Essential Fish Habitat ("EFH") is defined in the Magnuson-Stevens Fishery Management and Conservation Act as *"... those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity."* As required by the Act, the National Marine Fisheries Service ("NMFS") has promulgated regulations to provide guidance to the regional fishery management councils for EFH designation. The regulations further clarify EFH by defining *"waters"* to include: aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; *"substrate"* to include sediment, hard bottom, structures underlying the waters, and associated biological contribution to a healthy ecosystem; and *"spawning, breeding, feeding, or growth to maturity"* to cover a species' full life cycle.

The 1996 amendments to the Magnuson-Stevens Fishery Management and Conservation Act set forth a number of new mandates for NMFS, regional fishery management councils, and other federal agencies to identify and protect important marine and anadromous fish habitat. The councils, with assistance from NMFS, are required to delineate EFH for all managed species. Federal agencies that fund, permit, or carry out activities that may adversely impact EFH are required to consult with NMFS regarding the potential effects of their actions on EFH, and respond in writing to NMFS's recommendations. In addition, NMFS is required to comment on any state agency activities that will impact EFH. The EFH evaluation for Palisades Point follows.

The Palisades Point project site is located in the City of Yonkers on the eastern shore of the Hudson River. NMFS has designated the Hudson River in the project area to be an estuarine "mixing zone" which includes the mixing of freshwater with brackish saline waters. The NMFS designated mixing zone for the Hudson River extends from Albany to the southern tip of Manhattan with a broad range of salinities from a low of 0.5 part per trillion (ppt) to a high of 25 ppt. The Hudson River at the Yonkers waterfront is a mixture of Atlantic Ocean saltwater and Hudson River freshwater, with the lighter freshwater flowing over the denser saltwater, however, at the Yonkers waterfront the water column is vertically stratified. As the two water systems mix in this stretch of the river, no sharp boundary between them exists, with the exception of a lightly increasing salinity at the bottom as compared to the top of the water column. The salinity varies with the stage of the tidal cycle and the volume of freshwater runoff. The water temperature also varies with the seasons and volumes of freshwater and saltwater flows. This section of the Hudson River is generally the zone of greatest mixing of river water and ocean water. See Section 6(a) for further information on the distribution of the salinity gradient at the project site.

The Palisades Point project site has been designated as EFH for several species (see Table III.C-4). The managed fish species and related life history stages of concern are red hake (*Urophycis chuss*), winter flounder (*Pleuronectes americanus*), windowpane flounder (*Scopthalmus aquosus*), Atlantic herring (*Clupea harengus*), bluefish (P*omatomus saltatrix*), Atlantic butterfish (*Peprilus triacanthus*), Atlantic mackerel (*Scomber scombrus*), summer flounder (*Paralicthys dentatus*), scup (*Stenotomus chrysops*), black sea bass (*Centropristus striata*), king mackerel (*Scomberomorus cavalla*), Spanish mackerel (*Scomberomorus maculates*), and cobia (*Rachycentron canadum*). The life stage, habitat requirements and distribution of the designated fish species are discussed following Table III.C-4.

Table III. A-1
Summary of NMFS Designated Essential Fish Habitat (EFH) Species

Species	Scientific Name	Eggs	Larvae	Juveniles	Adults	Spawning Adults
Red hake	Urophycis chuss		X	X	X	
Winter flounder	Pleuronectes americanus	X	X	X	X	X
Windowpane flounder	Scopthalmus aquosus	X	X	X	X	X
Atlantic sea herring	Clupea harengus		X	X	X	
Bluefish	Pomatomus saltatrix			X	X	
Atlantic butterfish	Peprilus triacanthus		X	X	X	
Atlantic mackerel	Scomber scombrus			S	X	
Summer flounder	Paralicthys dentatus		X	X	X	
Scup	Stenotomus chrysops	X	X	X	X	
Black sea bass	Centropristus striata			X	X	
King mackerel	Scomberomorus cavalla	X	X	X	X	
Spanish mackerel	Scomberomorus maculatus	X	X	X	X	
Cobia	Rachycentron canadum	X	X	X	X	

Source: NMFS 2007

- Red Hake (*Urophycis chuss*) - Red hake have planktonic eggs with oil globules. According to the fisheries management EFH source documents, red hake juveniles are mainly found in salinities between 23 and 33 ppt. Furthermore, dissolved oxygen (DO) levels are 5-12 mg/L

and depths ranged from 20-75 feet. Red hake adults are mainly found in DO levels of 6-11 mg/L, depths of 30-70 feet and salinities of 24-31 ppt.

