NEW HAVEN HARBOR
CONNECTICUT
NAVIGATION IMPROVEMENT PROJECT

INTEGRATED FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT

APPENDIX H
ESSENTIAL FISH HABITAT ASSESSMENT

Essential Fish Habitat Assessment

New Haven Harbor

Navigation Improvement Project

New Haven, Connecticut

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ABBREVIATIONS AND ACRONYMS

A	adults
°C	degrees Celsius
cm	centimeter
District	U.S. Army Corps of Engineers, New York District DO
	dissolved oxygen
E	eggs
EFH	Essential Fish Habitat
EJ	early juveniles
F	fall
ft	feet
J	juveniles
L	larvae
LJ	late juveniles
m	meters
MAB	Mid-Atlantic Bight
MLW	Mean Low Water Mark
mm	millimeters
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act of 1976 NEFMC
	New England Fisheries Management Council
NGVD	National Geodetic Vertical Datum NMFS
	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration NOS
	National Ocean Services
ppt	parts per thousand
S	summer
SNE	southern New England
Sp	spring
TL	total length
W	winter
YOY	young-of-the-year

1.0 Introduction

In accordance with the Magnuson-Stevens Fishery Conservation and Management Act, this assessment identifies the potential impacts of the United States Army Corps of Engineers (USACE), New England District's (District), proposed New Haven Harbor navigation improvement project on essential fish habitat (EFH) in the cities of New Haven and West Haven, New Haven County, Connecticut. The Magnuson-Stevens Act as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267) set forth a number of new mandates for the National Marine Fisheries Service (NMFS), regional fishery management councils, and other federal agencies to identify and protect important marine and anadromous fish habitat.

EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The regulations further clarify EFH by defining "waters" to include aquatic areas that are used by fish (either currently or historically) and their associated physical, chemical, and biological properties; "substrate" to include sediment, hard bottom, and structures underlying the water; and, areas used for "spawning, breeding, feeding, and growth to maturity" to cover a species' full life cycle.

2.0 Project Description

The existing New Haven Harbor Federal Navigation Project (FNP) is shown in Figure 1. Navigation features of the existing Federal Navigation Project include:

- A main ship channel, -35 feet MLLW, extending about 5 miles from deep water in Long Island Sound to the head of the harbor at the mouth of the Quinnipiac River, varying in width from 500 feet (outer-harbor) to 400 feet (inner-harbor), and widened to 800 feet along the upper harbor terminals to provide a maneuvering area;
- A turning basin in the upper harbor west of the channel also at -35 feet MLLW;
- Two anchorages west of the main channel, at -15 and -16 feet MLLW;
- The Quinnipiac River Channel, at -18 feet MLLW (lower channel) and -16 feet MLLW (upper channel), and generally 200 feet wide;
- The Mill River Channel, at -12 feet MLLW, 200 feet wide, including two branches (east branch at 100 ft. wide, and west branch at 125 feet wide);
- The West River channel authorized at -12-feet MLLW, 100 to 150 feet wide, with a -6 foot MLLW anchorage;
- A pile and stone T-dike at Stony Point west of the main channel, 4,200 feet long; and
- Three offshore stone breakwaters, totaling 12,100 feet in length providing a refuge in the outer harbor.

Due to inefficiencies in large vessels transiting the harbor, USACE is considering navigation improvement to the New Haven Harbor FNP. The tentatively selected plan (TSP) for the New Haven Harbor Navigation Improvement project is the 40 ft. Plan. The TSP consists of the following General Navigation Feature Improvements:

General Navigation Feature Improvements

- Deepen the channel, maneuvering area, and turning basin from - 35 to -40 feet, MLLW
- Widen the turning basin to the north 200 feet
- Widen the inner channel from 400 to 500 feet and the entrance channel from 500 to 600 feet entrance.
- Widen the bend at the East Breakwater from 560 to 800 feet

The improvement features are shown in Figure 2. The dredged material quantity estimate for the improvement dredging is shown in Table 1.

Table 1. TSP Dredged Material Quantity Estimates.

TSP (40-ft Plan)	Dredging Quantities (CY)		
	Cut	2-ft. Over depth	Total
Entrance Channel**	278,300	240,000	518,300
Bend (Ordinary Material)	475,300	161,300	636,600
Bend (Rock) (Required Cut to El 42)	24,900	18,600	43,500
Interior Channel	1,537,400	776,000	2,313,400
Maneuvering Area	377,700	274,600	652,300
Turning Basin	117,900	40,200	158,100
Total Improvement Dredging	**2,811,500**	**1,510,700**	**4,322,200**

Dredged Material Placement Sites Base Plan

The following sites will be used for the placement of dredged material from the improvement project. These sites meet the Federal Standard of least cost environmentally acceptable and also represent beneficial use of the dredged material. The sites are:

- Morris Cove and West River Borrow Pits
- Create Oyster Habitat south of east breakwater
- Rock placement at west Breakwater (rock reef)
- Cover historic disposal mounds at CLDS

Salt Marsh Creation Additional Opportunity for Beneficial Use Site

In addition to the above placement sites the opportunity to use some of the dredged material that would go to CLDS to create about 58 acres of salt march was identified. This salt marsh creation site represents an increase in cost over the less expensive option of bringing the material to CLDS. The Non-Federal Sponsors support the salt marsh creation site and are willing to share in the incremental cost above the base plan.

