

4.6 PROTECTED SPECIES

4.6.1 Methods and Impact Definitions

Impacts to Protected Species, which includes all federal and state-listed threatened, endangered, at-risk, and candidate species, were evaluated using literature review, GIS, presence/absence, and best professional judgment. The NMFS Pile Driving Calculator Model (NMFS 2015) was used to assess the potential underwater noise impacts to Protected Species from pile driving activities for Alternative 1 (Proposed Project) and alternatives. This model is based on data from similar piles, installation, and water depth and requires an estimate of the total number of strikes per day to install the piles. Assumptions for input into the NMFS model for Alternative 1 (Proposed Project) were based on the number of strikes by an impact hammer for the 24-inch diameter pre-cast concrete piles and 14-inch steel H-piles, and a vibratory hammer for the 84-inch CISS piles. Reference noise levels were selected from the Compendium of Pile Driving Sound Data, updated in October 2012, provided as Appendix I to Caltran's Final Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish (February 2009) to represent Alternative 1 (Proposed Project) (Caltrans 2012).

Impacts to Protected Species would be considered adverse if actions associated with the Proposed Project would result in the taking of a species. Impacts to species habitat and critical habitat would be considered adverse if direct physical alterations to a species habitat impacts their ability to live. (Table 4.6-1).

Table 4.6-1
Impact Definitions, Protected Species

	Negligible	Minor	Major
Species	Very small impact to Protected Species	Small impact (in number, quantity, or extent) to Protected Species but not resulting in much trouble or damage	Large impact (in number, quantity, or extent) to Protected Species resulting in serious damage
Critical Habitat	Very small alteration to critical habitat	Small alteration (in quantity or extent) to critical habitat that does not impair a Protected Species' ability to live	Large alteration that appreciably diminishes the value of critical habitat for survival of Protected Species

4.6.2 No-Action Alternative

Under the No-Action Alternative, the Corps would not issue a DA permit, and construction and operation of the Navy Base ICTF would not occur. For the purposes of this EIS, the Corps assumes that the Project site and the River Center project site would continue to include mixed use (residential and commercial) and industrial land uses. In light of Palmetto Railways' ownership of the properties, there would be the potential for redevelopment of these areas to include rail-served warehousing and distribution. The Corps also assumes that available habitat for Protected Species in the Protected Species study area (Figure 3.6-1) would be similar to existing conditions. The natural resources throughout the region would likely change as a result of other urban growth and development projects.

Under the No-Action Alternative, there is the potential for impacts to some of the Protected Species and/or their habitat identified in Tables 3.6-2, 3.6-4, 3.6-6, and 3.6-7 from future construction and development activities associated with the Project site and River Center project site. Although the extent of potential impacts to Protected Species is unknown, the Corps assumes that future actions under the No-Action Alternative could have a negligible impact on Protected Species and/or their habitat as a result of future construction activities.

4.6.3 Alternative 1: Applicant's Proposed Project (South via Milford / North via Hospital District)

Construction of Alternative 1 (Proposed Project) has the potential to affect several Protected Species and/or their habitat (see Table 4.6-2). No critical habitat for any of the Protected Species in Table 4.6-2 occurs within the Protect Species study area (Figure 3.6-1). Potential short-term and permanent direct and indirect impacts are described in general below and then discussed with respect to certain Protected Species with the potential to occur in the Protected Species study area.

The majority of impacts to Protected Species anticipated as a result of Alternative 1 (Proposed Project) would be short-term in nature. Specific activities associated with Alternative 1 (Proposed Project) that could result in short-term displacement of individuals and/or alterations to habitat include the construction of the drayage road and arrival/departure tracks near tidal salt marsh and Shipyard Creek (physical alterations to habitat and fragmentation) and bridge improvements, including any temporary construction work areas, in Noisette Creek (shading and sedimentation).

Table 4.6-2
Protected Species Impacts for Alternative 1 (Proposed Project)

Species Common Names	Species Scientific Name	Habitat Quality within the Study Area	Potential Impacts	Summary of Impacts with BMPs and Mitigation Measures
Reptiles				
Green sea turtle	<i>Chelonia mydas</i>	marginally suitable foraging habitat	minor habitat removal; short- term indirect effects during construction if present	Negligible
Kemp's ridley sea turtle	<i>Lepidochelys kempii</i>	marginally suitable foraging habitat	minor habitat removal; short- term indirect effects during construction if present	Negligible
Loggerhead sea turtle	<i>Caretta caretta</i>	suitable foraging habitat	minor habitat removal; short- term indirect effects during construction if present	Negligible
Spotted turtle	<i>Clemmys guttata</i>	marginal shallow aquatic habitat	minor habitat removal; short- term indirect effects during construction if present	Negligible
Mammals				
Northern Long-Eared Bat	<i>Myotis septentrionalis</i>	marginally suitable habitat	minor habitat removal; short- term indirect effects during construction if present	Negligible
West Indian manatee	<i>Trichechus manatus</i>	suitable estuarine habitat	minor habitat removal; short- term indirect effects during construction if present	Negligible

