FINAL

FOCUSED ENVIRONMENTAL ASSESSMENT

FOR

PIER REPLACEMENT

AT

MARINE CORPS AIR STATION BEAUFORT SOUTH CAROLINA

December 2021

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Abstract

Designation:	Focused Environmental Assessment
Title of Proposed Action:	Pier Replacement
Project Location:	Marine Corps Air Station Beaufort, South Carolina
Lead Agency for the EA:	U.S. Marine Corps
Cooperating Agency:	Defense Logistics Agency
Affected Region:	Beaufort, South Carolina
Action Proponent:	Marine Corps Air Station Beaufort and Defense Logistics Agency
Point of Contact:	BFRT_JPAO@usmc.mil
Date:	December 2021

Marine Corps Air Station Beaufort has prepared this focused Environmental Assessment in accordance with the National Environmental Policy Act, as implemented by the Council on Environmental Quality Regulations and U.S. Marine Corps regulations for implementing the National Environmental Policy Act. The Proposed Action is to replace the existing pier at Marine Corps Air Station Beaufort to include new pilings, decking, storage shed, piping, and mooring dolphins. This focused Environmental Assessment evaluates the potential environmental impacts associated with 2 action alternatives and the No Action Alternative to the following resource areas: biological resources, water resources, and health and safety.

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EXECUTIVE SUMMARY

ES.1 Proposed Action

The United States (U.S.) Marine Corps proposes to replace the pier at Marine Corps Air Station (MCAS) Beaufort in Beaufort County, South Carolina. The Proposed Action is to replace the existing pier to include new pilings, decking, storage shed, piping, and mooring dolphins. This new pier would be constructed prior to the demolition of the existing pier. Use of the existing pier would be maintained during the entire term of the project with the exception of a brief period of weeks where utility switch overs would occur. Access to the existing Boat Dock would be maintained throughout construction.

Support activities would include new utility connections (lighting, power, piping, and potable water lines), minor site civil work (riprap and fill), and site demolition. Site demolition would include removing the existing decking, beams, vertical pilings when necessary, utility lines, piping, and mooring. Existing equipment would be reused if available and in good condition.

This project would provide Antiterrorism/ Force Protection (AT/FP) features and comply with AT/FP regulations and physical security mitigation in accordance with Unified Facilities Criteria (UFC) 4-020-01 Department of Defense Security Engineering Facilities Planning Manual.

ES.2 Purpose of and Need for the Proposed Action

The purpose of the Proposed Action is to provide a functional, efficient, and safe means of ship to shore operations to support training and readiness at MCAS Beaufort.

The Proposed Action is needed because the pier currently in use, and built in 1957 with an upgrade in 1999, was recently evaluated and received an undesirable engineering assessment. Advanced deterioration and overstressing observed on widespread portions of the structure has resulted in a downgraded capacity. This means the pier cannot support utilities for proper operation. Increased sustainment costs and eventual failure of the pier have been determined to be unacceptable.

ES.3 Alternatives Considered

MCAS Beaufort is considering two action alternatives that meets the purpose of and need for the Proposed Action and a No Action Alternative.

In order to meet the purpose and need, potential alternatives were required to provide a system for operations that:

- is functional and reliable,
- addresses environmental concerns,
- is modern, safe, and maintainable, and
- can maintain ship to shore operations during construction.

In support of the above, potential alternatives must additionally meet the following requirements:

- UFC 4-020-01 Department of Defense Security Engineering Facilities Planning Manual,
- UFC 2-000-05N Facility Planning Criteria for Navy/Marine Corps Shore Installations, and Navy/Marine Corps AT/FP requirements.

Under the Preferred Alternative, the Marine Corps would replace all of the existing pier at MCAS Beaufort. The existing Boat Dock would be kept and connected to the new pier. The existing pier would be demolished using demolition jaws to cut/crush concrete. Existing pilings would be left in place and cut below the mud line where possible. Pilings that require removal would be demolished by the direct pull method. Demolition and construction under Alternative 1 would take approximately 36 months. The new pier would have an expected life cycle of 50-75 years if properly maintained.

Under Alternative 2, the Marine Corps would replace portions of the existing pier at MCAS Beaufort. This would require demolition and replacement of a majority of the piling caps (those not replaced in 2015) and all of the prestressed deck beams and deck overlay. In addition, the portions of the north side of the pier that are currently not used would be demolished and not replaced. Finally, the piping from the shore as well as any other features that are not used would be demolished. Any pilings that are not reused as part of the repair would be demolished. Pilings being demolished would be left in place and cut below the mud line where possible or removed by the direct pull method. Access to the Boat Dock on the south end of the pier would be maintained throughout construction. Access would be achieved by launching another vessel from the boat ramp located on the southern end of MCAS Beaufort and transiting to the south end of the pier, or by having the contractor provide safe access through the construction site. Demolition and construction under Alternative 2 would take approximately 36 months. The repaired pier would have an expected life cycle of 30-50 years with a more frequent maintenance effort than that needed for the new pier.

As part of the analysis required by the CEQ and MCO 5090.2, the No Action Alternative is included as a baseline to compare potential impacts of the Proposed Action and Alternatives. Under the No Action Alternative, the Marine Corps would not replace the pier at MCAS Beaufort. However, the No Action Alternative would not meet the purpose and need as described in **Section ES.2** and is not considered a reasonable alternative, although this alternative was carried forward for purposes of analyses.

ES.4 Summary of Environmental Resources Evaluated in the EA

CEQ regulations, the National Environmental Policy Act (NEPA), and Navy and U.S. Marine Corps instructions for implementing NEPA, specify that an Environmental Assessment (EA) should address those resource areas potentially subject to impacts. The following resource areas have been addressed in this EA: biological resources, water resources, and health and safety. Because potential impacts were considered to be negligible or non-existent, the following resource areas were not evaluated in this EA: airspace, air quality, noise, land use, transportation, hazardous materials and wastes, socioeconomics and environmental justice, infrastructure, cultural resources, and geological resources.

ES.5 Public Involvement

For this project, which will affect lands within the boundaries of MCAS Beaufort, a project Factsheet and the Final Focused EA will be published to the base website and public notices will be published in local newspapers. Public comments can be submitted to BFRT_JPAO@usmc.mil.

ES.6 Summary of Potential Environmental Consequences of the Action Alternatives

Table ES-1 provides a tabular summary for the potential impacts to the resources associated with each of the action alternatives analyzed.

Table ES-1. Summary of Potential Impacts to Resource Areas			
Resource Area	***No Action Alternative***	***Alternative 1 (Preferred Alternative)***	***Alternative 2***
Biological Resources	The No Action Alternative would have no significant impacts to biological resources.	• Temporary impacts to nearby wildlife from demolition and construction noise. • Temporary impacts to Essential Fish Habitat (EFH), but would not have any lasting direct or indirect effect upon the status or sustainability of managed species or their habitat. • Project *may affect, but not likely to adversely affect* wood storks (*Mycteria americana*), black rails (*Laterallus jamaicensis jamaicensis*), and West Indian manatees (*Trichechus manatus*). • With proposed mitigations, there would be no significant impact on threatened and endangered species or marine mammals.	• Temporary impacts to nearby wildlife from demolition and construction noise. • Temporary impacts to EFH, but would not have any lasting direct or indirect effect upon the status or sustainability of managed species or their habitat. • Project *may affect, but not likely to adversely affect* wood storks, black rails, and West Indian manatees. • With proposed mitigations, there would be no significant impact on threatened and endangered species or marine mammals.
Water Resources	The No Action Alternative would have no significant impacts to water resources.	• Minor, temporary impacts to surface water and wetlands due to increased turbidity during construction and demolition activities.	• Minor, temporary impacts to surface water and wetlands due to increased turbidity during construction and demolition activities.
Health and Safety	The No Action Alternative would have a negative long-term impact to health and safety.	• During construction at the Proposed Action site, Occupational Safety and Health Administration (OSHA) regulations, procedures, and AT/FP requirements would be followed. • The new pier would provide long-term benefits to health and safety at MCAS Beaufort by replacing the aging current pier with a modern and safe pier. The new pier would have an expected life cycle of 50-75 years if properly maintained. • There are no environmental health or safety risks associated with the Proposed Action that would disproportionately affect children.	• During construction at the Proposed Action site, OSHA regulations, procedures, and AT/FP requirements would be followed. • The replaced pier would provide long-term benefits to health and safety at MCAS Beaufort by replacing the aging current pier with a modern and safe pier. However, the replaced pier would have an expected life cycle of 30-50 years with a more frequent maintenance effort than that needed for the new pier. • There are no environmental health or safety risks associated with the Proposed Action that would disproportionately affect children.

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Final

Focused Environmental Assessment for Pier Replacement Marine Corps Air Station Beaufort, South Carolina

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Abbreviations and Acronyms

Acronym	Definition
AT/FP	Antiterrorism Force Protection
ATLM	Acoustic Transmission Loss Modeling
BGEPA	Bald and Golden Eagle Protection Act
BMP	best management practice
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CWA	Clean Water Act
DoD	Department of Defense
DPS	Distinct Population Segment
EA	Environmental Assessment
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act
HAPC	Habitat Areas of Particular Concern
MBTA	Migratory Bird Treaty Act
MCAS	Marine Corps Air Station
MCO	Marine Corps Order
MMPA	Marine Mammal Protection Act
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
OSHA	Occupational Safety and Health Administration
PTS	permanent threshold shift
SCDNR	South Carolina Department of Natural Resources
TTS	temporary threshold shift
U.S.	United States
U.S.C.	United States Code
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
UFC	Unified Facilities Criteria
USFWS	U.S. Fish and Wildlife Service
ZOIs	Zones of Impact

1 Purpose of and Need for the Proposed Action

1.1 Introduction

The United States (U.S.) Marine Corps proposes to replace the pier at Marine Corps Air Station (MCAS) Beaufort in Beaufort County, South Carolina.

