ESSENTIAL FISH HABITAT ASSESSMENT
FOR THE
NEW JERSEY ROUTE 52
BETWEEN SOMERS POINT AND OCEAN CITY, NEW JERSEY
PROPOSED MODIFICATION

Submitted To:

Stanley W. Gorski
Field Offices Supervisor
National Marine Fisheries Service

Submitted By:

New Jersey Department of Transportation

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1.1 Applicants

New Jersey Department of Transportation (NJDOT) and the Federal Highway Administration (FHWA).

1.2 Location

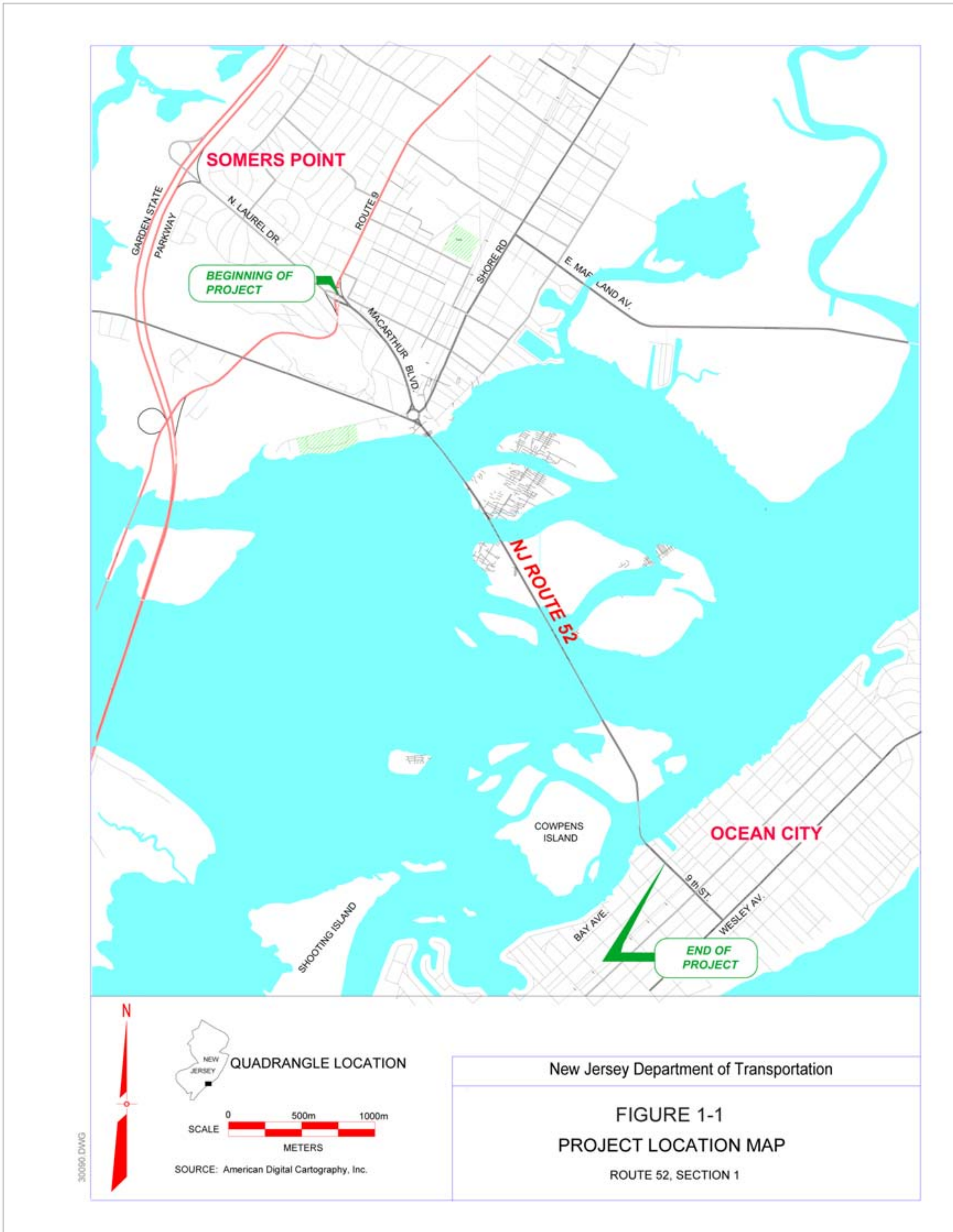
The project area extends from the intersection of Route 52 with Route 9 in Somers Point over Great Egg Harbor Bay to the intersection of 9th Street with Bay Avenue in Ocean City, New Jersey (see Figure 1-1, Project Location Map).

1.3 Activity

The NJDOT and the FHWA propose to reconstruct approximately 4.5 kilometers (2.8 miles) of New Jersey Route 52(1) between Somers Point, Atlantic County and Ocean City, Cape May County, New Jersey. The project area extends from the intersection of Route 52 with Route 9 in Somers Point over Great Egg Harbor Bay to the intersection of 9th Street with Bay Avenue in Ocean City. The purpose of the proposed project is to reconstruct an important but deteriorated section of the National Highway System in order to provide efficient vehicular and marine traffic flow as well as to improve safety. The project entails:

- Replacement of the causeway over Great Egg Harbor Bay, including four concrete bridges (approximately 3.5 kilometers (2.2 miles);
- Construction of standard width driving lanes and shoulders for the length of the causeway;
- Construction of a sidewalk along one side of the causeway and bicycle-compatible shoulders along both;
- Replacement of the Somers Point traffic circle with a signalized intersection that includes turning lanes; and
- Widening of Route 52 (MacArthur Boulevard) in Somers Point from Shore Road to U.S. Route 9 from two lanes to two lanes plus a center turning lane (approximately 1.0 kilometers [0.6 miles]).

Ten (10) "Build" alternatives plus five options, or variations, for the reconstruction of the causeway were evaluated conceptually in addition to the "No-Build" alternative. Three variations of one of the "Build" alternatives plus two variations of another "Build" alternative were selected for detailed environmental study and evaluation in the Draft Environmental Impact Statement (DEIS).



SOMERS POINT
GARDEN STATE PARKWAY
N. LAUREL DR.
ROUTE 9
SHORE RD.
E. MAPLAND AV.
BEGINNING OF PROJECT
MACARTHUR BLVD.
NJ ROUTE 52
COWPENS ISLAND
OCEAN CITY
9 th ST.
WESLEY AV.
BAY AVE.
SHOOTING ISLAND
END OF PROJECT
N
NEW JERSEY
QUADRANGLE LOCATION
SCALE
0
500m
1000m
METERS
SOURCE: American Digital Cartography, Inc.
30090.DWG
New Jersey Department of Transportation
FIGURE 1-1
PROJECT LOCATION MAP
ROUTE 52, SECTION 1

Based on the Draft Environmental Impact Statement (DEIS, August 2000) analysis, Alternative 9 (Option 1) is the Initially Preferred Alternative (IPA) identified in the DEIS. Under this alternative, the two existing bascule (i.e., draw) bridges are proposed to be replaced with fixed-span bridges. The primary factor in the selection of this bridge type is the need to improve vehicular and marine traffic flow within the project area. The IPA is on a centerline alignment offset from the existing embankment approximately 10 meters (33') east of the existing centerline alignment, and with high fixed bridges at both realigned channels. The portion of IPA that traverses the island between Elbow Thoroughfare and Rainbow Channel is proposed to be a continuous structure (i.e., no embankment). This greatly minimizes direct filling of tidal wetlands compared to other options considered which involved an embankment with side slopes.

Another alternative given additional consideration is Alternative 9A (Option 1). For Alternative 9A, a high fixed bridge with a 16.7-meter (55') clearance is used over the realigned Ship Channel. Alternative 9A is similar to Alternative 9, but proposes a high bascule bridge with a clearance of 13.7 meters (45') over the Intracoastal Waterway (ICWW) and requires no realignment of that channel. Similar to Alternative 9 (Option 1), the portion of Alternative 9A (Option 1) that traverses the island between Elbow Thoroughfare and Rainbow Channel is proposed to be a continuous structure (i.e., no embankment).

Alternatives 9 and 9A both propose high fixed bridges over a realigned Ship Channel. Realignment will occur through the movement of channel marker buoys, requiring no dredging at this channel. At the ICWW, Alternative 9 employs a high fixed bridge over the channel that has been realigned approximately 65 meters (215') further from the shore, whereas 9A employs a high bascule bridge over the existing channel. Accordingly, Alternative 9 (Option 1) will require dredging to realign the ICWW, whereas Alternative 9A will not require dredging. Figure 1-2 shows the extent and depth of dredging under the IPA.[4] New viaducts will be constructed over the other existing waterways. High fixed bridges with a minimum vertical clearance of 16.7 meters (55') are used for Alternative 9 over the Ship Channel and the ICWW. Alternative 9 requires realignment of both channels.

Also, the project includes the conversion of the Somers Point traffic circle into a four-legged-signalized intersection with turn lanes in order to improve traffic operations and increase safety. It also includes the widening of MacArthur Boulevard in Somers Point from two to four lanes between the circle and its recently improved intersection with Route 9.

The proposed action smoothes out the causeway between the Somers Point traffic circle and Ocean City, by reducing the severity of the horizontal and vertical curves and by providing more direct approaches into and out of both Somers Point and

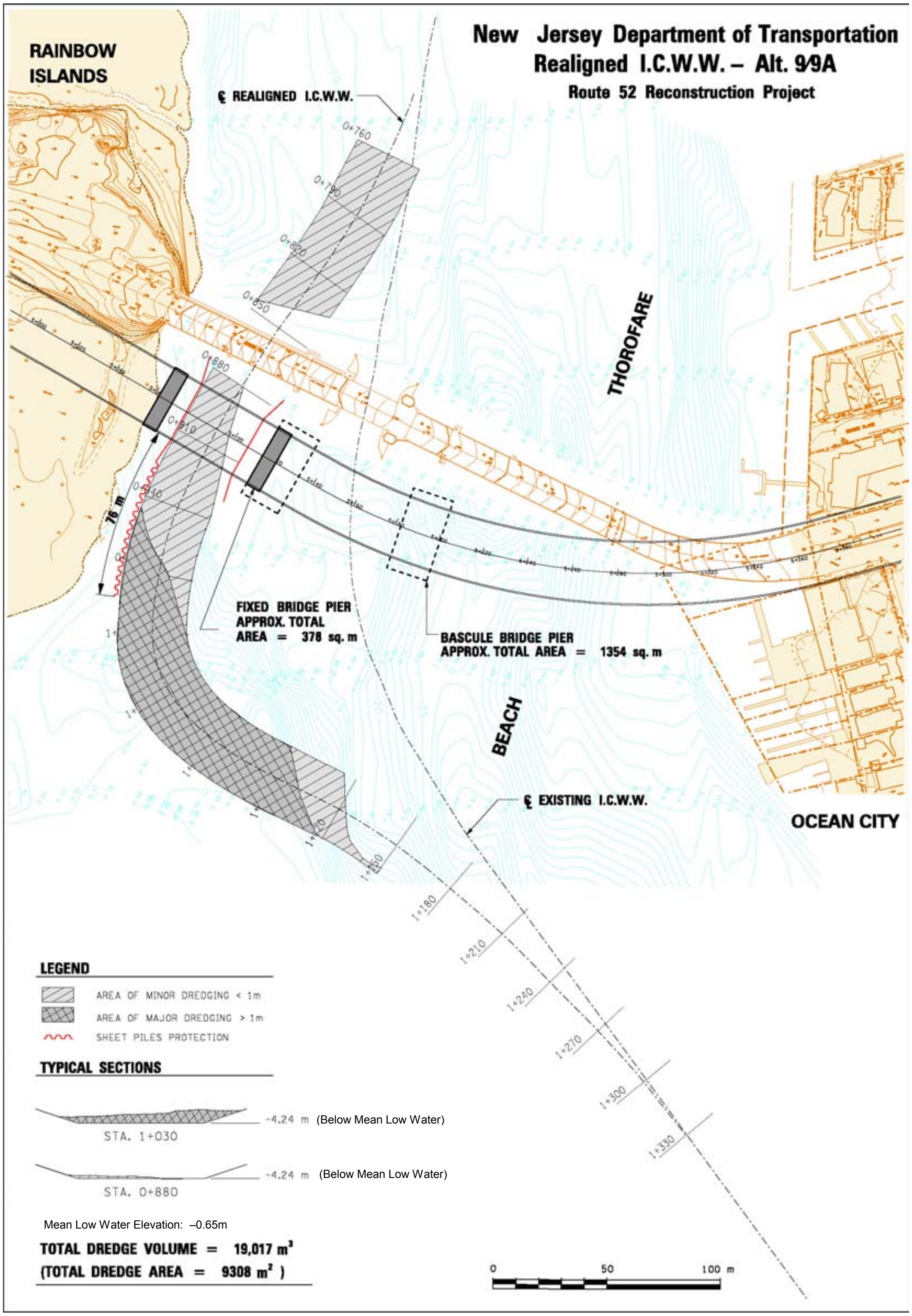


Figure 1-2: Footprint of Realigned ICWW Dredging for the Preferred Alternative

Ocean City. In addition the proposed action would also avoid the settlements caused by added embankment loads and the potential delays associated with the need to preconsolidate soft subsoils prior to final paving. Both Alternatives 9 (Option 1) and 9A (Option 1) suffer from the following adverse impacts:

- Their foundation piles penetrate tidal wetlands and high value clam habitat.
- They shade out tidal wetland grasses if kept at minimum heights. Conversely, they make access for recreational fisherman to tidal wetlands very difficult if raised sufficiently to avoid significant shading impacts.
- Since the NJDOT would acquire the land beneath the elevated structure, replacement of open space would have to be obtained for Ocean City's Open Space Program under Green Acres. This could be done by excavating the existing embankment down to below high tide and planting cordgrass (*Spartina alterniflora)*. An approved disposal area would have to be obtained.
- They impact properties in Somers Point and Ocean City, albeit to the minimal extent possible.
- The foundation piles penetrate high value clam habitat and a very limited area of tidal wetland.
- Realignment of the Ship Channel (no dredging required).
- Construction occurs immediately adjacent to maintained causeway traffic and will require staged construction activities.

