Appendix J

ESSENTIAL FISH HABITAT ASSESSMENT

ELBA ISLAND TERMINAL EXPANSION AND PIPELINE PROJECT

Essential Fish Habitat Assessment

March 2007

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1.0 RESOURCE CHARACTERIZATION

The Savannah River has been designated as Essential Fish Habitat (EFH) for seven species or species groups. The EFH species managed by the South Atlantic and Mid Atlantic Fishery Management Councils (SAFMC and MAFMC) and National Oceanic and Atmospheric Administration (NOAA) Fisheries include: penaeid shrimp, red drum, bluefish (*Pomotomus saltatrix*), summer flounder (*Paralichthys dentatus*), coastal migratory pelagic fishes, estuarine-dependent members of the snapper-grouper complex, and coastal and inshore sharks. Types of EFH in the general project area include marsh, unconsolidated intertidal flats, subtidal-unconsolidated substrate, and estuarine water column, however the work area occurs in subtidal unconsolidated substrate and estuarine water column (see table 1). Elba Express Company, LLC (EEC) has determined that EFH potential does not exist along the pipeline route, based on consultation with the Georgia Department of Natural Resources (GDNR), which in a November 9, 2006 correspondence on the project, indicated no tidally-influenced or estuarine waters would be affected. The proposed Elba Express Pipeline Project would cross the Savannah and Ogeechee Rivers upstream of dams that would prevent the passage of EFH species. Concurrence from NOAA Fisheries has been requested by EEC. Therefore, this EFH assessment pertains to the liquefied natural gas (LNG) facility location and the potential impacts to EFH species and their habitats from construction and operation of the new proposed facilities.

TABLE 1

Seasonal Relative Abundance of EFH Designated Species within the Project Area

Species / Lifestage	Relative Seasonal Abundance			
	November – February	**March – May**	**June - July**	**August - October**
Sargassum	Rare	Rare	Rare	Rare
Pink Shrimp				
Adult	Rare	Not present	Rare	Rare
Juvenile	Rare	Common	Common	Common
Larvae	Not present	Rare	Rare	Not present
White Shrimp				
Adult	Common	Common	Abundant	Abundant
Juvenile	Common	Abundant	Highly Abundant	Highly Abundant
Larvae	Not present	Rare	Rare	Not present
Brown Shrimp				
Adult	Not present	Not present	Rare	Common
Juvenile	Common	Common	Abundant	Common
Larvae	Rare	Rare	Not present	Not present
Red Drum				
Adult	Not present	Rare	Common	Common
Juvenile	Common	Common	Common	Abundant
Larvae	Not present	Not present	Common	Common
Eggs / Spawning	Not present	Not present	Rare	Rare
Atlantic Spadefish				
Juvenile	Common	Common	Common	Common
Black Sea Bass				
Juvenile	Rare	Rare	Rare	Rare

TABLE 1

Seasonal Relative Abundance of EFH Designated Species within the Project Area

Species / Lifestage	Relative Seasonal Abundance			
	November – February	**March – May**	**June - July**	**August - October**
Gray Snapper				
Juvenile	Rare	Rare	Rare	Rare
Sheepshead				
Adult	Common	Common	Common	Abundant
Juvenile	Common	Common	Common	Abundant
Larvae	Common	Not Present	Common	Common
Bluefish				
Larvae	Rare	Rare	Common	Common
Summer Flounder				
Adult	Rare	Rare	Common	Common
Juvenile	Common	Common	Common	Common
Larvae	Common	Common	Not present	Not present
Highly Migratory Species				
Adult	Not present	Rare	Rare	Rare
Juvenile	Not present	Rare	Common	Rare
Cobia				
Adult	Not present	Not present	Rare	Rare
Juvenile	Not present	Not present	Rare	Rare
Spanish Mackerel				
Juvenile	Not present	Rare	Rare	Rare

