations to assess impacts on water temperatures, dissolved oxygen, and other applicable parameters, and use adaptive management to minimize impacts.
- Sedimentation, siltation, and turbidity.
- Ensure stream grazing buffer width is at least 6 m (Hook 2002; Yuan et al. 2009) to retain banks and decrease sedimentation in EFH, and ensure that buffers cover enough length of stream so that restoration efforts are effective (Wooster and DeBano 2006).
- Monitor the duration of increased suspended sediments to evaluate potential impacts on invertebrates and fishes (Vondracek et al. 2003).
- Utilize spatially-explicit evaluations of land cover to understand erosion potential (Wissmar et al. 2004).
- Reduce erosion and run-off by using practices such as contour plowing and terracing, no-till agriculture, conservation tillage, crop sequencing, cover and green manure cropping and crop residue, and by maximizing use of riparian management zones. Some approaches include filter strips, field borders, grassed waterways, terraces with safe outlet structures, contour strip cropping, diversion channels, sediment retention basins, and restoration of riparian vegetation.
- Utilize upland grazing management that minimizes surface erosion and disruption of hydrologic processes. Eliminate livestock access into riparian zones and stream reaches.
- Establish proper streambank alteration move triggers and endpoint indicators in combination with the other management measures intended to reduce the amount of time livestock spend in riparian areas to reduce the amount of the fine sediment introduced into streams.

- Include BMPs for agricultural road construction plans, including erosion control, avoidance of side casting of road materials into streams, and using only native vegetation in stabilization plantings. Design road systems to direct water to infiltration areas rather than directly to streams (Sommarstrom et al. 2002).
- Protect and restore soil quality using practices that improve native soil characteristics such as permeability, water retention, nutrient uptake, organic matter content, and biological activity. BMP examples include cover cropping, crop sequencing, sediment and infiltration basins, contour farming, conservation tillage, crop residue management, grazing management, and the use of low-compaction farming equipment.

Release of contaminants

- Install fencing and expand riparian vegetation buffers to reduce discharge of animal waste into EFH (Kolodziej and Sedlak 2007).
- Minimize water withdrawals for irrigation, and promote water conservation measures, such as more efficient irrigation systems (e.g., convert sprinkler irrigation systems to drip systems in orchards). Use alternative water sources such as rooftop rain collection or reclaimed municipal (or agricultural) wastewater where available. Reuse drainage water on sequentially more salt tolerant crops or recapture and blend with fresh water until the necessary salinity is achieved (CDFG and NMFS 2002).
- Develop and use seasonal restrictions to avoid impacts to habitat during critical life history stages for aquatic organisms. Seasonal work windows are specific to regional or watershed-level environmental conditions and species-life history requirements.

Impacts to water quality

- For comprehensive review of stream water quality BMPs related to grazing, see Agouridis et al. (2005).
- Incorporate and incentivize water quality monitoring as an element of land owner assistance programs for water quality. Assist with evaluation of monitoring data, and assist landowner with adjustments to agricultural practices as needed.
- Ensure efficient use and appropriate applications of pesticides on agricultural land, and that such chemicals do not come into contact with EFH, neither directly nor indirectly. Monitor nearby water bodies for contamination, and incentivize measures to prevent the flow of pesticides into adjacent water bodies. BMPs include use of integrated pest management, planting of insectary cover crops or borders to increase beneficial insect populations, frequent calibration of spray equipment, monitoring of wind speeds with weather stations or anemometers rather than visual means, incentivized use of least toxic pesticides, irrigation management, monitor soil for moisture and nutrient levels, monitor plant nutrient levels, and careful timing of nutrient applications. Select pesticides considering their persistence, toxicity, runoff potential, and leaching potential.
- Eliminate the use of chemical treatments within the riparian zone. Reduce pesticide use by evaluating pest problems and understanding past pest control measures. Select pesticides considering their persistence, toxicity, runoff potential, and leaching potential.

- Do not site or expand animal facilities adjacent to EFH, or in areas with high leaching potential to surface or groundwater. Use BMPs to minimize discharges from animal facilities (for both wastewater and process water).
- Do not apply manure or other fertilizer to land unless appropriate management measures are in place to eliminate sediment and nutrient input to EFH.
- Do not site animal facilities such as feedlots, corrals, horse boarding facilities, etc. near EFH or adjacent habitats such as the riparian zone, or near areas with potential for leaching or runoff. Relocate existing facilities or management areas to appropriate locations. At new locations, ensure that adequate nutrient and wastewater collection facilities are in place and serviceable.
- Biofiltration systems, such as those used for urban runoff, could be investigated for utility in improving water quality in EFH located near systems degraded by agriculture and grazing practices.

10. Shoreline and Bank Stabilization

The potential adverse effects on EFH from shoreline and bank stabilization include: 1) altered hydrology and geomorphology; and 2) loss and alteration of habitat.

Potential Conservation Measures for shoreline protection and bank stabilization

General guidelines

- Use vegetation methods or "soft" approaches (beach nourishment, vegetative plantings, placement of large woody debris) instead of "hard" modifications. Hard modification should be a last resort after ruling out the efficacy of tree revetments, stream flow deflectors and vegetative riprap, among other soft approaches. "Soft," "natural", "ecosystem-based", or "living shoreline" coastal protection has potential to be more ecologically sound than coastal armoring (Piazza et al. 2005; Shepard et al. 2011; Hanak and Moreno 2012). Living shorelines provide the service of hard structures while also promoting ecological restoration (Swann 2008; Gedan et al. 2011).
- Pre-determine the cumulative effects of existing and proposed shoreline and bank modification projects on EFH. Assessments should include prey species.
- Use manmade structures in combination with ecosystem-based methods (e.g., oyster domes) to promote both shoreline protection and ecological benefits (Gedan et al. 2011).
- Use seasonal restrictions on construction or maintenance to avoid impacts during critical life history stages of fishes (e.g., spawning, egg, and larval development periods). Seasonal work windows are generally specific to regional or watershed-level environmental conditions and species requirements.

Altered hydrology and geomorphology

- Do not install new water control structures in tidal marshes and freshwater streams. If the installation of new structures in this EFH cannot be avoided, ensure that they are designed to allow optimal fish passage and natural water circulation.
- Develop design criteria based on site-specific geomorphology, hydrology and sediment dynamics appropriate for the stream channel for any stabilization, protection and restoration projects.
- Ensure that the hydrodynamics and sedimentation patterns are properly modeled and that the design avoids erosion to adjacent properties, especially when "hard" shoreline stabilization is deemed necessary.
- Ensure water control structures are monitored for potential alteration of water temperature, dissolved oxygen concentration, and other water quality variables.
- If all other alternatives have been exhausted and armoring a riverbed must occur, construct a low-flow channel to facilitate fish passage and help maintain water temperature in reaches where armoring occurs.

Loss and alteration of habitat

- Mitigate for any losses in stream EFH by installing habitat-forming structures such as anchored rootwads, deflector logs, boulders, or rock weirs, and by re-planting native vegetation.
- Use an adaptive management plan with ecological indicators to oversee monitoring and ensure mitigation objectives are met. Take corrective action as needed.
- Preserve and enhance EFH by providing new gravel for spawning areas (beach nourishment), removing anthropogenic barriers to fish passage, and using weirs, grade control structures, and low flow channels to provide suitable habitat for fishes.
- Re-vegetate sites to resemble the natural ecosystem community and maintain an appropriate riparian buffer zone.
- Do not dike or drain tidal marshlands, estuaries, or any other EFH waterbodies.
- Do not cause losses in area of coastal wetlands, or of riparian vegetation and habitat.

Release of contaminants

- Do not use protection or stabilization materials treated with chemicals

11. Marine and Freshwater Transportation

Four different types of activities associated with marine and freshwater transportation are covered here: 1) ports and marinas; 2) operation and maintenance of vessels; and 3) navigational dredging and disposal.

11.1. Ports and Marinas

The potential adverse effects on EFH from ports and marinas include: 1) loss and alteration of habitat; 2) altered hydrology and geomorphology; 3) sedimentation, siltation, and turbidity; 4) direct impacts to organism; and 5) noise.