- Summer Flounder (*Paralicthys dentatus*) - Summer flounder have planktonic eggs with oil globules. Juvenile summer flounder are primarily located in areas with DO levels at 6-11 mg/L, depths between 10 and 70 feet and salinities ranging from 22-32 ppt. Maximum growth rate and efficiency occurs at salinities greater than 10 ppt, corresponding with these salinities where the juveniles are most abundant in estuaries. NMFS studies indicate that juveniles less than 29 cm were found in salinities greater than 16 ppt. Adult summer flounder are found mainly in DO levels of 4-12 mg/L, depth of 15-50 feet and salinities of 20-32 ppt.

- Winter Flounder (*Pleuronectes americanus*) - Winter flounder eggs are most abundant in water with salinities of 10 to 30 ppt. Eggs are demersal, sticky and are usually deposited on sandy bottoms in estuaries. Eggs hatch with abnormal larvae development at salinities less than 10 ppt with little survival. Embryos are uryhaline with best survival between salinities of 10 and 30 ppt. Winter flounder juveniles are benthic and seldom lose contact with the substrate. Most juveniles spend much of their first two years in or near shallow natal waters, where they move in response to extreme heat or cold. After metamorphosis, the juveniles prefer a substrate of sand or sand and silt. Older juveniles in estuaries gradually move seaward as they grow larger. Temperature is a less important factor in the distribution of juveniles, which tolerate higher temperatures than adults. Adult winter flounder are found predominantly in 60-140 feet of water on muddy sand, clean sand, pebbly or gravelly bottom. The adults tolerate wide ranges of salinities, temperatures and DO.

- Atlantic butterfish (*Peprilus triacanthus*) - Atlantic butterfish eggs are planktonic with oil globules. Fisheries Management Program (FMP) studies indicate juvenile populations to be most abundant in areas with a DO level of 5-12 mg/L, depths of 15-65 feet and salinities of 19-33 ppt. Adults in the same region were most abundant in DO levels of 6-12 mg/L, depths of 15-65 feet and salinities of 20-33 ppt.

- Windowpane flounder (*Scopthalmus aquosus*) - The windowpane flounder has eggs that are usually found in seawater salinities of 25 ppt or greater and are planktonic with oil globules. Juveniles are most abundantly found in DO levels of 5-12 ppt, depths of 15-50 feet and salinities of 18-33 ppt. Adults desire DO levels of 6-12 mg/L, depths of 15-45 feet and salinities of 20-33 ppt.

- Black sea bass (*Centropristus striata*) - Black sea bass eggs are planktonic with oil globules. According to FMP EFH source documents for black sea bass, juveniles are found mostly in DO levels of 5-11 mg/L, depths of 15-50 feet and salinities of 20-33 ppt. Adults are found in 5-8 mg/L DO levels, depths of 15-65 feet and salinities of 20-30 ppt. Black sea bass are migratory in the northern part of their range, which includes the New York Bight. Black sea bass move inshore and northward in spring and offshore and south in fall due to changes in temperature.

- Bluefish (*Pomatomus saltatrix)* - Bluefish eggs are planktonic with oil globules. These eggs are more buoyant than most planktonic eggs because of a larger oil globule. Larva

development takes place in outer continental shelf waters, primarily within 18 feet of the surface, at temperature of 18-26^{o}C and salinities of 30-32 ppt.. Juveniles occur in outer continental shelf waters of the Middle Atlantic Region from April through June. As inshore waters warm, the juveniles move shoreward across the continental shelf into estuaries between Cape May and Long Island. Juveniles require temperatures higher than 10^{o}C for survival. Juveniles and adults occupy near shore habitats as shallow as 0.05 feet. In the fall and winter most adult bluefish from Atlantic Coast stocks migrate southward and overwinter along the east coast of Florida.