In addition to these impacts, the IPA, Alternative 9 (Option 1), suffers from the following adverse impacts:

- The IPA requires dredging to realign the ICWW within its own thoroughfare.

2. ESSENTIAL FISH HABITAT (EFH) DESIGNATIONS

The Magnuson-Stevens Fishery Conservation and Management Act (the Act) as amended in 1996 strengthened the ability of the National Marine Fisheries Service (NMFS) and the eight regional fishery management councils to protect and conserve the habitat of marine, estuarine, and anadromous finfish, mollusks, and crustaceans. This habitat is known as the essential fish habitat (EFH) and is defined by the Act as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity."

The Act requires the regional fishery management council to identify EFH for all managed species, to specify actions to conserve and enhance EFH, and to minimize adverse effects on EFH. Fish may change habitats with changes in life history stage, seasonal and geographic distributions, abundance, and interactions with other species. The *Guide to Essential Fish Habitats in the Northeastern United States* provides a geographic species list of EFH designations and is utilized to determine the species and life stages of fish, shellfish, and mollusks for which EFH has been designated in a particular area. Tabular summaries are provided for EFH species in selected 10-minute by 10-minute squares of latitude and longitude along the coast. The Route 52 project area is within the square described as the waters within the Atlantic Ocean and within the New Jersey Inland Bay estuary affecting south of Margate City, New Jersey, south and east of Ocean City, New Jersey, and Peck Beach within Great Egg Harbor Bay and Peck Bay. Along with the EFH descriptions, Estuaries Tables are often provided, indicating salinity zones for a given species. The Route 52 project area lies within a 10 minute x 10 minute square with a northern border at 39 degrees 20 minutes, an eastern border at 74 degrees 30 minutes, a southern border at 39 degrees 10 minutes and a western border at 74 degrees 40 minutes. A further description of this quadrant can be found at www.nero.nmfs.gov/ro/States4/new_jersey/39107430.html. These sources of information were used to compile Table 2-1, which summarizes the EFH by life stage (i.e., eggs, larvae, juveniles, adults) in the vicinity of the Route 52 project.

Table 2-1: Summary of Essential Fish Habitat by Life Stage – New Jersey Route 52 Proposed Modification

Common Name	Latin Name	Seasonal Occurrence	Description of Habitat
EGGS			
Red hake	*Urophycis chuss*	May–November, peaks in June and July	Surface waters of inner continental shelf
Winter flounder	*Pleuronectes americanus*	January–May	Bottom habitats with a substrate of sand, muddy sand, mud, and gravel
Windowpane flounder	*Scopthalmus aquosus*	February–November, peaks May and October in middle Atlantic	Surface waters
Monkfish	*Lophius americanus*	March–September	Surface waters (eggs contained in long mucus veils that float near or at the surface)
King mackerel	*Scomberomorus cavalla*		Sandy shoals of capes and offshore bars, high profile rock bottoms and barrier island ocean side waters from surf zone to shelf break but from the Gulf Stream shoreward; all coastal inlets
Spanish mackerel	*Scomberomorus maculatus*		Sandy shoals of capes and offshore bars, high profile rock bottoms and barrier island ocean side waters from surf zone to shelf break but from the Gulf Stream shoreward; all coastal inlets
Cobia	*Rachycentron canadum*		Sandy shoals of capes and offshore bars, high profile rock bottoms and barrier island ocean side waters from surf zone to shelf break but from the Gulf Stream shoreward; high salinity bays, estuaries, seagrass habitat; all coastal inlets
LARVAE			
Red hake	*Urophycis chuss*	May–December, peaks in September and October	Surface waters (newly settled larvae need shelter, including live sea scallops, also use floating or mid-water objects for shelter)
Winter flounder	*Pleuronectes americanus*	March to July	Pelagic and bottom waters
Windowpane flounder	*Scopthalmus aquosus*	February–November, peaks May and October in middle Atlantic	Pelagic waters
Monkfish	*Lophius americanus*	March–September	Pelagic waters

Common Name	Latin Name	Seasonal Occurrence	Description of Habitat
Summer flounder	*Paralicthys dentatus*	Mid-Atlantic Bight from September–February	Pelagic waters, larvae most abundant 19–83 km from shore (high use of tidal creeks and creek mouths)
King mackerel	*Scomberomorus cavalla*		Sandy shoals of capes and offshore bars, high profile rock bottoms and barrier island ocean side waters from surf zone to shelf break but from the Gulf Stream shoreward; all coastal inlets
Spanish mackerel	*Scomberomorus maculatus*		Sandy shoals of capes and offshore bars, high profile rock bottoms and barrier island ocean side waters from surf zone to shelf break but from the Gulf Stream shoreward; all coastal inlets
Cobia	*Rachycentron canadum*		Sandy shoals of capes and offshore bars, high profile rock bottoms and barrier island ocean side waters from surf zone to shelf break but from the Gulf Stream shoreward; high salinity bays, estuaries, seagrass habitat; all coastal inlets
Sand tiger shark	*Odontaspis taurus*		Neonate/early juveniles: shallow coastal waters from Barnegat Light, New Jersey south to Cape Canaveral, Florida to the 25m isobath.
Dusky shark	*Charcharinus obscurus*		Neonate/early juveniles: shallow coastal waters, inlets, and estuaries to the 25m isobath from the eastern end of Long Island, New York to Cape Lookout, North Carolina/
Sandbar shark	*Charcharinus plumbeus*		Neonates/early juveniles: shallow coastal areas to the 25m isobath from Montauk, Long Island, New York to Cape Canaveral, Florida
Tiger shark	*Galeocerdo cuvieri*		Neonate/early juveniles: shallow coastal areas to the 200m isobath from Cape Canaveral, Florida north to offshore Montauk, Long Island, and New York.
JUVENILES			
Red hake	*Urophycis chuss*		Bottom habitats with substrate of shell fragments, including areas with and abundance of live scallops.
Winter flounder	*Pleuronectes americanus*		Bottom habitats with a substrate of mud or fine-grained sand (major prey: amphipods, copepods, polychaetes, bivalve siphons).
Windowpane flounder	*Scopthalmus aquosus*		Bottom habitats with substrate of mud or fine-grained sand.

Common Name	Latin Name	Seasonal Occurrence	Description of Habitat
Atlantic sea herring	*Clupea harengus*		Pelagic waters and bottom habitats.
Bluefish	*Pomatomus saltatrix*	North Atlantic estuaries from June–October, Mid-Atlantic estuaries from May–October	Pelagic waters (use estuaries as nursery areas).
Atlantic butterfish	*Peprilus triacanthus*	(Winter: shelf; spring to fall: estuaries)	Pelagic waters (larger individuals found over sandy and muddy substrates, pelagic schooling: smaller individuals associated with floating objects including jellyfish).
Summer flounder	*Paralicthys dentatus*		Demersal waters, muddy substrate but prefer mostly sand; found in the lower estuaries in flats, channels, salt marsh creeks, and eelgrass beds. Habitat Area of Particular Concern: all native species of macroalgae, seagrasses and freshwater and tidal macrophytes in any size bed as well as loose aggregations. (major prey: mysid shrimp).
Scup	*Stenotomus chrysops*	Spring and summer in estuaries and bays	Demersal waters north of Cape Hatteras and Inshore on various sands, mud, mussel, and eelgrass bed type substrates.
Black sea bass	*Centropristus striata*	Found in coastal areas (April–December, peak June–November) between Virginia and Massachusetts, but winter offshore from New Jersey and south; estuaries in summer and spring	Rough bottom, shellfish and eelgrass beds, man-made structures in sandy-shelly areas, offshore clam beds and shell patches may be used during wintering (Young-of-Year use salt marsh edges and channels; high habitat fidelity).
Surf clam	*Spisula solidissima*		Throughout substrate to a depth of 3 feet within federal waters. (Burrow in medium to coarse sand and gravel substrates. Also found in silty to find sand, not in mud.)
King mackerel	*Scomberomorus cavalla*		Sandy shoals of capes and offshore bars, high profile rock bottoms and barrier island ocean side waters from surf zone to shelf break but from the Gulf Stream shoreward; all coastal inlets.
Spanish mackerel	*Scomberomorus maculatus*		Sandy shoals of capes and offshore bars, high profile rock bottoms and barrier island ocean side waters from surf zone to shelf break but from the Gulf Stream shoreward; all coastal inlets.

Common Name	Latin Name	Seasonal Occurrence	Description of Habitat
Cobia	*Rachycentron canadum*		Sandy shoals of capes and offshore bars, high profile rock bottoms and barrier island ocean side waters from surf zone to shelf break but from the Gulf Stream shoreward; high salinity bays, estuaries, seagrass habitat; all coastal inlets.
Sandbar shark	*Charcharinus plumbeus*		Late juveniles/subadults: shallow coastal areas to the 25m isobath from Barnegat Light, New Jersey to Cape Canaveral, Florida.
ADULTS			
Atlantic cod	*Gadus morhua*	Spawn during fall, winter, and early spring	Bottom habitats with a substrate of rocks, pebbles, or gravel (major prey: fish crustaceans, decapods, amphipods)
Winter flounder	*Pleuronectes americanus*	Spawn February–June	Bottom habitats including estuaries with a substrate of mud, sand, gravel (major prey: amphipods, polychaetes, bivalve siphons, crustaceans).
Windowpane flounder	*Scopthalmus aquosus*	Spawn February–December, peak in May in middle Atlantic	Bottom habitats with substrate of mud or fine-grained sand (major prey: polychaetes, small crustaceans, mysids, small fish).
Atlantic sea herring	*Clupea harengus*	Spawn July–November in bottom habitats with a substrate of gravel, sand, cobble and shell fragments, also on aquatic macrophytes.	Pelagic waters and bottom habitats (major prey: zooplankton). Herring eggs are spawned in areas of well-mixed water, with tidal currents between 1.5 and 3.0 knots.
Bluefish	*Pomatomus saltatrix*	North Atlantic estuaries from June–October, Mid-Atlantic estuaries from May to October	Pelagic waters. Highly migratory. (major prey: fish).
Summer flounder	*Paralicthys dentatus*	Shallow coastal & estuarine waters in warmer months and offshore on outer Continental Shelf at depths of 150m in colder months	Demersal waters and estuaries. Habitat Area of Particular Concern: all native species of macroalgae, seagrasses and freshwater and tidal macrophytes in any size bed as well as loose aggregations. (major prey: fish, shrimp, squid, polychaetes).
Scup	*Stenotomus chrysops*	Wintering adults (November to April) are usually offshore, south of New York–North Carolina	Demersal waters north of Cape Hatteras and Inshore estuaries (various substrate types). (spawn <30m during inshore migration May to August; prey: small benthic inverts).