Potential Conservation Measures for Ports and Marinas

General guidelines

- Identify the cumulative impacts of past, present, and foreseeable future development activities on aquatic habitats in the review process for port and marina construction and operations.
- Design ports and marinas to avoid adverse effects to EFH and mitigate unavoidable effects on EFH caused by new development or expansion of ports and marinas.
- Incentivize state and local authorities to assist port authorities and marinas in developing management plans that avoid and minimize impacts to EFH. Incorporate operational controls that practice BMPs to reduce impacts to EFH. Design job descriptions and work instructions to protect EFH within and around ports and marinas.
- Incentivize marina operator participation in NOAA/Environmental Protection Agency Coastal Nonpoint Program and the Clean Marina Initiative.
- Identify environmental impacts, and provide marina operators with the means to clearly and efficiently identify potential environmental impacts. Assist operators with implementing environmental practices and evaluating BMPs and technologies such as evaluation and monitoring technologies, reducing impacts of pump out facilities, improve stormwater management, and develop and implement environmental management guidelines.
- Incentivize alternative ports, such as satellite ports and offshore terminals to reduce impacts of inshore ports.

Loss and alteration of habitat

- Minimize the footprint of new facilities.
- Conduct site suitability analyses for new or proposed expansion of port and marina facilities. Analyses should predict alterations to current and circulation patterns, water quality, bathymetric and topographic features, fish utilization, species distributions, and substrates.

Altered hydrology and geomorphology

- Do not locate new port and marina facilities in areas that have reduced tidal exchange or shallow water habitats, such as enclosed bays, salt ponds, and tidal creeks.
- Retain and preserve marine riparian buffers to maintain intertidal microclimate, flood and stormwater storage capacity, and nutrient cycling.
- Design proposed ports and marinas to facilitate acceptable levels of water circulation and maintain migratory corridors for organisms.
- Do not construct structures that impede tidal exchange and that may interfere with the movement of marine organisms (e.g., solid breakwaters).
- Require low-wake vessel technology and appropriate vessel routes in facility design and permitting. Vessel speeds must minimize wake damage to shorelines, and no-wake zones should be considered in highly sensitive areas, such as fish spawning habitat and SAV beds.

Sedimentation, siltation, and turbidity

- Use hydrodynamics models to estimate sediment transport and turbidity prior to construction in ports and marinas to enable long-term monitoring of the effects of such developments.
- Site new or expanded port and marina facilities in deep-water areas to avoid the need for dredging. Do not site in areas that are subject to rapid shoaling or erosion, as they will require frequent maintenance dredging, which impacts EFH.
- Ensure that floating structures, including barges, mooring buoys, and docks are located in adequate water depths to avoid propeller scour and grounding of vessel and floating structures. When floating docks cannot be located in adequate depth to avoid contact on the bottom at low tides, install float stops (structural supports to prevent the float from resting on the bottom). Float stops should be designed to provide a minimum of 2 feet of clearance between the float and substrate to prevent hydraulic disturbances to the bottom. Greater clearances may be necessary in higher energy environments that experience strong wave action.
- Use anchoring techniques and mooring designs that avoid scouring from anchor chains (e.g., helical anchors, subsurface float moorings). Avoid areas prone to high current and wind velocity, which can cause losses to EFH.
- Use vibratory hammers when removing old piles to reduce suspended sediments, silt, and contaminants into the water column; these may be preferable over direct pull or the use of a clamshell dredge.

Release of contaminants

- Develop site-specific solutions to nonpoint source pollution by considering the frequency of marina operations and potential pollution sources. Management practices should be tailored to the specific issues of each marina.

- Do not use wood treated with preservatives, such as Ammoniacal Copper Zinc Arsenate (ACZA) and Chromate Copper Arsenicals (CCA). If CCA treated wood must be used, the wood can be presoaked for several weeks or the wood can be coated with a plastic sheath to reduce or eliminate leaching.
- Ensure that marina and port facility operations have contaminant spill response plans and equipment in place and is clearly marked and easily accessed. Oil spill response equipment may include oil booms, absorbent pads, and oil dispersant chemicals.
- Use dispersants that remove oils from the environment, rather than those that simply move them from the surface to the ocean bottom.
- Install automatic shut-off nozzles at fuel dispensing sites and require the use of fuel/air separators on air vents or tank stems to reduce the amount of fuel or oil spilled at stations.
- Incentivize the use of oil-absorbing materials in the bilge areas of all boats with inboard engines.
- Place containment berms around machinery.
- Incentivize and promote the use of pump out facilities and restrooms at marinas and ports to reduce the release of sewage into surface waters. Ensure that these facilities are maintained and operational, and provide these services at convenient times, locations, and reasonable cost.
- Designate protected areas for maintenance activities (sanding, painting, engine repairs, abrasive blasting).
- Ensure that facilities provide for appropriate storage, disposal, transfer, containment, and disposal facilities for harmful liquid material, such as solvents, antifreeze, and paints, and a containment filtering and treatment system for vessel wash down wastewater.
- Require proper disposal of solid debris and polluting materials.
- Provide lidded garbage containers to reduce litter in the marine environment.
- Prohibit disposal of fish waste or other nutrient-laden material in marina or port basins by providing containers for fish waste.
- Develop biofiltration systems for runoff in parking lots and from other impervious surfaces.
- Minimize the amount of impervious surfaces surrounding the port or marina facility and maintain a buffer zone between the coastal zone and upland facilities.
- Implement runoff control strategies to decrease the amount of contaminants entering marine waters from upland sources. This can be accomplished by using alternative surface materials such as crushed gravel, decreasing the slope of surfaces towards the waters' edge, and installing filtering systems or settling ponds.

Direct Impacts to organisms

- Design piers and docks to be tall and narrow. Such structures produce more diffuse shadows than those that are lower and wider, reducing shading impacts to SAV, such as seagrasses (Burdick and Short 1999; Shafer 1999).
- Unavoidable shading cast by structures should be ameliorated through the use of adequate spacing of the pilings and light reflecting materials (Thom and Shreffler 1996).
- Do not develop ports and marinas in or near areas that support high abundances and diversities of organisms (e.g., SAV beds, intertidal mudflats, emergent wetlands, fish spawning areas).
- Conduct pre- and post-project biological surveys over multiple growing seasons to assess impacts on submerged and emergent aquatic vegetation communities.
- Site floating docks, which limit light transmittance more than elevated structures, only in non-vegetated, deeper, protected areas.
- Orient night lighting such that illumination of the surrounding waters is avoided.
- Implement seasonal restrictions to avoid construction-related impacts organisms during critical life history stages.

Noise effects

- Vessel noise
- Incentivize ship designs that include technologies capable of reducing noise generated and transmitted to the water column, such as the use of muffling devices already required for land-based machinery that may help reduce the impacts of vessel noise.
- Evaluate the effects of proposed and existing vessel traffic and associated underwater noise for potential impacts to sensitive areas such as migration routes and spawning areas so that minimization efforts can be made.
- Reduce vessel speeds, which will result in lower sound levels.
- Pile driving noise
    - See conservation measures listed in Section 17.1 Pile Driving.

11.2. Operation and Maintenance of Vessels

The potential adverse effects on EFH from operation and maintenance of vessels include: 1) loss and alteration of habitat; 2) sedimentation, siltation, and turbidity; 3) release of contaminants; 4) invasive species; 5) noise; and 6) release of debris.

Potential Conservation Measures for Operation and Maintenance of Vessels

- *General guidelines*

Encourage marinas to participate in NOAA/US EPA's Coastal Nonpoint Program and the Clean Marina Initiative.

Loss and alteration of habitat

- Conduct site suitability analyses for new or proposed expansion of vessel docking facilities. Analyses should predict alterations to current and circulation patterns, water quality, bathymetric and topographic features, fish utilization, species distributions, and substrates.

Sedimentation, siltation, and turbidity

- Limit vessel speed near shorelines to reduce waves that erode the shore. Designate all sensitive EFH areas (e.g., eelgrass beds) as no-wake zones.

