ESSENTIAL FISH HABITAT ASSESSMENT FOR COLUMBIA RIVER CHANNEL IMPROVEMENT PROJECT AND OCEAN DISPOSAL SITE DESIGNATION ACTION

Action Agency: US Army Corps of Engineers, Portland District.

Location: Channel Improvement Project- Columbia River from RM 3 to 106.5 and Willamette River from RM 0 to 11. Ocean Disposal Sites- Pacific Ocean off the Mouth of the Columbia River.

Project Name: Columbia River Channel Improvement Project and Ocean Dredged Material Disposal Site Designation Document.

Project Description: This integrated feasibility report and Environmental Impact Statement (EIS) documents the results of a feasibility study for proposed improvements to the authorized Columbia and lower Willamette River navigation channel in Oregon and Washington. The channel is currently authorized at a 40-foot depth and generally a 600-foot width. The project area for improvements covers 11.6 miles of the Willamette River below Portland, Oregon and 103.5 miles of the Columbia River, from river mile 3 to 106.5, below Vancouver, Washington. The Willamette portion has been deferred until its status as a Superfund site has been resolved. The impact area for project extends upriver to Bonneville Dam on the Columbia and to Willamette Falls on the Willamette.

The study was authorized by a resolution of the U.S. House of Representatives, Committee on Public Works and Transport, adopted August 3, 1989. The feasibility study was initiated in 1994 and is co-sponsored by the U.S. Army Corps of Engineers and six lower Columbia River ports: St. Helens, and Portland in Oregon and Longview, Kalama, Woodland and Vancouver in Washington. The Port of Portland serves as the overall coordinator for the sponsoring ports. The U.S. Environmental Protection Agency (EPA), Region 10 in Seattle, Washington, is a cooperating agency for this report. National Marine Fisheries Service staff participated throughout the study and in the EIS and the selection of the ocean disposal sites.

The purpose of the project is to improve the deep-draft transport of goods on the authorized navigational channel. The need for navigation improvements has been driven by the steady growth in waterborne commerce and the use of larger, more efficient vessels to transport bulk commodities. With the increase of deep-draft vessels, limitations posed by the existing channel dimensions now occur with greater frequency. By improving navigation, the opportunity to realize greater benefits would result from reducing transportation costs by allowing deep-draft vessels to carry more tonnage, and by reducing vessel delays.

The report also includes documentation in support of EPA designation of new ocean disposal sites for maintenance of the Mouth of the Columbia River project, the existing Columbia and Lower Willamette River navigation channel, and construction/maintenance of proposed channel improvements. These new sites are needed because existing sites were not as dispersive as originally thought and consequently have reached their capacities.

Planning constraints recognized that channel improvement alternatives were limited to a maximum of 3 feet of deepening by the study's authorizing legislation. The study authorization also directed that the Dredged Material Management Plan (1998) would serve as the no action alternative for the study. This plan evaluated the most efficient way to maintain the currently authorized 40-foot navigation channel in the future. Endangered Species Act consultation for the 40-foot channel has been completed and consultation is underway for the Channel Improvement Project.

Essential Fish Habitat Designations: Pursuant to the Magnuson-Stevens Fishery Conservation and Management Act and the 1996 Sustainable Fisheries Act an Essential Fish Habitat (EFH) consultation is necessary for the channel improvement project as well as the designation of the new sites. Essential fish habitat is defined by the Act in Section 3 (104-297) as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The Columbia River estuary and the Pacific Ocean off the mouth of the Columbia River are designated as EFH for various groundfish, coastal pelagic and salmon species (PFMC 1998a and 1998b). EFH for groundfish, coastal pelagic and salmon species and their life history stages that would be affected by the two actions are listed below.

A detailed discussion of EFH for groundfish is provided in the Final Environmental Assessment/Regulatory Impact Review for Amendment 11 to The Pacific Coast Groundfish Fishery Management Plan [Pacific Fisheries Management Council (PFMC) 1998] and the NMFS (June 15, 1998) Essential Fish Habitat for West Coast Groundfish Appendix. A detailed discussion of EFH for Coastal Pelagic species is provided in Amendment 8 to the Coastal Pelagic Species Fishery Management Plan (PFMC 1998). Salmon EFH is discussed in Appendix A of Amendment 14 to the Pacific Coast Salmon Plan (PFMC, 2000). Assessments of the impacts to these species' EFH from the channel improvement project and the designation of new ocean disposal sites.