Species Common Names	Species Scientific Name	Habitat Quality within the Study Area	Potential Impacts	Summary of Impacts with BMPs and Mitigation Measures
Fish				
American eel	<i>Anguilla rostrata</i>	suitable foraging habitat	minor habitat removal; short-term indirect effects during construction if present	Negligible
Atlantic sturgeon	<i>Acipenser oxyrinchus</i>	marginally suitable spawning habitat for adults; suitable foraging habitat for juveniles, sub-adults, and adults	minor habitat removal; short-term indirect effects during construction if present	Negligible
Blueback herring	<i>Alosa aestivalis</i>	suitable foraging habitat	minor habitat removal; short-term indirect effects during construction if present	Negligible
Shortnose sturgeon	<i>Acipenser brevirostrum</i>	overwintering habitat for juveniles and adults	minor habitat removal; short-term indirect effects during construction if present	Negligible
Insects				
Rare skipper	<i>Problema bulenta</i>	suitable foraging habitat	minor habitat removal; short-term indirect effects during construction if present	Negligible
Birds				
Bald eagle	<i>Haliaeetus leucocephalus</i>	suitable foraging habitat	minor habitat removal; short-term indirect effects during construction if present	Negligible

Species Common Names	Species Scientific Name	Habitat Quality within the Study Area	Potential Impacts	Summary of Impacts with BMPs and Mitigation Measures
Black rail	<i>Laterallus jamaicensis</i>	suitable habitat	minor habitat removal; short- term indirect effects during construction if present	Negligible
Least tern	<i>Sterna antillarum</i>	suitable habitat	minor habitat removal; short- term indirect effects during construction if present	Negligible
MacGillivray's seaside sparrow	<i>Ammodramus maritimus macgillivraii</i>	suitable habitat	minor habitat removal; short- term indirect effects during construction if present	Negligible
Red knot	<i>Calidris canutus rufa</i>	suitable foraging habitat for overwintering migrants	minor habitat removal; short- term indirect effects during construction if present	Negligible
Wilson's plover	<i>Charadrius wilsonia</i>	suitable foraging habitat	minor habitat removal; short- term indirect effects during construction if present	Negligible

Species Common Names	Species Scientific Name	Habitat Quality within the Study Area	Potential Impacts	Summary of Impacts with BMPs and Mitigation Measures
Wood stork	<i>Mycteria americana</i>	suitable foraging habitat	minor habitat removal; short- term indirect effects during construction if present	Negligible

¹ *Federally Endangered* refers to a taxon “in danger of extinction throughout all or a significant portion of its range.” *Federally Threatened* refers to a taxon “likely to become endangered within the foreseeable future throughout all or a significant portion of its range.”

² *Federally At-Risk Species (ARS)* refers to species that a) are proposed for listing under the ESA by the USFWS, b) are candidates for listing under the ESA, or c) have been petitioned for listing under the ESA. Information is provided only for conservation actions as no federal protections currently exist.

³ Green turtles are listed as threatened, except for breeding populations in Florida and on the Pacific Coast of Mexico, which are listed as endangered.

⁴ Critical habitat refers to a specific geographic area(s) that contains features essential for the conservation of a threatened or endangered species, and that may require special management and protection (a more complete definition can be found in the ESA of 1973). There is no critical habitat for the loggerhead sea turtle within the study area.

⁵ *State Endangered* refers to “any species or subspecies of wildlife whose prospects of survival or recruitment within the state are in jeopardy or are likely within the foreseeable future to become so.”

State Threatened refers to “a species that is likely to become endangered and in need of management.”

Under Alternative 1 (Proposed Project), construction and/or improvements to the rail bridges and drayage road and arrival/departure tracks could affect the aquatic Protected Species that may inhabit the tidal open waters within the Protected Species study area. As summarized in Table 4.6-2, the tidal open waters of the Protected Species study area provide marginally suitable foraging habitat for the green, loggerhead, and Kemp’s ridley sea turtles; suitable estuarine habitat for the West Indian manatee; suitable spawning habitat for adult Atlantic sturgeon due to the presence of flow, salinity, and certain substrates, and suitable foraging habitat for juveniles, sub-adults, and adults and potential overwintering habitat for shortnose sturgeon. The Protected Species study area may contain marginal habitat for the spotted turtle in freshwater wetlands and ditches and nearby terrestrial habitats. Potential short-term indirect impacts on these species if present during construction include turbidity, sedimentation, and chemical contamination. Potential permanent direct impacts include the permanent loss of open marine waters that provide suitable foraging habitat for species. Accidentally spilled liquids onsite should be intercepted and temporarily contained by the storm sewer system to prevent draining directly into onsite or nearby surface waters. Off-site truck and rail traffic could result in the potential for minor and/or major (depending on location) indirect impacts to protected aquatic species from accidental pollutant spills. However, there are BMPs, mandated requirements, and regulations that cover spills (Section 4.15.3.2); therefore, construction and operation activities within or adjacent to Shipyard and Noisette creeks may result in negligible effects to these aquatic Protected Species.