- Atlantic sea herring *(Clupea harengus*) - Atlantic sea herring spawn in the vicinity of bays, estuarine and oceanic banks over rock, pebble, or gravel bottoms, but never over soft mud. They do not spawn in salinities below 31.99 ppt or above 33.0 ppt. Adults are found typically in salinities of 35 ppt.

- Scup *(Stenotomus chrysops)* - Spawning takes place from May to August, with a concentration in June. Eggs are planktonic with oil globules. Annual migrations are made to the offshore winter grounds and the inshore summer grounds. Scup prefer smooth to rock bottom, and temperatures of at least 10^{o}C.

- King mackerel (*Scomberomorus cavalla*) - Adults are a highly migratory species that range from the South Atlantic to Mid-Atlantic Bights. King mackerel prefer sandy shoals of capes and offshore bars, high profile rock bottoms and barrier island ocean side waters from the surf zone to the shelf break, but from the Gulf Stream shoreward. King mackerel prefer water temperatures in excess of 20^{o} C and salinities greater than 25 ppt. This species can also be found in high salinity bays, estuaries and seagrass habitats

- Spanish mackerel *(Scomberomorus maculatus)* - Adults are a highly migratory species that range from the South Atlantic to Mid-Atlantic Bights. Spanish mackerel prefer sandy shoals of capes and offshore bars, high profile rock bottoms and barrier island ocean side waters from the surf zone to the shelf break, but from the Gulf Stream shoreward. Spanish mackerel prefer water temperatures in excess of 20^{o} C and salinities greater than 30 ppt.

- Cobia (*Rachycentron canadum*) - Adults are a highly migratory species that range from the South Atlantic to Mid-Atlantic Bights. Cobia are generally found on sandy shoals of capes and offshore bars, high profile rock bottoms and barrier island/ocean side waters from the surf zone to the shelf break, but from the Gulf Stream shoreward. Cobia prefer water temperatures in excess of 20^{o} C and salinities greater than 25 ppt.

Anticipated Impacts and Mitigation Measures: Palisades Point

a. Floodplain

All proposed habitable structures at Palisades Point will have the lowest habitatable floors at elevations situated one foot above the 100-year flood elevation. The publicly accessible esplanade will be within the 100-year floodplain. As no building construction will occur within the floodway of the Hudson River, construction of the Project will not result in increased flooding in adjacent areas along the Hudson River waterfront.

b. Stormwater

As discussed previously, the lower Hudson River estuary in the area of the Palisades Point site contains significant aquatic resources. These resources include birds, fish, benthic organisms, planktonic organisms and several threatened/endangered species. The proposed shoreline rehabilitation and upland development would not have an adverse effect on these aquatic resources as the stormwater to be generated from Palisades Point will be treated through new treatment systems that would meet NYSDEC requirements, an improvement over the existing condition. In addition, the rehabilitated shoreline will continue to provide habitat and food resources for fish, including juvenile striped bass. Most species within the Hudson River are tolerant of variations in salinity and the treated stormwater to be generated from Palisades Point would not alter the levels of salinity to beyond the ranges that these species can tolerate. The proposed Project is therefore not expected to result in an adverse impact upon aquatic resources, including identified EFH resources, of the Hudson River. Supporting analysis of potential impacts follows. Section 2.d in Chapter III.M *Construction Impacts* discusses short-term impacts and mitigation associated with the realignment of the Saw Mill River channel, including environmental remediation and erosion, sediment control measures mitigation measures, and sequencing of the realignment of the Saw Mill River. Discussion regarding Remedial Investigation and a Remedial Action Work Plan in cooperation with NYSDEC is provided in Chapter III.L of this DEIS.

c. Local Impacts to Fish Species

Spawning strategies are important to identifying potential impacts to the reproductive success of the local fish and shellfish species managed under the EFH program. Spawning strategies are characterized by the type of eggs produced (i.e., demersal, pelagic) and the time periods during which spawning occurs. Environmental conditions influence the number of eggs that hatch and the success of larvae that mature into adults. The predominant environmental condition in this regard is seasonal water temperature.