Common Name	Latin Name	Seasonal Occurrence	Description of Habitat
Black sea bass	*Centropristus striata*	Wintering adults (November–April) offshore south of New York–North Carolina. Inshore, estuaries from May–October	Structured habitats (natural and man-made) sand and shell substrates preferred. (spawn in coastal bays but not estuaries; change sex to males with growth; prey: benthic and near bottom inverts, small fish, squid).
Surf clam	*Spisula solidissima*	(Spawn – summer to fall at 19–30ºCelsius)	Throughout substrate to a depth of 3 feet within federal waters.
King mackerel	*Scomberomorus cavalla*		Sandy shoals of capes and offshore bars, high profile rock bottoms and barrier island ocean side waters from surf zone to shelf break but from the Gulf Stream shoreward; all coastal inlets.
Spanish mackerel	*Scomberomorus maculatus*		Sandy shoals of capes and offshore bars, high profile rock bottoms and barrier island ocean side waters from surf zone to shelf break but from the Gulf Stream shoreward; all coastal inlets.
Cobia	*Rachycentron canadum*		Sandy shoals of capes and offshore bars, high profile rock bottoms and barrier island ocean side waters from surf zone to shelf break but from the Gulf Stream shoreward; high salinity bays, estuaries, seagrass habitat; all coastal inlets.
Sandbar shark	*Charcharinus plumbeus*		Shallow coastal areas from the coast to the 50m isobath from Nantucket, Massachusetts south to Miami, Florida.

Note: All information presented is part of the Regional Fishery Management Council's EFH designations except for that contained within () which is provided as important additional ecological information.

3. ANALYSIS OF EFFECTS TO ESSENTIAL FISH HABITAT

Alternative 9 Option 1, the Initially Preferred Alternative, and Alternative 9A Option 1 will be used in the analysis of effects to Essential Fish Habitat in Great Egg Harbor relative to the No-Build (i.e., existing conditions) alternative. Habitat, food source and species-specific distribution data will be reviewed in this analysis.

3.1 Adverse Effects to Habitat

Potential impacts to EFH resulting from the Route 52 modification may occur through a number of pathways, including impacts to surface water quality, wetlands and aquatic resources. Potential impacts to these resources from the proposed action are described below.

3.1.1 Surface Water Impacts

Surface water quality is essential to the maintenance of Great Egg Harbor Bay fish populations. Potential impacts to surface water quality relate mainly to non-point source stormwater runoff impacts. Roadway operation and maintenance can generate stormwater runoff containing heavy metals, hydrocarbons, deicing chemicals, sediment, and debris that can affect the quality of surface waters. In addition, short-term water quality impacts to Great Egg Harbor Bay can occur resulting from construction-related soil erosion that can increase turbidity and suspended solids, lower dissolved oxygen, and alter pH values. The most significant long-term impact to surface water quality associated with this project, however, will likely be sand and silt in stormwater runoff reaching Great Egg Harbor Bay and tidal wetlands.

Both Build Alternatives will result in runoff directly into Great Egg Harbor Bay or onto the surface of the tidal marsh islands. Also, both Build Alternatives involve a significant increase in impervious area, and they would eliminate the existing onsite infiltration on the wide sandy embankment area on the east side of the causeway over the islands, thereby potentially increasing the amount and rate of runoff relative to existing conditions.

Although the proposed Build Alternatives will result in an overall increase in impervious area and runoff, the number of vehicles traveling on the Route 52 causeway between Ocean City and Somers Point is not likely to increase significantly faster than it would on the existing facility. Therefore, the total mass load of pollutants would not increase significantly (i.e., greater runoff volume but lower concentration of pollutants). Effects to surface water are discussed in depth in Section 3.4.4 of the Draft Environmental Impact Statement (DEIS, August 2000). The proposed alternatives will result in a wider, more efficient roadway, especially since high-level fixed or high-level bascule bridges are to be used. This will result in a more unrestricted flow of traffic along Route 52 and over the bridges, reducing conditions such as stopping, idling, and delays, and resulting in less time for traffic to deposit pollutants. Additionally, according to the FHWA report on mitigation of highway stormwater runoff, for highways with an average daily traffic (ADT) of 30,000 or more, the ratio of cumulative impervious roadway surface to total watershed area for the receiving waters, (dilution ratio) should not exceed 0.01. A previous traffic report from 1996 estimated the ADT for Route 52 to be 40,800. Therefore, the dilution ratio was calculated for the proposed alternatives. Due to the size of the receiving waters (the Great Egg Harbor Bay), the dilution ratio is smaller than 0.01.

Water quality impacts due to soil erosion and sedimentation will be minimized through implementation of a Soil and Erosion Sediment Control Plan that will be developed specifically for this project. Specific surface water quality protection measures for the Route 52 modification project are provided below.

3.1.1.1 Ocean City

The proposed approach and roadway for Route 52 into Ocean City on 9th Street will remain within the existing curb lines and will not increase the impervious area. The existing stormwater pipeline under the roadway is adequate for the proposed condition and will be maintained. New inlets are proposed in this area. There is insufficient room to incorporate any of the conditionally approved pretreatment methods into this existing system. To improve the water quality, manufactured oil/grit separators are proposed on all new inlet connections.

3.1.1.2 Causeway between Somers Point and Ocean City

The low points in the profiles of the Build Alternatives occur within, or close to, the limits of the tidal marsh islands bordering the causeway. Point discharge from a large pipe at these low points carrying sediment-laden runoff could concentrate the deposition of sediments on the marsh surface and have a negative impact on the vegetation. Accordingly, the runoff from the elevated structures would be dispersed through a series of scuppers that discharge directly into open water. For Alternatives 9 and 9A, causeway Option 1, where the causeway structure passes over the marsh islands, the runoff would be routed through leader pipes into scour basins. The scour basins would serve to detain the flow of the runoff and allow some infiltration into the sandy substrate, enhancing the water quality, and minimizing the potential for erosion.

Construction activities can also result in impacts to surface water. For example, foundations consisting of large diameter precast concrete cylinder piles will be driven down through existing soft deposits to depths where firm support can be obtained. Jetting of water alongside the outside of the piles reduces skin friction and facilitates the driving of the piles; however, the jetting operation invariably creates a great deal of turbidity around piles being driven in open water locations. Even the pile driving operation itself tends to create some turbidity, but to a much lesser degree.

These potential impacts were given serious thought during the alternative evaluation process. The alignment chosen for the Initially Preferred Alternative is the one of all those considered that has the least impacts to surface water. The alignment of the IPA not only minimizes the number of piles required, but also ensures that a large number of the piles will be installed on the islands instead of in open water.

Furthermore, characteristics inherent to the nature of the project work to protect surface water resources. The impact of the jetting operation is temporary, and the impact area will be limited to the corridor along the centerline alignment. Further, the primary grain size of the dredged sediment (fine/medium sands: USDOT, FHA and NJDOT, 1998) will result in relatively rapid deposition.

Nevertheless, mitigation measures should also be implemented during construction to minimize impacts due to turbidity. For piling driving our proposed turbidity mitigation strategy consists of the following:

- Use turbidity curtains only in hydrologically quiescent areas (i.e., areas of low to no current velocity).

- Employ a stringent level of visual monitoring to ensure minimal offsite migration of suspended solids (e.g.; use a Secchi disk).

Surface water quality can also be affected by dredging, which would be required at the ICWW under Alternative 9. Dredging causes an increase in turbidity, which can adversely affect aquatic resources such as submerged vegetation, shellfish, and finfish habitat. Under Alternative 9, the dredged material would most economically be pumped directly into a 6000 square meter (66,000 square foot) triangular area directly east of the existing causeway on the island directly north of Beach Thoroughfare. It would be diked to contain the slurry of sand and water and allowed to drain. The dried out material will then be transported for use, sale or disposal at an appropriate dredged material disposal site. If necessary, any remaining dredge spoil will be disposed of permanently under the structure on the southernmost island, out of the wetlands.

For dredging operations our proposed turbidity mitigation strategy consists of the following:

- Where possible use a hydraulic dredge to pump sediment to a diked onshore dewatering area as described above.

- Where hydraulic dredging is not feasible and a clamshell bucket is necessary for dredging, an "Environmental Bucket", which seals upon closure and minimizes spillage and leakage, would be utilized. The transfer of dredge spoils for offsite transport would also be accomplished using best management practices.

- Where necessary, use turbidity curtains only in hydrologically quiescent areas (i.e., areas of low to no current velocity).
- Employ a stringent level of visual monitoring to ensure minimal offsite migration of suspended solids consistent with typical dredging operations (e.g.; use a Secchi disk).
- Prohibit dredging activities during the period December 1st to May 31st to protect winter flounder spawning and blue crab overwintering habitats (see also Sections 3.1.3.1, 3.1.3.4 and 4.3).

Although the initial dredging may result in temporary impacts to surface water, it is not anticipated that periodic maintenance dredging will be required. Studies have revealed that a large percentage of the tidal flow comes through Beach Thoroughfare; approximately 16 percent of the flood tide goes up Beach Thoroughfare, and 34 percent flows back through at ebb tide. These high flow rates indicate that the velocity of the water surging through the channel will be sufficient to keep the channel clean. The sedimentation rate in the bay was found to be about 1 inch in the last 25 years in shoaling areas. With no evidence of shoaling in Beach Thoroughfare, this channel has not been dredged in 25 years. Therefore, dredging the shelf for realigning the channel is unlikely to require maintenance dredging.

3.1.1.3 MacArthur Boulevard: Somers Point Circle to Route 9

Under Alternatives 9 and 9A, the traffic circle will be converted to a signalized four-legged intersection, and the configuration of MacArthur Boulevard will be modified. The result of the improvements will be slightly more than an 80 percent increase in impervious area. The projected future traffic is not expected to be any different than the traffic that would occur if the roadway were not widened. Accordingly, most of the pollutants associated with vehicular traffic will not increase because of the improvements. In fact, because the long delays and associated idling will be reduced, the pollutant load in general may be reduced. However, the quantity of runoff and amount of aggregates used for winter ice control can be expected to approximately double in magnitude. Further, the increase in sediments washed off the additional pavement could lead to an increase in turbidity. A preliminary watershed analysis of the MacArthur Boulevard area revealed that the overall increase in paved area due to the widening of MacArthur Boulevard would be 1.27 hectares (3.13 acres). This area is considered impervious, because it will not permit water to seep through.

The conceptual drainage plan for the Build Alternatives is the same in the vicinity of MacArthur Boulevard. Much of the existing drainage system, which is old and undersized, will be replaced with a new system of catch basins and piping capable of handling the flow of a 10-year frequency storm (the average worst storm occurring every 10 years). The proposed drainage system for MacArthur Boulevard will consist of piping along the west curb line, which will route runoff to an underground grid of pipes with slits, or perforations, in the bottoms. This system will be located under a parking lot (at Station 0+625) near the low point on MacArthur Boulevard in the vicinity of Braddock Avenue. This system will hold, or detain, the runoff water until it infiltrates, or soaks, into the ground underneath. The majority of runoff contributing to this drainage system will be from a 16-hectare (40-acre) drainage area north of the low point, including the roadway and adjacent areas from the Route 9 intersection to the low point. In addition, runoff from a 2.5-hectare (6-acre) drainage area south of the low point will contribute to the MacArthur Boulevard drainage system, including the roadway and adjacent areas from the low point to a point near the Somers Point traffic circle. To improve the useful life of the underground system, it is recommended that oil/grit separators be installed on the collecting pipes in MacArthur Boulevard.

A significant drainage area of approximately 28 hectares (70 acres) exists to the east of MacArthur Boulevard. However, the runoff from this area is collected in an existing piping system and does not contribute to the MacArthur Boulevard drainage system or underground detention/infiltration system. The flow from the east is piped under MacArthur Boulevard at the low point (Station 0+650), where it will be combined with the discharge from the MacArthur Boulevard drainage system and discharge through an existing outfall. Based on current design standards, the existing outfall is already undersized for the prevailing conditions and should be upgraded. Due to the detention capacities built into the proposed drainage design, the post-construction flows are anticipated to be less than, or equal to, the preconstruction flows.