This focused Environmental Assessment (EA) has been prepared in accordance with the requirements of the National Environmental Policy Act (NEPA) (42 United States Code [U.S.C.] section 4321 et seq.); the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 Code of Federal Regulations [CFR] 1500-1508); Marine Corps Order (MCO) 5090.2, Volume 12; and all other applicable laws, regulations, Executive Orders (EOs), and instructions.

1.2 Purpose of and Need for the Proposed Action

The purpose of the Proposed Action is to provide a functional, efficient, and safe means of ship to shore operations to support training and readiness at MCAS Beaufort (**Figure 1.2-1**).

The Proposed Action is needed because the pier currently in use, and built in 1957 with an upgrade in 1999, was recently evaluated and received an undesirable engineering assessment. Advanced deterioration and overstressing observed on widespread portions of the structure has resulted in a downgraded capacity. This means the pier cannot support utilities for proper operation. Increased sustainment costs and eventual failure of the pier have been determined to be unacceptable.

1.3 Scope of Environmental Analysis

This focused EA includes an analysis of potential environmental impacts associated with the action alternatives and the No Action Alternative. The environmental resource areas analyzed in this EA include: biological resources, water resources, and health and safety. The study area for each resource analyzed may differ due to how the Proposed Action interacts with or impacts the resource.

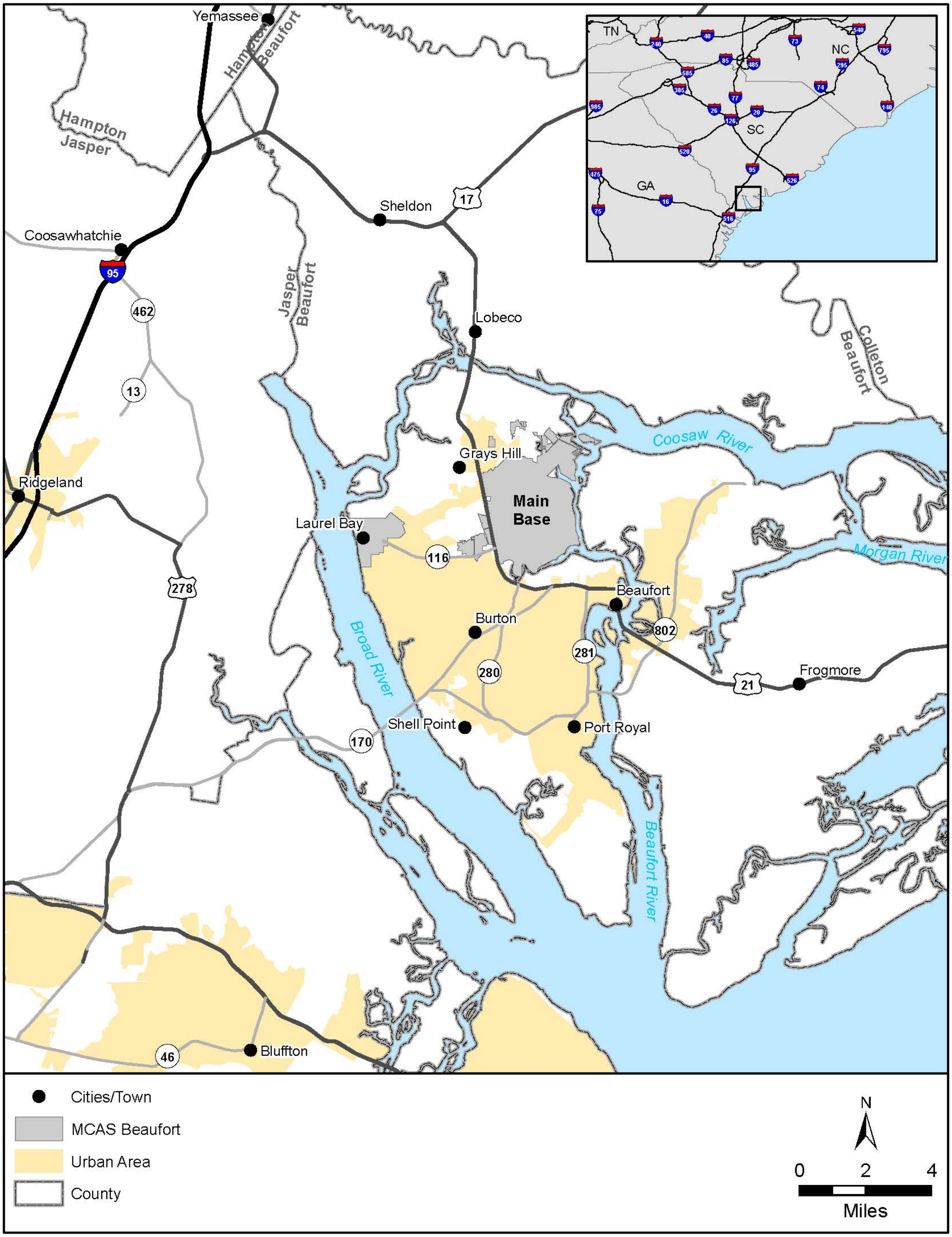

Figure 1.2-1. MCAS Beaufort Location

1.4 Relevant Laws and Regulations

This focused EA has been prepared in accordance with federal and state laws, statutes, regulations, and policies pertinent to the implementation of the Proposed Action, including the following:

- NEPA (42 U.S.C. sections 4321–4370h)
- CEQ Regulations for Implementing the Procedural Provisions of NEPA (40 CFR 1500-1508)
- Navy regulations for implementing NEPA (32 CFR 775)
- MCO 5090.2, Volume 12, Environmental Planning and Review
- National Historic Preservation Act (54 U.S.C. section 306108 et seq.)
- Endangered Species Act (ESA) (16 U.S.C. section 1531 et seq.)
- Migratory Bird Treaty Act (MBTA) (16 U.S.C. section 703-712)
- Marine Mammal Protection Act (MMPA) (16 U.S.C. section 1361 et seq.)
- Clean Water Act (CWA) (33 U.S.C. section 1251, et seq.)
- Coastal Zone Management Act (16 U.S.C. section 1451 et seq.)
- Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. section 1801-1891d)

A description of the Proposed Action's consistency with these laws, policies and regulations, as well as the names of regulatory agencies responsible for their implementation, is presented in **Chapter 5** (**Table 5.1-1**).

1.5 Public and Agency Participation and Intergovernmental Coordination

For this project, which will affect lands within the boundaries of MCAS Beaufort, a project Factsheet and the Final Focused EA will be published to the base website and public notices will be published in local newspapers. Public comments can be submitted to BFRT_JPAO@usmc.mil.

The U.S. Marine Corps has coordinated or consulted with the U.S. Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS), the South Carolina Department of Health and Environmental Control, and the State Historic Preservation Officer and/or Tribal Historic Preservation Officer regarding the Preferred Alternative.

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2 Proposed Action and Alternatives

2.1 Proposed Action

The Proposed Action is to replace the existing pier to include new pilings, decking, storage shed, piping, and mooring dolphins. This new pier would be constructed prior to the demolition of the existing pier. Use of the existing pier would be maintained during the entire term of the project with the exception of a brief period of weeks where utility switch overs would occur. Access to the existing Boat Dock would be maintained throughout construction.

Support activities would include new utility connections (lighting, power, piping, and potable water lines), minor site civil work (riprap and fill), and site demolition. Site demolition would include removing the existing decking, beams, vertical pilings when necessary, utility lines, piping, and mooring. Existing equipment would be reused if available and in good condition.

This project would provide Antiterrorism/ Force Protection (AT/FP) features and comply with AT/FP regulations and physical security mitigation in accordance with Unified Facilities Criteria (UFC) 4-020-01 Department of Defense Security Engineering Facilities Planning Manual.

2.2 Screening Factors

NEPA's implementing regulations provide guidance on the consideration of alternatives to a federally proposed action and require rigorous exploration and objective evaluation of reasonable alternatives. Only those alternatives determined to be reasonable and to meet the purpose and need require detailed analysis.

In order to meet the purpose and need, potential alternatives were required to provide a system for operations that:

- is functional and reliable,
- addresses environmental concerns,
- is modern, safe, and maintainable, and
- can maintain ship to shore operations during construction.

In support of the above, potential alternatives must additionally meet the following requirements:

- UFC 4-020-01 Department of Defense Security Engineering Facilities Planning Manual,
- UFC 2-000-05N Facility Planning Criteria for Navy/Marine Corps Shore Installations, and
- Navy/Marine Corps AT/FP requirements.

2.3 Alternatives to the Proposed Action Carried Forward for Analysis

Based on the reasonable alternative screening factors and meeting the purpose and need for the Proposed Action, two reasonable action alternatives (**Figure 2.3.1**) for replacement of the pier at MCAS Beaufort will be carried forward for analysis in this focused EA.