All potential in harbor disposal sites are shown in Figure 2. The CLDS is not shown.

Figure 1. New Haven Harbor Federal Navigation Project.

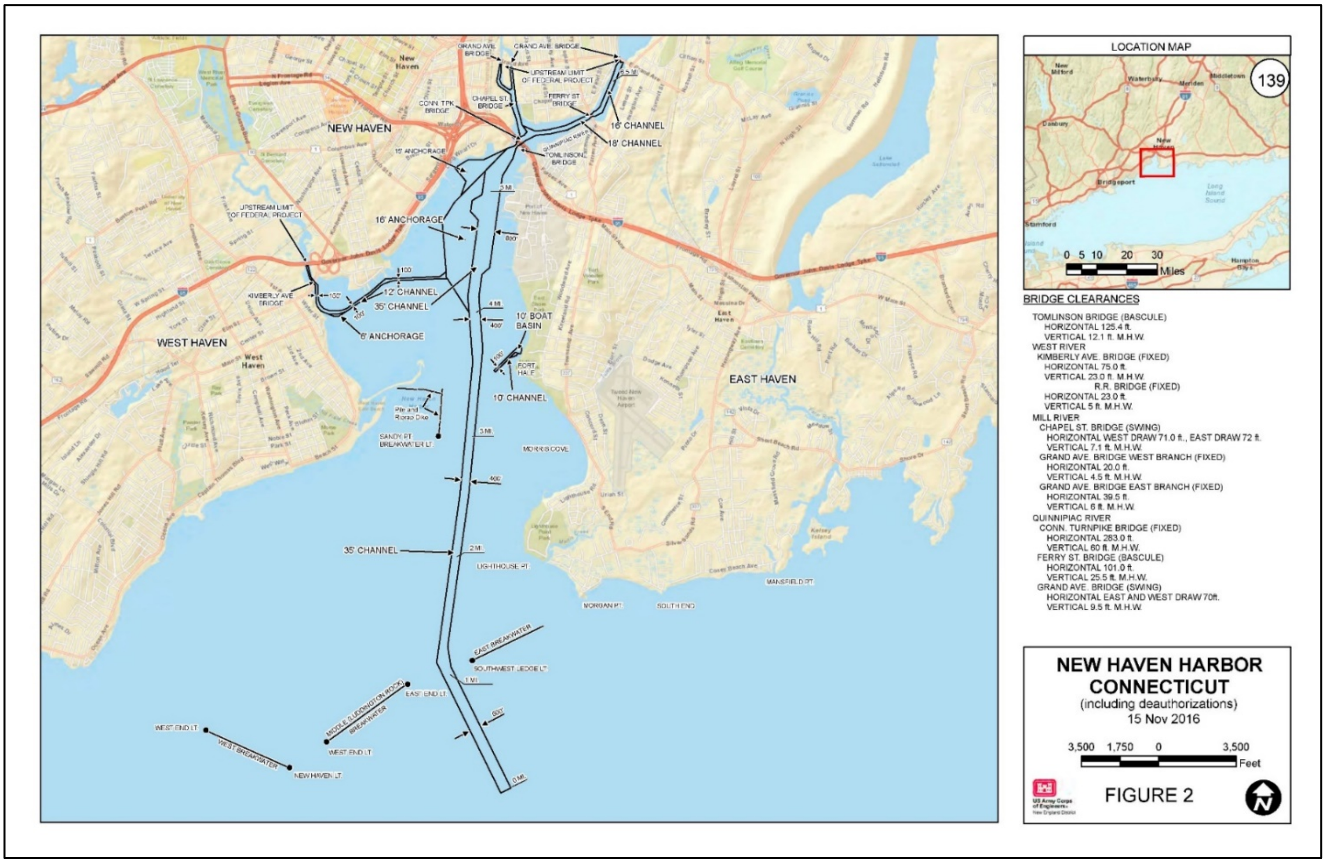
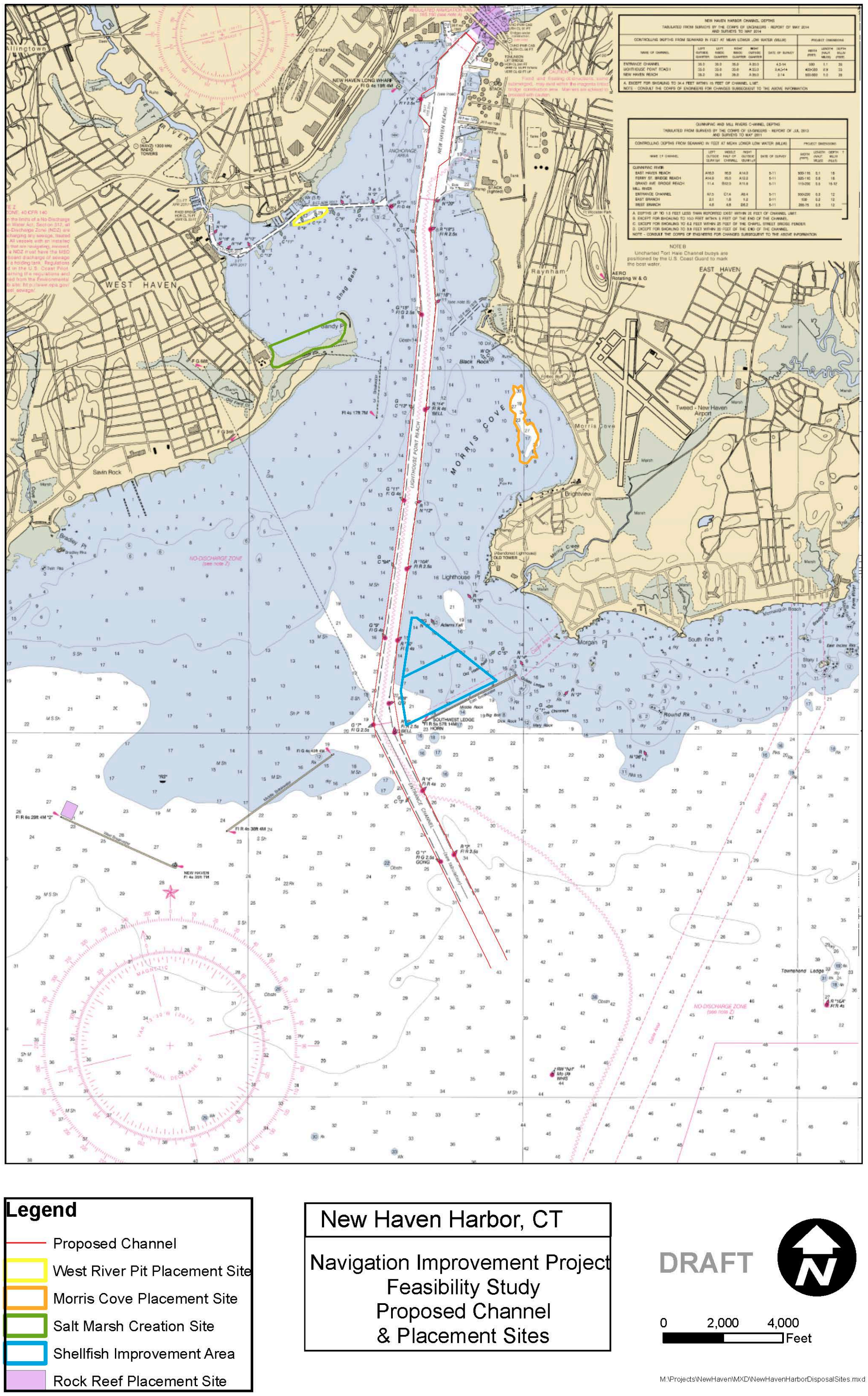