The existing detention/infiltration basin near Route 9 between Laurel Drive and MacArthur Boulevard is basically a deep open ditch. This basin will be modified and utilized to collect the flow from approximately 1.2 hectares (3 acres) in the northwest corner of the project. Existing pipes will be modified slightly so that all of the flow from the northwest will be routed into the new detention/infiltration basin prior to entering the MacArthur Boulevard piping system at Station 0+200. The new detention/infiltration basin will be approximately 14 meters (45') wide by 100 meters (325') long and could detain the runoff from a 1-year, 24-hour storm of 2.8 inches. Flow leaving this basin will ultimately also be routed through the detention/infiltration piping system located at the low point (Station 0+650). The basin will remain between the west curb line of MacArthur Boulevard and the new east curb line of Laurel Drive.

The Somers Point drainage system will be replaced to accommodate the flow from a 1.5-hectare (4-acre) drainage area surrounding the four-legged intersection proposed to replace the Somers Point traffic circle. The flow from the roadway between Station 0+900 and Station 1+100 will be collected in a new piping system along the west curb line, which will be routed through an oil/grit separator prior to discharge at the abutment of the new bridge. Runoff rainwater from the southwest quadrant of the new intersection will be detained in a depression in the traffic island prior to entering the piping system at Station 1+010. A separate piping system in the eastern portion of the intersection will be provided to accommodate the flow from the northeast and southeast quadrants of the intersection. This flow will be discharged into a vegetated swale on the east side of the north approach of the bridge over Ship Channel prior to being discharged into Great Egg Harbor Bay.

The proposed drainage system for MacArthur Boulevard, including the upgraded piping system and new pretreatment facilities, will be a significant improvement over the existing system from the Route 9 intersection to the Somers Point traffic circle. Currently, none of the runoff is pretreated prior to discharge into Great Egg Harbor Bay. In contrast, the proposed drainage system provides for pretreatment of all runoff through the use of detention/infiltration facilities, oil/grit separators, and/or grassed swales.

3.1.2 Wetland Impacts

Many fish species utilize the wetlands of Great Egg Harbor Bay in a number of ways. Some spend their entire lives in the wetlands, while others use the wetlands primarily for reproduction and nursery grounds. Many fish species frequent these marshes for feeding or feed on organisms produced in the wetlands. The tidal marshes are important for shellfish including bay scallops, grass shrimp, blue crabs, oysters and clams. Among the more familiar wetland-dependent fishes are menhaden, bluefish, fluke, white perch, sea trout, mullet, croaker, striped bass and drum. The estuarine aquatic beds found within the wetlands also provide important cover for juvenile fishes and other estuarine organisms. Also, due to the presence of wetlands immediately adjacent to Route 52, the marshes act as a pollution filter for man-made debris and they remove or partially remove and absorb sediments and chemicals emanating from the road.

In general, reconstruction of Route 52 will require placement of fill and installation of piles in wetland areas for the Build Alternatives. Wetland impacts (removal of wetland habitat) associated with the Build Alternatives are due to the driving of pilings into the tidal marsh, providing access to the recreational island, and shading. Also, in the Build Alternatives, a small tidal wetland area would be removed west of the existing causeway where the proposed highway enters into Somers Point. Generally, the wetlands to be affected by the installation of piles and shading from the causeway are stands of salt marsh cordgrass (*Spartina alterniflora*) that exist throughout much of the remaining islands in the vicinity of the study area. However, both Build Alternatives would also affect some wetlands immediately adjacent to the existing causeway that comprise the transitional zone between the upland areas and the salt marsh. These wetlands consist of transient species of wetland plants like marsh elder (*Iva frutescens*) that represent ecotones between upland and wetland communities. Pilings, embankment material or the shoulder of Route 52 often bordered their upland boundaries, along the causeway. Vegetation on the upland communities was absent or is consistent with disturbed environments and contains primarily phragmites (*Phragmites communis)* and poison ivy (*Toxicodendron radicans*).

Table 3-1 summarizes the direct impacts of wetlands, due to dredging and filling, and also the shading impacts for the entire wetlands areas beneath the structure. The amount of direct wetland impacts associated with these proposed alternatives is small when compared to the size of the project, considering that the entire project is being constructed within a large wetland/aquatic habitat.

Build Alternatives 9 (Option 1) and 9A (Option 1) are the same with respect to wetland impacts, resulting in the filling of about 1/10 of a hectare (just under ¼ acre). The Build Alternatives impact wetlands that are directly adjacent the existing causeway. Of all Build Alternatives considered in the DEIS, Alternatives 9 and 9A (Option 1) involve the least impact to wetlands.

Shading impacts are also indicated in Table 3-1. Alternatives 9/9A have comparable impacts (somewhat less than a hectare of additional shading relative to the No-Build Alternative). However, over some of this area, the structures shall be of sufficient height to allow a few hours of sunlight to reach the wetlands areas and, consequently, the effects of shading in these areas will be lessened.

Total shading created by the causeway over wetlands may inhibit the growth or displace the native wetland vegetation. Therefore, a design option involving a raised and split viaduct for the stretches of Route 52 that would pass over vegetated wetland islands was evaluated. This option would potentially reduce impacts to the marsh cordgrass by decreasing the shading effect of the new and wider roadway by allowing more sunlight to reach the vegetation. Raising the height from 4 meters to 12 meters, and separating the northbound and southbound lanes by approximately 10 meters (34'), would allow sunlight to reach vegetated areas that would otherwise be shaded by the lower viaduct. The split viaduct option was not selected because it would significantly increase the footprint of the causeway, inhibit angler access and significantly increase the project cost.

Table 3-1: Summary of Impacts of Various Alternatives on Wetlands, Route 52(1) Between Somers Point, Atlantic County and Ocean City, Cap May County

Block	Lot	Description	Area Impacted By Various Alternatives Units in Square Meters (Square Feet)		
			Alternative 9	Alternative 9A	Alternative 11 No-Build
			Option 1[3]	Option 1	
1750	1	Majority of lots are tidal wetlands. Access from Route 52.	0	0	0
1750	2		0[1] {F} 70 (753){S}	0[1] {F} 70 (753){S}	0
1750	4	Majority of lot is a tidal wetland. No access from Route 52.	0	0	
1750	11	Cowpens Island. Entire lot is a tidal wetland. No access from Route 52.	0	0	0
1750	16	Majority of lot is a tidal wetland. Access from Route 52. The Ocean City Information Center is located on this lot.	0[1]{F} 6071 (65,347){S}	0[1]{F} 6071 (65,347){S}	0
850	1	Majority of lots are tidal wetlands. Access from Route 52.	0[1]{F} 540 (5812){S}	0[1]{F} 540 (5812){S}	0
850	3		0[1]{F} 1244 (13,390){S}	0[1]{F} 1244 (13,390){S}	0
850	6 and/or 7	Majority of lots are tidal wetlands. Access from Route 52. Lot 7 is privately owned.	0[1]{F} 539 (5802){S}	0[1]{F} 539 (5802){S}	0
2012	12.01	Lot includes beach, wetland and developed area in Somers Point.	771 (8299){F}	771 (8299){F}	0
Not Determined		Piles[2]	162 (1743){F}	162 (1743){F}	0
Total			**911 (9806){F}** **8464 (91,105){S}**	**911 (9806) {F}** **8464 (91,105){S}**	**0**

Estimates are based on the Alternative designs, and may change based on the final design.

[1] Some area is impacted, but is addressed in terms of the total piles needed for the alignment, rather than by lot.

[2] Areas impacted were not determined in terms of lot and block, but by the number of piles in wetlands.

[3] Initially Preferred Alternative

{F} Fill Impact

{S} Shading Impact (worst case)

3.1.3 Aquatic Resource Impacts

Potential impacts to shellfish beds and submerged aquatic vegetation are discussed below. Table 3-2 summarizes the potential impacts to these aquatic resources.

Table 3-2: Summary of Impacts on Aquatic Resources, New Jersey Route 52(1) Between Somers Point, Atlantic County and Ocean City, Cape May County

		Build Alternatives		
		Alternative 9 Option 1[2]	**Alternative 9A Option 1**	**Alternative 11 (No-Build)**
Permanent Impacts	Permanent Habitat Loss Area[1]	420 SM (4520 SF)	1350 SM (14530 SF)	0
Permanent Habitat Change	Shallow Dredging Area (< 1 meter below bottom)	6,300 SM (68,000 SF)	0	0
	Deep Dredging Area (> 1 meter below bottom)	3,000 SM (32,000 SF)	0	0
	Total Dredging Area	9,300 SM (100,000 SF)	0	0
	Dredging Volume	19,017 M^3 (24,870 YD^3)	0	0
Aquatic Ecology	Impacts to Shellfish	Temporary/Long-term	Minor Temporary/ Long-term	Temporary
	Impacts to Finfish and Migratory Pathways	Temporary	Temporary	Temporary
	Impacts to Submerged Aquatic Vegetation	None	None	None
	Impacts to Wintering Areas	Temporary	Temporary	Temporary

[1] Construction Estimates for Habitat Loss Due to Pile Driving

[2] Initially Preferred Alternative

Temporary — Refers to impacts associated with disruption of the benthos, sediment resuspension, increased turbidity, lowered dissolved oxygen levels and physical obstruction during the construction phase of the project.

Long-term — Refers to impacts directly relating to the loss of habitat from the support structures.

3.1.3.1 Shellfish/Benthic Habitat

Great Egg Harbor Bay provides shellfish habitat in excess of 285 hectares (704 acres). According to the State Water Quality Inventory Report (1998), these shellfish habitats have been classified as either "Seasonal Area" or "Approved Area". Several shellfish species inhabit Great Egg Harbor Bay, including the surf clam (*Spisula solidissima*), which is a federally managed EFH species (Refer to Table 2-1). The most important commercial species is the hard clam (*Mercenaria mercenaria*). Although it is not a federally managed EFH species, it is given special mention due to its importance to the local economy. The hard clam is considered the most widely distributed shellfish species in New Jersey, present in abundant quantities in nearly every estuary from Raritan Bay to Cape May. The location of the existing Route 52 study area includes shellfish habitat classified as "Approved Area" with the exception of sections within the ICWW and the Ship Channel, which have a "Seasonal Area" classification. The "Seasonal Areas" are approved for the harvesting of shellfish only from November 1 through April 30 and are so designated typically due to the reduction of oxygen levels near the bay bottom adjacent to the urban areas during the warmer months.

Bottom habitat is important to other marine organisms in addition to shellfish. These organisms are a vital food source (forage base) for fish and crustaceans. These organisms live either on or within the bottom substrata (sediments, debris, macrophytes, filamentous algae, etc.) for at least part of their life cycle. The most common groups of benthic organisms include insects, clams, snails, worms, and crustaceans. Species-specific information on benthic organisms within the study area, with the exception of shellfish and some arthropods, is limited. However, the presence of polychaete worms, oligochaetes, various arthropods including blue crab (*Callinectes sapidus*), mud fiddler and various mollusk species, can be expected throughout the bay.

Furthermore, distinct variations in bottom topography and composition make many of the channels in the northern portion of the bay ideal habitat for benthic organisms and provide over-wintering grounds for blue crabs. Crabs overwinter in the substrate and separate by gender in the winter (i.e., December – March) according to salinity (Riportella 2001). In bays females tend to aggregate in areas with higher salinity (e.g., approximately >25 ppt) and males locate in areas with lower salinity (Riportella 2001; Kahn 2001). The salinity of the bay in the area of the Route 52 Bridge ranges on average from 28.4 ppt–30.3 ppt (NJDEP Department of Watershed Management 1999). Thus, the bay area near the causeway can be considered a female blue crab aggregate overwintering area. Therefore, construction activities in this area that impact benthic areas should be prohibited from December 1st to March 31st to protect this resource.

Shellfish habitat will be temporarily affected locally by construction activities associated with Alternative 9-1 or Alternative 9A-1, both of which would generate suspended sediments, create turbidity and lower oxygen levels in the immediate project vicinity. For Alternative 9-1 only, dredging to realign the ICWW would temporarily disrupt approximately 9,300 square meters (100,000 square feet) of localized areas of shellfish and benthic habitat.

The required elevation of channel bottom is –3.65 meters (-12') referenced to Mean Low Water, or –4.3 meters (-14') relative to the 1988 NGVD datum. Soil borings taken in the immediate vicinity of the proposed dredging indicate that the composition of the soil is uniform, consisting of gray fine sand and some shell fragments, to a depth of about -7 meters (-23') relative to the 1988 NGVD datum. So, the proposed dredging would not cause a change in substrate composition.