To reduce potential construction-related impacts to the manatee to discountable and insignificant levels, the Corps recommends implementing the USFWS Standard Manatee Construction Conditions (Fish and Wildlife Commission 2005) during project construction. Additionally, with implementation of the other BMPs and/or mitigation measures discussed in Section 4.6.12 as part of Alternative 1 (Proposed Project), the construction impacts to these aquatic Protected Species would be negligible.

There is the potential for bald eagles to inhabit or traverse the Protected Species study area, but the lack of extensive areas of forest needed for nesting and perching near the Cooper River or Shipyard and Noisette creeks minimizes the potential for a major adverse impact to the bald eagle. Additionally, according to the SCDNR database (SCDNR 2014c), there are no documented bald eagle nest sites in the immediate vicinity of the Protected Species study area. The Protected Species study area contains suitable habitat for the least tern due to the presence of graveled rooftops; however, nest surveys in 2014 showed no active nests within the Protected Species study area; thus, the potential for adverse impacts to this species would be minor.

The Protected Species study area contains the presence of suitable foraging habitat for overwintering or migrating red knots and Wilson's plover due to the presence of mud flats within the tidal salt marsh and tidal open water vegetation communities. The Protected Species study area also contains potentially suitable habitat for the black rail and MacGillivray's seaside sparrow due to the presence of salt marshes and shallow freshwater marshes. The tidal salt marsh and tidal open water vegetation communities also provide suitable foraging habitat for the wood stork and rare skipper. Potential short-term indirect impacts on these species if present during construction include turbidity, sedimentation, and chemical contamination. Potential long-term direct impacts include the permanent loss of tidal salt marsh and tidal open water that provide suitable foraging habitat. Accidentally spilled liquids onsite should be intercepted and temporarily contained by the storm sewer system to prevent draining directly into onsite or nearby surface waters. Off-site truck and rail traffic could result in the potential for minor and/or major (depending on location) indirect impacts to protected bird species from accidental pollutant spills. However, to ensure the safest handling of materials there are mandated requirements for rail, roadway, and intermodal facilities that must be followed (Section 4.15.3.2).

Short-term impacts on these species if present during construction include disturbance from human activities such as noise. However, these species would most likely depart the area of potential disturbance, thus resulting in a negligible impact from short-term displacement. Potential long-term impacts include the removal of vegetation that provides suitable habitat for these species. Similar quality habitat will redevelop within temporary disturbance footprints at the completion of the construction. Therefore, potential impacts on these Protected Species would be short-term and minor.

Underwater Noise

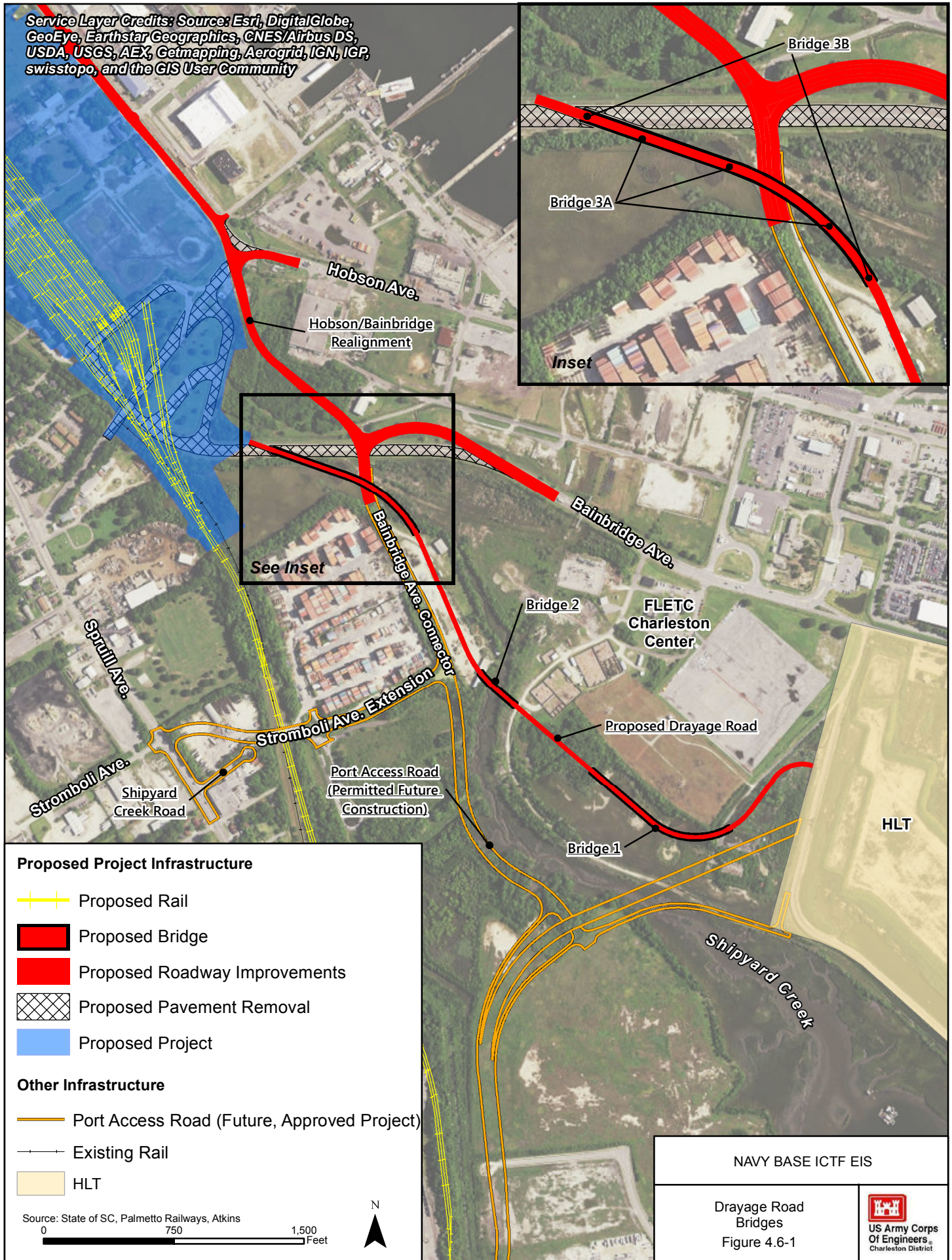
In-water construction activities associated with Alternative 1 (Proposed Project) would result in underwater noise from pile installation. As discussed in Section 3.6.6, during pile-driving activities, noise is produced when the energy from the hammer is transferred to the pile and released as pressure waves into the surrounding water and sediments. Depending on the type and location of the pile-driving activity, pile-driving noise can result in potential effects ranging from behavioral effects (caused by the animal hearing the noise) to physiological effects, with very extreme cases resulting in death (NMFS 2014).