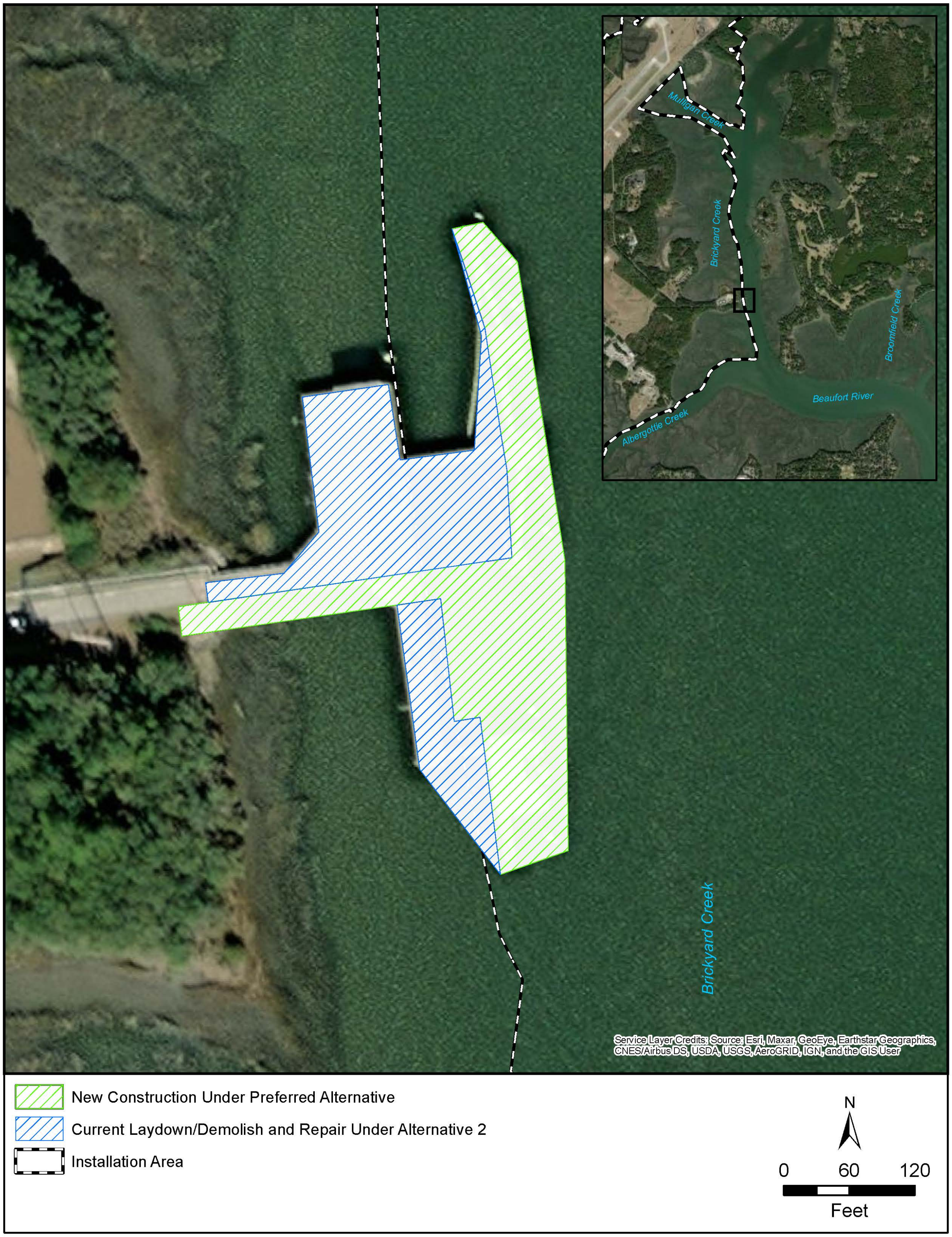

Figure 2.3-1. Pier Replacement Alternatives

2.3.1 No Action Alternative

As part of the analysis required by the CEQ and MCO 5090.2, the No Action Alternative is included as a baseline to compare potential impacts of the Proposed Action and Alternatives. Under the No Action Alternative, the Marine Corps would not replace the pier at MCAS Beaufort. However, the No Action Alternative would not meet the purpose and need as described in Section 1.4 and is not considered a reasonable alternative, although this alternative was carried forward for purposes of analyses.

2.3.2 Alternative 1 (Preferred Alternative)

Under the Preferred Alternative, the Marine Corps would replace all of the existing pier at MCAS Beaufort. The existing Boat Dock would be kept and connected to the new pier. The existing pier would be demolished using demolition jaws to cut/crush concrete. Existing pilings would be left in place and cut below the mud line where possible. Pilings that require removal would be demolished by the direct pull method. Demolition and construction under Alternative 1 would take approximately 36 months. The new pier would have an expected life cycle of 50-75 years if properly maintained.

The Preferred Alternative would be completed in four phases:

- Phase 1 – The waterway side of the new pier would be constructed first. This would allow access to be maintained to the Boat Dock while the southern end of the existing pier is being demolished.
- Phase 2 – The southern end of the existing pier would be demolished and construction of the remaining portions of the new pier would be completed.
- Phase 3 – Final connections between the utility systems on the new pier and the shore would be made. A brief outage (i.e., period of weeks) would be permitted to make these final connections.
- Phase 4 – The remaining portions of the existing pier structure would be demolished along with removal of utility systems associated with the existing pier structure.

2.3.3 Alternative 2

Under Alternative 2, the Marine Corps would replace portions of the existing pier at MCAS Beaufort. This would require demolition and replacement of a majority of the piling caps (those not replaced in 2015) and all of the prestressed deck beams and deck overlay. In addition, the portions of the north side of the pier that are currently not used would be demolished and not replaced. Finally, the piping from the shore as well as any other features that are not used would be demolished. Any pilings that are not reused as part of the repair would be demolished. Pilings being demolished would be left in place and cut below the mud line where possible or removed by the direct pull method. Access to the Boat Dock on the south end of the pier would be maintained throughout construction. Access would be achieved by launching another vessel from the boat ramp located on the southern end of MCAS Beaufort and transiting to the south end of the pier, or by having the contractor provide safe access through the construction site. Demolition and construction under Alternative 2 would take approximately 36 months. The repaired pier would have an expected life cycle of 30-50 years with a more frequent maintenance effort than that needed for the new pier.

Alternative 2 would be completed in five phases:

- Phase 1 – While keeping the existing systems operational, temporary utility systems, pedestrian access, and associated supports would be constructed. A brief outage (i.e., period of weeks) would be permitted to make connections between the temporary systems and the shore and the pier.

- Phase 2 – The existing piping (to the extent necessary) and utilities would be demolished after the temporary systems are in place. Piling caps, prestressed deck beams, and deck overlay on the south side of the pier would be demolished and replaced. The boom reel would be temporarily moved to the north edge of the pier so that operations could be maintained.
- Phase 3 – Piling caps, prestressed deck beams, and deck overlay on the north side of the pier would be demolished and replaced. The boom reel would be moved back to the south side of the pier so that operations could be maintained.
- Phase 4 – While keeping the temporary systems operational, new utility systems would be constructed along the north edge of the replaced pier. A brief outage (i.e., period of weeks) would be permitted to make final connections between the new systems on the pier and the shore.
- Phase 5 –Temporary utility systems would be demolished. Remaining unnecessary features of the pier would be demolished as required.

2.4 Alternatives Considered but not Carried Forward for Detailed Analysis

The following alternatives were considered, but not carried forward for detailed analysis in this focused EA as they did not meet the purpose and need for the project and did not satisfy the reasonable alternative screening factors presented in **Section 2.2**.

MCAS Beaufort considered modifying support operations to alleviate the use of the pier. In order to maintain training and readiness all ship to shore operations conducted at the pier would be converted to ground support operations. This approach reduces support capabilities for the installation, increases the likelihood of mishaps and is not favorable for long-term operations.

MCAS Beaufort considered building a new pier and leaving the existing pier in place. In order to build a new pier at least a portion of the existing pier would have to be removed. In addition, the degradation of the structure would pose a safety risk to anyone near it. Therefore, this is not suitable to support long-term operations.

2.5 Best Management Practices Included in the Proposed Action

This section presents an overview of the best management practices (BMPs) that are incorporated into the Proposed Action in this document. BMPs are existing policies, practices, and measures that the U.S. Marine Corps would adopt to reduce the environmental impacts of designated activities, functions, or processes. Although BMPs mitigate potential impacts by avoiding, minimizing or reducing/eliminating impacts, BMPs are distinguished from potential mitigation measures because BMPs are (1) existing requirements for the Proposed Action, (2) ongoing, regularly occurring practices, or (3) not unique to this Proposed Action. In other words, the BMPs identified in this document are inherently part of the Proposed Action and are not potential mitigation measures proposed as a function of the NEPA environmental review process for the Proposed Action. **Table 2.5-1** includes a list of BMPs. Mitigation measures are discussed separately in **Chapter 5**.

Table 2.5-1. Best Management Practices for the Proposed Action		
BMP	***Description***	***Impacts Reduced/Avoided***
Marine Mammal Observers	If a marine mammal or sea turtle were observed entering construction area, work would be stopped and would not commence until the animal moves out of the area.	Reduce impacts to threatened and endangered species and marine mammals.
General Construction BMPs	These requirements are incorporated into the Proposed Action work contract and include adherence to CWA permit requirements, spill containment, spill response, and construction equipment requirements.	Reduces potential water column Essential Fish Habitat (EFH) impacts.
General Piling Removal BMPs	Contractor will assess the condition of the piling and either remove it using a barge or upland equipment. The work plan must include procedures for extracting and handling pilings that break off and limit partial removal. Contractor should slowly remove piling. Pilings should not be shaken, or material removed during demolition. If clamshell bucket is used, extraction should be conducted during the best tidal conditions.	Reduces potential water column EFH impacts.
Soft start for impact pile driving	A soft start procedure will be used for impact pile driving at the beginning of each day's in-water pile driving or any time pile driving has ceased for more than 30 minutes. Soft start will consist of an initial set of strikes from the impact hammer at reduced energy, followed by a 30-second waiting period, then two subsequent sets. (The reduced energy of an individual hammer cannot be quantified because it varies by individual drivers. Also, the number of strikes will vary at reduced energy because raising the hammer at less than full power and then releasing it results in the hammer "bouncing" as it strikes the pile, resulting in multiple "strikes"). This will allow for animals to leave the Proposed Action vicinity before sound pressure increases.	Minimizes impacts to threatened and endangered species, marine mammals, managed fish species, and water column EFH.
Erosion and Sediment Control Plan	The Erosion and Sediment Control Plan would identify site-specific BMPs to implement during construction and demolition activities.	Reduce erosion at construction and site. Minimize impacts on nearby water resources from sedimentation.