Most of the proposed dredging would be quite shallow (see Figure 1-2, Footprint of Realigned ICWW Dredging for the Preferred Alternative). The total area that would require dredging would be about 9,300 square meters (100,000 square feet). Roughly two thirds of this area, or 6,300 square meters (68,000 square feet), would require dredging of less than 1 meter (3.3') below the existing bottom. The remaining third, or 3,000 square meters (32,000 square feet), would require dredging in the range of 1 meter (3.3') to 3.4 meters (11.5') below the existing channel bottom. It is unlikely that periodic maintenance dredging would be required. These changes in depth will result in a permanent change to benthic habitat only in areas affected by the proposed dredging. Such habitat changes may result in changes in benthic species diversity and abundance.

Since Beach Thoroughfare has a good flushing rate (due to relatively high current speeds), significant deposition of sediments on the seafloor is not anticipated. Therefore, smothering of benthic creatures is not expected from these activities. However, the magnitude of change in depth could have some effect on the diversity and abundance of benthic organisms (i.e., flora and fauna assemblages). A significant change in depth of this area from dredging would cause changes to hydrologic flow through this area with concomitant changes to light transmissivity, current flow, and the temperature profile throughout the water column. Accordingly, this could result in changes to the number and diversity of species assemblages. Conversely, a small relative change in the depth profile of dredged areas should have a marginal effect on species assemblages in dredged areas.

From an Essential Fish Habitat perspective, life stages of federally managed fish species expected to occur in the project area have been reported to inhabit the entire range of the pre- and post-dredge depths (see Table 3-3). Benthic organisms in the dredge area that serve as a forage base for the various fish species life stages will be temporarily impacted during the construction and/or dredging phase of the project. However, these organisms are expected to recolonize and become re-established after construction and/or dredging disturbances are ended. Due to the linear nature of this project, adjacent undisturbed forage base areas with benthic organisms are available for the various life stages of these mobile fish species life stages. As described above, potential changes may occur to the forage base species diversity and abundance due to dredge depth modifications; however, federally managed fish species expected in the project area are adapted to feeding on a forage base available at both the pre- and post-depths as evidenced by the habitat depth range shown on Table 3-3. Therefore, no significant impact to the forage base for EFH species is anticipated in this area.

Table 3-3: Habitat Depth Range of Life Stages of Federally Managed Species Expected to Occur in Great Egg Harbor Bay-New Jersey Route 52 Proposed Modification

Common Name	Life Stage(s)	Habitat Depth Range (Meters [m]/feet['])	Expected Occurrence
Red hake	Juveniles	<100m (328')	Rare
Winter flounder	Eggs Larvae Juveniles Adults	<5m (16') <6m (20feet) 1-50m (3-164') 1-100m (3-328')	Common Common Common Common
Windowpane flounder	Eggs Larvae Juveniles Adults	<70m (230') <70m (230') 1-100m (3-328') 1-75m (3-246')	Highly abundant Highly abundant Highly abundant Highly abundant
Spanish mackerel	Eggs Larvae	Throughout water column, outer estuary Throughout water column, outer estuary	May be found May be found
Summer flounder	Larvae Juveniles Adults	1-70m (3-230') 1-70m (3-230') 1-360m (3-1,180')	Rare Common Common
Sand tiger shark	Neonate	To 25m (82')	May be found
Dusky shark	Neonate	To 25m (82')	May be found
Sandbar shark	Neonate Juveniles Adults	To 25m (82') To 25m (82') To 50m (164')	May be found May be found May be found
Atlantic sea herring	Juveniles Adults	15-135m (49-443') 20-130m (66-426')	May be found May be found
Bluefish	Juveniles Adults	Ubiquitous within "mixing" and "seawater" zones. Ubiquitous within "mixing" and "seawater" zones.	Expected Expected
Atlantic butterfish	Juveniles	10-365m (33-1,200')	Expected
Scup	Juveniles Adults	<40m (132') <40m (132')	May be found May be found
Black sea bass	Juveniles Adults	<10m (33') 10-20m (33-66')	Expected Expected

Since EFH species in the area are already adapted to feeding on forage base species throughout the depth ranges of pre- and post-dredging, it is anticipated that these EFH species will continue to utilize the post-dredge areas for feeding following recolonization by benthic forage base species. Permanent loss of benthic environment would result from the installation of pilings for the causeway for a total area of either 420 square meters (4,520 square feet) for Alternative 9-1, or 1,350 square meters (14,530 square feet) for Alternative 9A-1.

Long-term impacts to the benthic substrate and shellfish beds are anticipated from the placement of piers or piles to support structures during the construction of either

Build Alternative. Both would permanently affect the benthic substrate and exclude colonization by shellfish of those areas occupied by the piles. These piers will provide a beneficial impact by increasing habitat for juvenile fish species and encrusting shellfish. In fact, the total surface area resulting from the new pilings (from the seafloor to the high tide line) is anticipated to be 3,436 m (36,970 square feet). This is more than double the benthic area lost due to piling installation.

Also, the removal of portions of the existing causeway bridges including numerous pilings that would represent navigational hazards can produce minor temporary impact to finfish habitat through displacement.

In a broader sense, these impacts would not be substantial, since the total area of impact is very small, relative to the total extent of shellfish beds in Great Egg Harbor Bay [in excess of 285 hectares (706 acres)]. Where viable, turbidity barriers would be employed during construction in order to minimize impact caused by the resuspension of sediments. These barriers should be positioned around the area of disturbance to minimize suspended particle drift during tidal fluctuation.

To mitigate for the loss of bottom habitat in the footprint of support structures, transplanting shellfish has been considered. In an attempt to investigate the possibility of mitigating for loss of shellfish habitat by transplanting, several experts in the field of aquaculture or shellfish research were contacted to determine their professional opinion of the success and or failures associated with shellfish transplants. In general, experts are unaware of any precedent that involved the seeding or transplantation of clams to areas where they were not already successful. Most have had poor success in growing clams where they were not already established.

3.1.3.2 Submerged Aquatic Vegetation

All native species of seagrasses, macroalgae, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations, within adult and juvenile summer flounder essential fish habitat are designated by the Mid-Atlantic Fishery Management Council as Habitat Areas of Particular Concern. Great Egg Harbor Bay supports limited areas of submerged aquatic vegetation. In fact, submerged vegetation is most prevalent in coastal areas north of the study area. Two areas of submerged aquatic vegetation, which have not been delineated as to species, are mapped in the vicinity of the study area. One mapped patch of vegetation is located to the northwest of the Ocean City Information Center, west of the existing causeway. The second area is located east of the existing alignment in Rainbow Channel (see Figure 3-1 for the locations of these areas). As can be seen from Figure 3-1, the approximate distance of the dredging operation from these two SAV

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Figure 3-1
Location of SAV Beds

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beds is 500m and 1,500m, respectively. The closer bed is on the opposite side of a marsh island and the more remote bed is located between two of the Rainbow Islands. Based on these distances, the primary grain size of the dredged sediment (fine/medium sands) (USDOT, FHA and NJDOT, 1998) which results in relatively rapid deposition, and the fact that the SAV beds are separated from the dredging operations by marsh islands, the potential for substantial sediment deposition within these beds is low.

No areas of submerged aquatic vegetation were observed in the vicinity of the existing causeway during field investigations in October 1997. Submerged shallow water areas directly adjacent to the causeway appeared to have a sandy or mud bottom barren of vegetation.

Long-term impacts to submerged aquatic vegetation could result from the placement of fill materials and/or the placement of piers or piles to support the Route 52 modification. However, the Build Alternatives under consideration will not be routed through the known areas of submerged aquatic vegetation. Therefore, Alternatives 9 (Option 1) and 9A (Option 1) will not affect submerged aquatic vegetation.

3.1.3.3 Finfish Habitat and Migratory Pathway

A review of the habitat depth ranges of egg, larval, juvenile, and adult life stages of resident and migratory EFH species inhabiting the area of dredging demonstrates these species are already adapted to the depth changes anticipated by the proposed dredging (Table 3-3). Therefore, material long-term impacts to these EFH species are not anticipated.

Short-term impacts to finfish habitat and migratory pathways are possible during construction of support structures and dredging for channel realignments for all of the Build Alternatives. Turbidity caused by resuspension of sediments could act as a temporary barrier to finfish passage. Similarly, turbidity and sediment deposition will temporarily displace wintering finfish species and crabs. Temporary impacts could also result from the use of turbidity barriers, sheet piles, cofferdams, and similar structures that could physically inhibit the movement of fish through an area. However, the causeway is very long, and work will take place and the work will be performed progressively and in stages, such that the contractor will only be working in a few localized areas at any given time. Further, it will be necessary to maintain channels for the passage of ships during construction. Accordingly, there will always be large zones of clear water for the fish to use for migration, while construction is taking place. These impacts will be temporary and the finfish migratory pathways would be re-established after construction disturbances end. Impacts will be similar for both Alternatives 9-1 and 9A-1.

The removal of portions of the existing structure, including the existing piers, can produce minor temporary impacts to finfish habitat through displacement. During final design, a decision will be made whether to leave the existing pilings in place below customary navigational draft depths. However, the construction of new pilings/support structures will provide additional habitat for finfish and some species of encrusting shellfish. It is expected that concrete pilings function similarly to artificial reefs and that fixed and shaded artificial structures would provide significant habitat for many species of larval fish.

3.1.3.4 Wintering Areas

Great Egg Harbor Bay serves as a wintering area for several finfish species and other commercially important species including winter flounder, striped bass, and blue claw crabs (Draft Environmental Impact Statement, August 2000). These species are expected to utilize Great Egg Harbor Bay, including the study area, during the winter months. In addition, marine turtles typically utilize New Jersey waters for periods ranging from May to November.

Short-term impacts to wintering grounds and utilization of the study area by these finfish, crabs, and marine turtles are possible during construction due to sediment resuspension, increased turbidity, and lowered oxygen levels. Short-term impacts may also result from the proposed dredging as described below.

As described in Section 3.1.3.1, the bay area where the Route 52 project will occur, tends to serve as an aggregate area for blue crabs. Since blue crabs overwinter in this area (by burrowing in the sediment), they are vulnerable to the impacts of marine construction that impacts the bay floor. Overwintering occurs from December–March (Riportella 2001). In addition, winter flounder spawn from January–May (Riportella 2001) in the area of construction and dredging, with spawning generally occurring from January–March (Stone *et al.* 1994, Scarlett 2001). Therefore, as described in Section 4.3, Fisheries Impact Mitigation, construction activities that impact winter flounder egg and blue crab overwintering habitats (i.e., demersal and benthic habitats) should not occur from December 1st through May 31st. Prohibitions on construction activities impacting benthic environments will result in the protection of these resources, while allowing construction to occur in an expeditious manner. This will minimize the need for repeated mobilization/ demobilization operations which, in themselves, impact the bay environment.

3.1.3.5 Removal of the Existing Causeway

During construction, most of the existing Route 52 structures and causeway will be removed once the new causeway and bridges have been built. The bridges and concrete pavements would generate a large quantity of debris, which poses disposal concerns. Consideration has been given to incorporation of recyclable construction materials and portions of demolition materials into the artificial reef program sponsored by the New Jersey Department of Environmental Protection (NJDEP).

These efforts will help to minimize impacts involving the disposal of construction materials and would mitigate habitat loss within the project area through the creation or enhancement of new, offsite marine habitats. The NJDEP has indicated willingness to incorporate these materials into the artificial reef program as long as the material meets the following conditions:

- The material consists of concrete, steel or rock;
- There is no wood or other floatable debris;
- The material is inspected by NJDEP personnel;
- The material is placed in either the Great Egg or Ocean City reef sites, each located approximately 7 miles from the Great Egg Inlet; and
- Deployment at sea is observed by NJDEP personnel.

Removal of the old bridges along with all of the piers may have a temporary negative impact on finfish habitat. However, this temporary negative impact will be offset by the beneficial impacts associated with the new pilings/support structures that will be constructed, which will serve to replace some of the lost finfish habitat. Consideration will be given during final design to leaving in place that portion of existing pilings below customary navigational draft depths.

3.1.3.6 Sound and Pressure Impacts

Temporary sound and pressure (i.e., shock waves) can result from construction activities associated with pile driving and blasting operations. At this time it is not known if blasting will be required to remove the existing causeway; but, if required, this section addresses blasting concerns. Blasting in or near water produces shock waves that can rupture internal organs. Blasting vibrations may also kill or damage fish eggs or larvae (CDFO 2000). Accordingly, the following sound mitigation strategies may be employed during project construction:

- Use of noise generators to move fish out of area;
- Detonation of small scaring charges set off one minute prior to detonation of main charge to scare fish away from the area;
- Installation of bubble/air curtain to disrupt shock waves; and
- Prohibition of blasting from January 1st to March 31st to protect winter flounder spawning overwintering habitat (blue crabs do not appear to be impacted by sound/shock waves (Young 1991)).