Ground Fish Species	Egg	Larvae	Young Juvenile	Juvenile	Adult	Spawning
Spiny Dogfish			X	X	X	
Ratfish				X	X	
Lingcod		X		X	X	X
Cabezon		X				
Kelp Greenling		X				
Pacific Cod		X	X	X	X	X
Pacific Whiting (Hake)			X	X	X	
Sablefish		X	X	X	X	X
Jack Mackerel					X	
Darkblotched Rockfish				X	X	
Greenstriped Rockfish				X	X	
Thornyheads		X				
Pacific Ocean Perch				X	X	
Widow Rockfish			X	X		
Misc. Rockfish				X	X	
Arrowtooth Flounder				X	X	
Butter Sole	X	X				

Curlfin Sole	X					
Dover Sole	X			X	X	
English Sole	X	X	X	X	X	X
Flathead Sole		X		X	X	X
Pacific Sanddab				X	X	
Petrale Sole			X	X	X	
Rex Sole	X	X		X	X	
Sand Sole	X	X				
Starry Flounder	X	X	X			X

Coastal Pelagic Species	Egg	Larvae	Young Juvenile	Juvenile	Adult	Spawning
Northern anchovy	X	X		X	X	
Pacific sardine	X	X		X	X	
Pacific mackerel	X	X		X	X	
Jack mackerel					X	
Market squid	?	?	?		X	?

Salmon						
Coho salmon				X	X	
Chinook salmon			X	X	X	

Potential Effects of Dredging and Dredged Material Disposal on EFH: The Channel Improvement Project would affect EFH for groundfish, coastal pelagic and salmon species by altering channel and bottom habitat by dredging and disposal. Dredging and disposal would affect EFH in the following ways: changing bottom topography, removal or covering of benthic populations, creating a temporary increase in turbidity and reducing migratory habitat by disturbance. Alteration of bottom habitat is likely to effect populations of managed species by reducing food sources through the reduction in benthic invertebrate populations. Reduced food sources and increased turbidities may reduce feeding success and consequently the overall value of the habitat to the managed species. Reduction in migratory habitat may delay salmon migration timing, which can reduce survival of juveniles and success of adults in reaching upriver spawning areas.

In general dredging and disposal impacts to managed species, however, are expected to be minimal. The navigation channel bottom is not considered highly productive habitat because it is disturbed on a regular basis from dredging and ship traffic. The deeper channel is below the photic zone, which is considered the more productive zone in the river because of increased light penetration. In addition, the amount of habitat impacted in the channel areas is small compared to the total amount available for the managed species. Loss of migratory habitat will occur primarily as a result of disturbance created by dredging operations. This impact is not expected to be large since the dredge is only operating in a small portion of the total width of the river. In addition, hopper dredges only operate intermittently since once they are full they have to go to the disposal area to empty the hopper. During this time period disturbance would not be occurring from the dredge operations and any impact to fish migration that may be occurring would be minimal.

Several ecosystem restoration projects are proposed with the project. Two involve filling of areas

to bring the depth up to a level that would improve their value as juvenile salmon rearing habitat. Several of the other projects will open historic habitat for use by juvenile salmon. These actions are described in the FEIS/Feasibility Report.

Use of the ocean disposal sites will involve covering of existing benthic populations and the loss of them as a food supply to the managed species. In addition, the bottom topography and sediment type may be changed such that recovery after disposal events may be to a different benthic community than what was there prior to disposal. This in turn may change the value of the habitat to the managed species. This is dependent upon where the disposal site is located and whether the type of material disposed of is similar to the natural sediment at the site.

The new sites have been selected and sized so that it will not be necessary to find a new site and create further impacts to the EFH and the ocean environment. The sites have also been sized so they can be managed to minimize impacts. Consequently, designating these sites will reduce further cumulative impacts to the area offshore of the mouth of the Columbia River. Mitigation for the ocean disposal sites was done by avoiding unique areas of greater biological productivity and thereby minimizing impacts to the bottom habitat. A buffer zone was also established at the Deep Water site to prevent disposal material from occurring outside the site. Selection of the sites was done through an extensive coordination process with both federal and state agencies and private interest groups. In addition, both pre and post studies will be done to further characterize the sites and help in the management use of the site. The Corps and EPA are continuing to conduct post disposal studies and use this information for the management of the sites. This site selection process and task force are described in detail in Appendix H of the Final EIS.