Exposure criteria are used to assess whether noise from construction projects may affect a listed species. If an animal is likely to be exposed to noise levels that exceed the injury threshold levels, injury is expected and measures to avoid or minimize the potential for harmful exposure should be required (NMFS 2014). Injurious levels are expressed in units of peak pressure level or sound exposure level (SEL). Sound exposure level can be expressed as a single strike or cumulative, sSEL or cSEL, respectively for exposure to pile-driving noise over time. The cumulative exposure is based on the amount of time an animal may be exposed to noise from repeated strikes of impact hammers. For any given set of conditions (source level, type of transmission loss, strikes/pile) over some period of time, cumulative exposure may result in some risk of hearing loss, even if the sSEL is below the threshold for injury. Animal hearing is characterized by the root mean square (RMS) dB level and is used as the criteria for the auditory detection and resulting behavioral reactions to a noise (NMFS 2014).

Alternative 1 (Proposed Project) includes the installation of three bridges along the drayage road that span over Shipyard Creek and associated marsh (Figure 4.6-1). The following assumptions were used for all bridges described below. During construction of the Alternative 1 (Proposed Project), the work day hours are estimated to be approximately 10 hours per day, with the actual pile driving activity to be an average of 8 hours per day.

The drayage road begins at the exit of the HLT, then continues across a broad stretch of inter-tidal marsh associated with Shipyard Creek. This 1,537-foot bridge (Drayage Road over Shipyard Creek marsh, Bridge 1 on Figure 4.6-1) would require the installation of 264, 24-inch pre-cast concrete piles with an impact hammer. The proposed installation plan estimates driving a maximum of 10 piles per day for a total of 4,000 strikes per day in approximately 0-1 foot water depth. Assuming one installation rig was used, it would take approximately 26 days to complete the Drayage Road over Shipyard Creek marsh bridge pile installation.




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Proposed Project Infrastructure

-  Proposed Rail
-  Proposed Bridge
-  Proposed Roadway Improvements
-  Proposed Pavement Removal
-  Proposed Project

Other Infrastructure

-  Port Access Road (Future, Approved Project)
-  Existing Rail
-  HLT

Source: State of SC, Palmetto Railways, Atkins
 0 750 1,500 Feet



NAVY BASE ICTF EIS

Drayage Road
 Bridges
 Figure 4.6-1



The drayage road continues north through FLETC property to the second bridge crossing (Drayage road over Shipyard Creek, Bridge 2 on Figure 4.6-1). This 240-foot bridge would require the installation of 40, 24-inch pre-cast concrete piles with an impact hammer. The proposed installation plan estimates driving a maximum of 10 piles per day for a total of 4,000 strikes per day in approximately 0–6 feet water depth. Assuming one installation rig was used, it would take approximately 4 days to complete the Drayage Road over Shipyard Creek bridge pile installation.

After crossing Shipyard Creek, the drayage road continues north across an area of upland parallel to the Bainbridge Avenue Connector (aka Local Access Road), then is elevated over the Bainbridge Avenue Connector. This 942-foot bridge (Drayage Road over Bainbridge Avenue Connector) would require different installation methods for the end bents and interior bents of the bridge. The interior bents would require the installation of 14, 84-inch cast in steel shell (CISS) piles with a vibratory hammer (interior bents, Bridge 3a on Figure 4.6-1). The proposed installation plan for interior bent piles estimates driving a maximum of 2 piles per day for a total of 1,000 strikes per day in approximately 0-4 feet water. Assuming one installation rig was used, it would take approximately 7 days to complete the interior bent piles for the Drayage Road over Bainbridge Avenue Connector bridge. The end bents would require the installation of 12, 14-inch steel H-piles into upland locations near the marsh edge with an impact hammer (end bents, Bridge 3b on Figure 4.6-1). The proposed installation plan for end bent piles estimates driving a maximum of 10 piles per day for a total of 4,000 strikes per day in an upland location (zero water depth). Assuming one installation rig was used, it would take approximately 1.2 days to complete the end bent piles for the Drayage Road over Bainbridge Avenue Connector bridge.