No brackish marsh or intertidal mud flat habitat would be impacted by the proposed LNG Terminal Expansion. The project would have minor temporary effects, however, on subtidal soft sediments and the water column during construction of the slip modifications and operations. Subtidal soft sediment provides feeding habitat for demersal fish that eat worms and mollusks living on and in the sediments. The community composition of unconsolidated sediments within the Savannah River channel is early successional, due to the constant disturbance from dredging maintenance, propeller wash from passing vessels, natural sedimentation, and other impacts. Additional dredging in the slip would constitute another such disturbance to perpetuate this condition. Unconsolidated subtidal habitat has been designated as EFH for two species, penaeid shrimp (post larval and juvenile) and the snapper/grouper complex species (larval, juvenile, and adult).

The estuarine water column serves as EFH for various life stages of several species and their prey by providing habitat for spawning, breeding, and foraging. Fish communities within the water column are determined by factors such as salinity, temperature, and dissolved oxygen. Salinity tests have been conducted in the waters in the vicinity of the slip, yielding concentrations of 14 to 30 parts per thousand (ppt) (ATM, 2001). Salinities in this range are indicative of salinity zones of “mixing” (5 to 25 ppt) and seawater (25+ ppt).

2.0 EFH SPECIES DESCRIPTIONS

2.1 SARGASSUM

The proposed LNG marine traffic route is located in an area that could contain *Sargassum* spp., which has been designated as EFH for several protected species. Sargassum EFH consists of rafts of free-floating macroalgae primarily of the *Sargassum* genus, which is a brown algae. Other epiphytic algae co-occur. The rafts or patches can be highly variable in size, from as small as an acre to many dozens of acres in area. In addition, these can occur in variable densities over many square miles of the oceans surface. These rafts of floating algae provide shelter and food for a number of fish and invertebrate species, some of which have adapted specific life history strategies to take advantage of the mobile nature of the habitat and its orientation on the open ocean surface. Along the U.S. Atlantic coast *Sargassum* spp. drifts between 2° North and 40° North latitude, and 30° West longitude and the western edge of the Gulf Stream. Because the western edge of the Gulf Stream is approximately 80 miles east of the Savannah, Georgia Coast, *Sargassum* spp. generally occurs outside the defined Marine Transportation Route and the project area.

2.2 SHRIMP

The proposed project is located in an area identified as EFH for the commercially and recreationally valuable penaeid shrimp (Shrimp Fishery Management Plan, SAFMC, 1998). For these species, all inshore nursery areas, brackish and salt marshes (especially the edges), unvegetated unconsolidated bottoms, and intertidal flats are the affected EFH for post larval and juvenile shrimp. While they spend their fastest growth phase in estuarine waters, the large adults migrate to coastal and offshore waters to spawn and grow. Adults are least common, therefore, in the fall and early winter after this migration occurs, as shown in table 1.

Brown and white shrimp would be the most common in the project area, as they are more common in surveys (Collins, 2001c). These species prefer a more unconsolidated muddy substrate than pink shrimp, which like harder substrates like sand and shell bottom. All three species eat a variety of other invertebrates, decaying plant matter, and other types of organic debris. No Habitat Areas of Particular Concern (HAPC) have been identified for shrimp in the proposed project area. Impacts to shrimp may include clogging of gills, but are unlikely to result in persistent damage due to the intermittent nature of the dredging activities, first for the berth deepening and then during periodic maintenance dredging.