Mitigation for dredging and disposal impacts are provided by the following measures that were incorporated into the project design to reduce impacts:

Dredging

1. Dredging will be done only in channel areas that are dredged on a regular basis and generally have a lower biological productivity than undisturbed areas.

2. Dredging in shallow areas will be done during recommended in-water work periods to minimize impacts to managed species habitat.

3. Dredging will be done principally with hydraulic dredges to reduce turbidity levels in the water column.

Disposal

1. Sediments have been tested and determined to be non-contaminated and suitable for in-water disposal.

2. Shallow water disposal has been greatly reduced by increasing upland disposal.

3. New upland disposal sites have a 300-foot setback from the river bank to prevent damage to critical habitat.

4. Deep water disposal sites in the river are being studied to determine fish use and habitat value. This information will be used to manage the sites to further reduce impacts.

5. Several ecosystem restoration projects have also been proposed in connection with the project. These projects will provide additional areas of EFH for some species. The ecosystem restoration projects are described in Chapter 8 in the Biological Assessment.

EFH Assessment: Channel Improvement Project: The Columbia River main navigation channel consists primarily of medium to fine grain sand. The bottom is relatively unstable consisting primarily of large sand waves that build and then collapse at irregular intervals as part of the sediment transport process. A detailed description of the physical properties of the navigation channel is given in Chapter 5, Section 5.1 of the Main Report of the EIS for the Channel Deepening Project.

Biological productivity of the channel is low because of low light penetration and an unstable bottom. Benthic sampling taken in the channel areas have shown benthic invertebrate densities a third less than in the areas less than 20-feet deep which are the more productive areas of the Columbia River. A detailed discussion of the biological productivity of the channel areas is given in Chapter 5, Section 5.2.4 of the main report of the EIS for the Channel Improvement Project.

Ground Fish EFH

The Columbia River navigation channel in the estuary is designated EFH for several species of flounder, the majority being starry flounder and English sole. Most occur primarily as different age juveniles that may use the channel as a migratory corridor to rearing areas in the bays and intertidal areas which have large concentrations of food organisms such as the amphipod *Corophium salmonis*. Less than one-year-old juveniles occur throughout the estuary but are more concentrated in the freshwater and low salinity areas. They are generally not as abundant in the estuary as the older age classes. Age one to two year old juveniles occur throughout the estuary but are abundant year around in the side channels and bays and also in the main navigation channel. Two-year-old juveniles are less widespread and occur mostly in the portions of the estuary with higher salinity.

The Columbia River estuary provides EFH for less than one, one and one plus year old juvenile English sole. They use the estuary primarily as a feeding and nursery area occurring in the lower part of the estuary where salinity is high. Less than one year old juveniles occur mostly in the side channels and bays and are most abundant in the spring and summer when salinity is higher in these areas. One plus year old juveniles occur only in the lowest portion of the estuary where salinity is greatest. Juvenile English sole are primarily benthic feeders and occur principally in side channels

and bays where benthic productivity is high.

Deepening the Columbia River navigation channel by dredging will have a minimal adverse effect on EFH for the above groundfish species, since the main navigation channel is the least productive of the designated estuarine EFH complex and does not provide critical feeding or rearing areas for juveniles or adults. Alteration of physical dynamics of the estuary by deepening is only expected to have a small impact and will not effect groundfish species' use of the area.

Coastal Pelagic EFH

The water column of the Columbia River navigation channel is designated EFH for the northern anchovy. Anchovies that occur in the estuary are an extension of the coastal population and occur primarily in the lower estuary where salinity is high. They spawn in the ocean, but all life history stages can occur in the estuary with the eggs and larvae apparently swept into the estuary by flood tides. Individuals less than one year old, however, are not abundant in the estuary while anchovy one year or older can be abundant particularly during low river flow periods when salinity is higher. Anchovies are pelagic feeders feeding primarily on copepods. Deepening the Columbia River by dredging is expected to have minimal impact on turbidity levels in the water column or coastal pelagic EFH.