Most fish species spawn either demersal or planktonic eggs that hatch into larvae in one day to six weeks, depending on the species, time of year, and water temperature. Demersal eggs are laid on or buried in the bottom sediments and remain on the bottom until the larvae hatch. Very often, demersal eggs are sticky and adhere to surfaces (e.g., rocks) until larvae have hatched. As these surfaces may be located on the bottom of the marine environment, the reproductive success rate of fish that produce demersal eggs may be lower, due to burial of eggs, than fish that produce planktonic eggs.

Most of the EFH fish species spawn planktonic eggs. Planktonic eggs float in the water column and are often referred to as buoyant. Buoyancy of eggs varies among different species and the eggs may or may not contain an oil globule. Oil globules cause eggs to be more buoyant. Neutrally buoyant eggs have a specific gravity close to that of seawater, thus, they are more readily mixed deeper into the water column by waves and other turbulence. Most planktonic eggs are found in the upper 120 to 150 feet of the water column. Eggs with oil globules are usually located in the upper 45 feet of the water column, closer to the surface than other planktonic eggs.

Water oriented construction activities (i.e., primarily the construction for the kayak/canoe launch and rejuvenation of the existing riprap for shoreline stabilization in the south way of the site) and the effects of these construction activities to the egg, larval, juvenile and adult life stages of EFH species are discussed below. The rip rap in the north half appears to be sufficient.

Egg and Larval Stages - The Palisades Point project site is not suitable for demersal egg laying fish such as the winter flounder. Winter flounder typically deposit eggs over a sandy substrate at depths of 6 to 240 feet. The predominant time frame for winter flounder to lay their eggs starts in January. The bottom of the Palisades Point project area is very soft mud predominantly composed of silts and clays with little sand. This sediment is easily resuspended due to tidal influences and/or wind or waves created by watercraft on the Hudson River. This results in covering of any demersal eggs and ultimately the non-recruitment of the winter flounder. Due to the silty/clay substrate, the Palisades Point project site is generally not deemed as preferred habitat for larvae and egg life stages of winter flounder. Nevertheless, the initial phase of the Palisades Point project, the construction activities related to the canoe/kayak launch and shoreline stabilizing riprap placement, will be scheduled so as to not adversely impact upon the winter flounder breeding period.

Bluefish, scup, butterfish, summer flounder and windowpane flounder produce planktonic eggs with oil globules. These eggs are freeloading and disperse quickly when released. In addition, these species reproduce primarily in the spring, summer and fall months. The proposed construction activities related to the canoe/kayak launch and placement of riprap will take place in the late spring to early summer months, resulting in minimal impacts to the eggs and larvae of these species, as they are free floating and will not likely congregate at the project site.

Juveniles and Adults - Juvenile and adult stages of the EFH species found on or in close proximity to the Palisades Point project site are highly mobile. Winter flounder in particular tend to congregate in the Hudson River Estuary starting in November. Fish species in the immediate canoe/kayak launch and riprap construction area will relocate unharmed to surrounding areas. Once the canoe/kayak launch and riprap construction activities are completed, the habitat will not be disturbed any further. Therefore, juvenile and adult fish will not be negatively impacted as result of the canoe/kayak launch and riprap construction activities.

Benthic Prey Species and Shellfish - Prey species in the waters surrounding the Palisades Point project area are mainly comprised of polychaetes, oligochaetes and amphipods. Species in the footprint of the canoe/kayak launch and riprap construction area will be displaced. After the initial construction period, recolonization of the benthic prey species from the adjacent areas to the Palisades Point project site is anticipated to occur quickly. In addition, the enhanced riprap shoreline will provide new vertical habitat within the water column upon which invertebrate encrusting organisms can colonize and provide new food resources for EFH species. Colonization of the new riprap will be determined by larval recruitment and immigration of mobile demersal and pelagic species from adjacent areas.

d. Regional Impacts to Fish Species

The proposed construction of Palisades Point will be local in scope. Therefore, no direct regional impacts will occur.

e. Other Impacts to Fish Species

The overall Palisades Point project area is the site of an existing riprapped shoreline, an adjacent port facility (the American Sugar Refinery) to the south and an existing mooring facility further to the north that is scheduled to start providing ferry service in the middle of 2007.

