



Appendix J - Marine
Mammal Protection Act
Technical Memorandum

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Technical Memo

Date: Monday, August 15, 2016

Project: US 21 (Sea Island Parkway) Harbor River Bridge Replacement (P026862)

Subject: **Marine Mammal Protection Act**

How are marine mammals protected?

Marine mammals are protected under the Marine Mammal Protection Act (MMPA). The MMPA prohibits the “take” of marine mammals, with certain exceptions, in waters of the US. “Take” is defined by the MMPA as “harass, hunt, capture, kill, or collect, or attempt to harass, hunt, capture, kill, or collect”. In the 1994 amendments to the MMPA, two levels of “harassment” were defined.

- Level A Harassment is defined as any act of pursuit, torment, or annoyance that has the potential to injure a marine mammal or marine mammal stock in the wild;
- Level B harassment is any act that has the potential to disturb a marine mammal or marine mammal stock in the wild by disrupting behavioral patterns, including, migration, breathing, nursing, breeding, feeding, or sheltering.

The MMPA is implemented by the National Ocean and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS).

What marine mammals could be found in the study area?

Two marine mammals, the common bottlenose dolphin (*Tursiops truncatus*) and West Indian manatee – Florida subspecies (*Trichechus manatus latirostris*), may occur within the study area.

Bottlenose Dolphin

Bottlenose dolphins are found in most coastal areas in temperate and tropical regions of the world (NOAA-NMFS 2015a). Bottlenose dolphins have been observed in the Harbor River. The NOAA-NMFS Northern Georgia/Southern South Carolina Estuarine System (NGSSCES) Stock occurs within the study area. The total number of bottlenose dolphins comprising the NGSSCES Stock is unknown (Waring et. al. 2014). The population associated with the study area likely consists of resident and transient bottlenose dolphin populations (Waring et. al. 2014). The abundance of the NGSSCES Stock is currently unknown, but likely small, with relatively little mortality and serious injuries. NOAA-NMFS considers NGSSCES to be a strategic stock under the MMPA.

West Indian (Florida) Manatee

The Florida manatee, a subspecies of the West Indian manatee, is a slow-moving, herbivorous mammals found in coastal habitats. The West Indian manatee was federally listed as endangered under the Endangered Species Act in 1967. The West Indian (Florida) manatee is considered a “strategic stock” and “depleted” under the MMPA (USFWS 2012). The Florida Fish

and Wildlife Conservation Commission (FWC) listed their number at 6,250 individuals, from their January 2016 count (FWC 2016). Because of improving population and habitat conditions, on January 7, 2016, the USFWS proposed reclassifying the manatee as threatened.

The U.S. populations appear to originate from Florida, but transient groups and individuals can be found in South Carolina coastal waters during the summer months (NatureServe 2014). The US Fish and Wildlife Service (USFWS) designated critical habitat for the West Indian manatee is not located in the study area and is limited to portions of coastal southern Georgia and Florida. Manatees prefer slow moving waters 3 to 6 feet deep and feed on marsh grasses, floating vegetation, and algae. Harbor River and its associated tidal creeks within the study area may provide suitable habitat for West Indian manatees between May and October.

How would the project affect marine mammals?

The South Carolina Department of Transportation (SCDOT) conducted an assessment to determine the potential effects on the marine mammals present within the study area. For the purposes of estimating the potential project impacts on marine mammals, SCDOT developed a construction scenario that is detailed below. The construction scenario may change during final design by the selected contractor. The contractor would coordinate major design changes that would affect marine mammals with SCDOT and NOAA-NMFS.

Construction Scenario

Direct impacts to the Harbor River, which comprises habitat for the manatee and bottlenose dolphin, would occur during construction of bridge support structures, such as drilled shafts for concrete columns. Bridge construction may include pile driving to support flat slab approaches. Flat slabs could be constructed over the salt marsh, not deep water habitats. Bridge construction methods may include a combination of drilling shafts and pile driving for the bridge support structures, which would introduce sound into the water. Temporary impacts such as suspension of sediments and increased turbidity in marine mammal habitat would occur during construction. Work in deep water habitats is likely to occur from barges. Temporary work trestles may be necessary to support cranes during the drilled shaft construction and load/unload barges in the Harbor River. Temporary work trestles would be constructed over the salt marsh and are not likely to occur in deep water habitats. Table J-1 provides a summary of the estimated size and number of drilled shafts and piles that may be used to construct the proposed bridge and its support structures.