Release of contaminants

- Ensure that commercial ships and port facilities have acceptable contaminant spill response plans and equipment in place.
- Use dispersants that remove oils from the environment rather than dispersants that simply move them from the surface to the ocean bottom.
- Establish no discharge zones to prevent sewage from entering EFH.
- Use appropriate methods for containment of wastewater, surface water collection, and recycling to avoid the discharge of pollution during the maintenance and operation of vessels.
- Promote education and signage on all vessels to encourage proper disposal of solid debris at sea.
- Encourage the use of innovative cargo securing and stowing designs that may reduce solid debris in the marine environment from the transportation of commercial cargo.

Invasive organisms

- Follow ballast water requirements and regulations for Western Region states:
    - Washington: Ballast Water Management, 77.120 RCW.
    - Oregon: Oregon Revised Statutes governing ballast water regulations, ORS 783.620-992.
    - California: Ballast Water Regulations for Vessels Arriving at California Ports or Places after Departing from Ports or Places within the Pacific Coast Region, Title 2, Division 3, Chapter 1, Article 4.6, Sections 2280 through 2284.
- Inspect all vessels for hull fouling invasive species prior to introducing the vessels into new waterbodies.

- Conduct vessel hull cleaning on land, and capture all run-off from such operations to ensure it does not enter waterbodies.
- Encourage natural resource managers to provide outreach materials on the potential impacts resulting from releases of invasive species into the natural environment.
- Develop appropriate early detection and rapid response eradication methods for invasive organisms consistent with Federal guidelines as specified by the National Invasive Species Management Plan.
- Provide and display educational materials on the potential impacts resulting from the release of invasive species into the natural environment to increase public awareness and engender broad cooperation amongst user groups and stakeholders.

Noise effects

- Incentivize ship designs that include technologies capable of reducing noise generated and transmitted to the water column, such as the use of muffling devices already required for land-based machinery that may help reduce the impacts of vessel noise.
- Assess the effects of proposed and existing vessel traffic and associated underwater noise for potential impacts to sensitive areas.
- Exclude vessels or limit high intensity use and low-frequency sonar in known sensitive marine areas.

Release of debris

- Promote the use of biodegradable materials when possible, especially in areas with tourism.
- Provide resources to the public on the impact of marine debris and guidance on how to reduce or eliminate the problem.

Abandoned and derelict vessels

- Existing Federal laws and regulations do not provide clear authority or funding to any single agency for the removal of grounded or abandoned vessels that harm natural resources and are not otherwise obstructing or threatening to obstruct navigation or threatening a pollution discharge (Helton and Zelo 2003). In many cases vessels are abandoned and are left to continually damage the marine environment because a responsible party cannot be identified or a funding source for removal cannot be secured (Zelo and Helton 2005).
- The potential for collateral impacts should be considered when planning a salvage operation to avoid fuel spillage (Michel and Helton 2003).
- Use appropriate equipment and techniques to salvage and remove grounded vessels and follow all necessary state and Federal laws and regulations. Avoid propulsion systems of salvage tugs that can cause propeller wash and scour the bottom. Instead, moor the tugs and use a ground tackle system to provide maneuvering and pull.

- Minimize additional seafloor damage when a derelict vessel has to be dragged across the seafloor to deep water by following the same ingress path. Alternatively, identify the least sensitive, operationally feasible towpath. Dismantling derelict vessels in place when stranded close to shore may cause less environmental impact than dredging or dragging a vessel across an extensive shallow habitat.
- Implement nonemergency salvage operations while including environmental considerations to minimize potential impacts on natural resources. Environmental considerations include periods when few sensitive species are present, avoidance of critical reproductive periods, and weather patterns that influence the trajectory of potential releases during operations
- Choose a scuttling site for a derelict vessel in a deep-water location in Federal or Exclusive Economic Zone (EEZ) waters that do not contain significant sensitive resources or geological hazards. Ensure that all proposed disposal of vessels in the open ocean adheres to state and Federal guidance and regulations, including section 102(a) of the Marine Protection, Research, and Sanctuaries Act (Ocean Dumping Act), and under 40 CFR § 229.3 of the US EPA regulations.

11.3. Navigational Dredging and Disposal

The potential adverse effects on EFH from navigational dredging and disposal include: 1) loss and alteration of habitat; 2) altered hydrology and geomorphology; 3) sedimentation, siltation, and turbidity; 4) release of contaminants; 5) direct impact to organisms; and 6) noise.

<u>Potential Conservation Measures for Navigational Dredging</u>

General guidelines

- Follow the technical provisions outlined in the Washington Administrative Code (WAC) 220-110-130 for dredging in freshwater areas and WAC 220-110-320 for dredging in marine or estuarine areas. Many of those provisions are included here.
- Use BMPs, such as the establishing riparian area buffers, to help reduce and control sediment input, thereby reducing the need for maintenance dredging.
- Do not dredge in or near sensitive EFH such as spawning grounds, eelgrass beds, or habitats that support important prey sources for MSA-managed fishes.
- Perform dredging only during periods that have the least impact on fishes and food webs. Areal extent and timing guidelines must be established in cooperation with local, state, tribal, and Federal fish biologists. Every effort must be taken to dredge deeply to the authorized depth, using single, one-day events rather than shallower, multiple-day events.
- Conduct pre-dredging site sampling and analyses to predict cumulative effects of existing and proposed dredging operations on EFH and organisms. Include all impacts to EFH as part of the permitting process, mitigate for all adverse effects and monitor mitigation effectiveness.
- Use alternative dredge material disposal options (e.g., upland disposal), and recycle dredged material for beneficial use opportunities.

Loss and alteration of habitat

- Do not place pipelines and accessory equipment used in conjunction with dredging operations close to sensitive EFH and HAPC such as kelp beds, eelgrass beds, estuarine/salt marshes, etc.
- Do not directly remove or bury habitat features. In cases where features are removed or buried, the operator must mitigate for these losses to EFH.

Altered hydrology and geomorphology

- Avoid new dredging projects. Activities that would likely require dredging (such as placement of piers, docks, marinas, etc.) should, instead be sited in deeper water areas or designed to alleviate the need for maintenance dredging. New projects should only be permitted for water dependent purposes, and only when no feasible alternatives are possible.

Sedimentation, siltation, and turbidity

- Incorporate adequate control measures to minimize turbidity where the dredging equipment used is expected to create significant turbidity, especially where effects may be long-lasting (>1 day).
- Always use equipment that generates the least amount of sedimentation, siltation, and turbidity. For example, use an environmental bucket instead of an excavator.
    - When using a clamshell bucket, dredge in complete passes.
    - Avoid stockpiling of dredged material below the ordinary high water line.
- Where sedimentation, siltation, or turbidity pose a greater risk to EFH than does entrainment and impingement, use only hydraulic dredges. If using a hopper dredge, allow no overflow from the barge.
- Where sedimentation, siltation, or turbidity pose a greater risk to EFH than does entrainment and impingement, use only hydraulic dredges.
- Allow no overflow from the barge or hopper.
- When using a mechanical dredge increase cycle time and reduce bucket deployment.
- Make every effort to avoid dredging very fine sediments, such as silt. In general, the finest substrate dredged should be sand (>80% sand).
- Implement light monitoring at treatment (within adjacent EFH) and control sites (area outside of dredging influence) during dredging.
- Explore collaborative approaches between material management planners, pollution control agencies, and others involved in watershed planning to identify point and nonpoint sources of sediment and sediment pollution associated with dredging.

Release of contaminants

- Use equipment specifically designed to minimize suspension of sediment when dredging areas with contaminated sediments.
- Monitor sediment contamination levels during dredging and report all effects, preferably in real-time. If contamination is acute, reevaluate dredging methodology and require methods that do not release contaminants.
- Using best available science, develop procedures for disposal of dredged material that protect EFH and organisms from contaminants.

Direct Impacts to organisms

Avoid dredging in or near EFH HAPC.

When entrainment of fishes or their prey poses a greater risk to EFH than sedimentation, siltation, or turbidity, use mechanical dredgers rather than hydraulic dredgers.

When using hydraulic dredgers, use equipment that that eliminates or minimizes entrainment or impingement of fishes and their prey.