Figure 2. Navigation Improvement Features and Placement Site Locations.



3.0 Existing Environment

3.1 Physical Setting

The dredging and placement site locations (with the exception of portions of the Sandy Point marsh creation area) are estuarine subtidal bottoms, the majority of which are comprised of predominately silty material. A portion of the Sandy Point marsh creation area is silty and sandy intertidal bottom. Chapters 2 and 3 of the New Haven Harbor Navigation Improvement Project Environmental Impact Statement detail the existing environment of the proposed dredging areas as well as the placement areas.

The Long Island Sound estuary is unique in that it is open to the ocean at both ends (through Block Island Sound to the east and the lower Hudson River estuary to the west) and most of its fresh water input is located at the higher salinity eastern end (through the Connecticut and Thames River). Salinity at the western boundary of the Sound ranges from around 22 ppt in the spring to 27 ppt in the fall, increasing eastward to 30 to 31 ppt at the western end of the Sound. The project area is located approximately at the mid-point of the geographic range. Salinity in the project area and vicinity has been recorded at approximately 27.5 ppt in the spring. Thermal stratification in the Sound develops in the spring and breaks down in the fall. The surface temperatures in the open Sound range from 2 to 5°C in the winter and from 20 to 25°C in late summer.

New Haven Harbor experiences semi-diurnal tides. NOAA installed a tide gage (Station 8465705) in August of 1999. The mean tide range in the Harbor is 6.14 feet and the diurnal range is 6.7 feet. Table 2 below summarizes the tidal datums for New Haven at Station 8465705.

Table 2. New Haven Harbor Tide Range – NOAA Station 8465705

Condition	Elevation (feet, MLLW)	Elevation (feet, NAVD88*)
Mean Spring High Water (MSHW)	7.22	3.60
Mean Higher High Water (MHHW)	6.71	3.09
Mean High Water (MHW)	6.39	2.77
NAVD88	3.62	0.00
Mean Sea Level (MSL)	3.32	-0.30
Mean Tide Level (MTL)	3.32	-0.30
Mean Low Water (MLW)	0.24	-3.38
Mean Lower Low Water	0.00	-3.62

***North American Vertical Datum of 1988**

4.0 Essential Fish Habitat

4.1 Designated Species

New Haven Harbor and the Federal Navigation Project have the potential to provide habitat for fish species in the area. Per EFH source documents (NEFMC/NMFS, 2017), Table 3 denotes the federally managed species and their associated life stages that have EFH within the project area.