3.2 Impact on Food Source

The implementation of either Alternative 9-1 or 9A-1 will result in varying impacts to the forage base of federally managed fish species relative to the No-Build Alternative. Impacts of food sources result mainly from temporary or permanent alterations to species inhabiting wetlands, hard surfaces and benthic environments.

3.2.1 Wetlands Forage Base Impacts

The loss of 911 square meters (0.23 acres) of wetlands due to filling and the 8,464 square meters (2.09 acres) reduction in wetland productivity from shading will result from either Alternative in permanent impacts to fish and shellfish species that utilize these wetland habitats in the bay (e.g., Atlantic silversides, mummichogs, and polychaete worms, quahogs). These species serve a forage base function to many of the federally managed species listed in Table 2-1 and described in greater detail below.

These reductions in marshlands relative to the areal extent of marshes in Great Egg Harbor Bay are not expected to measurably effect the source of epifaunal and infaunal forage base for federally managed fish species in bay.

3.2.2 Hard-Surface Forage Base Impacts

Both Alternative 9-1 and 9A-1 will result in the permanent increase of hard surfaces from pilings placement in the bay relative to the No-Build Alternative. Hard surfaces provide substrate for algae and marine invertebrates (e.g., gastropods, etc.) that serve a forage base function to many of the federally managed species listed in Table 2-1 and described in greater detail below. However, an overall increase in hard-surface areas from the pilings are not expected to have a measurable effect on fish populations that feed on algae and invertebrates that live on hard surfaces.

Also, as described above, consideration has been given to incorporation of recyclable construction materials and portions of demolition materials into the artificial reef program sponsored by the NJDEP. The NJDEP has indicated willingness to incorporate these materials into the artificial reef program as long as the materials meet their requirements. These efforts will help to minimize impacts involving the disposal of construction materials and would mitigate habitat/forage base loss near the project area through the creation or enhancement of new, offsite marine habitats. Areas considered for artificial reef development include the Great Egg or Ocean City reef sites each located approximately 7 miles from the Great Egg Inlet.

3.2.3 Benthic Forage Base Impacts

Benthic infauna and epifauna provide a forage base for federally managed species in Great Egg Harbor Bay. The benthic habitat/forage base located in the areas of piling placement will be permanently removed, resulting in the permanent loss of an estimated 708 square meters of benthic habitat under both Build Alternatives. The reduction of benthic area relative to the size of the benthos in the project area is not expected to have a measurable effect on fish populations that feed on benthic forage base.

Alternative 9 (Option 1), the IPA, requires the dredging of an estimated 19,017 cubic meters of sediment in order to realign the ICWW. The other Build Alternative does not require dredging. Such dredging will disrupt benthic habitat and, consequently, benthic forage base production. However, due to the relatively high current velocities in the area of dredging (i.e., Beach Thoroughfare), maintenance dredging is not anticipated. Therefore, only a one-time channel realignment dredging is expected. Accordingly, it is predicted that benthic infauna and epifauna will recolonize the disturbed dredged area, resulting in a temporary loss of forage base in the disturbed area. Such a temporary loss is not anticipated to have a measurable effect on fish population that feed on benthic forage base.

Both Build Alternatives are not routed through the submerged aquatic vegetation (SAV) beds. Therefore, no changes to benthic infauna and epifauna production associated with SAV beds are anticipated under either Build Alternative.

3.3 Fish Species Impacted by the Build Alternatives

An analysis of EFH for each fish species and appropriate life stages listed in Table 2-1, including the likelihood of the species using the project area, is presented below.

3.3.1 Red Hake

Great Egg Harbor Bay is designated as EFH for eggs, larvae, and juvenile Red Hake. EFH (NEFMC 1998a) for Red Hake eggs is surface waters of the Gulf of Maine, Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras, North Carolina. Eggs were found where sea surface temperatures were less that 10ºC (50ºF) along the inner continental shelf with salinities less than 25 parts per thousand (ppt). EFH (NEFMC 1998a) for larvae is in similar areas as the eggs where sea surface temperatures were less that 19ºC (66ºF), and in waters less than 200 meters (656') deep. EFH (NEFMC 1998a) for juveniles is in similar areas as the eggs with bottom habitats with substrates of shell fragments, areas with an abundance of live scallops, and areas with temperatures less than 16ºC (61ºF), depths less than 100 meters (328'), and a salinity range of 31–33 ppt. Data from the New Jersey Inland Bays (Stone *et al.* 1994) indicate that Red Hake eggs and larvae were not collected in these bays. Red Hake juveniles were reported as rare in these bays. Great Egg Harbor Bay is included as part of the New Jersey Inland Bays system as defined by Stone *et al.* (1994), therefore eggs and larvae are not expected in the project area. Juveniles may be expected to be rare in the project area.

3.3.2 Winter Flounder

Great Egg Harbor Bay is designated as EFH for eggs, larvae, juveniles, and adult Winter Flounder. EFH (NEFMC 1998b) for Winter Flounder eggs is bottom habitats with substrates of sand, muddy sand, and gravel on Georges Bank, inshore areas of the Gulf of Maine, southern New England, and the middle Atlantic south to Delaware Bay. Eggs are found where water temperatures are less than 10ºC (50ºF), salinities range from 10–30 ppt, and water depths are less than 5 meters (16'). Eggs are often observed in Great Egg Harbor from January to May (Riportella 2001) with spawning generally occurring from January through March (Stone *et al*. 1994, Scarlett 2001). EFH (NEFMC 1998b) for Winter Flounder larvae is pelagic and bottom waters of Georges Bank, inshore areas of the Gulf of Maine, southern New England, and the middle Atlantic to Delaware Bay. Larvae are found where sea temperatures are less than 15ºC (59ºF), salinities range from 4–30 ppt, and water depths are less than 6 meters (20'). Larvae are observed from March to July. EFH (NEFMC 1998b) for Winter Flounder juveniles is bottom habitats with substrates of mud or fine-grained sand on Georges Bank, inshore areas of the Gulf of Maine, southern New England and middle Atlantic areas south to Delaware Bay. Juveniles are found where water temperatures are below 25ºC (77ºF), water depths range from 1–50 meters (3–164'), and salinities range from 10-30 ppt. EFH (NEFMC 1998b) for Winter Flounder adults is bottom habitats that include estuaries with mud, sand, and gravel substrates on Georges Bank, inshore areas of the Gulf of Maine, southern New England and areas in the middle Atlantic south to Delaware Bay. Adults are found where water temperatures are less than 25ºC (77ºF), water depths range from 1–100 meters (3–328'), and salinities range from 15–33 ppt. Data from the New Jersey Inland Bays (Stone *et al* 1994.) indicate that Winter Flounder eggs, larvae, juveniles and adults were common in abundance. Great Egg Harbor Bay is included as part of the New Jersey Inland Bays system as defined by Stone *et al.* (1994), therefore, all the life stages of Winter Flounder may be found in the project area.

3.3.3 Windowpane Flounder

Great Egg Harbor Bay is designated as EFH for eggs, larvae, juveniles, and adult Windowpane Flounder. EFH (NEFMC 1998c) for Windowpane eggs is surface waters of the perimeter of the Gulf of Maine, on Georges Bank, southern New England and the middle Atlantic south to Cape Hatteras, North Carolina. Eggs are found where sea surface temperatures are less than 20ºC (68ºF) and water depths are less than 70 meters (230'). Peak numbers of eggs are observed from May to October in the middle Atlantic. EFH (NEFMC 1998c) for Windowpane larvae is pelagic waters of the perimeter of the Gulf of Maine, on Georges Bank, southern New England, and the middle Atlantic south to Cape Hatteras, North Carolina. Larvae are found where sea temperatures are less than 20ºC (68ºF) and where depths are less than 70 meters (230'). Peak numbers of larvae are observed from May to October in the middle Atlantic. EFH (NEFMC 1998c) for Windowpane juveniles is bottom habitats with substrates of mud or fine-grained sand of the perimeter of the Gulf of Maine, on Georges Bank, southern New England and the middle Atlantic south to Cape Hatteras, North Carolina. Juveniles are found in water temperatures below 25ºC (77ºF), where depths are 1–100 meters (3–328') and where salinities are between 5.5–36 ppt. EFH (NEFMC 1998c) for Windowpane adults is similar to that for juveniles except that adults are found where water temperatures are below 26.8ºC (80ºF), water depths range from 1–75 meters (3–246') and salinities are between 5.5–36 ppt. Data from the New Jersey Inland Bays (*Stone et al.*1994) indicate that Windowpane Flounder eggs, larvae, and juveniles and adults were highly abundant. Great Egg Harbor Bay is included as part of the New Jersey Inland Bays system as defined by Stone *et al.* (1994), therefore, all the life stages of Windowpane Flounder may be found in the project area.

3.3.4 Monkfish

Great Egg Harbor Bay is designated as EFH for eggs and larvae of Monkfish. EFH (NEFMC 1998d) for Monkfish eggs is described as surface waters of the Gulf of Maine, Georges Bank, southern New England, and the middle Atlantic south to Cape Hatteras, North Carolina. Monkfish egg veils are found where sea surface temperatures are below 18 ºC (64ºF) and water depths from 15–1000 meters (49–3,280') during March to September. EFH (NEFMC 1998d) for Monkfish larvae is pelagic waters of the Gulf of Maine, Georges Bank, southern New England and the Middle Atlantic south to Cape Hatteras, North Carolina. Larvae are found where water temperatures are approximately 15ºC (59ºF) and water depths range from 15–1,000 meters (49–3,280') during March to September. Characteristics of the pelagic waters with lower temperatures and greater depths are not typical of the shallower, estuarine habitat in Great Egg Harbor Bay. Communications with the NMFS Sandy Hook Laboratory (Fahay 2001) indicated that specific data have not been collected that suggest Monkfish eggs or larvae would occur in the Great Egg Harbor Bay area. Communication with the Ocean Stock Assessment Program of the New Jersey Division of Fisheries & Wildlife (NJDF&W) (Byrne 2001) indicated that Monkfish egg veils have not been observed in their trawl catches. Therefore, this species is not expected to be in the project area.

3.3.5 King Mackerel

Great Egg Harbor Bay is designated as EFH for eggs, larvae, juvenile, and adult King Mackerel. EFH for King Mackerel is described as including sandy shoals of capes and offshore bars, high profile rocky bottom and barrier island ocean-side waters from the surf to the shelf break zone. King Mackerel is a coastal migratory pelagic species and would not be expected in the lower portion of the moderately saline Great Egg Harbor estuary. Communications with NJDF&W (McClain 2001) and the Barnegat Bay Estuary Program (Dieterich 2001) indicated that this species is unlikely to occur in Great Egg Harbor Bay. This species is not expected to be in the project area.

3.3.6 Spanish Mackerel

Great Egg Harbor Bay is designated as EFH for eggs, larvae, juvenile, and adult Spanish Mackerel. Similar to the King Mackerel the EFH includes sandy shoals of capes and offshore bars, high profile rocky bottom and barrier island ocean-side waters from the surf to the shelf break zone. Spanish Mackerel is also a coastal migratory pelagic species. Communication with the NMFS Sandy Hook Laboratory (Fahay 2001) indicated that Spanish Mackerel, in recent years, have been documented as spawning off the New Jersey coast. Eggs and larvae of this species could be expected in the beach areas and also up into coastal estuaries (Fahay 2001). Therefore, eggs and larvae of this species may be found in the project area.

3.3.7 Cobia

Great Egg Harbor Bay is designated as EFH for eggs, larvae, juvenile, and adult Cobia. EFH for Cobia includes sandy shoals of capes and offshore bars, high profile rocky bottom and barrier island ocean-side waters from the surf to the shelf break zone and also high salinity estuaries, bays and eelgrass habitat. Cobia is a coastal migratory pelagic species and would not be expected in the mixed saline portion of the project area. Communications with NJDF&W (McClain 2001) and the Barnegat Bay Estuary Program (Dieterich 2001) indicated that this species is unlikely to occur in Great Egg Harbor Bay. This species is not expected to be in the project area.