An analysis of the potential underwater noise impacts from pile driving activities for the Alternative 1 (Proposed Project) was completed. Detailed methods and results are included in Appendix E. The modeling results for Alternative 1 (Proposed Project) are provided in Table 4.6-3 and summarized below.

Table 4.6-3
Underwater Noise Analysis of Pile Driving Activities for Alternative 1 (Proposed Project)

Map (Figure 4.6-1) Id	Location	Pile Type	Source sound at 10 meters			Estimated Number of Strikes per day (total) and impact type	Cumulative SEL (dB)	Distance (meters) to threshold			
			Peak sound dB	SEL, single strike dB	RMS dB			Onset of Physical Injury		Behavior	
								Peak dB (206)	Cumulative SEL dB* Fish ≥2 grams (187)	Fish <2 grams (183)	RMS dB (150)
1	Drayage road over Shipyard Creek Marsh	24-inch-diameter pre-cast concrete	185	155	166	4,000 impact hammer	191	0	19	22	117
2	Drayage road over Shipyard Creek	24-inch-diameter pre-cast concrete	185	155	166	4,000 impact hammer	191	0	19	22	117
3a	Drayage Road over Bainbridge Avenue Connector Interior Bents	84-inch-wide cast in steel shell (CISS)	183	170	170	1,000 vibratory hammer	200	0	74	136	215
3b	Drayage Road over Bainbridge Avenue Connector End Bents	14-inch wide steel H-pile	179	144	154	4,000 impact hammer	180	0	3	4	18

* This calculation assumes that single strike SELs < 150 dB do not accumulate to cause injury (Effective Quiet)

Source: Atkins 2017.

As summarized in Table 4.6-3, the underwater noise levels generated during pile-driving activities of unattenuated piles for any of the bridges over Shipyard Creek would not exceed the adopted 206 dB peak criteria for injury to fish (exceeded nowhere). For bridge sites 1 and 2 on Figure 4.6-1, the estimated distance at which the adverse behavioral effects on fish are attenuated is 117 meters from the pile, per the NMFS calculator (Table 4.6-3). For bridge site 3a, the estimated distance at which the adverse behavioral effects on fish are attenuated is 215 meters from the pile. For bridge site 3b, the estimated distance at which the adverse behavioral effects on fish are attenuated is 18 meters from the pile.

Sturgeon are hearing generalists that do not have specialized hearing structures or use sound as part of their behavior, and therefore sturgeon are less sensitive to noise than hearing specialist species of fish. Based on a study of lake sturgeon (a reasonable surrogate for shortnose and Atlantic sturgeon), sturgeon have comparatively poor hearing sensitivity (Meyer et al. 2010 and 2011 as cited in Parsons Brinckerhoff 2015), and it is likely that many of the sounds which are audible to most species are not audible to sturgeon (AKRF et al. 2012, as cited in Parsons Brinckerhoff 2015).

Krebs et al. (2013 as cited in Parsons Brinckerhoff 2015) evaluated pile driving effects on sturgeon for the Tappan Zee Pile Installation Demonstration project and found that sturgeon exhibited avoidance behavior by staying in the project vicinity for a shorter time period during pile driving activities than during silent control periods. In the Biological Opinion (BO) for the Tappan Zee Pile Installation Demonstration project, NMFS deduced that sturgeon would avoid pile driving noise and would not remain in proximity of the proposed construction area long enough to accumulate sufficient sound energy to reach the cumulative criterion. As such, given the avoidance behavior of sturgeon, cumulative exposure to pile-driving noise from that project would not affect sturgeon.

Additionally, as part of Alternative 1 (Proposed Project), the following minimization measures would be implemented to reduce potential impacts on sturgeon to a negligible effect:

- The contractor will use air bubble curtains and/or sleeve piles during pile installation. Depending on the type of bubble curtain (e.g. confined or unconfined air bubble curtains or multiple-stage unconfined air bubble curtains) and considering the velocity of the current/tidal flow, a range of 5 to 20 dB of noise reduction could be achieved (Caltrans 2015).
- The contractor will utilize soft-start techniques for pile driving activities. This will consist of a series of taps at 25–40 percent of the pile driver’s energy, followed by a one-minute waiting period.

In the BO for the Tappan Zee Pile Installation Demonstration project, NMFS (2012) concurred that soft-start techniques for pile driving activities is expected to cause fish to leave the area prior to full energy pile driving, and that a soft-start method will facilitate avoidance of physical injury. Aside from Noisette and Shipyard creeks, other areas in the Cooper River provide adequate foraging and overwintering habitat that sturgeon can move into during pile driving operations.