Fishery studies conducted in the Hudson River by the Army Corps of Engineers in the 1980s found that the majority of fish were found in inter-pier areas as opposed to open water shallows. Since these studies, a majority of dilapidated piers and pile fields in the region have been removed, resulting in the loss of this inter-pier habitat for many species of fish. The combination of the existing port facilities to the north and south of the Palisades Point project site maintains the EFH benefits of inter-pier habitat.

Although striped bass have not been designated as an EFH species, it is an important migratory species of the Hudson River estuary system. Striped bass tend to concentrate in interpier areas, especially the young of the year that over winter in the Hudson River. The existing adjacent pile supported structures to the north and south of the Palisades Point project site provides an extensive inter-pier habitat favorable for the striped bass. The proposed Project will not affect the existing inter-pier habitat favored by over wintering striped bass and EFH species.

f. Impacts to Endangered Species

NMFS and NYSDEC have documented shortnose sturgeon *(Acipenser brevirostrum)* as occurring in the Hudson River from the northern end of Staten Island (river mile (rm) –3.5) to the Troy Lock and Dam in Albany (rm 154). The Palisades Point project is proposed at approximately rm 19, within the documented range of shortnose sturgeon, albeit at the southern range for its habitat found in the Hudson River. In addition, NMFS has listed the Atlantic sturgeon *(Acipenser oxyrinchus)* as a candidate species for protection. As a candidate species, the Atlantic sturgeon do not receive any substantial or procedural protection under the Endangered Species Act; however, NMFS recommends that proponents of projects consider implementing conservation measures to limit the potential for adversely affecting this species. Based upon NMFS's best available scientific information on the Atlantic sturgeon, a reproductive population is located in the Hudson River, with the historical spawning grounds occurring near Hyde Park (rm 130) and Catskill (rm 182).

Some populations of shortnose sturgeon are considered anadromous in that the adults typically live in the ocean, but leave the ocean and migrate upstream into fresh water where they spawn. The adults then either die or migrate back to the ocean. The Hudson River shortnose sturgeon population is more correctly termed amphidromous in that shortnose sturgeon utilizes discrete habitats within a freshwater system for feeding and spawning. Shortnose sturgeons are bottom feeders and feed on a variety of organisms. Using their barbels to locate food and extendable mouths to then vacuum it up, they feed mainly on benthic invertebrates, such as clams, crustaceans, worms, aquatic insect larvae, crayfish, snails, shrimp and smaller fishes.

Concentrations of shortnose sturgeon are found near Kingston (rm 87) for the over wintering period from late fall to early spring. In mid-April, reproductively active adults begin a rapid migration upstream to their Hudson River spawning grounds that extend from the Troy Lock and

Dam in Albany (rm 154) to Coxsackie (rm 148-118). Spawning adults remain in this reach of the Hudson River from late April through May after which they quickly disperse to their summer range further down river from rm 24 to rm 94. Juveniles and non-spawning adults occupy the region of Haverstraw Bay (rm 34-39) by late fall and early winter and are distributed throughout the mid-river area, similar to spawning adults, during the summer. Recently, shortnose sturgeons have been documented below the Tappan Zee Bridge (rm 27) from July through December.

Shortnose sturgeons have been documented primarily in freshwater (salinity of 0 to .49 ppt), but a small percentage has been captured in the oligohaline zone (salinity of .5 to 2.9 ppt). In general, shortnose sturgeons are not found in salinities above 1.5 ppt. The Hudson River in the vicinity of the Palisades Point project has salinities that range from a low of 5.0 ppt during a flood event to a high of 25 ppt during drought conditions.