3.3.8 Summer Flounder

Great Egg Harbor Bay is designated as EFH for larvae, juveniles, and adult Summer Flounder. EFH for Summer Flounder larvae for inshore areas is all estuaries where Summer Flounder were identified as present (including rare) in the NOAA Estuarine Living Marine Resource Program (ELMR) data in the “mixing” and “seawater” salinity zones. Larvae were reported as most abundant in nearshore areas at water depths of 1–70 meters (3–230'). In the northern part of the Mid-Atlantic Bight they occur frequently from September to February. EFH for Summer Flounder juveniles in inshore areas is all estuaries where juvenile Summer Flounder were identified as being present (including common) in the ELMR data for “mixing” and “seawater” salinity zones. Juveniles use several estuarine habitats as nursery areas (salt marsh creeks, open bay areas, eelgrass beds) where water temperatures are greater than 3ºC (37ºF) with salinities ranging from 10–30 ppt. EFH for adult Summer Flounder in inshore areas is in estuaries where Summer Flounder were identified as common, abundant, or highly abundant in the ELMR data for “mixing” and “seawater” salinity zones. Adults have been observed in shallow coastal and estuarine areas during the warmer months. Data from the New Jersey Inland Bays (Stone *et al.* 1994) indicate that Summer Flounder larvae were rare in abundance and juvenile and adult Summer Flounder were common in abundance. Great Egg Harbor is included as part of the

New Jersey Inland Bays system as defined by Stone *et al.* (1994), therefore larvae, juveniles and adults of Summer Flounder are expected to be in the project area.

3.3.9 Sand Tiger Shark

Great Egg Harbor Bay is designated as EFH for the neonate stage of the Sand Tiger Shark. Typical conditions for Sand Tiger Shark neonates are shallow coastal waters from Barnegat Inlet, New Jersey to Cape Canaveral, Florida to a depth of 25 meters (82') (NOAA 1999). Communications with the NJDF&W (McClain 1999) and National Marine Fisheries Service (NMFS) (Pratt 2001) indicated that this species may be present in Great Egg Harbor. Therefore, this species may be expected in the project area.

3.3.10 Dusky Shark

Great Egg Harbor Bay is designated as EFH for the neonate stage of the Dusky Shark. Typical conditions for Dusky Shark neonates are inlets, estuaries and shallow coastal waters to a depth of 25 meters (82') from the eastern end of Long Island, New York to Cape Lookout, North Carolina (NOAA 1999). Communications with the NJDF&W (McClain 2001) and NMFS (Pratt 2001) indicated that this species is rare in the area but may be present in Great Egg Harbor Bay. Therefore, this species is expected to be in the project area.

3.3.11 Sandbar Shark

Great Egg Harbor Bay is designated as EFH for the neonate stage, juveniles, and adult of the Sandbar Shark. Typical conditions for Sandbar Shark neonates are shallow coastal areas to depths of 25 meters (82') from Montauk, Long Island, New York south to Cape Canaveral, Florida. Nursery areas are in shallow coastal waters from Great Bay, New Jersey to Cape Canaveral, Florida. Important nursery and pupping grounds were noted in shallow areas and in the locale of the mouth of Great Bay, New Jersey. Typical conditions for juveniles are from Barnegat Inlet, New Jersey to Cape Canaveral, Florida in shallow coastal areas to a depth of 25 meters (82'). Typical conditions for adults are coastal shallow areas from Nantucket, Massachusetts to Miami, Florida, from the coastal area to depths of 50 meters (164') (NOAA 1999). Communications with the NMFS (Pratt 2001) indicated that this species has been collected in Great Egg Harbor Bay. Juveniles have been noted to occur from the last week in May through October. Female adults have been noted from the second week of June through the first week of July. Pupping occurs during this time. Neonates have been noted from early June through the first week of October (Pratt 2001). Therefore, this species is expected to be in the project area.

3.3.12 Tiger Shark

Great Egg Harbor Bay is designated as EFH for the neonate stage of the Tiger Shark. Typical conditions for Tiger Shark neonates are from shallow coastal areas to depths of 200 meters (656') from Cape Canaveral, Florida north to offshore Montauk, Long Island, New York (NOAA 1999). Communication with the Ocean Stock Assessment Program of the NJDF&W (Byrne 2001) indicated that in the annual trawl surveys that sample out to depths of approximately 30 meters (approximately 90') adult Tiger Sharks have not been captured. Communication with NMFS (Pratt 2001) indicated that the main nursery area for this species has been observed to be off the coast of Georgia and northern Florida. Neonates of this species would not be expected to occur in Great Egg Harbor Bay. Communications with the NJDF&W (McClain 2001) also indicated that this species is unlikely to occur in Great Egg Harbor Bay. Therefore, this species is not expected to be in the project area.

3.3.13 Atlantic Sea Herring

Great Egg Harbor Bay is designated as EFH for juveniles and adult Atlantic Sea Herring. EFH (NEFMC 1998e) for juvenile Atlantic Sea Herring is pelagic waters and bottom habitats in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic to Cape Hatteras. Juveniles are found where water temperatures are less than 10ºC (50ºF), water depths of 15–135 meters (49–443') with a salinity range of 26–32 ppt. EFH (NEFMC 1998e) for adult Atlantic Sea Herring is similar to that of juveniles, but in areas with water temperatures below 10ºC (50ºF), water depths from 20–130 meters (66–426'), and salinities above 28 ppt. Data from the New Jersey Inland Bays (Stone *et al.* 1994) indicate that Atlantic Sea Herring juveniles and adults were common in abundance. Great Egg Harbor Bay is included as part of the New Jersey Inland Bays system as defined by Stone *et al.* (1994), therefore, the juvenile and adult stage of this species may be expected in the project area.

3.3.14 Bluefish

Great Egg Harbor Bay is designated as EFH for juveniles and adult Bluefish. EFH for juvenile and adult Bluefish inshore is all major estuaries between Penobscot Bay, Maine and St. Johns River, Florida. Juvenile Bluefish occur in Mid-Atlantic estuaries from May–October within the “mixing” and “seawater” salinity zones. Adult Bluefish occur in Mid-Atlantic estuaries from April–October in the “mixing” and “seawater” zones. Bluefish are generally found in salinities greater than 25 ppt. Data from the New Jersey Inland Bays (Stone *et al.* 1994) indicate that Bluefish juveniles were abundant and adults were common in relative abundance. Great Egg Harbor Bay is included as part of the New Jersey Inland Bays system as defined by Stone *et al.* (1994), therefore, the juvenile and adult stages of this species are expected in the project area.

3.3.15 Atlantic Butterfish

Great Egg Harbor Bay is designated as EFH for juvenile Butterfish. EFH for Atlantic Butterfish juveniles in the inshore areas are the" mixing" and "seawater" portions of estuaries where juvenile Atlantic Butterfish are "common," "abundant," or "highly abundant" along the Atlantic coast from Maine to Virginia. Juvenile Atlantic Butterfish have been collected in depths of 10–365 meters (33–1,200') and in temperatures between 3–28ºC (37–82ºF). Data from the New Jersey Inland Bays (Stone *et al.* 1994) indicate that Butterfish juveniles were common in abundance. Great Egg Harbor Bay is included as part of the New Jersey Inland Bays system as defined by Stone *et al.* (1994). Depth and temperature conditions described above are present in Great Egg Harbor Bay and juvenile Atlantic Butterfish are reported as common in abundance, therefore juveniles of this species are expected in the project area.

3.3.16 Scup

Great Egg Harbor Bay is designated as EFH for juvenile and adult Scup. EFH for Scup juveniles are estuaries where Scup have been identified as common, abundant or highly abundant in the Estuarine Living Marine Resources Program (ELMR) data for "mixing" and "seawater" salinity zones. Juveniles are generally found in spring and summer in estuaries and bays from Massachusetts to Virginia in water temperatures greater than 7ºC (45ºF) and salinities greater than 15 ppt. Juveniles can be found in association with sand, mud and eelgrass bed types of substrates. EFH for Scup adults in the inshore area is estuaries where adults were identified as common, abundant, or highly abundant in ELMR data for the "mixing" and "seawater" salinity zones. Wintering adults are usually offshore south of New York to North Carolina in water temperatures great than 7ºC (45ºF). Data from the New Jersey Inland Bays (Stone *et al.* 1994*)* indicate that Scup juveniles and adults were rare in abundance. Great Egg Harbor Bay is included as part of the New Jersey Inland Bays system as defined by Stone *et al.* (1994). Communication with NJDF&W (McClain 2001) indicated that mostly juveniles and some adults of this species have been reported in Great Egg Harbor Bay. Therefore, juveniles and adults of this species may be expected in the project area.

3.3.17 Black Sea Bass

Great Egg Harbor Bay is designated as EFH for juvenile and adult Black Sea Bass. EFH for juvenile and adult Black Sea Bass is in estuaries where the juveniles and adults were identified as being common, abundant or highly abundant in the ELMR data for "mixing" and "seawater" salinity zones. Juveniles and adults are found in estuaries during the spring and summer in water temperatures above 6ºC (43ºF) with salinities greater that 18 ppt. They tend to prefer rough substrate, shell patches, and man-made objects in the habitat (Steimle *et al.* 1999). Data from the New Jersey

Inland Bays (Stone *et al.* 1994) indicate that Black Sea Bass juveniles and adults were common in abundance. Great Egg Harbor Bay is included as part of the New Jersey Inland Bays system as defined by Stone *et al.* (1994), therefore juvenile and adult stages of this species are expected to occur in the project area.

3.3.18 Atlantic Surfclam

Great Egg Harbor Bay is designated as EFH for juvenile and adult Atlantic Surfclam. Great concentrations of juvenile and adult Atlantic Surfclams are reported (Cargnelli *et al* 1999) as usually found in well-sorted, medium sand, but also may occur in fine sand and silty-fine sand. This species is common at depths of 8–66 meters (25–215') in turbulent areas beyond the breaker zone. In the field, Atlantic Surfclams have been found only at salinities greater than 28 ppt (Cargnelli *et al*. 1999). Habitat conditions in the more estuarine Great Egg Harbor Bay differ from those of the beach zone, oceanic, and more turbulent areas where this species is most common. This species is not expected to be in the project area.

3.3.19 Atlantic Cod

Great Egg Harbor Bay is designated as EFH for adult Atlantic Cod. EFH (NEFMC 1998f) for Atlantic Cod adults includes bottom habitats with a substrate of smooth sand, rocks, pebbles, or gravel in the Gulf of Maine, Georges Bank, southern New England, and the middle Atlantic south to Delaware Bay. Conditions where Atlantic Cod adults are found include water temperatures below 10ºC, depths from 10–150 meters (33–492'), and oceanic salinities. These lower temperatures and greater depths and salinity are not typical of the more estuarine habitat in the vicinity of the project site. Stone *et al*. (1994) noted that Atlantic Cod adults were not present in the New Jersey Inland Bays. Great Egg Harbor Bay is included as part of the New Jersey Inland Bays system as defined by Stone *et al.* (1994). Communication with NJDF&W (McClain 2001) indicated that Atlantic Cod adults have not been noted in Great Egg Harbor Bay. Therefore, this species is not expected to be in the project area.

3.4 Cumulative Impacts

Cumulative impacts are impacts that result from the incremental consequences of an action (the project) when added to other past and reasonably foreseeable future actions. The cumulative effects of an action may be undetectable when viewed in the individual context of direct and even indirect impacts, but nevertheless when added to other actions may eventually lead to a measurable environmental change.

The major natural resources that are within the area of potential effects of the project include parts of Somers Point, Ocean City, the Great Egg Harbor Bay, and the barrier islands in the bay. The ecosystem of Great Egg Harbor Bay has been formed over time by geological forces. This ecosystem, including the fish habitat, is vulnerable to incremental effects. Table 3-4 summarizes temporary and permanent impacts to EFH resulting from the Route 52 Reconstruction Project.