2.3 RED DRUM

While red drum were not observed in gill net surveys in the immediate project area, the entire Savannah River estuary is designated as EFH for this species. Affected EFH for red drum includes brackish and salt marshes, estuarine water column, and unvegetated unconsolidated bottoms. HAPC for red drum include spawning areas and estuarine nursery grounds. Red drum typically spawn in early fall near passes and inlets, where eggs, larvae, and early juveniles are carried by currents into shallow estuaries and bays. Following a short pelagic stage, individuals often settle into seagrass habitats. While no spawning grounds have been identified in the

Savannah River, fisheries studies have encountered larval and juvenile red drum there, indicating that the fish may spawn in the estuary or mouth (Collins et al. 2001d, Jennings and Weyers, 2002). A study dedicated using hydrophones to find red drum spawning areas in the Savannah River harbor in 2001 was limited by weather conditions and hindered by acoustic interference from boats that could have obscured the sounds of red drum. Red drum spawn from August to October in other southeast estuaries, such as Charleston Harbor.

Although the propose project area does not include any identified spawning areas, Nelson et al., (1991) indicates that larval, juvenile, sub-adult, and adult red drum use the Savannah River mixing zone. Red drum eat a variety of invertebrates and fish depending upon their size, with plankton, fiddler crabs, and small fish comprising much of their diet.

2.4 SNAPPER-GROUPER SPECIES COMPLEX

The snapper-grouper species complex (SGSC) includes 73 species, some of which spend part of their juvenile life stage in estuaries, such as the gray snapper and gag grouper. The snapper and grouper assemblage generally spawns offshore, but the adults and juveniles can tolerate freshwater and use estuaries such as the Savannah River for rearing and feeding. EFH for this assemblage includes brackish and salt marshes and unconsolidated bottom habitats, and these are also considered HAPC's for the SGSC.

Studies on estuarine dependent species in the Savannah River have encountered larval or juvenile gag grouper, Jack crevalle, and gray snapper in the Savannah River watershed, but it is not known whether they utilize the affected area (Jennings and Weyers 2002*).* Nelson et al. (1991) list several species from the SGSC as occurring in the Savannah River mixing zone, including Atlantic spadefish, black sea bass, gray snapper, and sheepshead. Gag grouper are listed as only occurring in the seawater at the harbor mouth, not in the mixing zone upstream.

Juvenile snapper and grouper eat crustaceans, fish, mollusks, and other invertebrates, while the adults eat mostly fish, shrimp, and crabs. Impacts to species in the snapper grouper species complex may include clogging of gills during the dredging event, but are unlikely to be persistent, due to the intermittent nature of the dredging activities, first for the berth deepening and then during periodic maintenance dredging, or result in significant mortality. While larvae of most SGSC species were not identified as being present in the Savannah River by Nelson et al. (1991) the findings of Jennings and Weyers 2002 underscore the general nature of these data. Sheepshead larvae are shown as being common in the Savannah River during July to December, as shown in table 1.

2.5 BLUE FISH

Adult bluefish migrate vast distances and are distributed over the continental shelf from Cape Cod to Key West (Fahay, 1998). EFH for this species includes the mixing and seawater zones of the Savannah River (and all other major estuaries between Maine and north Florida) from March through December for juveniles, and May through January (MAFMC et al., 1998a). This is based on the time frame that bluefish in any southeastern estuary may enter brackish water. No HAPC's have been identified for this species due to a lack of information on their life history.

During the summer and fall, juveniles in South Carolina and Georgia use high salinity tidal creeks and rivers for nursery areas, but avoid areas with salinity below 10 ppt (Shipman personal communication in MAFMC et al., 1998). Adults and juveniles seek prey such as Atlantic menhaden during the summer and fall in the estuary, as well as along beach areas. Nelson et al. (1991) indicate that bluefish juveniles are the only life stage found at significant levels in the Savannah River mixing zone, with rare occurrence from December to April and common occurrence from May to November, as shown in table 1. Substantial impacts to bluefish are unlikely to occur since only one lifestage has the potential to be present in the project vicinity with only rare to common levels of occurrence.

2.6 SUMMER FLOUNDER

Summer flounder are benthic dwellers whose EFH includes the mixing and seawater zones of the Savannah River for the larval, juvenile, and adult life stages. While this species typically goes offshore during the fall and winter, fisheries studies have encountered summer flounder in the river from approximately April to May, as shown in table 1.