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3 Affected Environment and Environmental Consequences

This chapter presents a description of the environmental resources and baseline conditions that could be affected from implementing any of the alternatives and an analysis of the potential direct and indirect effects of each alternative.

All potentially relevant environmental resource areas were initially considered for analysis in this EA. In compliance with NEPA, CEQ, and Department of Navy and Marine Corps guidelines; the discussion of the affected environment (i.e., existing conditions) focuses only on those resource areas potentially subject to impacts. Additionally, the level of detail used in describing a resource is commensurate with the anticipated level of potential environmental impact.

“Significantly,” as used in NEPA, requires considerations of both context and intensity. Context means that the significance of an action must be analyzed in several contexts such as society as a whole (e.g., human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of a proposed action. For instance, in the case of a site-specific action, significance would usually depend on the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant. Intensity refers to the severity or extent of the potential environmental impact, which can be thought of in terms of the potential amount of the likely change. In general, the more sensitive the context, the less intense a potential impact needs to be in order to be considered significant. Likewise, the less sensitive the context, the more intense a potential impact would be expected to be significant.

This section includes biological resources, water resources, and health and safety. Resources that have little to no potential for impact have been eliminated from further evaluation. These include:

Airspace: The Proposed Action does not alter, use, or have the potential to affect airspace at the installation.

Air Quality: Impacts to air quality from the Proposed Action would be temporary and would not exceed any pollutant thresholds.

Noise: Impacts to noise from the Proposed Action would be temporary and localized to the project area.

Land Use: There would be no change in land use as a result of the Proposed Action. A Coastal Consistency Determination (**Appendix A**) was prepared for the project that finds the Proposed Action consistent with the enforceable policies of South Carolina’s Coastal Zone Management Program.

Transportation: There would be no change in the local transportation system as a result of the Proposed Action. No impacts to transportation would be expected.

Hazardous Materials and Wastes: The Proposed Action would not introduce any new hazardous materials in the environment. All hazardous wastes generated by construction and demolition activities would be handled under the existing Resource Conservation and Recovery Act -compliant waste management programs and MCAS Beaufort Standard Operating Procedures.

Socioeconomics and Environmental Justice: The proposed construction and demolition activities could generate short-term employment and income to civilian contractors, as well as temporary beneficial impacts in the local economy, resulting from an increase in demand for goods and services. The Proposed Action would not change the local, regional, or statewide economics or social conditions or affect any specific population or demographic group. No impacts to socioeconomics and environmental justice would be expected.

Infrastructure: It is not anticipated that there would be any changes to personnel loading, operations, or training activities as a result of the Proposed Action. During construction and demolition activities, contractors are responsible for the removal of construction debris. The Proposed Action would not alter the stormwater infrastructure at MCAS Beaufort.

Cultural Resources: There are no known cultural resources within the project area. Ground disturbing activities during demolition and construction could unearth an unknown or unmapped cultural resource. In an event such as this, all work would cease and the MCAS Beaufort Cultural Resources Manager would be notified. MCAS Beaufort consulted with the South Carolina State Historic Preservation Office regarding the Proposed Action, which concurred that it was unlikely to affect cultural resources.

Geological Resources: Standard erosion and sedimentation control procedures, outlined in MCAS Beaufort's stormwater pollution prevention plan, would be implemented to minimize impacts to soils.

3.1 Biological Resources

Biological resources include living, native, or naturalized plant and animal species and the habitats within which they occur. This section will focus on marine species including threatened and endangered species and marine mammals that may utilize the project area and vicinity. Additionally, no terrestrial habitats would be affected by the Proposed Action.

3.1.1 Regulatory Setting

Special-status species, for the purposes of this assessment, are those species listed as threatened or endangered under the ESA as well as species afforded Federal protection under the MMPA and Bald and Golden Eagle Protection Act (BGEPA).

The purpose of the ESA is to conserve the ecosystems upon which threatened and endangered species depend and to conserve and recover listed species. Section 7 of the ESA requires action proponents to consult with the USFWS or National Oceanic and Atmospheric Administration (NOAA) NMFS to ensure that their actions are not likely to jeopardize the continued existence of federally listed threatened or endangered species, or result in the destruction or adverse modification of designated critical habitat. Critical habitat is an area protected by ESA that contains features essential to the conservation of an endangered or threatened species and that may require special management and protection. Critical habitat cannot be designated on any areas owned, controlled, or designated for use by the Department of Defense (DoD) where an Integrated Natural Resources Management Plan has been developed that, as determined by the Department of Interior or Department of Commerce Secretary, provides a benefit to the species subject to critical habitat designation.

All marine mammals are protected under the provisions of the MMPA. The MMPA prohibits any person or vessel from "taking" marine mammals in the U.S. or the high seas without authorization. The MMPA defines "take" to mean "to harass, hunt, capture, or kill or attempt to harass, hunt, capture, or kill any marine mammal." The MMPA defines "harassment" as: any act of pursuit, torment, or annoyance which: (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B harassment] (50 CFR, Part 216, Subpart A, Section 216.3-

Definitions). Level A is the more severe form of harassment because it may result in injury, whereas Level B only results in behavioral disturbance without the potential for injury. NMFS equates the onset of permanent threshold shift (PTS), which is a form of auditory injury, with Level A harassment under the MMPA and "harm" under the ESA. Temporary threshold shift (TTS) is noise-induced hearing loss that recovers over time, and is a form of Level B harassment.

Bald and golden eagles are protected by the BGEPA. This Act prohibits anyone, without a permit issued by the Secretary of the Interior, from taking bald eagles, including their parts, nests, or eggs. The Act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb."

The Magnuson-Stevens Fishery Conservation and Management Act provides for the conservation and management of the fisheries. Under the Act, EFH consists of the waters and substrate needed by fish to spawn, breed, feed, or grow to maturity.

Species protected by the MBTA are not assessed here in accordance with the Department of Interior Solicitor's Opinion M-37050, Incidental Take Prohibited Under the MBTA, issued December 22, 2017 which concludes that the MBTA's prohibition on take (defined as pursuing, hunting, taking, capturing, killing, or attempting to do the same) applies only to "direct and affirmative purposeful actions that reduce migratory birds, their eggs, or their nests" and not to the losses incidental to otherwise lawful activities.

3.1.2 Affected Environment

The pier at MCAS Beaufort is located on Brickyard Creek. McCalleys and Mulligan Creeks are located to the north, and Albergottie Creek and the Beaufort River are located to the south.

3.1.2.1 Threatened and Endangered Species

The species listed below in **Table 3.1-1** have the potential to occur within the water bodies in the vicinity of the project area (Brickyard Creek, Albergottie Creek, and Beaufort River). Potential presence of species is based on Marine Mammal Stock Assessment Reports in the Atlantic (Waring et al., 2016), South Carolina Environmental Index Maps-Atlas (NOAA 2015), U.S. Fish and Wildlife Service species information for West Indian Manatee (USFWS 2019), the South Carolina Department of Natural Resources (SCDNR 2020), and the Navy's Marine Species Density Database (Navy 2017).

Table 3.1-1. Threatened and Endangered Species with the Potential to Occur in Project Area		
Common Name	***Scientific Name***	***Regulatory Authority***
Marine Mammals		
West Indian manatee (T)	*Trichechus manatus*	MMPA, ESA
Common bottlenose dolphin	*Tursiops truncatus*	MMPA
Sea Turtles		
Leatherback (E)	*Dermochelys coriacea*	ESA
Loggerhead (Northwest Atlantic Ocean DPS) (T)	*Caretta caretta*	ESA
Green (North Atlantic DPS) (T)	*Chelonia mydas*	ESA
Kemp's ridley (E)	*Lepidochelys kempii*	ESA
Fishes		
Atlantic sturgeon (E)	*Acipenser oxyrinchus*	ESA
Shortnose sturgeon (E)	*Acipenser brevirostrum*	ESA
Birds		
Wood stork (T)	*Mycteria americana*	ESA
Eastern black rail (T)	*Laterallus jamaicensis jamaicensis*	ESA

Legend: T = Threatened, E = Endangered, MMPA = Marine Mammal Protection Act, ESA = Endangered Species Act; DPS = Distinct Population Segment.

None of the threatened and endangered species that have the potential to occur in the project area have been observed in Brickyard Creek. No designated critical habitat is located within the project area.

3.1.2.2 Marine Mammals

Jurisdiction over marine mammals is maintained by NMFS and the USFWS. NMFS maintains jurisdiction over whales, dolphins, porpoises, seals, and sea lions. The USFWS maintains jurisdiction for certain other marine mammal species, including manatees. Common bottlenose dolphin (*Tursiops truncates*), and West Indian Manatee have the potential to occur in waters near the proposed project activities.

An Acoustic Transmission Loss Modeling (ATLM) Workplan and Mitigation Strategy was prepared for the project and is included in **Appendix B.** The ATLM analyzes the potential impacts from project related in-water noise on marine mammals.