The location of pile driving is in inter-tidal areas with depths ranging from 0-6 feet (depending on tidal conditions). Sturgeon have poor hearing sensitivity compared to other fish species, and sturgeon have documented avoidance behavior. Due to the habitat and low water depth in the location of proposed pile driving activities, poor hearing sensitivity, and avoidance behavior, there is low potential for sturgeon to be present in proposed pile driving areas. Additionally, minimization measures (i.e., air bubble curtains and/or sleeve piles and soft-start techniques) would decrease the potential for injury if a sturgeon was present. Potential impacts such as physical injury from peak, sSEL, and cSEL noise levels, to sturgeon would be negligible; therefore, Alternative 1 (Proposed Project) will have no effect on sturgeon.

The use of vibratory pile driving is non-impulsive, which is not known to cause injury to marine mammals and may be used along with other underwater noise mitigation measures to reduce noise exposure to marine species. While some underwater noise exposure would be unavoidable, the following minimization measures would be implemented as part of Alternative 1 (Proposed Project) to reduce potential impacts on manatees to a negligible effect:

- During in-water work, a floating semi-permeable turbidity curtain will be deployed around areas where pile driving is taking place.
- Adherence to USFWS's standard manatee guidelines during construction (listed in Section 4.6.12).
- The contractor will hire a qualified marine biologist to be on-site during in-water construction activities to avoid potential impacts to aquatic Protected Species.

Similar to sturgeon, manatees are expected to avoid the Project site during pile driving activities. The semi-permeable turbidity curtain will act as a physical barrier between manatees and the Project site as well as preventing suspended sediment from migrating offsite during the placement of the pilings. Therefore, the Corps does not anticipate that manatees would be adversely affected by physical injury from in-water construction activities with the implementation of the USFWS manatee guidelines and proposed use of turbidity curtains as part of Alternative 1 (Proposed Project).

Like manatees, sea turtles are expected to avoid the Project site during pile driving activities. As discussed above for the manatee, during in-water work, should sea turtles be present, a floating semi-permeable turbidity curtain will be deployed around areas where pile driving is taking place. The turbidity curtain will act as a physical barrier between sea turtles and the Project site. Noise associated with the construction work and location of work will likely deter any animals from remaining in the area extensively. If a Protected Species is observed in the work area, the contractor would issue a stop-work order until the Protected Species had vacated the area.

Additionally, potential impacts resulting from construction activities associated with Alternative 1 (Proposed Project) could be further minimized by adhering to environmental in-water work windows that are established by the Corps, which restricts construction activities to periods when

turtles are least abundant or least likely to be affected by such activities. The environmental work windows for sea turtles typically target the winter months, because sea turtle abundance is dramatically reduced during colder water temperatures. Therefore, the Corps does not anticipate that sea turtles would be adversely affected by in-water construction activities with implementation of the above-mentioned avoidance and minimization measures; thus, potential impacts on sea turtles from Alternative 1 (Proposed Project) would be negligible.

Turbidity/Siltation

Construction and pile driving activities will cause temporary increases in the turbidity and siltation of the water column, but the duration of these activities will be brief and a semi-permeable turbidity curtain will be used to minimize sedimentation around areas where pile driving is taking place. Piles compress the sediment around them when they are driven (Parsons Brinckerhoff 2015). This temporary increase in turbidity would only cause minimal effects to Noisette Creek, Shipyard Creek, and the Cooper River localized at the Project site, since tidally influenced water bodies, such as the Cooper River, exhibit naturally high turbidity levels. Therefore, turbidity impacts on the aquatic Protected Species should be minimal and would be limited to the immediate area of construction.

During construction activities, temporary siltation may occur in Noisette Creek, Shipyard Creek, and the Cooper River. Temporary siltation may cause indirect impacts by effecting thermal loading in the environment. Alterations in light attenuation in the water column can cause decreased visibility for organisms, effecting feeding, movement, and predator avoidance. Redistribution of sediments can alter nutrient distribution, dissolved oxygen (DO) levels, and primary productivity locally and throughout the estuarine waters (Parsons Brinckerhoff 2015). As described above, these sediment changes should be minimal and short-term and will not adversely impact the sediment budget in the overall Cooper River system. The use of the semi-permeable turbidity curtain around areas where pile driving is taking place would further reduce the potential for siltation.

4.6.4 Alternative 2: Proposed Project Site (South via Milford / North via S-line)

The impacts to Protected Species under Alternative 2 would be similar to those under Alternative 1 (Proposed Project). The exception would be the location of pile driving impacts to aquatic species associated with the construction of the rail bridge crossing of Noisette Creek along Spruill Avenue. The exact number of piles required for the rail bridge in this alternative is unknown; however, the underwater noise impacts from the pile drivings would be similar to the impacts for Noisette Creek, as outlined in Table 4.6-3.

4.6.5 Alternative 3: Proposed Project Site (South via Kingsworth / North via Hospital District)

The impacts to Protected Species under Alternative 3 would be similar to those under Alternative 1 (Proposed Project).