For juveniles, small invertebrates such as grass shrimp, mysids, copepods, and polychaetes make up a large portion of their prey (Wenner et al., 1990). As with many opportunistic feeders, prey size increases with body size and the adults graduate to eating fish such as bay anchovies and mummichogs as well as grass shrimp as their size increases (Wenner et al., 1990). Impacts to summer flounder may include clogging of gills and temporary loss of prey

2.7 HIGHLY MIGRATORY SPECIES

Five species of tuna, five of billfish (marlin, sailfish, *etc.*) and twenty-five species of shark are protected under the Highly Migratory Species Management Plan, and seven species of these sharks may use the Savannah River estuary during their juvenile life stage (NMFS 1999). However, most of these would not be expected to occupy mixing zones seven miles upstream of the river mouth. The Atlantic sharpnose shark may be an exception, as adults and juveniles may be common in the seawater zone (where salinity exceeds 25 ppt) from May through July. Nelson et al. (1991) list the sharpnose shark as common in June and July in the Savannah River mixing zone, as shown in table 1.

While a bull shark pup was caught in a survey ten miles upstream from the mouth of the river (Collins et al. 2000), and three miles from the proposed project site, no other shark species have been captured in the mixing zone. Juvenile sharks can swim away from the disturbance associated with the proposed project.

2.8 COASTAL MIGRATORY SPECIES

The coastal migratory species assemblage includes Spanish mackerel and cobia, which spend their adult life in the coastal and open ocean. Their larval and juvenile life stages, however use estuaries as nursery grounds, and many of their prey species are also estuarine dependent. To protect them, all estuaries within the species' latitudinal range are considered EFH for coastal pelagic species. The broadly defined EFH for these species includes estuaries in general.

Fisheries studies found one Spanish mackerel in a tidal creek in the brackish section of the Savannah River, but it is not known whether they occur in the proposed project area (Jennings and Weyers, 2002). Nelson et al. (1991) list cobia and Spanish mackerel as rare in all seasons in the Savannah River mixing zone, as shown in table 1.

3.0 IMPACT CHARACTERIZATION

3.1 CONSTRUCTION PERIOD

Activities that have the potential to impact EFH and EFH species include dredging associated with enlarging the berth, sheetpile installation, pile driving associated with the dolphin installation, hydrostatic test water withdrawals and discharges, and washwater discharge.

The fisheries habitat in the vicinity of the proposed LNG Terminal Expansion Project site is already subject to routine disturbances, including commercial and recreational vessel wakes, maintenance dredging, engine noise, industrial and municipal pollution, and heavy sediment loads. The proposed modification of the slip is one component of the proposed LNG Terminal Expansion that would have a potential adverse impact on fisheries. Modification of the slip would require the dredging of approximately 72,000 cubic yards of material from the toe of the slip and the installation of four mooring dolphins, two of which would be in open water near the Savannah River channel. These activities would affect water quality, cause sedimentation, and create noise, but all of these effects would be minor and temporary, especially when compared to impacts of current dredging and other operations in the Savannah River.

Dredging within the slip would cause some sediment to become suspended and would increase turbidity temporarily, lowering the water quality within a localized area of the dredging activities. The Savannah River has a naturally high suspended sediment load which, during storm events, is expected to increase well beyond the 200 mg/L increase typically created by a hydraulic dredge. Also during storm events the higher suspended sediment loads would likely be more uniform throughout the water column due to mixing as the sediment proceeds downstream.

Therefore, the potential effects of increased suspended sediments would be short term and localized, due to the relatively short duration of construction. The lowered water quality could cause some mobile species to avoid the area temporarily since they may experience some stress (gill clogging or abrasion) related to elevated suspended sediments, however, juvenile and adult fish typically exhibit an avoidance response to declining water quality conditions (Wilber et al., 2005), but other species could find the disturbance an opportunity to feed on exposed or injured benthic invertebrates.