Table 3. Federally managed species and their associated life stages that have EFH within the project area.

Common Name	Scientific Name	Life Stages with EFH in Project Area
pollock	*Pollachius virens*	juveniles, adults
windowpane flounder	*Scopthalmus aquosus*	eggs, larvae, juveniles, adults
winter flounder	*Pseudopleuronectes americanus*	eggs, larvae, juveniles, adults
silver hake	*Merluccius bilinearis*	eggs, larvae, juveniles, adults
red hake	*Urophysis chuss*	eggs, larvae, juveniles, adults
little skate	*Leucoraja erinacea*	juveniles, adults
winter skate	*Leucoraja ocellata*	juveniles, adults
Atlantic sea herring	*Clupea harengus*	juveniles, adults

4.2 Individual Species Assessments

Atlantic Herring (*Clupea harengus*): Juveniles and Adults

Life History Information: Adult Atlantic sea herring migrate south into southern New England and mid-Atlantic shelf waters in the winter after spawning in the Gulf of Maine, on Georges Bank, and Nantucket Shoals. Juveniles and young of the year are abundant in LIS during the fall at depths of 30-60 m and preferred salinities of 30-32 ppt.

Occurrence in Project Area and Impacts: Juvenile and adult Atlantic herring are not expected to be within the project area in great numbers as their preferable depths are deeper than those found within the project areas and their preferred salinities area higher. Also these fish area highly mobile filter feeders and not closely associated with the benthos where potential impacts would be greatest. Constructing the proposed project is not expected to significantly impact this species.

Pollock (*Pollachius virens*): Juveniles and Adults

Pollock are not commonly caught in the surveys of LIS. In surveys conducted by the Connecticut Fisheries Division from 1984-2014 throughout LIS, only 68 adults were caught. Generally, juvenile pollock have been reported over a wide variety of substrates including sand, mud, or rocky bottom and vegetation and prefer salinities of 29-32 ppt, temperatures from 0-16 ºC and depths of ranging from 5-150 m. Inshore subtidal and intertidal zones serve as an important nursery area for age 0 - 1 juveniles while juveniles aged 2+ move offshore, inhabiting depths of 130-150 m.

Adults exhibited little preference for bottom types and were found at salinities 31-34 ppt, temperatures of 0-14 ºC and depths ranging from 35-36 m. Adults tend to inhabit deeper waters in spring and summer than in winter and are found further offshore than juveniles.

Occurrence in Project Area and Impacts: The possibility exists that the juvenile life stage of this species may occur within the project area but would not be expected to occur in significant numbers within the project area due to preferred higher salinities. However, because pollock is a benthic species, juveniles might be susceptible to project impacts such as direct mortality during dredging, and turbidity and burial of prey species during material placement.

Because of the Pollock's mobility, impacts to adults are not expected to be common as pollock can feed at other nearby locations. Pollock are not expected to be common in the project area and therefore, significant short term or long term adverse impacts to this species are not expected from project implementation.

Red Hake (*Urophycis chuss*): All Life Stages

Life History Information: This species spawns along the continental shelf off southern New England and eastern Long Island. Larvae dominate the summer ichthyoplankton in the Mid Atlantic Bight and are most abundant on the mid-and outer continental shelf. Eggs and larvae are pelagic with demersal settlement beginning in the juvenile stage generally occurring in the fall. Juveniles seek shelter and commonly associate with scallops, surf clam shells, and seabed depressions. Juveniles were found in LIS in the spring although they were most abundant during the summer. Their preferred substrate was mud, water depths ranged between 5- 50 m, salinities were between 24-32 ppt, and temperatures between 2-22 ºC.

Adults were generally found in abundance within the Sound from spring to fall in water depths greater than 25 m, salinities between 20-33 ppt, and on mud substrates. Both juveniles and adults make offshore migrations during the winter months.

Occurrence in Project Area and Impacts: Eggs and larval red hake are not expected to be impacted by the proposed dredging or placement alternatives. Juvenile and adult red hake could be in the project area but would not be expected to be present in significant numbers. The depth and structure of the bottom habitat in the project area is not preferred by red hake, a demersal fish which spends most of its time on or very close to the bottom in association with scallops, surf clam shells, or seabed depressions. There would be temporary increases in turbidity at the project site which would be expected to displace individuals of this species at the various project sites if juveniles and adults were present. Insignificant short term impacts may occur. The deepening of the New Haven Harbor channel and the creation of oyster habitat may benefit juvenile and adult hake by creating a more preferred bottom habitat (i.e., deeper and more complex). Therefore, no more than short-term impacts to red hake and their associated EFH are expected.

Silver Hake (*Merluccius bilinearis*): All Life Stages

Life History Information: Silver hake are a demersal fish that occur in the Atlantic Ocean from Newfoundland to Cape Fear, North Carolina. This species is most abundant from Nova Scotia to New Jersey. Adult silver hake spawn from May through October with peaks in August. Silver hake feed primarily on fish, crustaceans, and squid. This species makes seasonal migrations from the continental slope during the fall and winter to near-shore waters during the spring and summer. Silver hake have been found on most substrates (gravel to fine silt and clay) but are more common on silt and clay substrates. Silver hake occur in all areas of Long Island Sound but are more abundant during the spring (Lock and Packer 2004).