3.1.2.3 Essential Fish Habitat

Fish are vital components of the marine ecosystem. They have great ecological and economic importance. To protect this resource, NMFS works with the regional fishery management councils to identify the essential habitat for every life stage of each federally managed species using the best available scientific information. In accordance with the Magnuson-Stevens Fishery Conservation and Management Act of 1976, Federal agencies must consult with the NMFS for activities that may adversely affect EFH that is designated in a Federal Fisheries Management Plan. EFH is defined as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” EFH has been described for approximately 1,000 managed species, or species groups, to date. An EFH assessment was prepared for the proposed project and is included in **Appendix C**.

Table 3.1-2 presents the species or species units potentially present in the project area for which EFH and/or Habitat Areas of Particular Concern (HAPC), a subset of EFH that refers to specific locations required by a life stage, exist.

Table 3.1-2. Marine Resources with Designated Essential Fish Habitat Within the Proposed Action Area		
Common name	***Scientific name***	***Life Stage (Eggs, Larvae, Juvenile, and Adult)***
Penaeid Shrimp (Brown, Pink, and White)	*Farfantepenaeus aztecus, Farfantepenaeus aduorarum, Litopenaeus setiferus*	All
Snapper-Grouper	*Lutjanidae, Epinephelinae*	All
Spiny Lobster	*Panulirus argus*	All
Lemon Shark	*Negaprion brevirostris*	All
Bonnethead Shark	*Sphyrna tiburo*	All
Sandbar Shark	*Carcharhinus plumbeus*	All
Spinner Shark	*Carcharhinus brevipinna*	All
Tiger Shark	*Galeocerdo cuvier*	All

Various types of EFH are found within and adjacent to the Proposed Action area, such as wetlands (estuarine and marine emergent wetlands and tidal palustrine forested wetlands), tidal influenced reaches, submerged aquatic vegetation (estuarine and marine submerged aquatic vegetation), shell bottom (oyster reefs and shell banks), intertidal flats, aquatic beds, soft bottom, and the estuarine water column. These habitats support managed species, such as shrimp or snapper/grouper.

Based on the geographical location, the Proposed Action is located within designated HAPC for only one species, penaeid shrimp. Habitat areas that meet the criteria for HAPC for penaeid shrimp include all coastal inlets, all state-designated nursery habitats of importance to shrimp, and state-identified overwintering areas. In South Carolina, shrimp nursery habitat is marsh areas with shell hash and mud bottom; HAPC encompasses the entire estuarine system.

3.1.2.4 Wildlife

The nearshore habitats in the project area provide habitat for several species of rails, blackbirds, wading birds, raccoons, otter, alligators, osprey, and bald eagles. The creeks and rivers adjacent to MCAS Beaufort support a wide diversity of marine and estuarine fishes; including flounder, sheepshead, black drum, black sea bass, pinfish, croaker, spotted seatrout, red drum, whiting, rock bass, mullet, ladyfish, and immature stages of many other species. The adjacent waters also contain oysters, hard clams, shrimp, and blue crabs (MCAS Beaufort 2013).

3.1.3 Environmental Consequences

3.1.3.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to existing biological resources. Therefore, no significant impacts to biological resources would occur with implementation of the No Action Alternative.

3.1.3.2 Alternative 1 (Preferred Alternative)

Threatened and Endangered Species and Marine Mammals

Under the Preferred Alternative, the Marine Corps would replace all of the existing pier at MCAS Beaufort. An ATLM Workplan and Mitigation Strategy was prepared for the project in order to assess acoustic impacts to marine mammals and threatened and endangered species with the potential to occur in the project area. This section summarizes the results of the ATLM Workplan and Mitigation Strategy. See **Appendix B** for a more detailed discussion.

Replacing the pier would require demolition and construction activities. Demolition activities would involve removal of piles, pile caps, prestressed concrete deck beams, and concrete deck overlay. Pilings being demolished would be left in place and cut below the mud line where possible or removed by the direct pull method. Demolition and construction under Alternative 1 would take approximately 36 months.

Construction of the new pier would require installation of up to 250 14-inch square concrete piles using an impact pile driver and installation of up to four mooring dolphins each composed of three, 30-inch steel pipe piles using both vibratory and impact pile driving methods. Tidal fluctuations vary in the proposed pile installation areas from less than 1.0 meter to greater than 2.4 meters, depending on tidal conditions. To be conservative, the total number of piles were assumed to be installed during high tide.

For impact pile driving of 30-inch steel pipe, the Zones of Impact (ZOIs) to potential Level A (PTS onset) are 6.9 and 12.3 meters to injurious thresholds for bottlenose dolphins and manatees, respectively. For Level B (Behavioral harassment), the ZOI would extend out 2,512 meters from a driven pile. The ZOIs for sea turtles are 251 meters for behavioral, 1.8 meters for temporary threshold shift (TTS), and 0.2 meters for PTS.

For vibratory pile driving of 30-inch steel pipe, the ZOIs to potential Level A (PTS onset) are 2 and 2.2 meters to injurious thresholds for bottlenose dolphins and manatees, respectively. For Level B (Behavioral harassment), the ZOI would extend out 5,412 meters from a driven pile. Because vibratory pile driving has a relatively low source level, it is highly unlikely, based on best available science, for sea turtles to experience PTS or TTS, even if exposed to a full day of pile driving.

For impact pile driving of 14-inch square concrete piles, the ZOIs to potential Level A (PTS onset) are less than 1 meter to injurious thresholds for bottlenose dolphins and manatees. For Level B (Behavioral harassment), the ZOI would extend out 6 meters from a driven pile. The ZOIs for sea turtles are 1 meter for behavioral, 0 meters for TTS, and 0 meters for PTS.

In order to mitigate impacts from pile installation, the Marine Corps would utilize marine mammal observers, which would likely also observe any sea turtles entering the project area. If a marine mammal or sea turtle were observed entering the pile driving ZOIs, work would be stopped and would not commence until the animal moves out of the area. Contractors would also be required to utilize a soft start procedure for impact pile driving at the beginning of each day's in-water pile driving or any time pile driving has ceased for more than 30 minutes. This would allow for animals to leave the Proposed Action vicinity before sound pressure increases.

Potential impacts to protected bird species could occur if an individual is foraging in the immediate vicinity on the pier during demolition and construction activities. Bird species that use the nearshore waters of MCAS Beaufort are acclimated to the noise associated with a military airfield.

The Marine Corps conducted informal consultation with USFWS regarding the Preferred Alternative. It was determined that the project *may affect, but is not likely to adversely affect wood storks, black rails, and West Indian manatees.* The Preferred Alternative would have no affect on leatherback sea turtles, loggerhead sea turtles, green sea turtles, Kemp's ridley sea turtles, Atlantic sturgeon, or shortnose sturgeon.

Therefore, there would be no significant impact on threatened and endangered species or marine mammals, and no MMPA permits would be required.

Essential Fish Habitat

The potential for adverse impacts to fish with EFH designated in the Proposed Action area is likely to differ from species to species, depending upon life history, habitat use (demersal vs. pelagic), and distribution and abundance. It is anticipated that short-term impacts to older life-stages (e.g., juveniles and adults) of fish (both pelagic and demersal) will be limited to temporary displacement from the Action Area. Juvenile and adult stages would likely leave the construction areas and move to nearby unaffected habitat during construction given the minimal increase in turbidity, sedimentation, and underwater sound. Impacts to these life stages would consist of a temporary displacement and a temporary loss of a very small portion of food/foraging area. Potential impacts could impact species (fish and invertebrates) with demersal eggs/larvae as they would be subjected to sedimentation or potential crushing from the new piles, but it is likely this will be minimal given the small construction footprint. In contrast, species with pelagic larvae and eggs are not expected to be impacted because they will continue to be carried through the Proposed Action area with prevailing tides, currents, and wave action should spawning take place during the Proposed Action period and within or vicinity of the Proposed Action area.

In order to mitigate impacts from pile installation on EFH, the Marine Corps would implement general construction BMPs, including adherence to CWA permit requirements, spill containment, spill response, and construction equipment requirements. Piling removal BMPs would also be implemented during demolition activities. Contractors would be required to assess the condition of the piling and either remove it using a barge or upland equipment. The work plan would include procedures for extracting and handling pilings that break off and limit partial removal. Contractors would be required to slowly remove pilings. Pilings would not be shaken, or material removed during demolition. If clamshell bucket is used, extraction would be conducted during the best tidal conditions. Contractors would also be required to utilize a soft start procedure for impact pile driving at the beginning of each day’s in-water pile driving or any time pile driving has ceased for more than 30 minutes. This would allow for animals to leave the Proposed Action vicinity before sound pressure increases.

Overall, the Preferred Alternative would not substantially adversely affect EFH. The Preferred Alternative may cause minimal and temporary impacts, but would not have any lasting direct or indirect effect upon the status or sustainability of managed species or their habitat.

Wildlife

Potential impacts to bird species could occur if an individual is foraging in the immediate vicinity on the pier during demolition and construction activities. Bird species that use the nearshore waters of MCAS Beaufort are acclimated to the noise associated with a military airfield. Any impacts that could occur as a result of the Preferred Alternative would not jeopardize the population or foraging habitat of any of the known bird species that utilize the nearshore areas of MCAS Beaufort.

For fish, impacts would primarily be limited to temporary displacement from benthic or water column habitats. Pile driving activities could result in injury or mortality to fish species. The overall potential for adverse impacts to fish would be highly localized.