Impacts of dredging on marine fisheries using the area are expected to be temporary and localized, with habitat use reverting to normal conditions following completion of construction. Pelagic species, such as the red drum could be displaced from the construction area temporarily during dredging activities, but would be expected to return once construction is completed. Also, increased turbidity levels would be contained mostly within the slip and minimized through the use of a suction dredge and on-land disposal of dredge spoil.

Another aspect of dredging activities that could affect some marine resources is the disturbance of the estuarine bed within the slip. Soft bottom benthic communities experience obvious changes following dredging activities. Within the first few days following completion of dredging operations, the benthic community can be as much as 80 percent reduced in species richness and up to 90 percent reduced in species abundance and biomass. However, these effects are not long lasting, as polychaetes, oligochaetes and other similar species begin to quickly recolonize the disturbed area. Through natural processes and their rapid population growth, these opportunistic species take advantage of the unoccupied space created in the newly exposed sediments, paving the way for later succession species. The Minerals Management Service has performed a number of studies of dredging effects and recolonization, some associated with offshore sand mining operations. One of these studies (MMS, 2004) provides an overview of this topic including some of the early work on succession theory in soft sediment benthos by Rhoads and Germano. The MMS study reviews several studies by others, such as Burlas et al. (2001) states abundance, biomass, and richness decline immediately after dredging but recover quickly and by the following spring (within 9 to 12 months of the end of dredging); the dredge areas show no detectable differences between dredged and undisturbed areas. McCauley et al. al., (1977), looked at infauna during maintenance dredging in Coos Bay, Oregon and found that, after a significant post-dredging decrease in benthic infaunal abundance, the community re-adjusted to pre-existing community abundances within 28 days of dredging. McCauley suggests that in areas with maintenance dredging, the benthic community adapts to frequent disturbances associated with ship movement and harbor activities. Based on these types of results, the incremental change due to the larger area of maintenance dredging represents a negligible change in impacts to benthos within the slip, and therefore only a potential minor change in EFH species prey base.

Installation of the mooring dolphins in open water could cause avoidance of the immediate area of the installation by mobile species intolerant of the noise generated by pile driving. Pile driving equipment can create rapid concussive noise as the pneumatic hammer strikes the piling. Depending upon the sound frequency and intensity associated with this activity, it could cause injury to fish in close proximity, such as hemorrhaging or organ damage. This level of affect is usually seen only within a few feet to yards of a piling. Eliciting an avoidance behavior can cause fish to move out of foraging areas or into areas where they may be more susceptible to predation. Most likely, resident fish would move out of the area temporarily during pile installation. This type of pile installation would be expected to create about 133 decibels on the A weighted sound power level (dBA), which is less than the 155 decibels that illicit avoidance behaviors, and well below the 190 decibels thought to physically injure some species. Soft starts consisting of a handful of short drops over a one minute period could be a useful means of avoiding injury as this would initially create lower intensity sound to scare fish away before the actual driving commences.

Acoustic bubble curtains can provide an approximately 20 decibel reduction in noise (Vagle, 2003). The project already involves the use of concrete piles, which would produce lower noise levels than hollow steel piles and typically are smaller so they can be driven more easily. Concrete piles produce less noise because they have a less resonant quality than steel, they are square or octagonal in cross section compared to cylindrical steel and the drivers of steel piles produce more noise than those used for concrete piles. Noise associated with the pile driving

activities would be expected to be a maximum of 133 decibels on the A weighted sound power level (dBA), which is less than the 155 decibels that illicit avoidance behaviors, and well below the 190 decibels thought to physically injure some species. Construction related noise would not be expected to create a "choke point" in the Savannah River given that the work would occur mostly within the berth area and there is an adequate width of the remaining river channel to allow fish movement outside of the zone influenced by elevated noise levels resulting from pile driving. Noise also would be generated during installation of the sheeetpiling on the slip bank and would have a similar avoidance effect but with sound intensity dropping quickly with distance, the intensity of sound at the bank is unlikely to cause harm to fish. For these reasons, use of bubble curtains is not warranted, particularly since they would also increase the overall duration of the pile driving operations.