Table J-1. Summary of Preferred Alternative Worst-Case Construction Scenario

	Installation Method	Total Number Installed (Approximate Numbers)			Estimated Time per Unit	Total Estimated Pile Driving Timeframe
		Total	Open Water	Marsh		
Drilled shaft concrete columns (8-foot diameter)	Vibratory hammer and augering	56	20	36	2 Hours per Steel Casing	112 Hours
Flat Slab Square Concrete Piles (24-in by 24-in)	Impact Pile Driver	308	0	308	1 Hour per Pile	308 Hours
End Bent Steel H-Piles (14-in wide)	Impact Pile Driver	16	0	0	1 Hour per Pile	16 Hours
Temporary Trestle Steel Pipe Piles (24-in diameter)	Vibratory Hammer	370	24	346	1 Hour per Steel Pile	740 Hours*

*Note: Installation and removal of trestle piles would each take 370 hours, for a total of 740 hours.

Vessel Strikes

Construction activities may have a direct effect on marine mammals if a vessel (such as a barge or tug boat) strikes a dolphin or manatee. Because of the manatee’s slow movements, vessel strikes are the most significant threat faced by manatees (USFWS 2001, FWC 2007). The likelihood of direct strikes from vessels on bottlenose dolphins is low due to their high maneuverability coupled with the slow speeds at which the construction vessels would operate. Individual bottlenose dolphins would be able to avoid collisions.

Turbidity

Construction may indirectly affect marine mammals through a temporary increase in turbidity during placement of bridge pilings. However, this increase would be temporary and localized and would likely dissipate and settle within a few hours. Marine mammals and/or their prey may temporarily avoid the construction area. The temporary increase in turbidity would not permanently change habitat conditions.

Noise

How are marine mammals affected by in-water noise?

Marine mammals have the potential to be affected by noise traveling through the waterway during construction of the proposed bridge. Dolphins emit sound waves to detect and locate prey, and both dolphins and manatees rely on their hearing to avoid boats. NOAA-NMFS uses underwater criteria to assess exposure of marine mammals to underwater anthropogenic noise. On July 30, 2015, the NOAA-NMFS released the *Draft NOAA Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing*. This guidance helps determine if activities are expected to result in particular types of impacts to marine mammals via acoustic exposure.

Marine mammals experience an auditory injury after a permanent shift in hearing range. This impact is classified as “Level A harassment”. There are two thresholds for noninjurious harassment, also known as “Level B harassment”, which includes temporary, recoverable, loss of hearing sensitivity and behavioral disturbance. Behavioral disturbance include noise levels or other activities that might potentially cause marine mammals to alter normal biological behavior. Behavioral changes in response to vessel presence include avoidance reactions, alarm/startle responses, and other behavioral and stress-related changes.

How is in-water noise defined and estimated?

A general increase in in-air and in-water noise would be expected during construction. Construction noise is generally considered to generate impulsive or nonimpulsive sounds, as defined below.

- Impulsive sounds are transient, brief (less than 1 second), and typically consist of high peak pressure with rapid rise time and rapid decline (ANSI 1986; NIOSH 1998; ANSI 2005). Examples of impulsive sounds include airguns or impact pile drivers.
- Nonimpulsive sounds can be brief or prolonged and continuous or intermittent, but typically do not have a high peak pressure with rapid rise time (ANSI 1995; NIOSH 1998). Examples of nonimpulsive activities include sonar and vibratory pile drivers.

Typical metrics used to evaluate construction noise impacts for impulsive or nonimpulsive activities include peak sound pressure level (dB_{peak}) and sound exposure level (SEL) (CalTrans 2015, Horwitz 2015). SEL can be expressed as a value for a single strike and for multiple strikes. The latter value is commonly referred to as the cumulative SEL or SEL_{CUMULATIVE}.