Table 3-4: Summary of Impacts to EFH[1]

EFH Resource	Summary of Effects
Surface Water Quality	
Ocean City	• New inlets proposed along with oil/grit separators for all new inlet connections. • No increase in impervious area.
Causeway between Somers Point and Ocean City	• Causeway runoff put through scuppers. • Scour basins over marsh islands to enhance water quality/minimize erosion. • Pile driving using jetting can increase turbidity during construction. • Dredging of realigned ICWW will cause increased turbidity during dredging. • Maintenance dredging not anticipated.
MacArthur Boulevard: Somers Point Circle to Route 9	• 3.13 acre increase in paved area. • MacArthur Boulevard drainage system using catch basins, piping and oil/grit separators will be installed to upgrade existing system. • Outfall upgraded. • Upgrade to existing detention/infiltration basin near Route 9. • Somers Point drainage system upgraded.
Wetland Resources	
Fill Impact	9,806 square feet
Shading Impact	91,105 square feet
Aquatic Resources	
Permanent Impacts	4520 square feet due to pile driving
Permanent Habitat Change	• Shallow (<1 m) dredging: 68,000 square feet • Deep (>1m) dredging: 32,000 square feet • Dredging volume: 19,017 cubic meters
Shellfish	Temporary/Long-Term[2]
Finfish Habitat and Migratory Pathway	Temporary[2]
Submerged Aquatic Vegetation	None
Wintering Areas	Temporary[2]
Sound and Pressure Impacts	Temporary[2], if blasting occurs
Impacts on Food Source	
Wetland Forage Base Impacts	Loss of 9,806 square feet due to fill and 91,105 square feet due to shading of wetland resources will result in a reduction of forage base species that utilized wetland habitat.

Table 3-4: Summary of Impacts to EFH (Cont'd)

EFH Resource	Summary of Effects
Hard-Surface Forage Base Impacts	An increase of 36,970 square feet of hard-surface habitat will result from piling construction, further resulting in an increase in forage base species that utilize intertidal and subtidal hard surface habitat.
Benthic Forage Base Impacts	Loss of 4,520 square feet of benthic habitat due to pile driving will result in a reduction of forage base species that utilized benthic habitat.
Fish Species Potentially Impacted by the Build Alterative	
Winter Flounder	Spawning occurs in the bay from January to May with most spawning occurring from January through March.
Windowpane Flounder	Present in all life stages.
Summer Flounder	Larvae, juveniles and adults present in the Bay.
Spanish Mackerel	Eggs and larvae are present in the Bay.
Sand Tiger Shark	Neonates may be in the Bay.
Dusky Shark	Neonates may be in the Bay.
Sandbar Shark	Neonates, juveniles and adults may be in the Bay.
Atlantic Sea Herring	Juveniles and adults may be in the Bay.
Bluefish	Juveniles and adults may be in the Bay.
Atlantic Butterfish	Juveniles may be in the Bay.
Scup	Juveniles and adults may be in the Bay.
Black Sea Bass	Juveniles and adults may be in the Bay.

[1] Effects Summary based on the Initially Preferred Alternative.

[2] Temporary refers to impacts associated with disruption of the benthos, sediment resuspension, increased turbidity, lowered dissolved oxygen levels and physical obstruction during the construction phase of the project; Long-term refers to impacts directly related to the loss of habitat from the support structures.

At this time, there are no other activities or projects that are ongoing or contemplated in this geographical area, within the life cycle of this project, that could result in additional impacts to the resources affected by the project, resulting in cumulative effects of any significance. Extensive coordination has been done with the public, the city of Somers Point Planning and Zoning, the city of Ocean City Planning Department, the Atlantic County Economic Development Corporation and the Department of Public Works, the Cape May County Planning Department and the Department of Public Works, the South Jersey Transportation Planning Organization, and State and federal agencies having jurisdiction in the area. None of the above contacts have identified any projects that involve dredging or in any other way could have additive, countervailing, or synergistic effects on the natural systems that will be affected by the proposed project. Moreover, there are no projects or actions in the reasonably foreseeable future that would impose any kind of cumulative effect, when added to the direct effects of the subject project, on the habitat or the flora and fauna on which these fish rely.

4. PROPOSED MITIGATION

4.1 Surface Water Impact Mitigation

To mitigate potential impacts to surface water, a storm drainage system will be designed to minimize impacts to surface water and ground water, and a comprehensive sediment and erosion control plan will be implemented to insure that severe construction-related impacts do not occur. Construction techniques, such as prefabrication, also can significantly reduce on-site construction duration and subsequent erosion and sedimentation concerns. Any and all dredging shall comply with the stipulations in the "Biological Opinion to the Army Corps of Engineers (ACOE) for Dredging Activities within the Philadelphia District" issued from the NMFS to the ACOE, dated November 26, 1996 and modified on May 25, 1999 (Biological Opinion). Potential impacts to surface water and proposed mitigation measures are discussed in detail in Section 3.4.4 of the Draft Environmental Impact Statement (DEIS, August 2000). For both Build Alternatives, measures suggested to mitigate potential impacts to surface water quality are as follows:

4.1.1 Ocean City

- Integrate into existing drainage system and install manufactured oil/grit separators on all new inlet connections.

*4.1.2 **C**auseway Between Somers Point and Ocean City*

- Design all stormwater discharge systems to either discharge small volumes frequently through scuppers over open water, or through scuppers and leaders to scour basins under the structure;

- During construction take precautions to minimize spillage and tracking of sand and silt on the road surface and promptly clean them up should they occur;

- For piling driving and other construction activities affecting the water column and seafloor (except dredging), the proposed turbidity mitigation strategy consists of the following:

  – Use turbidity curtains only in hydrologically quiescent areas (i.e., areas of low to no current velocity).

  – Employ a stringent level of visual monitoring to ensure minimal offsite migration of suspended solids (e.g., use a Secchi disk).

- Dewater impounded dredge material properly in order to prevent the release of sediments into the bay.

- Use Best Management Practices to contain all materials used in above water construction activities.

4.1.3 MacArthur Boulevard: Somers Point Circle to Route 9

- Remove and replace the existing detention/infiltration basin near the Route 9 intersection between Laurel Drive and MacArthur Boulevard.

- Abandon the existing 60-year old drainage system located under MacArthur Boulevard and replace this system with a new drainage system of catch basins and piping located along the west curb line of MacArthur Boulevard.

- Increase the size of the existing outfall pipeline, which is currently inadequate, to handle the developed flow.

- Provide an underground detention/infiltration piping system at the low point in MacArthur Boulevard near Braddock Avenue, to retain the first flush of a storm and improve water quality.

- Abandon the existing 60-year old drainage system located under the Somers Point Traffic Circle and replace this system with a new drainage system of catch basins and piping.

- Utilize a vegetated detention basin in the southwest quadrant of the four-legged intersection proposed to replace the traffic circle, and a vegetated swale located directly east of the north approach of the bridge over Ship Channel, discharging into Great Egg Harbor Bay.

- Integrate oil/grit separators in the new drainage system to improve water quality.

Implementation of the above measures and comprehensive storm drainage design will minimize water quality impacts due to soil erosion and sedimentation.

4.2 Wetland Impact Mitigation

To comply with E.O. 11990, entitled "Protection of Wetlands," the project must be designed to avoid wetland impacts unless there is no practicable alternative, and that, all practicable measures, be taken to minimize harm to wetlands. Due to the nature of the project, it is impossible to avoid wetland impacts. However, construction in wetlands, especially filling, has been minimized as much as practicable for the proposed Build Alternatives. For instance, Alternatives 9 and 9A (Option 1) involve a causeway on continuous structure rather than fill.

Methods to further mitigate wetland impacts include the implementation of sedimentation and erosion control plans and, to the maximum extent possible, avoidance of work or staging conducted within the wetland. The following specific mitigation measures are proposed:

- Use the maximum structural span lengths economically feasible, probably 27 meters (90'), to minimize the number of piers;
- Use pile foundations, rather than excavated pier foundations, so that construction disturbance is limited to the penetration of the piles themselves;
- Use meadow mats (30 cm × 30 cm timbers lashed together), or approved equivalent, during construction in wetland areas to minimize temporary impacts, and restore wetlands, where disturbance does occur; and
- Implement soil erosion control measures to minimize the deposition of eroded soils in wetlands.

After the wetland impacts have been reduced as much as practicable, adequate wetland mitigation will be provided. The United States ACOE and the NJDEP normally require wetland mitigation in the ratio of 2 acres created for each acre impacted. Under Alternatives 9 and 9A, efforts to create wetlands in place of those removed may be coordinated with the removal of portions of the existing causeway. Portions of these areas would be excavated down to a grade consistent with the existing tidal wetlands, and revegetated with tidal marsh species. Mitigation will be done on an “in-kind” basis, and will be detailed in the Wetlands Mitigation Plan to be prepared as part of the Final Design.

4.3 Fisheries Impact Mitigation

In order to mitigate for temporary impediments to migratory finfish pathways, construction techniques that interfere with the movement of fish along finfish migratory pathways should be avoided. Construction techniques that create a physical or biological barrier to the movement of fish along finfish migratory pathways should not be employed, unless acceptable mitigating measures are used. Further, any and all dredging shall comply with the stipulations in the “Biological Opinion.”

The following mitigation measures are proposed:

- Implement a phased approach to the construction effort to limit impacts to discrete sections of the highway at any one time, so as not to create a continuous barrier along the entire length of the project.
- For piling driving and other construction activities affecting the water column and seafloor (except dredging), the proposed turbidity mitigation strategy consists of the following:

- Use turbidity curtains only in hydrologically quiescent areas (i.e., areas of low to no current velocity).

- Employ a stringent level of visual monitoring to ensure minimal offsite migration of suspended solids (e.g.; use a Secchi disk).

- For dredging operations our proposed turbidity mitigation strategy consists of the following:

  - Where possible use a hydraulic dredge to pump sediment to a diked onshore dewatering area as described above.

  - Where hydraulic dredging is not feasible and a clamshell bucket is necessary for dredging, an "Environmental Bucket", which seals upon closure and minimizes spillage and leakage, would be utilized. The transfer of dredge spoils for offsite transport would also be accomplished using best management practices.

  - Where necessary, use turbidity curtains only in hydrologically quiescent areas (i.e., areas of low to no current velocity).

  - Employ a stringent level of visual monitoring to ensure minimal offsite migration of suspended solids consistent with dreding operations (e.g.; use a Secchi disk).

  - Prohibit dredging activities during the period December 1^{st} to May 31^{st} to protect winter flounder spawning and blue crab overwintering habitats (see also Sections 3.1.3.1, 3.1.3.4).

- If feasible, dredged materials will be used for beneficial uses such as beach replenishment/nourishment or as construction materials by contractors. If these uses are not feasible the dredged material will be placed or disposed of at a location that does not adversely harm or impact intertidal or subtidal habitat.

- To the extent possible, recycle acceptable construction materials (i.e., clean concrete and rebar) from the demolition of the four existing causeway bridges into artificial reefs to create habitat in mitigation for habitat lost in pile areas.

- Use demolition containment techniques to minimize the scattering of debris.

- For Sound Mitigation the following sound mitigation strategies may be employed during project construction:

  - Use of noise generators to move fish out of area.

- Detonation of small scaring charges set off 1 minute prior to detonation of main charge to scare fish away from the area.
- Installation of bubble/air curtain to disrupt shock waves.

- Blasting is prohibited from January 1st to March 31st to protect winter flounder spawning overwintering habitat (blue crabs do not appear to be impacted by sound/shock waves [Young 1991]).

- For Construction over the Water use Best Management Practices to contain all materials used in above water construction activities.

5. CONCLUSIONS

The applicants have identified a number of construction and long-term issues associated with the proposed modifications to New Jersey Route 52 that may have impacts to essential fish habitat in Great Egg Harbor Bay, including impacts to surface water, wetlands, and aquatic resources. Pile-driving and construction-associated dredging may increase sediment input into the bay. However, due to water velocity in the area, maintenance dredging is not anticipated. An increase in impervious area associated with road upgrades is mitigated through the proposed use of oil/grit separators, an improved detention/infiltration system and a new stormwater piping system, improving the stormwater treatment in the area of road improvement.

Reconstruction of Route 52 will require placement of fill in wetland areas for either of the two Build Alternatives. Wetland impacts (removal of wetland habitat) associated with the Build Alternatives are due to the driving of pilings into the tidal marsh, enhancing recreational access, and shading. Overall, the Initially Preferred Alternative, Alternatives 9 (Options 1) involves the least impact to wetlands.

Dredging and ICWW realignment under the IPA option will affect shellfish and benthic habitat. Since these activities are expected to be associated only with construction activities, it is anticipated that affected benthic areas will recolonize with time. Any dredging needed shall comply with the stipulations in the "Biological Opinion." The phased construction approach will allow finfish to avoid construction operations. Though bottom habitat decreases with piling installation, these same pilings and the existing causeway materials (anticipated to be used in the artificial reef program) will provide additional fishery habitat. Also, federally managed species in the area of dredging are already adapted to pre- and post-dredge depths, therefore impacts to these species due to depth change are not anticipated.

Based on the scope and nature of impacts expected from the project and the mitigation measures identified above, the applicants have determined that there will be minimal adverse individual or cumulative effects on EFH in the project area.

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