4.6.6 Alternative 4: Proposed Project Site (South via Milford)

The impacts to Protected Species under Alternative 4 would be similar to those under Alternative 1 (Proposed Project); however, there would be no pile driving impacts to fish species, marine mammals, and sea turtles in Noisette Creek.

4.6.7 Alternative 5: River Center Site (South via Milford / North via Hospital District)

The impacts to Protected Species under Alternative 5 would be similar to those discussed under Alternative 1 (Proposed Project).

4.6.8 Alternative 6: River Center Site (South via Kingsworth / North via Hospital District)

The impacts to Protected Species under Alternative 6 would be similar to those under Alternative 1 (Proposed Project).

4.6.9 Alternative 7: River Center Site (South via Milford)

The impacts to Protected Species under Alternative 7 would be similar to those under Alternative 1 (Proposed Project).

4.6.10 Related Activities

The Related Activities include two components, the southern rail connection, which occurs for all alternatives, but has unique alignments for Alternatives 3 and 6, and the northern rail connection, which is only proposed for Alternative 2. Despite the unique rail alignments for Alternatives 3 and 6, no additional impacts to available habitat for Protected Species would occur from the Related Activity. Under Alternative 2, an additional Related Activity would be required to connect the arrival/departure tracks from the Project site, crossing a portion of tidal salt marsh and tidal open water that drains to Noisette Creek, to the existing NCTC track along Virginia Avenue. Impacts to Protected Species associated with the Related Activity for each of these alternatives will be similar to those discussed under Alternative 1 (Proposed Project); however, the exception would be for the Related Activity associated with Alternative 2, which involves additional pile driving activities and underwater noise impacts to aquatic species associated with the construction of the rail bridge

crossing a small tributary to Noisette Creek (Figure 4.5-2). The exact number of piles required for the rail bridge is unknown at this time; however, water depths in this tributary to Noisette Creek are similar to conditions modeled for Shipyard Creek. Therefore, underwater noise levels generated during pile driving of unattenuated piles would be similar to those for Shipyard Creek as presented in Table 4.6-3 and discussed in Section 4.6.3.

4.6.11 Summary of Impacts Table

Table 4.6-4 summarizes the environmental consequences and final determinations of effect to Protected Species from Alternative 1 (Proposed Project) and all the alternatives. The final determination effect considers the use of the mitigation measures listed below to avoid and/or minimize potential impacts to aquatic species during construction.

4.6.12 Mitigation

4.6.12.1 Applicant's Proposed Avoidance and Minimization Measures

The Applicant has committed to several measures that avoid and/or minimize potential impacts of Alternative 1 (Proposed Project). These measures are taken from Palmetto Railways Mitigation Plan provided in Appendix N. Some of these measures are required under federal, state, and local permits; others are measures that Palmetto Railways has incorporated into the design and operations of Alternative 1 (Proposed Project). Each mitigation measure is also designated as one that either helps to avoid an impact or one that minimizes an impact.

- Where possible, limit the placement of pilings for bridges within waterways, ensuring channels are not blocked. (Minimization)
- Reconstruct the existing superstructure of the rail trestle bridge of Noisette Creek to reduce impacts. (Avoidance and Minimization)
- Contractors will be required to use bubble curtains or sleeve piles to mitigate underwater noise while driving piling in essential fish habitat (EFH) areas. (Minimization)
- The contractor will utilize soft-start techniques for pile driving activities. This will consist of a series of taps at 25 to 40 percent of the pile driver's energy followed by a one-minute waiting period. (Minimization)
- The contractor will hire a qualified marine biologist to be onsite during in-water construction activities to avoid potential impacts to marine resources and EFH. (Avoidance and Minimization)
- Implement an SPCC plan to minimize the impact of a potential spill on protected species. (Minimization)
- Permanent loss of EFH habitat will be mitigated through the mitigation plan and efforts described above. (Mitigation)

Table 4.6-4
Summary of Impacts, Protected Species

Alternative	Habitat Alteration/ Fragmentation	Species Displacement
No-Action	Negligible effect on habitat alteration/fragmentation with implementation of avoidance and minimization measures due to the continuation of mixed use and industrial land uses	Potential exists for direct and indirect short-term species displacement during future land use activities but minor effects with implementation of avoidance and minimization measures in consultation with NMFS and USFWS as applicable
1: Proposed Project: South via Milford / North via Hospital District	Negligible effect on habitat alteration/fragmentation of Protected Species with implementation of avoidance and minimization measures during construction activities	Potential exists for direct and indirect short-term effects during construction; but negligible with implementation of Applicant's prescribed avoidance and minimization measures in combination with the additional Corps mitigation measures listed in Section 4.6.12
2: South via Milford / North via S-line	Same as Alternative 1 (Proposed Project)	Same as Alternative 1 (Proposed Project)
3: South via Kingsworth / North via Hospital District	Same as Alternative 1 (Proposed Project)	Same as Alternative 1 (Proposed Project)
4: South via Milford	Same as Alternative 1 (Proposed Project)	Similar to Alternative 1 (Proposed Project) but in-water construction activities would be limited to Shipyard Creek
5: River Center Site: South via Milford / North via Hospital District	Negligible effect on habitat alteration/fragmentation of Protected Species with implementation of avoidance and minimization measures during construction	Potential exists for direct and indirect effects during construction, but minor effects with implementation of Applicant's prescribed avoidance and minimization measures in combination with the additional potential mitigation measures listed in Section 4.6.12
6: River Center Site: South via Kingsworth / North via Hospital District	Same as Alternative 5 (Proposed Project)	Same as Alternative 5 (Proposed Project)
7: River Center Site: South via Milford	Same as Alternative 5 (Proposed Project)	Similar to Alternative 5, but in water construction activities would be limited to Shipyard Creek

Species Impact Definitions

Negligible = Very small impact to Protected Species.