Appendix I (Compendium of Pile Driving Sound Data) from the California Department of Transportation (CalTrans) *Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish* (2015) was used to estimate underwater sound pressure levels caused by in-water pile driving during construction. Noise levels are generally higher if impact pile driving is used, as compared to vibratory hammer driving or extraction. Impact pile driving creates an impulsive sound, while vibratory hammers generate a continuous, low-level noise that is generally considered nonimpulsive.

How would in-water construction noise affect bottlenose dolphins?

Bottlenose dolphins are part of the order Cetacea and are characterized as part of the mid-frequency cetaceans functional hearing group in NOAA’s 2015 Draft Guidance. The diameter of drilled shaft columns, temporary trestle piles, and flat slab piles shown in Tables J-2, J-3, and J-4 is estimated for the purpose of evaluating potential project impacts on marine mammals. The contractor would coordinate major design changes that would affect marine mammals with SCDOT and NOAA-NMFS.

Nonimpulsive activities

Injury thresholds for bottlenose dolphins for nonimpulsive activities, such as vibratory hammers, are shown in Table J-2. The drilled shafts would primarily be installed in deep water habitats. The temporary trestle would primarily be installed over salt marsh, which is inundated by approximately 6 to 12 inches of water twice a day. Construction of the drilled shafts and temporary trestle would likely use vibratory hammers that are not expected to produce sound levels that would exceed peak or SEL injury thresholds for bottlenose dolphins.

Table J-2 Bottlenose dolphin injury thresholds and projected sound pressure levels for nonimpulsive activities

Species of concern under MMPA	Injury thresholds for nonimpulsive activities	
	Peak sound pressure levels (dB ^{peak})	Cumulative sound exposure levels (dB SEL ^{cum})
Bottlenose dolphin	230	199
Potential construction method	Projected average sound pressure levels for vibratory pile-driving activities in study area (dB)	
8-foot-diameter drilled shaft concrete columns installed with a vibratory hammer ¹	195	180
24-inch-diameter temporary trestle piles installed with a vibratory hammer ²	180	170

Source: NOAA-NMFS 2015b and CalTrans 2015

¹ dB based on Table I.2-2 of CalTrans 2015 for a 72-inch (6-foot) steel pipe pile (loudest measurement) at approximately 5-meter relative water depth

² dB based on Table I.2-2 of CalTrans 2015 for a 36-inch steel pile pipe at approximately 5-meter relative water depth

Impulsive Activities

The flat slab approaches may be supported by 24-inch-square concrete piles that would likely be installed using an impact hammer. The flat slab approaches would primarily be installed over high marsh, which is occasionally inundated by approximately 6 inches of water. The proposed impulsive activities would not produce sound levels that would exceed peak or SEL injury thresholds for bottlenose dolphins.

Table J-3 Bottlenose dolphin injury thresholds and projected sound pressure levels for impulsive activities

Species of concern under MMPA	Injury thresholds for impulsive activities	
	Peak sound pressure levels (dB ^{peak})	Cumulative sound exposure levels (dB SEL ^{cum})
Bottlenose dolphin	230	187
Potential construction method	Projected average sound pressure levels for impact pile-driving activities in study area (dB)	
24-inch-square flat slab piles installed with an impact hammer ¹	203	177

Source: NOAA-NMFS 2015b and CalTrans 2015

¹ dB based on Table I.2-1 of CalTrans 2015 for a 24-inch steel pipe pile at approximately 5-meter relative water depth

Behavioral Disturbance

NOAA-NMFS’s behavioral disturbance threshold for bottlenose dolphins has been characterized as 120 dB for non-impulsive noise, such as those generated by vibratory hammers, and 160 dB for impulsive noise, such as those generated by impact pile driving. The Root Mean Square (RMS) dB of potential construction methods was approximated for each potential construction method. As shown in Table J-4, construction of the drilled shafts, flat slab approaches, and temporary trestle may exceed this threshold and cause a behavioral disturbance for bottlenose dolphins. The potential for behavioral disturbance would be minimized by the proposed construction commitments outlined below.