Occurrence in Project Area and Impacts: Eggs and larval silver hake are not expected to be impacted by the proposed dredging or placement alternatives. Juvenile and adult red hake could be present in the project area as New Haven Harbor contains mainly fine sediments throughout the harbor. There will be temporary increases in turbidity at the project site which would be expected to displace individuals of this species at the various project locations if juveniles and adults are present. However, the mobility of this species should allow for the majority of juveniles and adults to avoid construction areas. Long term impacts will include a loss of approximately 58 acres of intertidal and subtidal habitat (for the Sandy Point marsh creation alternative) as those areas will be converted to salt marsh habitat. This impact is not expected to significantly affect silver hake populations in LIS as the areas being converted to salt marsh are abundant throughout New Haven Harbor and LIS. Therefore, no significant impacts to silver hake and their EFH are expected due to the proposed project.

Windowpane (*Scophthalmus aquosus*): All Stages

Life History Information: This is a mid and inner-shelf species found primarily between Georges Bank and Cape Hatteras on fine sandy sediment. Spawning begins in February and March in inner shelf waters, and peaks in spring and autumn within the LIS. Spawning occurs in inner shelf waters, including many coastal bays and sounds, and on Georges Bank. In the Mid Atlantic Blight, eggs and larvae are planktonic, found in waters less than 70m deep from February- July and again in September- November.

Juveniles and adults are similarly distributed. They are found in most bays and estuaries south of Cape Cod throughout the year at a wide range of depths (1 to 110 m), bottom temperatures (3–12°C in the spring and 9–12°C in the fall), and salinities 15-33ppt. Juveniles that settle in shallow inshore waters move to deeper offshore waters as they grow. Adults occur primarily on sand substrates off Southern New England and Mid Atlantic Bight.

Bottom trawl surveys during the period 1992-1997 in Long Island Sound found that juvenile and adult windowpane were most abundant in spring (April-June). In spring, they were caught at bottom temperatures of 3-18 ºC and at salinities 21-31 ppt and depths less than 60 m. The distribution pattern in autumn (September-November) was similar to the pattern in the spring, but abundance was reduced. In autumn, windowpane adults were caught at bottom temperatures of 8-23 ºC, salinities of 18-32 ppt and depths less than 50m.

Occurrence in Project Area and Impacts: All life history stages may occur within the project area. If spawning does occur around the project area there is a low potential for adverse impacts to early life history stages as both larvae and eggs tend to occur closer to the surface than to the bottom. Construction activities that result in a temporary increase in turbidity may have an adverse impact on the windowpane because of this species' dependence on sight for foraging. This adverse effect is expected to be short term and localized. It is expected that juvenile and adults will avoid highly turbid conditions. Long term impacts will include a loss of approximately 58 acres of intertidal and subtidal habitat (for the Sandy Point marsh creation alternative) as those areas will be converted to salt marsh habitat. This impact is not expected to significantly affect windowpane populations in LIS as the areas being converted to salt marsh are abundant throughout New Haven

Harbor and LIS. Therefore, no significant impacts to windowpane flounder and their EFH are expected due to the proposed project.

<u>Winter Flounder (*Pseudopleuronectes americanus*): All Stages</u>

<u>Life History Information</u>: Winter flounder spawning occurs from mid-winter through early spring, peaking south of Cape Cod in February and March at depths of less than 5 m – 45 m. Eggs are found inshore in depths of .3–4.5 m and salinities ranging from 10–30 ppt. Eggs are adhesive and demersal and are deposited on a variety of substrates, but sand is the most common; they have been found attached to vegetation and on mud and gravel. Larvae are negatively buoyant and non-dispersive; they sink when they stop swimming. Thus, recently settled young of year (YOY) juveniles are found close to spawning grounds and in high concentrations in depositional areas with low current speeds.

YOY juveniles migrate very little in the first summer, move to deeper water in the fall, and remain in deeper cooler water for much of the year. Habitat utilization by YOY is not consistent across habitat types and is highly variable among systems and from year to year. Several field and lab studies suggest a "preference" for muddy/fine sediment substrates where they are most likely to have been deposited by currents. Adult winter flounder utilize a variety of substrates and prefer temperatures of 12-15 ºC, and salinities above 22 ppt, although they have been shown to survive at salinities as low as 15 ppt. Mature adults are found in very shallow waters during the spawning season.

<u>Occurrence in Project Area and Impacts</u>: Winter flounder has EFH for all life stages in the project area. Winter flounder eggs are demersal and larvae are found near the bottom in shallow areas. Minimal levels of sedimentation can potentially have an adverse impact on early and/or critical life stages of fish as sediments have the potential to bury demersal eggs, while larvae may be trapped or buried by the sediments (Wilbur and Clarke, 2001). To protect these sensitive life stages (i.e., eggs and larvae) of winter flounder, dredging will only occur from October 1 to January 1 in areas within winter flounder essential fish habitat (i.e., shallower that 5 meters). Dredging will occur between October 1 and March 1 in areas outside of winter flounder essential fish habitat (i.e., deeper than 5 meters). Placement of material inside the New Haven Harbor breakwaters will occur from October 1 through January 1. Placement of material at CLDS will occur between October 1 and March 1.