Because of these features of the proposed project, the majority of the time required to drive each pile would be unlikely to have adverse impacts on fish. Collins et al. (2001) found that there are abundant sources of noise during these kinds of activities, from passing vessels to tugs and workboats associated with the construction activities, and that fish tend to continue normal activity in the general area. Regardless of these mitigating conditions, the fact remains that fish within 10 m of pile driving may experience sound levels high enough to cause avoidance, although the exact number of fish that would be involved during this project cannot be predicted.

Based on the information carried forward from the 2003 EFH Assessment performed for the earlier expansion work at Elba, spawning within the Savannah River is possible for red drum during the months of June through October, although no specific spawning grounds or migration patterns for any EFH species are known to exist within the proposed LNG Terminal Expansion area. If spawning grounds or migration exist in the area, they are not likely to be affected, given the limited scope of work proposed for the LNG Terminal Expansion and that little of the work would occur in the main river channel.

Hydrostatic testing of the tanks and piping, as well as washdown water discharges from the tanks have been identified during scoping as potential activities that could affect fishery resources in the Savannah River (South Channel). Of particular concern is the effect on striped bass eggs and larvae (primarily entrainment) associated with the volume and withdrawal rate of hydrostatic test water from the river for the tanks. The striped bass is the subject of a recovery program implemented by the GDNR Wildlife Resources Division (WRD) to restore the fishery to the Savannah River after years of decline. The decline has been linked to alterations of the river channels that changed flow patterns and increased salinity levels in areas that were vital for striped bass reproduction.

It is unlikely that viable striped bass eggs or larvae would be affected by withdrawal of the hydrostatic test water or any subsequent discharges of hydrostatic test water or washdown water from the LNG Terminal Expansion, because these life stages require lower salinities (<15 ppt for eggs; <9 ppt for larvae) than typically are found around Elba Island. Typically striped bass spawn in the spring upstream of the Elba Terminal Expansion Project. The issue of entrainment of striped bass eggs, larvae, and/or juveniles, as well as various potentially vulnerable life stages of other important Savannah River species, however, is the subject of ongoing consultation with the GDNR WRD and NOAA Fisheries. We have recommended that Southern LNG consult with

NOAA Fisheries regarding the time of year when hydrostatic test water withdrawals would impact the fewest number and species of fish eggs and larvae (Section 4.3.3). We feel that this recommendation would minimize the level of impacts to EFH species in the project area due to hydrostatic test water withdrawal.

3.2 OPERATION PERIOD

Impacts from operation activities, include entrainment and impingement associated with water withdrawals resulting from the increased ship ballast and hoteling needs. Water discharges associated with ship hoteling, any submerged combustion vaporizer (SCV) discharges and stormwater discharges, increases in nighttime lighting levels, maintenance dredging, increased potential for accidental spills and releases of potential pollutants, and increased vessel traffic along the waterway all have the potential to affect EFH and EFH species.

Entrainment of smaller lifestages of EFH species or their prey could occur during water withdrawals. Entrainment concerns during ballast intake apply to all cargo ships on the Savannah River. In general, when ships do not reload their cargo, they require ballast to maintain trim. The background level of entrainment of larvae and eggs in the Savannah River, with sediment resuspension systems in operation, and high levels of boat traffic transiting on a daily basis, is likely high. Surface plankton net tows downstream from the project area near the confluence of the intracoastal waterway and the Savannah River done in 2003 yielded mysid shrimp, ctenophores, anchovies, and jellyfish as dominant by number, with occasional larvae including spotted seatrout, croaker, weakfish, spot, menhaden, sea robin, as well as copepods, grass shrimp, isopods, and larval crabs. If the storage and regasification quantities remain the same, the use of larger ships actually reduces the annual ballast water withdrawal levels since fewer ships would unload at the terminal. This factor may partially offset the increase in number of ships that would unload at the Elba facility as a result of other upgrades associated with this project.