Salmon EFH

The Columbia River navigation channel is designated EFH for both chinook and coho salmon. Both species occur in the channel area as juvenile and adult stages when they use the channel as a migratory corridor out to and in from the ocean. Juvenile chinook and coho use the shallow water portion of the estuary for rearing and acclimating to salt water, stream type juvenile (spring and summer) populations rear in upstream tributaries. Young salmonids consume a variety of prey, primarily insects in the spring and fall and *Daphnia* from July to October, which occur primarily in the shallow water areas and to a lesser extent in the channel. The Columbia River Channel Improvement Project along with the designation of new and existing ocean disposal sites have the potential to impact both rearing and migration EFH.

Vibration and noise from dredging operations may displace or otherwise harass both adult and juvenile salmon during their migration. The extent of this potential impact cannot be quantified, however, the depth and length of areas being dredged is small relative to the cross section of the river.

Temporary increases in suspended sediment and resultant turbidity from dredging and disposal operations may also impact salmon migration habitat. An increase in suspended sediment will generally be limited to the navigational channel during the time dredging is taking place and to the area around disposal sites during disposal operations. The Columbia River navigation channel consists primarily of medium and fine grain sand that quickly settles out of suspension with little or no fines or silts. No quantification of the potential impacts is established, but sedimentation will have greater effects in smaller, shallow channels since migrating fish will have less room to

avoid it.

Impacts to salmon rearing habitat may also result from dredging and disposal operations but are expected to be low. The dredged navigational channel and new and existing disposal sites are normally not productive rearing habitat for salmon since they are dredged or used for disposal on a regular basis, and contain little production of benthic invertebrate populations, which juvenile salmon feed upon. As a result, it is unlikely that continued dredging and disposal in these areas will have a significant impact on chinook or coho salmon EFH.

Construction of the Miller Sands/Pillar Rock and Lois/Mott Island sites will result in impacts to existing salmon EFH. Both Miller/Pillar and Lois/Mott sites provide some rearing area though it is extremely limited. The restoration projects are intended to provide additional juvenile salmon rearing habitat. Consequently, these actions could increase EFH. Opening of the historic habitat will increase available EFH.

EFH Assessment: Ocean Disposal Site Use: The physical characteristics of the Shallow Water site and the Deep Water site are described and detailed in Appendix H, Volume 1 and 2 of the Final EIS for the Channel Improvement Project. The Shallow Water site encompasses both the existing smaller designated Site E and the Section 103 expanded Site E. It is located off the end of the North Jetty and is approximately 2 miles long and from 1,000 to 3,600 feet wide covering an area of 670 acres. Water depths range from 40 to 70 feet and it is primarily medium to fine grain and very fine grain sand. The site is considered to be erosive with an unstable bottom. No benthic samples have been collected in this site, but benthic productivity is considered to be low because of the erosive nature of the site.

The Deep Water site is located about 4.5 miles west of the entrance to the Columbia River and extends westerly to about 7 miles. The site varies in depth from 200-300 feet with a bottom topography that is featureless and gently slopes away from shore. Overall site dimensions including a 3000 feet buffer zone, are 17,000 x 23,000 feet. Disposal will occur only in the inner 11,000 x 17,000 rectangle and not in the buffer area. Sediment type is very fine-grained sand and the bottom is generally very stable except under extreme wave conditions.

Benthic populations have been sampled in the Deep Water site and the area is considered to be moderate to highly productive averaging between 8,000 to 10,000 organisms per meter squared in Oct/Nov 1995 and from 5,000 to 8,000 in June of 1996. A detailed discussion of the benthic productivity of this site is given in Appendix H, Volume 1, Exhibit A.

Ground Fish EFH

The Shallow Water and proposed Deep Water sites are designated EFH for the groundfish species listed in Table 1. However, the Shallow Water site does not provide productive habitat for any of the groundfish species because of the low benthic productivity, unstable bottom and high current and wave action in this area. Some of the groundfish species may occur in the area because of its proximity to the north jetty. The deep-water site provides EFH for some of the groundfish listed.