Noise effects

Clearly report predicted noise levels that will occur during dredging activities.

Sample and monitor noise levels in real-time during dredging activities. If noise levels surpass accepted thresholds for aquatic organisms, cease operations and implement alternative methodology.

Incentivize development of peer-reviewed studies that identify how noise generated from dredging impacts aquatic organisms and EFH.

12. Coastal Development

Four types of activities associated with coastal development are covered here: 1) beach nourishment; 2) shoreline protection and bank stabilization; 3) aquatic fill; and 4) marine debris.

12.1. Beach Nourishment

The potential adverse effects on EFH from beach nourishment include: 1) altered hydrology and geomorphology; 2) sedimentation, siltation, and turbidity; and 3) direct impacts to organisms.

Potential Conservation Measures for Beach Nourishment

General guidelines

- Complete nourishment in one season (e.g., one winter season).
- Obtain beach nourishment materials from either upland sources or from maintenance or navigational dredging (i.e., beneficial use). Avoid obtaining materials from offshore sand mining.
- Include efforts to preserve and enhance EFH by providing substrates that can be utilized by reproducing aquatic organisms.
- Restoration efforts must have specific ecological goals that can be measured and monitored to evaluate efficacy of restoration efforts.
- Preserve, enhance, or create beach dune and native dune vegetation in order to provide natural beach habitat and reduce the need for nourishment.
- Address the cumulative impacts of past, present and foreseeable future development activities on aquatic habitats by considering them in the review process for beach nourishment projects.

Altered hydrology and geomorphology

- Develop design criteria based on site-specific geomorphological, hydrological and sediment transport processes appropriate for the stream channel for any stabilization, protection and restoration projects.

Sedimentation, siltation, and turbidity

- Monitor turbidity during operations, and cease operations if turbidity exceeds predetermined threshold levels at the beach and borrow sites.
- Dispose of dredged spoils properly (USACE 2014).

Direct Impacts to organisms

- Do not harvest sand in areas containing sensitive marine benthic habitats (e.g., spawning and feeding sites, hard bottom, cobble/gravel substrate, shellfish beds).

- Do not conduct beach nourishment in areas containing sensitive marine benthic habitats adjacent to the beach (e.g., submerged aquatic vegetation, kelp, spawning and feeding sites, hard bottom, and cobble/gravel substrate).
- Conduct beach nourishment during the winter, when productivity for benthic infauna is at a minimum; this may minimize the impacts for some beach sites.
- Verify that nourishment activities are not coinciding with kelp recruitment.
- Implement seasonal restrictions to avoid impacts to habitat during species critical life history stages (e.g., spawning season, egg, and larval development period).
- Recommended seasonal work windows are generally specific to regional or watershed-level environmental conditions and species requirements.
- Identify life history traits, such as reproductive strategy and dispersal capabilities to determine potential for species recovery from beach nourishment and other impacts (Peterson et al. 2000; Speybroeck et al. 2006; Jones et al. 2008).
- Assess source material for compatibility with that of material to be placed on beach (e.g., grain size and shape, color). Slope of nourished beach should mimic the natural beach profile.
- Use an adaptive management plan with ecological indicators to oversee monitoring and ensure mitigation objectives are met. Take corrective action as needed.

12.2. Shoreline Protection and Bank Stabilization

The potential adverse effects on EFH from shoreline protection and bank stabilization include: 1) loss and alteration of habitat; 2) altered hydrology and geomorphology; and 3) release of contaminants.

Potential Conservation Measures for Shoreline Protection and Bank Stabilization

General guidelines

- Use soft approaches (e.g., beach nourishment, vegetative plantings, and placement of LWD) in lieu of “hard” shoreline stabilization and modifications (such as concrete bulkheads and seawalls, concrete or rock revetments).
- Use manmade structures in combination with ecosystem-based methods (e.g., oyster domes) to promote both shoreline protection and ecological benefits (Gedan et al. 2011).
- Use an adaptive management plan with ecological indicators to oversee monitoring and ensure mitigation objectives are met. Take corrective action as needed.

Loss and alteration of habitat

- Use seasonal restrictions to avoid impacts to habitat during species critical life history stages (e.g., spawning, egg, and larval development periods). Recommended seasonal work windows are generally specific to regional or watershed-level environmental conditions and species requirements.

- Do not dike or drain tidal marshlands or estuaries.
- Do not develop structures that cause or lead to the loss of coastal wetlands.
- Preserve and enhance fishery habitat to offset any impacts of structures (e.g., new gravel for spawning or nursery habitats).

Altered hydrology and geomorphology

- Do not install structures in tidal marshes and freshwater streams flowing into coastal waters. If installation of new structures cannot be avoided, ensure they are designed to allow optimal fish passage and natural water circulation.
- Ensure that the hydrodynamics and sedimentation patterns are properly modeled and that the design avoids erosion to adjacent properties when “hard” shoreline stabilization is deemed necessary.

Release of contaminants

- Do not use materials that are treated with potentially harmful chemicals.

12.3. Aquatic Fill

The potential adverse effects on EFH from aquatic fill include: loss and alteration of habitat; 2) altered hydrology and geomorphology; 3) release of contaminants; and 4) direct impacts to organisms.

<u>Potential Conservation Measures for Aquatic Fill</u>

General guidelines

- Do not place aquatic or other types of fill in riparian habitats, freshwater habitats, estuaries, and bays.
- Plan filling activities to avoid special aquatic sites such as native eelgrass beds. This may include the placement of pipes and anchoring of barges and other vessels associated with the project.
- Address cumulative impacts of past, present, and foreseeable future fill operations on aquatic habitats by considering them in the review process.

Loss and alteration of habitat

- Require the use of multiple-season biological sampling data (both pre- and post-construction) when appropriate to assess the potential and resultant impacts on certain habitat and aquatic organisms.
- Avoid or minimize loss or alteration of EFH habitat. Seek funding for restoration or conservation of critical coastal EFH that may be affected by planned activities.

Altered hydrology and geomorphology

- Utilize BMPs to limit and control the amount and extent of turbidity and sedimentation. Standard BMPs may include constructing silt fences, coffer dams, and operational modification (e.g., hydraulic dredge rather than mechanical dredge).
- Identify sources of sedimentation within the watershed that may exacerbate repetitious maintenance activities. Implement appropriate management techniques to control these sources.

Release of contaminants

- Do not use materials that are treated with toxic materials, instead use natural untreated materials.

Direct Impacts to organisms

- Schedule fill activities when the fewest species and least vulnerable life stages are present. Appropriate work windows can be established based on the multiple season biological sampling. Recommended seasonal work windows are generally specific to regional or watershed-level environmental conditions and species requirements.
- Require the use of multiple-season biological sampling data (both pre- and post-construction) when appropriate to assess the potential and resultant impacts on certain habitat and aquatic organisms.

12.4. Marine Debris

The potential adverse effects on EFH from marine debris include: 1) direct impact to organisms; and 2) introduction of invasive species.

Potential Conservation Measures for Marine Debris

General guidelines

- Require all existing and new commercial construction projects near the coast (e.g., marinas and ferry terminals, recreational facilities, boat building and repair facilities) to develop and implement refuse disposal plans.
- Install barriers to catch floating debris in harbors, ports, and near-shore developments (Gregory 2009).
- Promote the use of biodegradable materials when possible, especially in areas with tourism (Guo et al. 2009).
- Provide resources to the public on the impact of marine debris and guidance on how to reduce or eliminate the problem.

13. Dredging

The potential adverse effects on EFH from dredging include: 1) loss and alteration of habitat; 2) altered hydrology and geomorphology; 3) sedimentation, siltation, and turbidity; 4) release of contaminants; 5) entrainment; and 6) noise.