Table J-4 Bottlenose dolphin thresholds for Level B behavioral disturbance

Species of concern under MMPA	Behavioral disturbance thresholds	
	Vibratory driving criteria (dB)	Impact driving criteria (dB)
Bottlenose dolphin	120	160
Potential construction method	Projected average sound pressure levels (dB)	
8-foot-diameter drilled shaft concrete columns installed with a vibratory hammer ¹	180	N/A
24-inch-diameter piles	175 ²	190 ³

Source: NOAA-NMFS 2015b and CalTrans 2015

¹ RMS dB based on Table I.2-2 of CalTrans 2015 for a 72-inch (6-feet) steel pipe pile (loudest measurement) at approximately 5-meter relative water depth

² RMS dB based on Table I.2-2 of CalTrans 2015 for a 36-inch steel pipe pipe at approximately 5-meter relative water depth

³ RMS dB based on Table I.2-1 of CalTrans 2015 for a 24-inch steel pipe pile at approximately 5-meter relative water depth

How would in-water construction noise affect West Indian (Florida) Manatees?

The manatee’s functional hearing range and responsiveness to noise has been disputed in recent studies (Gerstein et al. 2008; Gerstein et al. 1999, Mann et al. 2009). Injury and behavioral impact thresholds for manatees have not been developed at this time. Loud levels of intermittent or continuous construction noise could harm manatees if they were close to the noise source for prolonged periods. Adverse effects on manatees are not expected to occur within the project area because construction operations would follow the USFWS *Manatee*

Protection Guidelines. Furthermore, manatees would likely avoid the construction area given the increased vessel traffic and noise.

What would be done to avoid and minimize impacts to marine mammals on this project?

The proposed project is not expected to injure bottlenose dolphins or West Indian (Florida) manatees. The proposed project would not result in a “take” of marine mammals under the MMPA.

SCDOT would implement the conservation measures, or commitments, to minimize the potential for harm or “take” of marine mammals. The following commitments mimic those proposed for federally threatened and endangered species (see Section 5.10 of the EA).

Vessel Strikes

Equipment and materials used during the construction of the bridge would not obstruct or impede passage through more than 50 percent of the channel. SCDOT also commits to following the USFWS *Manatee Protection Guidelines*, which will minimize potential project effects on manatees and bottlenose dolphins. To avoid striking manatees, construction vessels would operate at safe, slow speeds (no-wake or idle) in the study area and in waters with less than a 4-foot clearance from the bottom sediments. In accordance with USFWS *Manatee Protection Guidelines*, the contractor would use a trained spotter between May 15 and October 15 to protect manatees from collisions. The contractor would be restricted from in-water work for a minimum of 8 hours each night, when visibility is low. The use of in-water moving equipment would be halted if a manatee is spotted within 50 feet of the in-water construction area.

Turbidity

In general, the contractor would follow SCDOT Best Management Practices (BMPs), such as seeding slopes, installing silt fences, and creating sediment basins, during construction to avoid potential turbidity impacts within the Harbor River. If siltation or turbidity barriers are used, they would be made of material in which manatees or other marine mammals cannot become entangled, would be properly secured, and would be regularly monitored to avoid marine mammal entanglement or entrapment. Stormwater runoff from bridges would be treated prior to discharging into the waters surrounding Harbor River. A National Pollutant Discharge Elimination System (NPDES) permit pursuant to Section 402 of the CWA would be required for construction activities. The NPDES permit application would include a Stormwater Pollution Prevention Plan (SWPPP), which would be implemented by the contractor.

Noise

During construction, the potential effect of noise impacts on marine mammals would be minimized through the use of “slow starts”, where pile driving ramps up slowly in an effort to deter marine species from the work area. The contractor would also stop in-water work at night for a minimum of 8 hours, which creates a daily lapse of in-water noise and provides time for marine species to navigate through the construction area during ambient noise levels.

If explosives are used for demolition, the contractor would be required to hire qualified personnel for evaluating the potential effect on protected species to submit to SCDOT. SCDOT would be responsible for reinitiating consultation with the USFWS and NOAA-NMFS. Future separate consultation on blasting would be required if the contractor would plan to use explosives. The contractor may be required to develop a blasting plan to include a marine wildlife watch plan to submit to the SCDOT. SCDOT would then reinitiate consultation with the USFWS and NOAA-NMFS to evaluate impacts as a result of the plan.