To minimize entrainment and impingement of fishes, there are 5 mm screens on the ballast water intakes. The screens are not fine enough to prevent entrainment of very small larvae and eggs, however. The volume of water taken on by an off-loading vessel depends on the vessel. Annual ballast uptake estimates range from 2 billion gallons if all deliveries are made using 125,000 cubic meter vessels (2,045,300,000 gallons) to 0.6 billion gallons if 266,000 cubic meter vessels are utilized (614,400,000 gallons). The inverse relationship between ship size and water volume is because the bigger the ship, the fewer the number of ships required to meet the project objective, so on an annual basis, bigger ships mean less ballast water intake overall. However, because the project also involves increased sendout capacity, even with some bigger ships, it is estimated by EEC that there would be a net increase of 95 ships per year.

To put this in perspective, of the vessels operating on the river in 2006, Southern LNG, Inc. (SLNG's) vessels accounted for less than 5 percent of the river traffic with 60 vessels (of 2,500 for Savannah total) calling annually. The majority of the vessels calling in the port of Savannah are liquid bulk carriers that leave without cargo, and therefore also would take on ballast to maintain proper trim. The total impact to larvae and eggs in the river from ballast uptake is unknown and would depend upon where in the river they were berthed, density of the material

displaced, the intake velocity, time of day, *etc.* For example, LNG is a very light material, much lighter than water, so less water is taken on to compensate for the LNG offloaded, than for similar volumes of oil discharged from an oil carrier. The number of larvae in a given gallon of ballast water varies, but some idea may be provided by looking at the turboscour study results (ATM, 2002b). The study simulated the effects of the sediment suspension systems now in operation at Container Berth 7 at the Garden City Terminal located about 8 miles upstream**.** A sampling pump was operated at 125 gpm and withdrew a total volume of 2,006,400 gallons over two seasons during 76 sampling events. There were 223 larval fish in the samples, total. If there were 223 fish larvae in 2,006,400 gallons of water at Container Berth 7, one could extrapolate that there could be 68,287 to 227,323 larvae entrained, annually, by SLNG vessel ballast intakes if they were operating at the same velocity as the turboscour units and all other things were equal. While this assessment provided by EEC is not entirely accurate, it is probably within an order of magnitude of a realistic estimate. Even at an order of magnitude greater entrainment numbers, these numbers are low and still represent a fraction of the overall entrainment affect resulting from all the ships transiting in and out of the various Savannah River ports. Therefore, impingement and entrainment resulting from the project would not jeopardize any species or year class of fishes, nor their prey.

SCV discharges would involve cooling of the water but there should be no addition of chemicals other than for pH adjustment. In winter months the SCV discharge may be at a similar temperature to ambient but in summer months there would be a small cool water discharge plume. Given the volume of water in the river and the currents involved, the plume should mix rapidly and there should be no significant impacts to water quality.

There would be a slightly larger area of the berth requiring maintenance dredging, but the percentage change from the area currently undergoing maintenance dredging would be minimal. The incremental increase in amount and duration of elevated total suspended sediments levels during maintenance dredging is unlikely to have a measurable increase in impacts to EFH or EFH species. Other operational changes such as any changes in nighttime lighting, altered potential for accidental spills, or changes in stormwater runoff are likely to be extremely minor compared to the existing conditions at the berth, and subsequently would not adversely affect EFH or EFH species.

Waterway for LNG Marine Traffic

Increased offshore vessel traffic may temporarily disturb Sargassum habitat if present within the navigation corridor. However, vessel activities would not result in the harvest of Sargassum habitat and are expected to be intermittent with minor and localized impacts. Additionally, Sargassum is rare along the transit route within the territorial sea. Additional impacts to EFH from increased LNG marine vessel traffic would be minimal because of the disturbed nature of the vessel route currently being used by other vessels.