Potential Conservation Measures for Dredging

General guidelines

- Follow the technical provisions outlined in the Washington Administrative Code (WAC) 220-110-130 for dredging in freshwater areas and WAC 220-110-320 for dredging in marine or estuarine areas. Many of those provisions are included here.
- Use BMPs, such as the establishing riparian area buffers, to help reduce and control sediment input, thereby reducing the need for maintenance dredging.
- Do not dredge in or near sensitive EFH such as spawning grounds, eelgrass beds, or habitats that support important rearing or spawning habitats, and prey sources for MSA-managed fishes.
- Perform dredging only during periods that have the least impact on fishes and food webs. Areal extent and timing guidelines must be established in cooperation with local, state, tribal, and Federal fish biologists. Every effort must be taken to dredge deeply to the authorized depth, using single, one-day events rather than shallower, multiple-day events.
- Conduct pre-dredging site sampling and analyses to predict cumulative effects of existing and proposed dredging operations on EFH and organisms. Include all impacts to EFH as part of the permitting process, mitigate for all adverse effects and monitor mitigation effectiveness.
- Use alternative dredge material disposal options (e.g., upland disposal), and recycle dredged material for beneficial use opportunities.

Loss and alteration of habitat

- Do not place pipelines and accessory equipment used in conjunction with dredging operations close to sensitive EFH and HAPC such as kelp beds, eelgrass beds, estuarine/salt marshes, etc.
- Do not directly remove or bury habitat features. In cases where features are removed or buried, the operator must mitigate for these losses to EFH.

Altered hydrology and geomorphology

- Avoid new dredging projects. Activities that would likely require dredging (such as placement of piers, docks, marinas, etc.) should, instead be sited in deeper water areas or designed to alleviate the need for maintenance dredging. New projects should only be permitted for water dependent purposes, and only when no feasible alternatives are possible.

Sedimentation, siltation, and turbidity

- Always use equipment that generates the least amount of sedimentation, siltation, and turbidity. For example, use an environmental bucket instead of an excavator.
- Where sedimentation, siltation, or turbidity pose a greater risk to EFH than does entrainment and impingement, use only hydraulic dredge. If using a hopper dredge, allow no overflow from the barge.
- When using a mechanical dredge increase cycle time and reduce bucket deployment.
- When using a clamshell bucket, dredge in complete passes.
- Avoid stockpiling of dredged material below the ordinary high water line.
- Make every effort to avoid dredging very fine sediments, such as silt. In general, the finest substrate dredged should be sand (>80% sand).
- Implement light monitoring at treatment (within adjacent EFH) and control sites (area outside of dredging influence) during dredging (Thackston and Palermo 1998).
- Incorporate adequate control measures to minimize turbidity where the dredging equipment used is expected to create significant turbidity, especially where effects may be long-lasting (>1 day).
- Explore collaborative approaches between material management planners, pollution control agencies, and others involved in watershed planning to identify point and nonpoint sources of sediment and sediment pollution associated with dredging.

Release of contaminants

- Current standards are based on toxicity to benthic invertebrates, so while they may protect against impacts to the fish prey base, they are not necessarily protective of fish. (e.g., see Johnson et al. 2002 and Meador et al. 2002). This is especially true for contaminants such as polycyclic aromatic hydrocarbons (PAHs), which are metabolized to mutagenic and carcinogenic intermediates in fish, but to a much lesser extent in invertebrates (see Varanasi 1989 or Meador 2008).
- Monitor sediment contamination levels during dredging and report all effects, preferably in real-time. If contamination is acute, reevaluate dredging methodology and require methods that do not release contaminants.
- Using best available science, develop procedures for disposal of dredged material that protect EFH and organisms from contaminants.

Entrainment

- Design and implement dredging suction mechanisms that minimize or eliminate entrainment or impingement of fish and their prey sources.

Noise effects

- Clearly report predicted noise levels that will occur during dredging activities.

- Sample and monitor noise levels in real-time during dredging activities. If noise levels surpass accepted thresholds for aquatic organisms, cease operations and implement alternative methodology.
- Incentivize development of peer-reviewed studies that identify how noise generated from dredging impacts aquatic organisms and EFH.

14. Aquaculture

The potential adverse effects on EFH from aquaculture include: escapes and releases; 2) introduction of pathogens; 3) release of contaminants; 4) water quality impacts; and 5) benthic impacts.

For the purposes of policy development, aquaculture is defined under the National Aquaculture Act of 1980 (16 U.S.C. §§ 2801-2810) as the propagation and rearing of aquatic marine organisms for any commercial, recreational, or public purposes. This definition covers all authorized production of marine finfish, shellfish, plants, algae, and other aquatic organisms for 1) food and other commercial products; 2) wild stock replenishment and enhancement for commercial and recreational fisheries; 3) rebuilding populations of threatened or endangered species under species recovery and conservation plans; and 4) restoration and conservation of aquatic habitat (NOAA 2011; USDOC 2011). This chapter summarizes some of the potential impacts of aquaculture on marine and freshwater organisms and the EFH that they inhabit.

West Coast Region Aquaculture

Current marine aquaculture facilities in the West Coast Region (WCR) are generally located in nearshore areas. However, one offshore shellfish facility has been permitted, and one offshore finfish facility has applied for permits. Shellfish species cultured in the West Coast Region include oysters, clams, mussels, and abalone. Pacific oysters (*Crassostrea gigas*) account for the majority of production. Salmon species (Atlantic salmon, *Salmo salar*, and Pacific salmon and trout, *Oncorhynchus* spp.) are the most commonly produced finfish, but white sea bass (*Atractoscion nobilis*) are also grown. For examples of EFH consultations on aquaculture operations in the WCR, please refer to WCR-2014-1502 and WCR-2014-825 (for shellfish) and NWR-2010-06071 (for finfish).

<u>Potential Conservation Measures for Aquaculture</u>

General guidelines

- Use modern production technologies, proper siting protocols, standardized operating procedures, and BMPs to reduce the risk of environmental damage and degradation that can be caused by aquaculture development and activities (Shumway 2011, Price and Morris 2013, Rust et al. 2014).

Escapes and releases

- Use only native or naturalized species unless best available science demonstrates use of non-native or other species would not cause undue harm to wild species, habitats, or ecosystems in the event of an escape.
- Ensure that monitoring and maintenance plans and protocols employ BMPs designed to reduce aquaculture escapes. Plans should provide protocols (e.g., recapture, mitigation) for situations where an escape occurs.
- Use risk assessment tools and empirical models (ICF 2012; RIST 2009) to identify and evaluate risks of farmed escapes on wild populations (Waples et al. 2012). The Offshore Mariculture Escapes Genetics Assessment model (OMEGA) is one such tool developed

for this purpose and is available from the NOAA Aquaculture web site (http://www.nmfs.noaa.gov/aquaculture/science/omega_model_homepage.html)

Introduction of pathogens

- Prevent introduction of pathogens at aquaculture facilities (LaPatra 2003).
- An accredited aquatic organism health professional should regularly inspect crops and perform detailed diagnostic procedures to determine if disease presents a risk.
- Biosecurity plans to prevent or control the spread of pathogens within a farm site, between aquaculture operations, or to wild populations should be developed by veterinarians with expertise in fish culture, or qualified aquatic animal health experts.
- Document all stocking and transplanting activities to improve tracking ability if an outbreak occurs.
- Ensure compliance with Federal and state health control legislation. Import and export certifications and testing for certain types of diseases falls under the jurisdiction of the USDA Animal and Plant and Health Inspection Service (APHIS). States in the WCR all have specific protocols that must be followed when transplanting cultured species into wild environments to minimize the incidence of disease transfer.

Release of contaminants

- Employ BMPs and use vaccines to reduce the need for antibiotics (Forster 2010; Rico et al. 2012, Rust et al. 2014).
- Employ preventative husbandry practices and proper stocking densities to reduce the need for chemical treatments.
- If needed, use only prescribed antibiotics, paraciticides, and other medicines. Use sparingly and in accordance with approved protocols to minimize environmental contamination.

Water quality impacts

- Site finfish operations appropriately in well-flushed, non-depositional areas (Price and Morris 2013). For example, site cages in water at least twice as deep as the cage, in areas with minimum flows of 7cm/second, or use models (i.e. Aquamodel or depomod) to determine adequacy of site to avoid impacts to water quality.
- Use BMPs, including siting aquaculture operations outside of nutrient sensitive habitats, responsible cleaning practices, integration of feed management strategies, use of optimally formulated diets, and other management measures to minimize nutrient discharge.
- Construct wetlands at or near facilities to filter and help remove solids, phosphorous, and nitrogen compounds from aquaculture effluent (Michael 2003).