Reporting

If SCDOT or the contractor discovers an injured, sick, or dead marine mammal, NOAA-NMFS will be notified immediately by contacting the NOAA-NMFS Stranding Coordinator for the Southeast Region. NOAA-NMFS would be provided with the species or description of the animal(s), the condition of the animal (carcass condition if deceased stranding), location, the date and time of first discovery, observed behaviors (if alive), and photo or video (if available). Any collision, injury, or mortality to manatees will also be reported immediately to the USFWS South Carolina Field Office.

References

- ANSI (American National Standards Institute). 1986. Methods of Measurement for Impulse Noise (ANSI S12.7-1986). New York: Acoustical Society of America.
- ANSI (American National Standards Institute). 1995. Bioacoustical Terminology (ANSI S3.20-1995). New York: Acoustical Society of America.
- ANSI (American National Standards Institute). 2005. Measurement of Sound Pressure Levels in Air (ANSI S1.13-2005). New York: Acoustical Society of America.
- California Department of Transportation (CalTrans). 2015. Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish.
http://www.dot.ca.gov/hq/env/bio/files/bio_tech_guidance_hydroacoustic_effects_110215.pdf
- Florida Fish and Wildlife Conservation Commission (FWC). 2007. Florida Manatee Management Plan: *Trichechus manatus latirostris*.
http://myfwc.com/media/214332/Manatee_Mgmt_Plan.pdf
- Florida FWC. 2016. Manatee Synoptic Surveys. Accessed April 14, 2016.
<http://myfwc.com/research/manatee/research/population-monitoring/synoptic-surveys/>
- Gerstein, E., Gerstein, L., Blue, J. & Forsythe, S. 2008. Ultrasonic hearing and vocalizations are used in communication by West Indian manatee mothers and calves. *Journal of the Acoustical Society of America*, 124(4, pt. 2), 2548-2548.
- Gerstein, E. R., Gerstein, L., Forsythe, S. E., & Blue, J. E. 1999. The underwater audiogram of the West Indian manatee (*Trichechus manatus*). *Journal of the Acoustical Society of America* 105(6):3575-3583.
- Horwitz, J., Jenkins, A., & Morgan, J. 2015. In-Water Noise and Pile Driving. Powerpoint Presentation.
http://www.greenbusch.com/files/Greenbush_AQ%20Combined%20Presentation_Final.pdf
- Mann, D., NBauer, G., Reep, R., Gaspard, J., Dziuk, K. & Read, L. 2009. Auditory and Tactile Detection by the West Indian Manatee. St. Petersburg, FL: Fish and Wildlife Research
- National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS). 2015a. Bottlenose Dolphin (*Tursiops truncatus*). Website updated January 16, 2015. Accessed April 14, 2016.
<http://www.fisheries.noaa.gov/pr/species/mammals/dolphins/bottlenose-dolphin.html>
- National Institute for Occupational Safety and Health (NIOSH). 1998. Criteria for a recommended standard: Occupational noise exposure. Cincinnati, Ohio.: United States Department of Health and Human Services.

- NOAA-NMFS. 2015b. DRAFT Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing – Underwater Acoustic Threshold Levels for Onset of Permanent and Temporary Threshold Shifts. Revised version for Second Public Comment Period, July 23, 2015.
<http://www.nmfs.noaa.gov/pr/acoustics/draft%20acoustic%20guidance%20July%202015.pdf>
- NatureServe. 2014. "Trichechus manatus." NatureServe Explorer: An Online Encyclopedia of Life. Accessed October 3, 2014.
<http://explorer.natureserve.org/servlet/NatureServe?searchName=Trichechus+manatus>
- USFWS. 2001. Florida Manatee Recovery Plan, (Trichechus manatus latirostris), Third Revision. US Fish and Wildlife Service. Atlanta, Georgia. 144 pp. + appendices.
- USFWS. 2012. 2012 Final Revised Stock Assessment Reports for West Indian Manatee Stocks: 2012 Florida Manatee SAR.
http://www.fws.gov/northflorida/manatee/SARS/FR00001606_Final_SAR_WIM_FL_Stock.pdf
- Waring, G.T., E. Josephson, K. Maze-Foley, and P. Rosel. 2014. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments. NOAA Technical Memorandum NMFS-NE-228, 475 pp.