Spiny Dogfish- EFH for young juvenile, juvenile and adult spiny dogfish has the potential to be impacted by ocean disposal. Spiny dogfish are inner shelf-mesobenthal species that occur at depths from 0-900m, but most occur in depths less than 350m. Adult females move inshore to shallow waters in the spring to release their young. Young juveniles are neritic while juveniles and adults are sublittorial bathyal. Juveniles occur principally on mud bottoms when not in the water column while adults can occur from the intertidal to great depths. Based on the above description of habitat requirements for spiny dogfish, the Deep Water site does not provide any unique habitat that is not available elsewhere and is only a small proportion of the total areal extent of the EFH described by NMFS (1998). Therefore, impact to the total EFH for this species is anticipated to be minimal.

Ratfish- EFH for juvenile and adult ratfish has the potential to be impacted by the ocean disposal sites. Ratfish are a middle shelf mesobenthal species that occur in depths from 0 to 913m. They are most abundant, however in depths from 100-150m. They also occur in the estuarine EFH complex during the winter and early spring to feed and mate. Ratfish are, however, generally a deep water species that prefer low relief rocky bottoms or exposed gravel or cobble. They are not common over sand or boulders. Based on the above description of Ratfish habitat requirements the Deep Water site does not provide any unique habitat that is not available elsewhere and it is only a small proportion of the total areal extent of the EFH described by NMFS (1998). Therefore, impact to the total EFH for this species is anticipated to be minimal.

Lingcod- EFH for spawning, larval, juvenile and adult lingcod has the potential to be impacted by the ocean disposal sites. Lingcod are an estuarine-mesobenthal species that occurs in depths from 0 to 475m. Spawning occurs in 3-10m below mean lower low water over rocky reefs in areas of swift currents. Larvae occur in nearshore areas from winter to late spring. Larger larvae are epipelagic primarily found in the upper three meters of the water column. Juveniles settle in estuaries and shallow waters along the coast while older juveniles move offshore as they grow but are most common in waters greater than 150m. Adults prefer slopes of submerged banks 10-70m below the surface with sea weeds, kelp and eelgrass beds that form feeding grounds for small prey fish. They also prefer channels in rocky intertidal areas with swift currents that concentrate plankton and plankton feeding fish. Based on the habitat requirements for Lingcod, the Deep Water site does not provide any unique habitat that is not available elsewhere and in only a small proportion of the total areal extent of the EFH described by NMFS (1998). Therefore, impact to the total EFH for this species is anticipated to be minimal.

Cabezon and Kelp Greenling- EFH for larval cabezon and kelp greenling has the potential to be impacted by ocean disposal. Both species are abundant all year in estuarine and subtidal areas. Larval and young juvenile cabezon and kelp greenling are pelagic and have been found offshore as far as 322 km. Juveniles settle to the bottom and are found primarily in the shallow water bays and estuaries. Both of the disposal sites would provide minimal habitat for larval stage cabezon and kelp greenling. Impacts to these species from using the sites are expected to be minimal.

Pacific Cod- EFH for larval, young juvenile, juvenile, adult and spawning of Pacific cod has the

potential to be impacted by ocean disposal. Pacific cod are a member of the inner shelf-mesobenthal community. The majority of Pacific cod are found at depths between 50-300m with spawning occurring at depths from 40-265m. The eggs are demersal, adhesive and are found sublittorally. Larvae and small juveniles are pelagic, with the highest abundance in the upper 15 to 30m of the water column. Larvae are found over the continental shelf from winter through summer. Small juveniles occur from 60 –150m gradually moving to deeper water with increased age. Larger juveniles and adults are parademersal occurring over mud, sand and clay and occasionally coarse sand and gravel bottoms. Based on the above habitat descriptions for Pacific cod, it is possible that disposal at the Deeper Water site could have an impact on habitat used by some life stages of Pacific cod. Based on the habitat requirements described above for Pacific cod, the Deep Water site does not provide any unique habitat that is not available elsewhere and is only a small proportion of the total areal extent of the EFH described by NMFS (1998). Therefore, impact to the total EFH for this species is anticipated to be minimal.