In order to mitigate impacts from pile installation, contractors would be required to utilize a soft start procedure for impact pile driving at the beginning of each day’s in-water pile driving or any time pile driving has ceased for more than 30 minutes. This would allow for animals to leave the Proposed Action vicinity before sound pressure increases.

Therefore, implementation of the Preferred Alternative would not result in significant impacts to biological resources.

3.1.3.3 Alternative 2

Under Alternative 2, the Marine Corps would replace portions of the existing pier at MCAS Beaufort. Demolition activities would involve removal of piles, pile caps, prestressed concrete deck beams, and concrete deck overlay. Pilings being demolished would be left in place and cut below the mud line where possible or removed by the direct pull method. Demolition and construction under Alternative 2 would take approximately 36 months.

Impacts to threatened and endangered species, marine mammals, EFH, and wildlife would be similar to those described under Alternative 1. The pile driving ZOIs would be identical for both alternatives, and a similar number of piles would be demolished and installed.

Mitigation measures to minimize impacts to marine species would be identical to Alternative 1.

Therefore, impacts would be similar to Alternative 1, and implementation of Alternative 2 would not result in significant impacts to biological resources.

3.2 Water Resources

This discussion of water resources includes surface water, wetlands, and floodplains. This section also discusses the physical characteristics of wetlands, etc.

Surface water resources generally consist of wetlands, lakes, rivers, and streams. Surface water is important for its contributions to the economic, ecological, recreational, and human health of a community or locale. A Total Maximum Daily Load is the maximum amount of a substance that can be assimilated by a water body without causing impairment. A water body can be deemed impaired if water quality analyses conclude that exceedances of water quality standards occur.

Wetlands are jointly defined by U.S. Environmental Protection Agency (USEPA) and U.S. Army Corps of Engineers (USACE) as “those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.” Wetlands generally include “swamps, marshes, bogs and similar areas.”

Floodplains are areas of low-level ground present along rivers, stream channels, large wetlands, or coastal waters. Floodplain ecosystem functions include natural moderation of floods, flood storage and conveyance, groundwater recharge, and nutrient cycling. Floodplains also help to maintain water quality and are often home to a diverse array of plants and animals. In their natural vegetated state, floodplains slow the rate at which the incoming overland flow reaches the main water body. Floodplain boundaries are most often defined in terms of frequency of inundation, that is, the 100-year and 500-year flood. Floodplain delineation maps are produced by the Federal Emergency Management Agency and provide a basis for comparing the locale of the Proposed Action to the floodplains.

3.2.1 Regulatory Setting

The CWA establishes federal limits, through the National Pollutant Discharge Elimination System (NPDES) program, on the amounts of specific pollutants that can be discharged into surface waters to restore and maintain the chemical, physical, and biological integrity of the water. The NPDES program regulates the discharge of point (i.e., end of pipe) and nonpoint sources (i.e., stormwater) of water pollution.

The South Carolina NPDES stormwater program requires construction site operators engaged in clearing, grading, and excavating activities that disturb one acre or more to obtain coverage under an NPDES Construction General Permit for stormwater discharges. Construction or demolition that necessitates an individual permit also requires preparation of a Notice of Intent to discharge stormwater and a Stormwater Pollution Prevention Plan that is implemented during construction. As part of the 2010 Final Rule for the CWA, titled Effluent Limitations Guidelines and Standards for the Construction and Development Point Source Category, activities covered by this permit must implement non-numeric erosion and sediment controls and pollution prevention measures.

Wetlands are currently regulated by the USACE under section 404 of the CWA as a subset of all "Waters of the United States." Waters of the United States are defined as (1) traditional navigable waters, (2) wetlands adjacent to navigable waters, (3) nonnavigable tributaries of traditional navigable waters that are relatively permanent where the tributaries typically flow perennially or have continuous flow at least seasonally (e.g., typically 3 months), and (4) wetlands that directly abut such tributaries under section 404 of the CWA, as amended, and are regulated by USEPA and USACE. The CWA requires that South Carolina establish a section 303(d) list to identify impaired waters and establish Total Maximum Daily Loads for the sources causing the impairment.

Section 404 of the CWA authorizes the Secretary of the Army, acting through the Chief of Engineers, to issue permits for the discharge of dredge or fill into wetlands and other Waters of the United States. Any discharge of dredge or fill into Waters of the United States requires a permit from the USACE.

Section 438 of the Energy Independence and Security Act establishes storm water design requirements for development and redevelopment projects. Under these requirements, federal facility projects larger than 5,000 square feet must "maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to the temperature, rate, volume, and duration of flow."

EO 11990, Protection of Wetlands, requires that federal agencies adopt a policy to avoid, to the extent possible, long- and short-term adverse impacts associated with destruction and modification of wetlands and to avoid the direct and indirect support of new construction in wetlands whenever there is a practicable alternative.

EO 11988, Floodplain Management, requires federal agencies to avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development unless it is the only practicable alternative. Flood potential of a site is usually determined by the 100-year floodplain, which is defined as the area that has a one percent chance of inundation by a flood event in a given year.

3.2.2 Affected Environment

The following discussions provide a description of the existing conditions for each of the categories under water resources at MCAS Beaufort.

3.2.2.1 Surface Water

Surface water includes all lakes, ponds, rivers, streams, and impoundments, within a defined area or watershed. MCAS Beaufort is located within the Broad-St. Helena Watershed. Brickyard, Albergottie, Salt, Mulligan, and McCalleys Creeks drain MCAS Beaufort into the Beaufort River, Port Royal Sound, Whale Branch, the Coosaw River, and St. Helena Sound (MCAS Beaufort 2013).

The project site is located on Brickyard Creek.

3.2.2.2 Wetlands

MCAS Beaufort contains freshwater and estuarine wetlands. The project site is located adjacent to emergent estuarine wetlands. The majority of the estuarine wetlands on the air station are located along Brickyard and Albergottie Creeks. The estuarine wetlands are composed predominately of smooth cordgrass. At higher elevations near the islands, the smooth cordgrass becomes progressively less vigorous and small sandy flats and saltmeadow areas exist. The predominant vegetation in these areas includes black needlerush, wiregrass, sea oxeye, and other species. Other species include various bulrushes and sedges (MCAS Beaufort 2013).

3.2.2.3 Floodplains

Extensive floodplain areas exist in the Beaufort area because of its slight elevation above sea level and the relatively flat topographic relief of the land surface. Areas predicted to be subject to a 100-year flood event (1 percent chance of flooding annually) on MCAS Beaufort include much of the eastern portion of the Installation (MCAS Beaufort 2013). The project area is located within the 100-year floodplain.

3.2.3 Environmental Consequences

In this EA the analysis of water resources looks at the potential impacts on surface water, wetlands, and floodplains. The analysis of surface water quality considers the potential for impacts that may change the water quality, including both improvements and degradation of current water quality. The impact assessment of wetlands considers the potential for impacts that may change the local hydrology, soils, or vegetation that support a wetland. The analysis of floodplains considers if any new construction is proposed within a floodplain or may impede the functions of floodplains in conveying floodwaters.

3.2.3.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline water resources. Therefore, no significant impacts to water resources would occur with implementation of the No Action Alternative.

3.2.3.2 Alternative 1 (Preferred Alternative)

Under the Preferred Alternative, the Marine Corps would replace all of the existing pier at MCAS Beaufort.

Construction and demolition related activities may temporarily lower surface water quality. Demolition or pile installation may briefly cause sediment resuspension and turbidity to increase within the project area, which could lower dissolved oxygen levels. Elevated turbidity plumes may last from a few minutes to several hours depending on various factors, such as sediment type and water hydrology. This impact would be temporary during demolition and construction activities and would be reduced from implementation of BMPs. All construction and demolition would be done in adherence to MCAS Beaufort's state-required Stormwater Pollution Prevention Plan as well as all state and Marine Corps required erosion and sedimentation control procedures.

Implementation of the Preferred Alternative would not have any permanent impacts on estuarine wetlands. Increased turbidity and associated sedimentation from Proposed Action construction and demolition has the potential to impact salt marsh habitat if sediment deposition smothers or covers the salt marsh for an extended time period. However, the expected turbidity and sedimentation is comparable to what might be circulated through a typical storm event. Appropriate BMPs to minimize turbidity within the project area would be used.

The Preferred Alternative would not alter the function of the 100-year floodplain.

Therefore, implementation of the Preferred Alternative would not result in significant impacts to water resources.

3.2.3.3 Alternative 2

Under Alternative 2, the Marine Corps would replace portions of the existing pier at MCAS Beaufort. Impacts to water resources under Alternative 2 would be identical, but on a smaller scale, to those described for the Preferred Alternative.

Therefore, implementation of Alternative 2 would not result in significant impacts to water resources.

3.3 Health and Safety

This discussion of health and safety includes consideration for any activities, occurrences, or operations that have the potential to affect the safety, well-being, or health of members of civilians and the personnel at MCAS Beaufort. A safe environment is one in which there is no, or optimally reduced, potential for death, serious bodily injury or illness, or property damage. The primary goal is to identify and prevent potential accidents or impacts. Health and safety within this EA discusses information pertaining to community emergency services, construction activities, operations, and environmental health and safety risks to children.

Health and safety during construction, demolition, and renovation activities is generally associated with construction traffic, as well as the safety of personnel within or adjacent to the construction zones.

Operational safety may refer to the actual use of the facility or built-out proposed project, or training or testing activities and potential risks to inhabitants or users of adjacent or nearby land and water parcels. Safety measures are often implemented through designated safety zones, warning areas, or other types of designations.

Environmental health and safety risks to children are defined as those that are attributable to products or substances a child is likely to come into contact with or ingest, such as air, food, water, soil, and products that children use or to which they are exposed.