Benthic impacts

- Site aquaculture facilities in well-flushed waters. Belle and Nash (2008) recommend the siting of cages in water at least twice as deep as the cage with minimum flows of 7cm/second.
- Use fallowing to reduce benthic impacts. Fallowing is the temporary relocation or suspension of aquaculture operations to allow sediments and the benthic community to recover from excessive nutrient loading (Brooks et al. 2003, Brooks et al. 2004, Tucker and Hargreaves 2008).
- Optimize feeding practices and use low-phosphorous feed (MacMillan et al. 2003). Actions that could reduce benthic impacts of feed include:
    - Reducing the use of solids by using highly digestible feed with high nutritional value
    - Reducing dissolved nitrogen by using feed that contains proper protein and energy content (Amirkolaie 2011)
    - Setting rations to reduce excessive feed and feces
- Implement benthic monitoring plans to detect nutrient enrichment and effects on benthic community structure. Establish treatment (facility) and control (non-facility) sites to evaluate aquaculture effects versus natural and seasonal variability.
- Do not site new aquaculture operations in or above sensitive benthic communities such as eelgrass or other SAV, near fish spawning habitat. If forage fish spawn is detected on aquaculture gear, cease aquaculture activities in the area until such time as the eggs have hatched and spawn is no longer present.

15. Overwater Structures

The potential adverse effects on EFH from overwater structures include: 1) loss and alteration of habitat; 2) altered hydrology and geomorphology; 3) release of contaminants; 4) direct impacts to organisms; 5) stormwater runoff; 6) invasive species; and 7) noise.

<u>Potential Conservation Measures for Overwater Structures</u>

General guidelines

- Decrease shading impacts during the design phase of all overwater structure projects. Factors such as structure orientation, height above water, structure width, and decking material can significantly affect overwater structure shading impacts on EFH (Beal et al. 1999; Burdick and Short 1999; Fresh et al. 2006; Landry et al. 2008; Shafer et al. 2008).
- Use light transmitting material on all overwater structure projects. Use grated decking (grated decking, minimum 40% light transmittance, > 60% open space), and increased spacing between deck boards to increase the light transmitted through overwater structures (Fresh et al. 2006; Landry et al. 2008; Shafer et al. 2008).
- For all overwater structure projects, new and existing, increase elevation of all overwater structures (above mean higher high water line), maximize piling spacing, minimize number of piles, design narrower structures, minimize float size and configuration, reduce the amount of pier area that directly contacts the shoreline, and orient structures north-south to improve light transmittance and SAV growth (Shafer et al. 2008).
- Use upland boat storage to minimize need for overwater structures.
- Use floating breakwaters whenever possible and remove them during periods of low dock use. Encourage only seasonal use of docks and off-season haul-out of boats and structures.
- Implement projects that mitigate for adverse effects on EFH that remain after implementing all avoidance and minimization measures.
- Consider cumulative impacts of past, present, and foreseeable future development projects on EFH in the review process for overwater structure projects.
- Incentivize community-use docks to minimize the proliferation of single-family residential docks along shorelines.

Loss and alteration of habitat

- Do not site overwater structures above vegetation that currently exists at a site. Mitigate on-site for any and all losses of such important EFH.
- Conduct surveys and provide an inventory of presence and location of important marine vegetation (eelgrass, *Gracilaria*, kelp, macroalgae, intertidal wetland vascular plants, etc.), and relative abundance and habitat use by important forage fishes such as herring, surf smelt, or sandlance prior to permitting overwater structure projects. All impacts to these organisms and their respective habitats should be mitigated for.

- Site or relocate boathouses to land above the Highest Astronomical Tide line, or offshore of the 5m mean lower low water line contour to minimize shading.
- Place floats in deep water to avoid impacts from propeller scour, shading, etc. and reduce the need for navigational dredging.
- Design only non-grounding floats, and require rebuilds for existing floats that ground.
- Relocate all persistently moored vessels in waters deep enough so that the bottom of the vessel remains a minimum of 18 inches off the substrate during extreme low tide events. This will prevent adverse grounding impacts to benthic habitat. If vessel must be moored over SAV or rocky reef habitats with less than 18 inches between the bottom of the vessel and the substrate at low tides, then float stops should be utilized. This will prevent adverse grounding impacts to benthic habitat.
- Use midline float mooring anchors if placed within SAV or habitat suitable for SAV to prevent chain scour to the substrate. This will prevent adverse impacts to SAV and other benthic habitat.

Altered hydrology and geomorphology

- Minimize impacts to hydrology and nearshore processes by avoiding floats that ground at low tide (incorporate stops on piles).

Release of contaminants

- Do not use treated wood for any structures. Use alternatives such as concrete, steel, or composites (recycled plastic, etc.).
- Take measures to eliminate loss of flotation materials (typically Styrofoam) through requirement of full enclosure of flotation materials.
- Require use of rub strips on treated wood piles or timbers that are abraded by vessels (fender piles) or docks (guide piles) to reduce physical breakup of the piles.
- Encourage removal of treated wood structures (piles and decking) in aquatic areas to decrease overall shading and contamination.
- Contain construction-related pollutants by using containment and spill cleanup techniques.

Direct Impacts to organisms

- Conduct in-water work during the time of year when EFH-managed organisms and their prey are least affected.
- Fit all pilings and navigational aids, such as moorings and channel markers, with devices to prevent perching by piscivorous birds and mammals.
- Orient night lighting such that illumination of the surrounding waters is reduced or eliminated.

- Site all anchored moorings and moored vessels in areas devoid of SAV. This will prevent adverse shading impacts to SAV and subsequent mitigation needs.

Stormwater runoff

- See conservation measures in Section 2.4 Stormwater and Urban Runoff

Invasive organisms

- Assess project areas for susceptibility to, or presence of invasive organisms. If invasive organisms are present or the site could be susceptible to invasive hosts, design and implement an eradication management and monitoring plan prior to construction phases to eliminate the spread of such organisms. Submit all information on newly discovered invasions or spreading to local conservation or regulatory agencies (fish and wildlife) and organizations:
    - Washington: Washington Invasive Species Council Annual Report (http://www.invasivespecies.wa.gov)
    - Oregon: Oregon Invasive Species Council (http://www.oregoninvasivespeciescouncil.org)
    - California: Invasive Species Council of California (http://www.iscc.ca.gov)
- Develop appropriate early detection and rapid response eradication methods for nonnative plant and animal species, consistent with Federal guidelines as specified by the National Invasive Species Management Plan.
- Provide and display educational materials on the potential impacts resulting from the release of invasive species into the natural environment to increase public awareness and engender broad cooperation amongst user groups and stakeholders.

Noise effects

- Pile driving noise: See section 17.1 Pile Driving
- Ship noise: see conservation recommendations in Section 10.1 Ports and Marinas

16. Water Intake and Discharge Facilities

Five different types of activities associated with water intake and discharge facilities are covered here: 1) desalination facilities; 2) cooling-water intake facilities; 3) sewage discharge facilities; 4) combined sewer overflow; and 5) industrial discharge facilities.

16.1. Desalination Facilities

The potential adverse effects on EFH from desalination facilities include: 1) release of contaminants; 2) entrainment or impingement; and 3) altered water quality.

<u>Potential Conservation Measures for Desalination Facilities</u>

General guidelines

- Develop and implement BMPs to avoid and minimize impacts to EFH during facility construction (e.g., minimizing noise, prohibiting construction below the mean high water line, and development of stormwater pollution prevention plan).
- Conduct evaluations of facility development-effects on EFH, followed by a minimum of three years of monitoring operational effects on EFH.
- Mitigate for any and all impacts to EFH and the biota it supports that cannot be avoided through BMP project design or operations (for examples, see Guidelines for Desalination Plants in the Monterey Bay National Marine Sanctuary): http://montereybay.noaa.gov
- Desalination should only be considered when existing alternatives (e.g., wastewater recycling) are not feasible.
- Desalination plants should be designed, sited, and operated with the lowest possible carbon footprint to avoid or minimize cumulative impacts including contributions to emissions (e.g., carbon dioxide, methane) that accelerate global warming.
- Do not locate desalination plants, intakes or discharges in or near Habitat Areas of Particular Concern (HAPCs). Do not site desalination facilities in or near areas of high biological productivity, such as upwelling centers.