If an unignited LNG spill were to occur along the transit route, given that LNG is lighter than water, the LNG would float on the water's surface until it had vaporized. The primary impact to EFH would be LNG rapidly boiling upon contact with water, resulting in the rapid cooling of water within the pool of LNG within Zone 1 (Zones of Concern are described in section 4.12.4.3

of this EIS). If the LNG were to contact any EFH species or habitat, the species could be injured or expired. Further, because the colder water would be more dense than the ambient water, it would sink to the bottom and could affect the benthos in the area of the incident. More mobile species would move from the area until water temperatures returned to normal. However, non-mobile species or habitat, such as Sargassum, would be subjected to the water temperature changes associated with an LNG release. No impacts outside of Zone 1 would be expected as a result of an LNG release.

If an associated pool fire were to occur with the marine LNG spill, the species within Zone 1 in the vicinity of the fire could be impacted. Impacts to EFH species would be limited to those that may be on or near the water's surface at the time of ignition. Species within Zone 2 could experience radiant heat, though impacts in this area would be expected to be less than those in Zone 1. No impacts would be expected within Zone 3. The maximum flammable range for a vapor cloud could extend to the outer limits of Zone 3. If the vapor cloud were to come in contact with an ignition source, the resulting fire could burn back to the spill and impact any species within its path. However, because of the marine transit safety and security measures, the probability of a LNG carrier spill from collisions, allisions and terrorist attacks would be unlikely. The potential impacts would be considered as not significant due to the low probability of a spill. Additionally, most EFH species would be able to avoid the area impacted by a release or associated fire.

4.0 IMPACT MINIMIZATION AND MITIGATION MEASURES

Dredging techniques would be used that minimize turbidity in the water column. Sensitive seasons of spawning and migration of fish would be avoided to the extent practicable. Minimization includes placing dredged materials in existing, upland disposal sites rather than in the river or by creating new spoil sites. Entrainment and impingement would be reduced by maintaining hydrostatic testing intake velocities below the swimming speeds of most species of concern, with the exception of non-swimming planktonic forms such as ctenophores, jellyfish, non buoyant fish eggs, and weakly swimming larvae at the mid to bottom of the water column. Furthermore, we have recommended Southern LNG consult with NOAA Fisheries to time hydrostatic test water withdrawal during seasons when eggs and larvae are least likely to be in the project area.

5.0 CONCLUSIONS

While the project does involve some temporary alteration of soft bottom area at the inner end of the berth, where the deepening would occur, the entire berth area was, not so long ago, created out of land. The deepened area would become recolonized with soft bottom benthic organisms, but would undergo periodic disruption due to required maintenance dredging. In addition, a very small area of soft bottom habitat would be altered by the placement of additional piles associated with mooring dolphin structures. The area lost is inconsequential as habitat for EFH species. In addition, there would continue to be periodic elevated turbidity events associated with maintenance dredging. These events represent an inconsequential increase in the already periodic and episodic nature of elevated turbidity due to ongoing maintenance dredging that occurs throughout much of the Savannah River Estuary.

Pile driving would result in the production of noise at levels that could result in avoidance for some fish species. Although this would be a relatively short-term event, there are methods available to minimize this impact, and this document suggests that EEC undertake one of these methods, namely soft starts.

Of more concern is the increased water withdrawals associated with increased numbers of LNG vessels berthing at the facility, primarily because this would occur throughout the year, every year for many years. Water withdrawals for engine cooling and ship service have the potential to result in cropping of fish eggs and larvae as well as planktonic prey for filter feeding fish such as shad and alewife, which are prey for other EFH species such as bluefish and sharks. Therefore, it is important for EEC to attempt to minimize this increased water usage.

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