Pacific Whiting (Hake)- EFH for young juvenile, juvenile and adult Pacific whiting has the potential to be impacted by disposal at the deep water sites. Pacific hake is a migratory species that inhabits the continental slope and shelf from Baja California to British Columbia. Juvenile hake usually reside in shallow coastal waters, bays and estuaries with adults occurring further offshore, usually between depths of 50- 500m. Along the Pacific Coast from British Columbia to California adults use a narrow band of feeding habitat near the shelf break for 6-8 months per year. Based on the habitat requirements described above for Pacific whiting, the Deep Water site does not provide any unique habitat that is not available elsewhere and is only a small proportion of the total areal extent of the EFH described by NMFS (1998). Therefore, impact to the total EFH for this species is anticipated to be minimal.

Sablefish- EFH for larval, young juvenile, juvenile, adult and spawning of sablefish has the potential to be impacted by disposal at the Deep Water site. Sablefish are an inner shelf-bathybenthal species that occurs in deep water. Sablefish are most abundant from 200-1000m but have been reported to depths of 1900m. Spawning occurs at depths greater than 300m. Larvae and young juveniles are pelagic and may move inshore and remain there for up to four years to rear. Older juveniles and adults inhabit progressively deeper water and are benthopelagic on soft bottoms. Based on the habitat requirements described above for sablefish, the Deep Water site does not provide any unique habitat that is not available elsewhere and is only a small proportion of the total areal extent of the EFH described by NMFS (1998). Therefore, impact to the total EFH for this species is anticipated to be minimal.

Jack mackerel- EFH for adult jack mackerel has been identified as having the potential to be impacted by disposal at the Deep Water site. Adults occur in neritic and oceanic areas to depths as great as 402m. They are relatively uncommon below 75m. Since jack mackerel are pelagic and show no affinity to any type of bottom substrate, it is not expected that disposal at the deeper water sites would have any affect on jack mackerel EFH.

Rockfish species, Darkblotched, Greenstriped and Misc. Rockfish- EFH for juveniles and adults of these species have the potential to be impacted by disposal at the Deep Water site. These

species are primarily mid- to deep water species. The inshore depth range of adults and juveniles of these species overlaps, to some extent, the depth of the deep water disposal site. Based on the habitat requirements described above for rockfish species, the Deep Water site does not provide any unique habitat that is not available elsewhere and is only a small proportion of the total areal extent of the EFH described by NMFS (1998). Therefore, impact to the total EFH for this species is anticipated to be minimal.

Thornyheads- EFH of larvae of the thornyhead has the potential to be effected by disposal in the Deep Water site. Thornyheads are deep water species occurring in depths from 400-1400m. Larvae and small juveniles are pelagic for 18-20 months before settling to the bottom. During this time they may occur at the outer edge of the deep water sites. Based on the habitat requirements described above for thornyhead, the Deep Water site does not provide any unique habitat that is not available elsewhere and is only a small proportion of the total areal extent of the EFH described by NMFS (1998). Therefore, impact to the total EFH for this species is anticipated to be minimal.

Pacific Ocean Perch- Pacific Ocean Perch is a deep water species that does not occur to any extent in the area of the Deep Water Disposal site. Therefore there will be no impact to their habitat from the use of the Deep Water site.

Widow Rockfish- EFH of young juvenile and juvenile widow rock fish has the potential to be impacted by disposal in the Deep Water site. Both juvenile stages are pelagic. Young juveniles occur from near surface to 20m deep from the inshore out to 300km offshore. Juveniles occur near bottom inshore at depths of 9-37 meters. Off Oregon, widow rockfish are most abundant on the continental shelf. All life histories stages are associated with some type of bottom structure such as seamounts, rocks, and ridges near canyons and headlands. Based on the above habitat requirements for widow rockfish, and because the disposal sites are featureless and do not provide the preferred habitat complexity, no adverse impacts on widow rockfish EFH are anticipated.

Arrowtooth flounder- EFH for juvenile and adult arrowtooth flounder habitat has the potential to be impacted by ocean disposal. Juveniles and adults are sublittorial-bathyal and occur from depths of 18-900m. They prefer sand or sandy gravel bottoms. Arrowtooth flounder migrate from shallow water feeding areas in the summer to offshore spawning areas in the winter. Based on the habitat requirements described above for arrowtooth flounder, the Deep Water site does not provide any unique habitat that is not available elsewhere and is only a small proportion of the total areal extent of the EFH described by NMFS (1998). Therefore, impact to the total EFH for this species is anticipated to be minimal.