Winter flounder spawn on various substrates and (within the proposed project area) in areas less than 5 meters deep. In order to quantify the proposed project's effects on the areal extent of winter flounder habitat that would be permanently affected, two specific calculations were made. The first, winter flounder habitat lost, was calculated by measuring subtidal areas that were at depths of 5 meters or shallower and were planned to be deepened by the proposed dredging efforts or filled by the creation of salt marsh. The second, winter flounder habitat gained, was calculated by measuring areas that were deeper than 5 meters (i.e., the borrow pits), but were planned to be filled to depths shallower than 5 meters deep. Table 4 below notes the values for each calculation. The net loss of winter flounder habitat, which is due in large part to the creation of 58 acres of salt marsh (51.6 acres of which is flounder habitat), is approximately 3.2 acres.

Table 4. Losses and Gains of Winter Flounder Essential Fish Habitat in New Haven Harbor from the proposed project.

	Winter Flounder EFH lost (acres)	Winter Flounder EFH gained (acres)
Main Channel and Turning Basin	8.6	0.0
Morris Cove Borrow Pit	0.0	42.0
West River Borrow Pit	0.0	15.0
Sandy Point Marsh Creation	51.6	0.0
Shellfish Habitat Creation Area	0.0	0.0
Rock Placement Area	0.0	0.0
TOTALS	**60.2**	**57.0**

Little Skate (*Leucoraja erinacea*): Juveniles and Adults

Life History Information: This species ranges from Nova Scotia, Canada to Cape Hatteras. It is most abundant in the northern section of the Mid-Atlantic Bight (MAB) and on the northeastern part of Georges Bank. Little skate exhibit seasonal movements. Adult and juvenile little skate move inshore during spring and autumn, and offshore in mid to late summer, and midwinter. They also move north and south with seasonal temperature changes along the southern fringe of their range. They may leave some estuaries for deeper water during warmer months. Little skates are common on sandy or gravelly substrates, but may occur on mud as well. They tend to bury themselves in depressions during the day and become active at night. Data is unavailable about the specific spawning habits of little skate along the New York shoreline, but it is known that they spawn biannually; typically in October and May.

Trawl surveys conducted from 1984-1994 in LIS found both adults and juveniles in spring and fall on transitional and sand bottoms at depths less than 9 m. Their preferred summer and fall depths were less than 27 m.

Occurrence in Project Area and Impacts: Both juveniles and adult skates may occur within the project area during those periods in which they are expected to move inshore. As both life stages of this species are motile, during construction they can avoid the area during periods of disturbance. Additionally, the majority of New Haven Harbor bottom is predominately fine (silt) material and not a preferred habitat for little skate. No significant impacts to little skate and their associated EFH are expected due to the construction of the proposed project.

Winter Skate (*Leucoraja ocellata*): Juveniles and Adults

Life History Information: Winter skates are found over a wide range extending from southern New England and the Mid-Atlantic Bight (MAB) to North Carolina. They exhibit seasonal movements by moving offshore in the summer and nearshore in the autumn. Egg deposition of winter skate occurs during the summer and fall off Nova Scotia and the Gulf of Maine. It continues into the winter (December and January) off southern New England. The preferred substrate of this species is sand

and gravel bottoms although they have been documented in areas with mud bottoms. Winter skates are most active at nights and remain buried in depressions during the day. General depths at which they are found range from the shoreline to 111m. Adults are typically found in most abundance on sand bottoms of LIS during the spring. Trawl surveys conducted from 1984-1994 report juveniles most abundant during the spring on sand bottom in LIS. Abundance increased again in for both juveniles and adults in October and November in depths ranging from 0-9 m and then in depths greater than 18 m in April-May.

Occurrence in Project Area and Impacts: Both juveniles and adult skates may occur within the project area during those periods in which they are expected to move inshore. As both life stages of this species are motile, they can avoid the area during periods of disturbance due to construction by moving to adjacent non- disturbed areas. Long term impacts will include a loss of approximately 58 acres of intertidal and subtidal habitat (for the Sandy Point marsh creation alternative) as those areas will be converted to salt marsh habitat. This impact is not expected to significantly affect overall winter skate populations in LIS as the areas being converted to salt marsh are abundant throughout New Haven Harbor and LIS. Therefore, no significant impacts to winter skate and their associated EFH are expected due to the proposed project.

4.3 Prey Species

The abundance and/or distribution of prey species for fish which EFH has been designated, may be impacted from dredging and placement activities. Many of these fish feed on organisms that live in or on the sediment and have the potential to be buried by the direct material placement and/or by removal during the dredging process. However, following project completion, the majority of the substrate type at the dredging locations and placement locations will be similar to current conditions, thus recolonization by organisms from adjacent areas are expected to occur. Therefore, the majority of impacts to fish species using these areas for forage, would be expected to be temporary.