3.3.1 Regulatory Setting

The Occupational Safety and Health Administration (OSHA) is responsible for ensuring safe and healthful working conditions for workers by setting and enforcing standards and by providing training, outreach, education, and assistance. OHSA was created through the Occupational Safety and Health Act of 1970. Safety on Marine Corps installations is upheld through numerous MCOs and base (or air station) orders.

3.3.2 Affected Environment

The pier currently in use, and built in 1957 with an upgrade in 1999, was recently evaluated and received an undesirable engineering assessment. Advanced deterioration and overstressing observed on widespread portions of the structure has resulted in a downgraded capacity. This means the pier cannot support utilities for proper operation.

The intent of the Proposed Action is to provide a modern, safe, and maintainable pier.

3.3.3 Environmental Consequences

The safety and environmental health analysis addresses issues related to the health and well-being of military personnel and civilians living on or in the vicinity of MCAS Beaufort. Specifically, this section provides information on hazards associated with demolition and construction associated with the Proposed Action and the long-term impact of replacing the pier. Additionally, this section addresses the environmental health and safety risks to children.

3.3.3.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur. The current pier has a downgraded capacity. Increased sustainment costs and eventual failure of the pier have been determined to be unacceptable. Implementation of the No Action Alternative would result in long-term negative impacts to health and safety at MCAS Beaufort.

3.3.3.2 Alternative 1 (Preferred Alternative)

During construction and demolition, contractors would be required to wear proper personal protective equipment such as hard hats, gloves, steel toed boots, eye protection, and long pants/long sleeve shirts as necessary, and safe equipment operation procedures would be followed. Construction and demolition activities occurring at MCAS Beaufort are required to be conducted in a manner that is consistent with all federal regulations, including all applicable OSHA and Marine Corps requirements.

Once operational, the new pier would have an expected life cycle of 50-75 years, if properly maintained, providing long-term benefits to health and safety.

There are no environmental health or safety risks associated with the Proposed Action that would disproportionately affect children.

Therefore, implementation of the Preferred Alternative would not result in significant impacts to health and safety.

3.3.3.3 Alternative 2

Under Alternative 2, the Marine Corps would replace portions of the existing pier at MCAS Beaufort. Impacts to health and safety under Alternative 2 would be similar to those described for the Preferred

Alternative; however, the repaired pier would have an expected life cycle of 30-50 years with a more frequent maintenance effort than that needed for the new pier.

Therefore, implementation of Alternative 2 would not result in significant impacts to health and safety.

3.4 Summary of Potential Impacts to Resources and Impact Avoidance and Minimization

A summary of the potential impacts associated with each of the action alternatives and the No Action Alternative is presented in **Table 3.4-1**. There are no anticipated significant impacts.

Table 3.4-1. Summary of Potential Impacts to Resource Areas

Resource Area	***No Action Alternative***	***Alternative 1 (Preferred Alternative)***	***Alternative 2***
Biological Resources	The No Action Alternative would have no significant impacts to biological resources.	• Temporary impacts to nearby wildlife from demolition and construction noise. • Temporary impacts to Essential Fish Habitat (EFH), but would not have any lasting direct or indirect effect upon the status or sustainability of managed species or their habitat. • Project *may affect, but not likely to adversely affect* wood storks, black rails, and West Indian manatees. • With proposed mitigations, there would be no significant impact on threatened and endangered species or marine mammals.	• Temporary impacts to nearby wildlife from demolition and construction noise. • Temporary impacts to EFH, but would not have any lasting direct or indirect effect upon the status or sustainability of managed species or their habitat. • Project *may affect, but not likely to adversely affect* wood storks, black rails, and West Indian manatees. • With proposed mitigations, there would be no significant impact on threatened and endangered species or marine mammals.
Water Resources	The No Action Alternative would have no significant impacts to water resources.	• Minor, temporary impacts to surface water and wetlands due to increased turbidity during construction and demolition activities.	• Minor, temporary impacts to surface water and wetlands due to increased turbidity during construction and demolition activities.
Health and Safety	The No Action Alternative would have a negative long-term impact to health and safety.	• During construction at the Proposed Action site, Occupational Safety and Health Administration (OSHA) regulations, procedures, and AT/FP requirements would be followed. • The new pier would provide long-term benefits to health and safety at MCAS Beaufort by replacing the aging current pier with a modern and safe pier. The new pier would have an expected life cycle of 50-75 years if properly maintained. • There are no environmental health or safety risks associated with the Proposed Action that would disproportionately affect children.	• During construction at the Proposed Action site, OSHA regulations, procedures, and AT/FP requirements would be followed. • The replaced pier would provide long-term benefits to health and safety at MCAS Beaufort by replacing the aging current pier with a modern and safe pier. However, the replaced pier would have an expected life cycle of 30-50 years with a more frequent maintenance effort than that needed for the new pier. • There are no environmental health or safety risks associated with the Proposed Action that would disproportionately affect children.

4 Cumulative Impacts

This section (1) defines cumulative impacts, (2) describes past, present, and reasonably foreseeable future actions relevant to cumulative impacts, (3) analyzes the incremental interaction the Proposed Action may have with other actions, and (4) evaluates cumulative impacts potentially resulting from these interactions.

4.1 Definition of Cumulative Impacts

The approach taken in the analysis of cumulative impacts follows the objectives of the NEPA, CEQ regulations, and CEQ guidance. Cumulative impacts are defined in 40 CFR section 1508.7 as "the impact on the environment that results from the incremental impact of the action when added to the other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."

To determine the scope of environmental impact analyses, agencies shall consider cumulative actions, which when viewed with other proposed actions have cumulatively significant impacts and should therefore be discussed in the same impact analysis document.

In addition, CEQ and USEPA have published guidance addressing implementation of cumulative impact analyses—Guidance on the Consideration of Past Actions in Cumulative Effects Analysis (CEQ 2005) and Consideration of Cumulative Impacts in USEPA Review of NEPA Documents (USEPA 1999). CEQ guidance entitled Considering Cumulative Impacts Under NEPA (1997) states that cumulative impact analyses should "…determine the magnitude and significance of the environmental consequences of the Proposed Action in the context of the cumulative impacts of other past, present, and future actions...identify significant cumulative impacts…[and]…focus on truly meaningful impacts."

Cumulative impacts are most likely to arise when a relationship or synergism exists between a proposed action and other actions expected to occur in a similar location or during a similar time period. Actions overlapping with or in close proximity to the Proposed Action would be expected to have more potential for a relationship than those more geographically separated. Similarly, relatively concurrent actions would tend to offer a higher potential for cumulative impacts. To identify cumulative impacts, the analysis needs to address the following three fundamental questions.

- Does a relationship exist such that affected resource areas of the Proposed Action might interact with the affected resource areas of past, present, or reasonably foreseeable actions?
- If one or more of the affected resource areas of the Proposed Action and another action could be expected to interact, would the Proposed Action affect or be affected by impacts of the other action?
- If such a relationship exists, then does an assessment reveal any potentially significant impacts not identified when the Proposed Action is considered alone?

4.2 Scope of Cumulative Impacts Analysis

The scope of the cumulative impacts analysis involves both the geographic extent of the effects and the time frame in which the effects could be expected to occur. For this EA, the study area delimits the geographic extent of the cumulative impacts analysis. In general, the study area will include those areas previously identified in Chapter 3 for the respective resource areas. The time frame for cumulative impacts centers on the timing of the Proposed Action.

Another factor influencing the scope of cumulative impacts analysis involves identifying other actions to consider. Beyond determining that the geographic scope and time frame for the actions interrelate to the Proposed Action, the analysis employs the measure of “reasonably foreseeable” to include or exclude other actions. For the purposes of this analysis, public documents prepared by federal, state, and local government agencies form the primary sources of information regarding reasonably foreseeable actions. Documents used to identify other actions include notices of intent for Environmental Impact Statements (EIS) and EAs, management plans, land use plans, and other planning related studies.

Where feasible, the cumulative impacts were assessed using quantifiable data; however, for many of the resources included for analysis, quantifiable data is not available and a qualitative analysis was undertaken. In addition, where an analysis of potential environmental effects for future actions has not been completed, assumptions were made regarding cumulative impacts related to this EA where possible. The analytical methodology presented in Chapter 3, which was used to determine potential impacts to the various resources analyzed in this document, was also used to determine cumulative impacts.

4.2.1 Past Actions

There are no past actions that interact temporally or geographically with the study area for the Proposed Action.

4.2.2 Present and Reasonably Foreseeable Actions

There are no present or reasonably foreseeable actions that might interact with the study area for the Proposed Action.

4.3 Cumulative Impact Analysis

None of the past, present, or future actions would overlap temporally or geographically with the Preferred Alternative or Alternative 2. Therefore, implementation of the Preferred Alternative or Alternative 2 combined with the past, present, and reasonably foreseeable future projects, would not result in significant impacts within the project area.

5 Other Considerations Required by NEPA

5.1 Consistency with Other Federal, State, and Local Laws, Plans, Policies, and Regulations

In accordance with 40 CFR 1502.16(c), analysis of environmental consequences shall include discussion of possible conflicts between the Proposed Action and the objectives of federal, regional, state and local land use plans, policies, and controls. **Table 5.1-1** identifies the principal federal and state laws and regulations that are applicable to the Proposed Action and describes briefly how compliance with these laws and regulations would be accomplished.