Release of contaminants

- Design the facility to minimize impacts of effluent on EFH and organisms or ecological processes therein.
- Provide a complete list of all chemicals used during construction and operation of the desalination facility. Include quantities for routine use (e.g., cleaning of filter membranes), deleterious effects on aquatic biota, and vetted protocols for storage and disposal. Include a detailed HazMat spill prevention and response plan for chemicals as needed.
- Evaluate and report on the feasibility of using alternative pretreatment techniques such as ozone pretreatment, subsurface intakes, and membrane filtration. Such alternatives can reduce the need for use of chemicals.

Entrainment or impingement

- Do not site desalination facilities in or near biologically productive areas (e.g., kelp forests or other dense beds of submerged aquatic vegetation) since entrainment and impingement impacts are in large part dictated by the biological productivity at the site.
- Design desalination facilities to reduce or eliminate impingement and entrainment. Design subsurface intakes as opposed to traditional open water intakes if at all feasible. However, subsurface intakes should not:
    - cause saltwater intrusion into aquifers
    - negatively impact coastal wetlands that may be connected to the same aquifer
    - exacerbate coastal erosion
- Other options to reduce entrainment and impingement include:
    - vertical and radial beach wells
    - horizontal directionally drilled (HDD) and slant-drilled wells
    - seabed filtration systems or other sub-seafloor structures
- When open water intakes are used, the project plans should include measures to plans to minimize impingement and entrainment, such as:
    - placement of the intake structure to avoid sensitive habitat or highly productive areas
    - screening the intake ports
    - increasing the number of intake ports, or decreasing the intake velocity
- The project proponent should provide appropriate and applicable estimates of entrainment and impingement rates, and the impacts associated with various intake velocities and screen mesh sizes. Evaluations should be done using local data, including diurnal and seasonal variations in planktonic abundance and location.
- In cases where a sub-surface intake is not feasible, use existing pipelines to minimize impacts to the seafloor. If a new pipeline is necessary, evaluate seafloor or sub-seafloor placement to minimize disturbances to EFH.
- Mitigate for any impacts to EFH and the biota it supports that cannot be avoided through project design or operations. The necessary level of mitigation could be determined through the use of a biologically based model, such as the habitat production foregone method, in order to account for all "non-use" impacts to affected biota. Mitigation projects should attempt to directly offset the impacted species or habitat (in-place, in-kind mitigation).

Altered water quality

- Determine the feasibility of diluting brine effluent by blending it with other existing discharges.

- Evaluate potential for an integrated regional water supply project with other water suppliers and agencies considering water supply projects in the area.
- Discharge brine in an area with high circulation and not located in or near ecologically sensitive areas, such as HAPCs.
- Desalination plants proposing to co-locate with power plant once-through cooling systems should include an assessment of the impacts along with alternative intake and outfall structures that would avoid or minimize these impacts. Evaluate the continued availability and reliability of the feedwater source and assess the impacts that would occur from operating the intake and outfall structures without the use of the power plant once-through cooling structures.
- Evaluate measures that minimize impacts from desalination plant discharge, including:
    - discharge effluent to an area with greater circulation or greater depth
    - increase the number of diffusers
    - increase the diffuser velocity while minimizing the volume at each outlet
    - dilute brine with seawater or another discharge or use a subsurface discharge structure.
- The project proponent should provide a detailed evaluation of the projected short- term and long-term impacts of the brine plume on marine organisms based on a variety of operational scenarios and oceanographic conditions. Modeling should address different types of seasonal ocean circulation patterns, including consideration of "worst case scenarios".
- Areas with limited water circulation such as enclosed bays or estuaries, which can "trap" the brine discharge, should be avoided. Instead, brines should be discharged in areas with strong tidal currents to achieve more rapid dilution of the brine by the receiving waters.
- Results of accepted plume models should be included, to illustrate how the plume will behave during variable oceanographic conditions. The plume model should estimate salinity concentrations at the discharge point, as well as where and when it would reach ambient ocean concentrations. The extent, location, and duration of the plume where the salinity is 10 percent above ambient salinity should also be provided.
- The project proponent should provide information on the physical and chemical parameters of the brine plume including salinity, temperature, metal concentrations, pH, and oxygen levels. These water quality characteristics of the discharge should conform to California Ocean Plan requirements and should be as close to ambient conditions of the receiving water as feasible.
- A continuous monitoring program should be implemented to verify the actual extent of the brine plume. Mitigate for unanticipated impacts on EFH.

16.2. Cooling-water Intake Facilities

The potential adverse effects on EFH from cooling-water intake facilities include: 1) altered hydrology; and 2) construction and maintenance.

Potential Conservation Measures for Cooling-water Intake Facilities

General guidelines

- All unavoidable impacts to EFH should be mitigated for in-place and in-kind or as determined through the permitting process. Alternatively, a habitat equivalency analysis could be reviewed, approved in conjunction with NOAA.
- Avoid constructing new facilities with once-through cooling systems. All new facilities, regardless of size, should utilize dry cooling (air cooled) systems or closed cycle cooling systems to prevent or minimize impacts.
- Utilize air-cooling and wastewater systems in lieu of building new intake pipes and facilities. If intake pipes and facilities must be built, do so during low flow periods and tidal stage
- Implement erosion and sediment control BMPs, and have an equipment spill and containment plan and appropriate materials onsite.
- Utilize alternative water resources, such as reclaimed municipal wastewater or brackish groundwater for cooling water supply to reduce impacts to EFH.
- Do not locate facilities that rely on surface water in or near critical EFH, such as estuaries, inlets, heads of submarine canyons, rock reefs, or small coastal embayments.

Altered hydrology

- Redesign and operate existing facilities to create flow conditions that provide for passage and proper timing of life history stages.
- Monitor facility operations to assess impacts on water temperatures, dissolved oxygen, and other applicable parameters, and use adaptive management to minimize impacts.
- Entrainment or impingement.
- Incorporate juvenile and adult fish passage facilities on all water diversion projects (e.g., fish bypass systems) according to the most updated NMFS fish passage policies.
- Design intake structures to minimize entrainment or impingement using the most recent guidelines from NMFS.
- Screen all water intakes that draw from waters designated as EFH. Screening sizes and materials should follow guidelines outlined in the most updated fish screening criteria reports and memorandums. Screening design should minimize impacts to MSA-managed species and their prey.

Construction and maintenance

- Use the least damaging antifouling alternatives, such as screens constructed with anti-fouling coatings or materials, and self-cleaning systems to minimize impacts to EFH. Do not use biocides (e.g., chlorine) to prevent fouling.

16.3. Sewage Discharge Facilities

The potential adverse effects on EFH from sewage discharge facilities include: 1) release of contaminants; 2) maintenance and construction; and 3) loss and alteration of aquatic vegetation.

<u>Potential Conservation Measures for Sewage Discharge Facilities</u>

General guidelines

- Develop programs and projects to reuse treated municipal wastewater and minimize the volume discharged to EFH. Common uses include cooling water uses, agricultural irrigation, landscaping and large grassy areas such as golf courses and recreational fields.
- Upgrade wastewater treatment facilities from the standard secondary treatment level. Tertiary treatments can include denitrification, increased pathogen removal, or other customization depending upon end use and need.
- Develop and enforce strong pretreatment programs for industrial and institutional users in the wastewater system (e.g., plating operations for metals, dentists for mercury, hospitals for medications, etc.) to reduce the amount of these contaminants entering the system. Many municipalities have these programs already and need to increase participation and enforcement of existing programs.
- Develop, incentivize, and enforce collection programs for personal care products and medications that otherwise end up in the wastewater treatment system and subsequently in EFH.

Release of contaminants

- Pretreat industrial and institutional flows.
- Incentivize collection of unused personal care products and medications.