The area encompassing the Sandy Point marsh creation area will be converted from intertidal and subtidal estuarine environment into salt marsh. Therefore, subtidal prey species in these areas will be permanently removed.

5.0 Impact Assessments

The improvement dredging of the New Haven Harbor Federal Navigation Project and the associated placement of dredged material at various beneficial use sites are not anticipated to have significant effects or long-term lasting effects on the "spawning, breeding, feeding, or growth to maturity" of the majority of managed species that have EFH within the project area. Winter flounder will experience a net loss of approximately 3.2 acres of EFH, however this loss will allow for the creation of approximately 58 acres of salt marsh in New Haven Harbor.

The proposed activities will have immediate, short-term, direct and indirect impacts on EFH for some of the designated fish species and life history stages that occur in the immediate project area and vicinity. This section identifies direct and indirect effects that could result from the proposed project.

5.1 Direct and Indirect Impacts

Dredging and Disposal

The proposed project would impact fish species in the project area. Effects of the proposed project include possible death and injury of fish, interference with fish movements, disruption of the forage base, and changes in water quality during dredging operations. Direct removal of soft bottom habitats will occur in the dredging areas and direct covering of soft bottom habitats will occur in the placement areas. Impacts to water quality will occur, however they are anticipated to be short-term and localized to within hundreds of feet of the dredging and disposal efforts.

Intermittent, short-term impacts to fish also include disturbance of fish throughout the water column within the localized area during dredging and disposal efforts. Due to their mobility, most fish would be expected to move out of an active dredging area or a dredged material burial area. The sediment plume associated with dredging and the plume following material placement would also have potential short-term water quality impacts that may also have indirect impacts on fish by temporarily altering certain finfish behaviors, such as migration, spawning, foraging, schooling, and predator evasion (O'Connor, 1991). Increased turbidity has also been associated with potential gill abrasion and respiratory damage (Saila, et al. (1971); Wilber & Clark (2001)).

Sediment characteristics and the life stage of species affect how sensitive species are to suspended sediment, with egg and larval stages tending to be the most sensitive (Johnson, et al., (2008); Berry *et al*. (2003), Wilber & Clark (2001)). During material placement, these impacts are limited both in duration and spatially due to the short time needed for dredged material to reach the bottom (Kraus (1991); Dragos & Lewis (1993); Dragos & Peven (1994)). Saila, et al. (1971) also point out that "aquatic animals are able to tolerate high concentrations of suspended sediments for short periods." Since the tolerance level for suspended solids is high in shallow and mid-depth coastal waters, and fish may experience major changes in turbidity during storms, Saila, et al. (1971) conclude that mortality due to elevated sediment concentrations in the water column resulting from dredged material placement is not likely.

Concentrations of sediments and the duration needed to cause impacts to fish resources are expected to be short-term and localized and as such, effects to fish sources and EFH in the proposed project areas should be minimal.

As noted in the project description and in the impacts to winter flounder, approximately 51.6 acres of shallow subtidal habitat and 6.4 acres of intertidal habitat will be used to create salt marsh habitat within New Haven Harbor. This habitat conversion will be offset in part by filling two borrow pits in New Haven Harbor, however a net loss of 3.2 acres of subtidal winter flounder EFH and 6.4 acres of intertidal flat habitat will be realized.

Blasting

The extent of damage to fish populations by blasting depends primarily on the proximity to the blast and the presence or absence of a swim bladder. Fish with swim bladders (e.g., Atlantic herring) will be unable to adjust to the abrupt change in pressure propagated by the blast. If they are within a zone of influence, fish with swim bladders may be injured or killed. Fish without swim bladders (e.g., winter flounder) are less likely to be injured, and would likely sustain injuries only if they are in the immediate vicinity of the blast. Blasting may displace resident fishes, although this impact is expected to be only temporary. Blasting impacts will be avoided or minimized by the methods discussed in the following paragraphs.

Several precautionary measures, or best management practices (BMPs) will be put in place to avoid or minimize the incidence of injury to fish and marine mammals from blasting. These blasting mitigation measures include:

- Limiting blasting events to a period between October 1 and March 1
- Use of a fish detecting and startle system to avoid blasting when fish are present or transiting through the area;
- Requiring the use of sonar and the presence of a fisheries and marine mammal observer during blasting events;
- Prohibiting blasting during the passage of schools of fish, or in the presence of marine mammals, unless human safety is a concern;
- Using inserted delays of a fraction of a second per blast drill hole, and;
- Placing material on top of the borehole (stemming) to deaden the shock wave reaching the water column.

Given the BMPs noted above to minimize blasting impacts to fish resources, significant impacts from the proposed blasting efforts are not expected to significantly affect fisheries resources in the project area.

As the areas to be blasted are characterized as estuarine bottoms with veneers of silt on top of rock, and the proposed project is not anticipated to change shoaling and sedimentation dynamics within New Haven Harbor, post construction bottom characteristics are anticipated to return to preconstruction conditions within months of the cessation of blasting and rock removal activities. Therefore, any EFH that may have been impacted as a result blasting operations would be expected to return to pre-blast conditions, along with the functions and values of the areas as EFH, within several months of construction.