Butter Sole- EFH for eggs and larvae of the butter sole has the potential to be impacted by ocean disposal. Spawning takes place in coastal areas, within 18 km of the shore. They utilize the shallow waters to rear and then move offshore, as they grow larger. Based on the habitat requirements described above for butter sole, the Deep Water site does not provide any unique habitat that is not available elsewhere and is only a small proportion of the total areal extent of the EFH described by NMFS (1998). Therefore, impact to the total EFH for this species is anticipated

to be minimal.

Curlfin Sole- EFH for eggs of the curlfin sole has the potential to be impacted by ocean disposal. Curlfin sole are an inshore coastal species that occur on soft bottom. Little information is available on their habitat requirements but it is possible that their eggs could occur in the area of the disposal sites. Any adverse impact to the EFH for eggs will be minimal considering the eggs are pelagic.

Dover Sole- EFH for egg, juvenile and adults of the Dover sole has the potential to be impacted by ocean disposal. Dover sole are a dominant meso-benthal species in the North Pacific. They occur primarily in off shore waters at depths less than 500m. Eggs are epi-pelagic and may occur in the water column over the Deep Water site. Juvenile and adults are demersal and may occur in the disposal site during summer when they are inshore feeding. Based on the habitat requirements described above for Dover sole, the Deep Water site does not provide any unique feeding habitat that is not available elsewhere and is only a small proportion of the total areal extent of the EFH described by NMFS (1998). Therefore, impact to the total EFH for this species is anticipated to be minimal.

English Sole- EFH for all life history stages of the English sole has the potential to be impacted by ocean disposal. English sole are an inner shelf-mesobenthal species that occurs to depth of 55m. Adults spawn in inshore waters and the eggs and larvae are pelagic settling to the bottom as young juveniles. Juveniles rear in the inshore areas and in the bays and estuaries. As they grow older they move offshore. English sole are distributed throughout the inshore area on soft bottom habitat. Based on the habitat requirements described above for English sole, the Deep Water site does not provide habitat that is not available elsewhere and is only a small proportion of the total areal extent of the EFH described by NMFS (1998). Therefore, impact to the total EFH for this species is anticipated to be minimal.

Flathead Sole- EFH for spawning, larval, juvenile and adult flathead sole has the potential to be impacted by ocean disposal. Flathead sole are mesobenthic, occurring on the continental shelf to depths of 550m, but usually less than 366m. Spawning occurs at depths of 80 –140m. Eggs and larvae are generally buoyant in seawater. The juveniles settle to the bottom and rear in the inshore areas and bays and estuaries. Larger juveniles and adults are usually found further offshore on soft, silty or mud bottoms. Based on the habitat requirements described above for flathead sole, the Deep Water site does not provide any unique habitat that is not available elsewhere and is only a small proportion of the total areal extent of the EFH described by NMFS (1998). Therefore, impact to the total EFH for this species is anticipated to be minimal.

Pacific Sanddab- EFH for juvenile and adult pacific sanddab has the potential to be impacted by ocean disposal at the Deep Water site. Pacific sanddab is an inshore sublittorial species that occurs between 0 and 306m, but are most abundant off Oregon from 37- 90m. Juvenile pacific sanddab occur in shallow water coastal areas, bays and estuaries on silty sand bottoms. Adults are found further offshore on coarser sandy areas. Based on the habitat requirements described above for Pacific sanddab, the Deep Water site does not provide any unique habitat that is not available

elsewhere and is only a small proportion of the total areal extent of the EFH described by NMFS (1998). Therefore, impact to the total EFH for this species is anticipated to be minimal.

Petrale Sole- EFH for young juvenile, juvenile and adult Petrale sole has the potential to be impacted by ocean disposal. Petrale sole is an inner shelf-mesobenthal species that occurs at depths up to 460m. Juveniles and adults are demersal with young juveniles found at depths of 18-82m and larger juveniles at depths of 25-145m. Adults occur from the surf line to 550m but are most abundant at depths less than 300m on sand and sandy mud bottoms. Adults migrate seasonally from winter spawning grounds in deep water to summer feeding areas in shallow water. Based on the habitat requirements described above for Petrale sole, the Deep Water site does not provide any unique habitat that is not available elsewhere and is only a small proportion of the total areal extent of the EFH described by NMFS (1998). Therefore, impact to the total EFH for this species is anticipated to be minimal.