As such, due to the salinity concentrations at the Palisades Point project site, and the documented historic range of the shortnose sturgeon, there is a low potential for shortnose sturgeons to be found in the vicinity of Palisades Point. With the breeding areas of shortnose sturgeon being in the upper Hudson River, there is no potential to impact upon breeding areas. When conditions (salinity and time of year) are within the range for the shortnose sturgeon to survive at the Palisades Point project site (i.e., high concentrations of fresh water flow (flood event) in the Hudson River that drives back the salt wedge) they may potentially be found for a short period of time at the project site. However, due to the normal range of salinity concentrations at the project site, and the historic range of the shortnose sturgeon, there is a low potential for shortnose sturgeon to be found in the vicinity of the Palisades Point project site.

Once water related construction activities are completed, including the placement of new riprap to rejuvenate the shoreline and the construction of the canoe/kayak launch area, the substrate in the Hudson River waters fronting Palisades Point will continue to provide the food resources that are preferred by the shortnose sturgeon. The proposed construction of Palisades Point is therefore not likely to jeopardize the shortnose sturgeon or result in the destruction or adverse modification of its critical habitat.

g. Summary

In evaluating EFH impacts, it is necessary to address fish life cycles by using the five stages of life that include: egg; larval; juvenile; adult; and spawning adults. Juvenile and adult life stages are usually highly mobile and able to retreat during disturbances. This also allows for a quick repopulation of a project site once construction activities are completed as fish are likely to return when disturbances cease. Egg and larval stages are the most often impacted life stages due to their lack of mobility.

The redevelopment/construction of the Palisades Point project site is planned to provide enhanced food resources and habitat for EFH species, especially from the new riprap that will stabilize and rejuvenate the shoreline. The waters of the Hudson River that front the site are not generally considered suitable for demersal egg laying fish such as the winter flounder. Winter flounder typically deposit eggs over a sandy substrate at depths of 6 to 240 feet. The project site is subject to strong currents and the bottom of the Hudson River in the area is composed of very soft mud, predominantly silts and clays with very little sand, and is not deemed as preferred

habitat for the larvae and egg life stages of winter flounder. This sediment is easily resuspended due to wind, waves or currents created by watercraft and tidal influence on the Hudson River. The continued resuspension of these fine sediments results in the sediments covering of any demersal eggs and ultimately the non-recruitment of the winter flounder. Juvenile and adult fish species in the immediate construction area are capable of relocating unharmed to surrounding areas. The proposed construction/redevelopment activities will be local and should not adversely impact the breeding period or eggs (if present) of winter flounder.

The proposed supplemental riprap will provide new vertical structures that will in turn provide a larger surface area for the recruitment of encrusting organisms, thus providing an enhanced food source for many EFH species. The existing mooring structures to the north and south of the project site will not be impacted by the proposed redevelopment/construction activities and will continue to provide over wintering habitat for striped bass and winter flounder. In addition, the proposed shoreline rehabilitation activities are not likely to jeopardize the shortnose sturgeon or result in the destruction or adverse modification of its critical habitat.

The development of Palisades Point will improve the quality of the stormwater that is discharged into the Hudson River. Currently, all precipitation either percolates into the ground and reaches the Hudson River via a subsurface route, or runs directly unabated to the Hudson River. With the implementation of the Project, impermeable surfaces, such as roadways and buildings, will limit infiltration of the precipitation. To prevent flooding of the uplands and minimize pollutants reaching the Hudson River, a stormwater management/treatment system will be constructed in accordance with NYSDEC requirements to limit the discharge of particulates/pollutants to the Hudson River. A separate sanitary sewage system would be constructed and will not contribute to combined sewer overflows and thereby not contribute pollutant loads to the Hudson River.

The proposed Project is not expected to have an adverse effect upon the hydrology of the Hudson River, nor will the Project have an adverse impact upon the existing aquatic resources, including EFH resources. With proposed improvements that will manage stormwater discharges in accordance with NYSDEC requirements, the quality of water discharged to the Hudson River will be improved over existing conditions. No adverse impacts have been identified from implementing the Project as designed, and no further mitigation measures are required.