5.2 Cumulative Impacts

Cumulative impacts are those resulting from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions. Past actions in association with the New Haven Harbor FNP include the construction of navigation channels and anchorages in New Haven Harbor and the construction of the harbor's breakwaters. Past actions in New Haven Harbor include: the construction of bulkheads, rock revetments, seawalls, and groins along the harbor; filling of salt marsh and deforestation of forested uplands for residential and commercial development; the dredging of borrow pits in the harbor for sand and gravel reclamation; the construction of waste water treatment plants and a power generation station that discharge into the harbor; the placement of electrical transmission lines through the harbor; the development of a commercial shipping port; commercial and recreational navigation; and commercial fishing of the harbor.

There are no concurrent Federal or State projects being constructed in the project area or projects slated to occur in the near future. Reasonably foreseeable future actions include the continuation of maintenance of the FNP as needed as well as the majority of the activities described above. The effects of these previous and existing actions are generally limited to infrequent disturbances of the benthic communities and occasional impacts to water quality. Air quality, hydrology, and other biological resources are generally not significantly affected by these actions. The direct effects of this project are not anticipated to add to impacts from other actions in the area. Therefore, no significant cumulative impacts to EFH or EFH species are expected as a result of implementing the proposed action.

6.0 BIBLIOGRAPHY

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Appendix A: Essential Fish Habitat Worksheet

Action: New Haven Harbor Navigation Improvement Project

1. INITIAL CONSIDERATIONS			
EFH Designations	Y	N	Species
Is it located in or adjacent to EFH	X		Study area experiences resident and transient EFH designated species along with forage species of EFH designated species.
Is EFH designated for eggs?	X		Red hake, winter flounder, windowpane, and silver hake
Is EFH designated for larvae?	X		Red hake, winter flounder, windowpane, and silver hake
Is EFH designated for juveniles?	X		Red hake, winter flounder, windowpane, silver hake, pollock, winter skate and little skate
Is EFH designated for adults?	X		Red hake, winter flounder, windowpane, silver hake, pollock, winter skate and little skate
Is there HAPC at or near project site?		X	
Does action have the potential to adversely affect EFH of species or life stages checked above to any degree?	X		

2. SITE CHARACTERISTICS	
Site Characteristics	Description
Is the site intertidal/sub-tidal/water column?	Dredging site is subtidal; placement alternatives are both intertidal;and subtidal
What are the sediment characteristics?	The sediment characteristics are primarily silts. Some silty sand is also present.
Is there HAPC at the site, if so what type, size, characteristics?	No HAPC at the site.
What is typical salinity and temperature regime?	Salinity is approximately 27-28 ppt in the project site. Temperature ranges from 2 to 5°C in the winter and from 20 to 25°C in late summer
What is the normal frequency of site disturbance?	Irregular – disturbance through coastal storm events and tidal action.
What is the area of impact (work footprint & far afield)?	Varies – See Environmental Impact Statement

3. ASSESSMENT OF IMPACTS			
Impacts	Y	N	Description
Nature and duration of activity (s)			Dredging. Year one - 5 months, Year two – 5 months.
Will benthic community be disturbed?	X		Benthic communities in the direct project footprint of dredging and placement activities will be removed or buried during construction activities. Recolonization of benthic communities will occur following construction completion.
Will SAV be impacted?		X	No SAV in project area.
Will sediments be altered and/or sediment rates changed?	X		Improvement areas will remain silt. Shellfish and Marsh beneficial use sites will be altered.
Will turbidity increase?	X		There will be short-term and localized increases in water column turbidity during construction.
Will water depth change?	X		Improvement areas will be deepened from approximately -37 ft to -42 ft MLLW. Depths at beneficial use sites will all be made shallower.
Will contaminants be released into sediments or water column?		X	All the dredged material has been found suitable for open water placement.
Will tidal flow, currents or wave patterns be altered?		X	Improvement dredging will not alter hydrologic conditions in New Haven Harbor. Some currents and wave patterns may be altered in the vicinity of the marsh creation area.
Will ambient salinity or temperature regime change?		X	
Will water quality be altered?		X	
Will functions of EFH be impacted for:			If yes, list species, Life State and Habitat to be Impacted
Spawning	X		Winter flounder – all life stages – shallow subtidal
Nursery	X		Winter flounder – all life stages – shallow subtidal
Forage	X		Winter flounder – all life stages – shallow subtidal
Shelter	X		Winter flounder – all life stages – shallow subtidal
Will impacts be temporary or permanent?			Temporary (turbidity, loss of forage) and permanent impacts (cumulative loss of 3.2 acres of winter flounder EFH)

Will compensatory mitigation be used?		X	

4. DETERMINATION OF IMPACT		
		EFH Determination
Overall degree of adverse effects on EFH (not including compensatory mitigation) will be: (check the appropriate statement)		No more than minimal adverse effect on EFH- there is no need for further assessment. This worksheet is sufficient for consultation.
		Adverse effect on EFH is not substantial-use contents of this form to develop written assessment
	X	Adverse effect on EFH substantial-a written assessment and methods to avoid or minimize impacts must be provided expanding upon the impacts revealed in this form. Typically, this degree of impact will require an expanded consultation