Rex Sole- EFH for egg, larvae, juvenile and adult for Rex sole have the potential to be impacted by ocean disposal. Rex sole is a middle shelf-mesobenthal species occurring at depths from 0 to 850m. It is one of the mostly widely distributed sole on the shelf and upper slope, occurring in a variety of depths and sediment types. Spawning occurs at depths from 100-300m. Larvae are pelagic and are widely distributed offshore with a peak of abundance at about 46km offshore. Rex sole settle to the bottom at the outer continental shelf and rear in the outer continental shelf. Intermediate sized Rex sole move inshore to depths of 55-150m. Adults are distributed throughout the depth range but are more abundant inshore in the summer when they are feeding. Based on the habitat requirements described above for Rex sole, the Deep Water site does not provide any unique habitat that is not available elsewhere and is only a small proportion of the total areal extent of the EFH described by NMFS (1998). Therefore, impact to the total EFH for this species is anticipated to be minimal.

Sand sole-EFH for egg and larvae of the sand sole will not be affected by ocean disposal at the Deep Water site. Sand sole eggs and larvae are pelagic and are generally found in the upper 10m of the water column at water depths greater than 200m which is deeper than the deep water site.

Starry Flounder- EFH of egg, larvae and young juvenile starry flounder have the potential to be impacted by dredged material disposal at the ocean sites. Eggs and larvae are epipelagic and occur near the surface over water 20-70m deep. Juveniles are demersal and occur in the estuaries or in the lower reaches of the major coastal rivers. Juveniles prefer sandy to muddy substrates and are found at depths less than 375m. Eggs and larvae may occur in the water column over the disposal sites and could be adversely impacted. Juveniles may occur on the bottom in the disposal areas and could also be adversely impacted. Based on the habitat requirements described above for starry flounder, the Deep Water site does not provide any unique habitat that is not available elsewhere and is only a small proportion of the total areal extent of the EFH described by NMFS (1998). Therefore, impact to the total EFH for this species is anticipated to be minimal.

Coastal Pelagic EFH

EFH for the all the coastal pelagic species life history stages is the water column except for the market squid, which spawns in specific spawning grounds on the bottom. Squid spawn year around at various locations. Eggs are fertilized as the females extrude them into egg capsules. The female then attaches the egg capsules to the bottom substrate. As spawning continues, mounds of capsules can cover an area of 100 square meters.

Some individuals may be present in the water column during disposal and there would be a potential for some impact from disposal material. Since the dredged material settles rapidly, however, it is unlikely the impact would be very significant. Disposal on squid spawning EFH could have a major effect on the reproductive success of the squid population, since it is unlikely that the eggs would survive. Squid spawning areas have been identified off the Oregon coast and none have been found in the vicinity of the disposal sites. In the event that squid spawning grounds are identified in this area, the site would have to be adjusted or a timing restriction placed on its use to reduce impacts.

Salmon EFH

EFH for chinook and coho salmon in the vicinity of the Deep Water site is used primarily as a migratory area for both adults and juveniles and as a rearing area for juveniles as they enter the ocean. Disposal at these sites is expected to have only minimal impact on migratory salmon since the disposal sites represent only a small portion of the overall area used by salmon for migration and rearing.

Conclusions: The following conclusions can be drawn from the above EFH assessment:

1. Deepening of the Columbia River navigational channel by dredging will have a minimal adverse effect on EFH for groundfish, coastal pelagic species and chinook and coho salmon since the main navigation channel is the least productive of the designated estuarine EFH and does not provide critical feeding or rearing areas for juveniles or adults. Alteration of the hydrologic regime by deepening the channel is also expected to be small and not effect its use as EFH.

2. As indicated above, there is a potential to impact EFH, as defined by NMFS, for some of the groundfish, coastal pelagic species and chinook and coho salmon, by use of the ocean disposal sites. The amount of the habitat impacted, however, is very small compared to the total EFH habitat identified for any of the species evaluated. In no case does the habitat provided by the disposal sites represent any unique distribution or is not available elsewhere. Because of the minimal impact of the total EFH available for a given species, it is unlikely that use of the ocean site will reduce the total designated EFH to the point that the population levels for any species evaluated will be significantly adversely affected.