Minor = Small impact (in number, quantity, or extent) to Protected Species but not resulting in much trouble or damage.

Major = Large impact (in number, quantity, or extent) to Protected Species resulting in serious damage.

Critical Habitat Impact Definitions

Negligible = Very small alteration to critical habitat.

Minor = Small alteration (in quantity or extent) to critical habitat that does not impair a Protected Species ability to live.

Major = Large alteration that appreciably diminishes the value of critical habitat for survival of Protected Species.

- During in-water work, a floating semi-permeable turbidity curtain will be deployed around areas where pile driving is taking place. (Minimization)
- Adherence to environmental windows for construction during the winter months when sea turtles are less abundant. (Avoidance and Minimization)

These avoidance and minimization measures, except the items noted with an asterisk (*), have been considered in the preceding impact analysis. The complete list of Applicant-proposed avoidance and minimization measures for the Navy Base ICTF is provided in Chapter 6, Table 6-1.

4.6.12.2 Additional Potential Mitigation Measures

The following additional mitigation measures as recommended by the Corps would further minimize and/or reduce potential effects of Alternative 1 (Proposed Project) on Protected Species.

- Adherence to the following USFWS Manatee Guidelines during in-water construction:
 - The permittee will stop work if a manatee is seen near the Project site.
 - The Project Manager shall instruct all personnel associated with the Project of the potential presence of manatees and the need to avoid collisions with manatees. All construction personnel must monitor water-related activities for the presence of manatee(s) during May 15 through October 15.
 - The Project Manager shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing manatees which are protected under the MMPA of 1972 and the ESA of 1973.
 - Any siltation barriers used during the Project shall be made of material in which manatees cannot become entangled and must be properly secured, and regularly monitored to avoid manatee entrapment.
 - All vessels associated with the Project shall operate a “no wake/idle” speeds at all times while in the construction area and while in water where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will follow routes of deep water whenever possible.
 - If manatee(s) are seen within 100 yards of the active construction area all appropriate precautions shall be implemented to ensure protection of the manatee. These precautions shall include the operation of all moving equipment no closer than 50 feet to a manatee. Operation of any equipment closer than 50 feet to a manatee shall necessitate immediate shutdown of that equipment. Activities will not resume until the manatee(s) has departed the Project area of its own volition.
 - Any collision with and/or injury to a manatee shall be reported immediately to Jim Valade of the U.S. Fish and Wildlife Service, North Florida Field Office, at (904) 731-3116.
- The permittee will also stop work if a turtle or sturgeon is seen near the Project site during construction.

- Adherence to environmental windows for construction during the winter months when sea turtles are less abundant.
- The contractor will hire a qualified marine biologist to be on-site during in-water construction activities to avoid potential impacts to aquatic Protected Species.
- Time of year and methods for preconstruction surveys for protected bird species will be coordinated with the USFWS.

Additional avoidance, minimization, and mitigation may be considered by the Corps in its decision-making process. Final mitigation measures may be adopted as conditions of the DA permit and documented in the Record of Decision (ROD).

4.7 ESSENTIAL FISH HABITAT

4.7.1 Methods and Impact Definitions

Potential impacts to EFH were addressed in the context of EFH species and habitat based on research, field observations, and best professional judgement. The level of detail to document existing resources within the study area is intended to provide data to analyze potential impacts to existing marine resources identified by NMFS and the field surveys. These data were used as a baseline to further analyze the alternatives through the process of minimization and avoidance. Impacts could include direct, indirect, site specific, or habitat impacts, including individual, cumulative, or synergistic consequences of actions.

Table 4.7-1
Impact Definitions, Essential Fish Habitat

	Negligible	Minor	Major
EFH	Very small alteration to EFH, or to federally managed and/or common fishery species.	A small alteration (in quantity or extent) to EFH that does not impair a species' ability to live.	A large alteration that appreciably diminishes the value of EFH for survival of a species.

4.7.2 No-Action Alternative

Under the No-Action Alternative, the Project site and the River Center project site would continue to be used for mixed use industrial activities. While future land uses and human activities may occur adjacent to and/or within aquatic environments within the study area, it would be speculative to attempt to estimate the acreage of impacts to EFH at this time. Therefore, the acreage of impacts to EFH is unknown, but EFH habitat could experience an adverse impact if these future activities resulted in a reduction in quantity and/or quality of EFH habitat. While population assessments and trends of EFH species are evaluated regularly by NMFS, and the species response to management