Maintenance and construction

- Use the least damaging antifouling alternatives, such as screens constructed with anti-fouling coatings or materials, and self-cleaning systems to minimize impacts to EFH. Do not use biocides (e.g., chlorine) to prevent fouling.
- Schedule maintenance so that effects to EFH are minimized.

Loss and alteration of aquatic vegetation

- Develop, implement, and increase treated sewage reuse opportunities.
- Denitrify wastewater if nitrogen enrichment is impacting SAV.
- Use constructed wetlands to remove nutrients from wastewater flows prior to discharge.
- Adjust temperature of discharge by using cooling ponds or towers.

16.4. Combined Sewer Overflow

The potential adverse effects on EFH from combined sewer overflows include release of contaminants.

Potential Conservation Measures for Combined Sewer Overflow (CSO)

General guidelines

- Conduct routine maintenance and inspection to prevent blockages of the combined sewer system (CSS).
- Develop and implement public outreach materials to educate the public on the effects of improperly disposing of items in the CSS (e.g., restaurants improperly disposing of grease, homeowners or landscapers disposing of greenwaste into a CSS).
- Conduct inspections of facilities and areas likely to contribute to or cause CSO.
- Increase capacity or separate the municipal and storm sewers in frequently overwhelmed areas.
- Add capacity to wastewater treatment plant holding ponds, especially if new developments are being built with a CSS.
- Implement new development, and retrofit existing development with numerous infiltration-based BMPs (e.g. vegetate swales, infiltration basins) to accommodate all flows, even those during storms.
- Institute and enforce programs such as stenciling storm sewers, outreach to identified problem areas and neighborhoods, etc. to reduce and prevent the release of contaminants into EFH.

16.5. Industrial Discharge Facilities

The potential adverse effects on EFH from industrial discharge facilities includes the release of contaminants.

Potential Conservation Measures for Industrial Discharge Facilities

General guidelines

- Do not site discharge points near shellfish beds, submerged aquatic vegetation, reefs, fish spawning grounds, and similar fragile and productive EFH.
- Determine pre-development benthic productivity by sampling the benthos prior to any construction activity related to installation of new or modified facilities. Implement BMPs to maintain habitat quality during construction. Include seasonal restrictions on development or maintenance activities, use cofferdams, and conduct work at low tide to reduce impacts to EFH. Seasonal restrictions during construction and maintenance operations will help avoid impacts to EFH during species' critical life history stages (e.g., spawning and egg development periods). Seasonal work windows must be based on documented, accurate periodicity of species of concern.

Release of contaminants

- Improve wastewater treatment systems to minimize contaminant discharge.
- Improve water use efficiency at the facility to generate less wastewater.
- Develop appropriate modeling studies for plume effects and other parameters of concern in cooperation with resource agencies before finalizing outfall design. Recommendations that involve agencies and developed as a consequence of the study results must be incorporated in the construction plans and operation plan for these facilities as enforceable permit conditions.
- Ensure that maximum permissible discharges are appropriate for the given project setting and specify any and all operational procedures, performance standards, and BMPs that must be observed to address all reasonably foreseeable contingencies over the life of the project.
- Develop an adaptive management plan. Plans must include representatives from appropriate agencies, as they will participate in future consultations for administering the management plan. The management plan must include monitoring protocols designed to measure discharge and potential impacts to EFH.
- Install diffusers on outlets to maximize the rate of dispersion and dilution.
- Use the most effective technology to treat discharge. Implement measures that reduce discharge of biocides and other toxic substances.
- Mitigate the ecological damage arising from outfall maintenance activities.
- If biocides must be used, they must be specifically designed for their intended use, they must be applied as directed by the manufacturer, and the minimal effective dose must not be exceeded.
- Use land treatment and upland disposal or storage for any sludge or other remaining wastes after wastewater processing is concluded. Use of vegetated wetlands as biofilters and pollutant assimilators for large-scale discharges should be limited only to circumstances where other less damaging alternatives are not available, and the overall environmental impacts to EFH of such an action has been evaluated and vetted by appropriate agency personnel.
- Do not locate pipelines and treatment facilities in or near wetlands and streams.
- Do not site discharges near eroding waterfronts or where receiving waters cannot assimilate the amount of anticipated discharge.
- The design capacity for all facilities must satisfy present and foreseeable needs, and best available technologies must be implemented to reduce impacts to EFH.

17. Pile Driving and Removal

17.1. Pile Driving

The potential adverse effects on EFH from pile driving are primarily limited to underwater noise.

Potential Conservation Measures for Pile Driving

Noise

- When possible, avoid driving piles when MSA-managed species are most abundant, especially the younger life stages and spawning adults.
- Avoid driving piles with an impact hammer when possible. Alternatives include vibratory hammers or press-in pile drivers. Limit impact driving to the minimum necessary for proofing the piles.
- In cases where an impact hammer must be used, drive the piles as far as possible with a vibratory or other method that produces lower levels of sound before using an impact hammer.
- Select piles that are made of alternate materials that produce less-harmful sounds than those from hollow steel piles, such as concrete or untreated wood instead of steel.
- When driving piles in intertidal or shallow subtidal areas, do so during periods of low tide. Sound does not propagate as well in shallow water as it does in deep water.
- Implement measures to attenuate the sound. Such measures include the use of a bubble curtain, dewatered pile sleeve or coffer dam or use mandrel-driven piles. Monitor the sound levels during pile driving to ensure that the attenuation measures are functioning as expected.
- Where tidal currents can be strong, drive the piles when the current is reduced (i.e., centered on slack current) to minimize the number of fish exposed to adverse levels of underwater sound. Strong currents can bring more fish into close proximity to the pile than would a weak current.
- Develop and carry out a plan to monitor the sound levels during pile driving to verify that the assumptions in the analysis were correct and to ensure that any attenuation device is properly functioning. A report on the hydroacoustic monitoring should be provided to NMFS according to the individual project requirements, but no later than 60 days after completion of the pile driving.

17.2. Pile Removal

The potential adverse effects on EFH from pile removal is primarily with sedimentation, siltation, and turbidity.

Potential Conservation Measures for Pile Removal

Sedimentation, siltation, turbidity

- Minimize the suspension of sediments and disturbance of the substrate when removing piles. Measures to help accomplish this include, but are not limited to, the following:
    - Remove piles with a vibratory hammer, rather than the direct pull or clamshell method.
    - Remove the pile slowly to allow sediment to slough off at, or near, the mudline.
    - Shake or vibrate the pile to break the bond between the sediment and pile. Doing so causes much of the sediment to slough off the pile at the mudline, thereby minimizing the amount of suspended sediment.
    - Place a ring of clean sand around the base of the pile. This ring will contain some of the sediment that would normally be suspended.

18. Underwater Explosions

The potential adverse effects on EFH from underwater explosions is the underwater blast wave.

Potential Conservation Measures for Underwater Explosions

Underwater Blast wave

- Evaluate the need to use explosives and use practical alternatives if they are available.
- Avoid times of the year when MSA-managed species are most abundant, especially the juveniles of these species.
- Do not conduct the activity where it could affect spawning adult salmon.
- Rather than use a single large charge, use a series of smaller charges that are separated by delays that are longer than the duration of the blast wave.
- Plan the blasting program to minimize the size of explosive charges per delay and the number of days that explosives are used.
- Surround the explosion with a bubble curtain or other sound attenuation device to minimize the extent of the habitat area where salmon could be injured.

19. Seismic surveys

The potential adverse effects on EFH from seismic surveys is limited to the underwater sound generated by seismic airguns.

Potential Conservation Measures for Seismic Surveys

Underwater Noise

- When possible, use seismic survey data that was collected from a previous survey in the same area of interest. Doing so would limit the number of times that MSA-managed species are exposed to these sounds.
- Avoid areas and times of year when MSA-managed are least abundant, especially the juveniles of these species.
- Avoid areas and times of year when the prey species for MSA-managed species are most abundant.
- When MSA-managed species are migrating through the area, provide sufficient breaks in the survey to allow transit through the area.
- Use marine vibroseis instead of airguns when possible.
- Use the least powerful airguns that will meet the needs of the survey.
- Survey the smallest area possible to meet the needs of the survey.

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