Table 5.1-1. Principal Federal and State Laws Applicable to the Proposed Action

Federal, State, Local, and Regional Land Use Plans, Policies, and Controls	***Status of Compliance***
NEPA; CEQ NEPA implementing regulations; Navy procedures for Implementing NEPA; MCO 5090.2, Volume 12, Environmental Planning and Review	Completion of EA will document compliance
Clean Air Act	Completion of EA will document compliance
Clean Water Act	Completion of EA will document compliance
Coastal Zone Management Act	Concurrence with Coastal Consistency Determination will document compliance.
National Historic Preservation Act	Completion of EA will document compliance
Endangered Species Act	Completion of EA will document compliance
Migratory Bird Treaty Act	Completion of EA will document compliance
Bald and Golden Eagle Protection	Completion of EA will document compliance
Comprehensive Environmental Response and Liability Act	Completion of EA will document compliance
Emergency Planning and Community Right-to-Know Act	Completion of EA will document compliance
Federal Insecticide, Fungicide, and Rodenticide Act	Completion of EA will document compliance
Resource Conservation and Recovery Act	Completion of EA will document compliance
Toxic Substances Control Act	Completion of EA will document compliance
Invasive Species Act	Completion of EA will document compliance
Noxious Weed Act	Completion of EA will document compliance
EO 11988, Floodplain Management	Completion of EA will document compliance
EO 12088, Federal Compliance with Pollution Control Standards	The Proposed Action would comply with this order.
EO 13045, Protection of Children from Environmental Health Risks and Safety Risks	Completion of EA will document compliance
EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations	Completion of EA will document compliance
EO 13834, Efficient Federal Operations	Completion of EA will document compliance

5.2 Irreversible or Irretrievable Commitments of Resources

Resources that are irreversibly or irretrievably committed to a project are those that are used on a long-term or permanent basis. This includes the use of non-renewable resources such as metal and fuel, and natural or cultural resources. These resources are irretrievable in that they would be used for this project when they could have been used for other purposes. Another impact that falls under this category is the unavoidable destruction of natural resources that could limit the range of potential uses of that particular environment.

Implementation of the Proposed Action would involve the consumption of fuel, oil, and lubricants for construction vehicles and loss of natural resources; however, it would not result in a significant irreversible or irretrievable commitment of resources.

5.3 Unavoidable Adverse Impacts

This EA has determined that the alternatives considered would not result in any significant impacts. Implementing the alternatives would result in minor, temporary impacts to wildlife, which are unavoidable.

5.4 Relationship between Short-Term Use of the Environment and Long-Term Productivity

NEPA requires an analysis of the relationship between a project's short-term impacts on the environment and the effects that these impacts may have on the maintenance and enhancement of the long-term productivity of the affected environment. Impacts that narrow the range of beneficial uses of the environment are of particular concern. This refers to the possibility that choosing one development site reduces future flexibility in pursuing other options, or that using a parcel of land or other resources often eliminates the possibility of other uses at that site.

In the short-term, effects to the human environment with implementation of the Proposed Action would primarily relate to the construction activity itself. Air quality and noise would be impacted in the short-term. There are no anticipated long-term impacts. The construction of the facility and operation would not significantly impact the long-term natural resource productivity of the area. The Proposed Action would not result in any impacts that would significantly reduce environmental productivity or permanently narrow the range of beneficial uses of the environment.

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Appendix A
Coastal Consistency Determination

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1.0 INTRODUCTION

This document provides the State of South Carolina with the United States Marine Corps (USMC) Consistency Determination under section 307(c)(1) of the Coastal Zone Management Act (CZMA) of 1972, as amended, and 15 Code of Federal Regulations [CFR] part 930, subpart C, for the proposed replacement of the existing pier at Marine Corps Air Station (MCAS) Beaufort.

The USMC analyzed the potential environmental impacts of the proposed construction of a replacement pier and the demolition of the existing pier.

2.0 REGULATORY BACKGROUND INFORMATION

The CZMA of 1972, codified in 16 U.S. Code section 1451 et seq. established a comprehensive regulatory scheme for effective management, beneficial use, protection, and development of the coastal zone and its natural resources. The CZMA encourages coastal states and provides a mechanism for them to develop, obtain federal approval for, and implement a broad-based coastal management program (CMP).

The CZMA section 307 provides that federal agency activities shall be carried out in a manner which is consistent to the maximum extent practicable with the enforceable policies of approved state management programs. Section 307 applies to federal agency activity in a state's coastal zone and also to federal agency activity outside the coastal zone, if the activity affects a land or water use in or natural resources of the coastal zone. Federal agency activity includes activity performed by a federal agency, approved by a federal agency, or for which a federal agency provides financial assistance. Such activity, whether direct, indirect, or cumulative, must be demonstrated to be consistent with the enforceable policies of the state's CMP, unless full consistency is otherwise prohibited by federal law (per 15 CFR part 930.32, "consistent to the maximum extent practicable"). The USMC's Proposed Action constitutes a direct federal action.

3.0 PROJECT LOCATION

The Proposed Action would take place onboard MCAS Beaufort, specifically at the site of the existing pier along Brickyard Creek (**Figure 1**).

4.0 DESCRIPTION OF THE PROPOSED FEDERAL AGENCY ACTION

The USMC's Proposed Action is to replace the existing pier to include new pilings, decking, storage shed, piping, and mooring dolphins. This new pier would be constructed prior to the demolition of the existing pier. Use of the existing pier would be maintained during the entire term of the project with the exception of a brief period of weeks where utility switch overs would occur. Access to the existing Boat Dock would be maintained throughout construction. **Figure 2** shows the proposed layout of the new pier and areas of old pier scheduled for demolition. Construction would occur within the 100-year floodplain.

Support activities would include new utility connections (lighting, power, piping, and potable water lines), minor site civil work (riprap and fill), and site demolition. Site demolition would include removing the existing decking, beams, vertical pilings when necessary, utility lines, piping, and mooring dolphins. Existing equipment would be reused if available and in good condition.

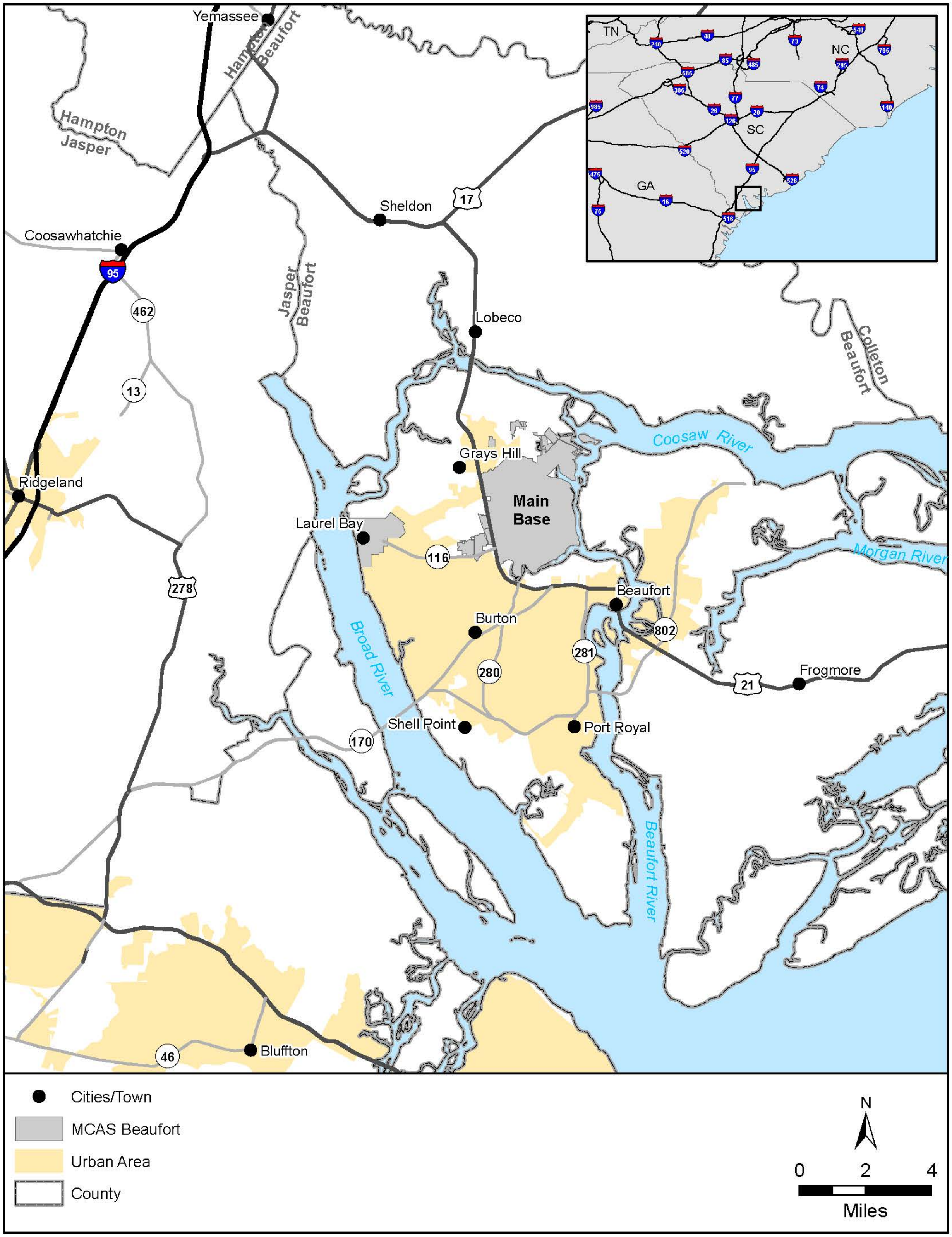

Figure 1. Project Location

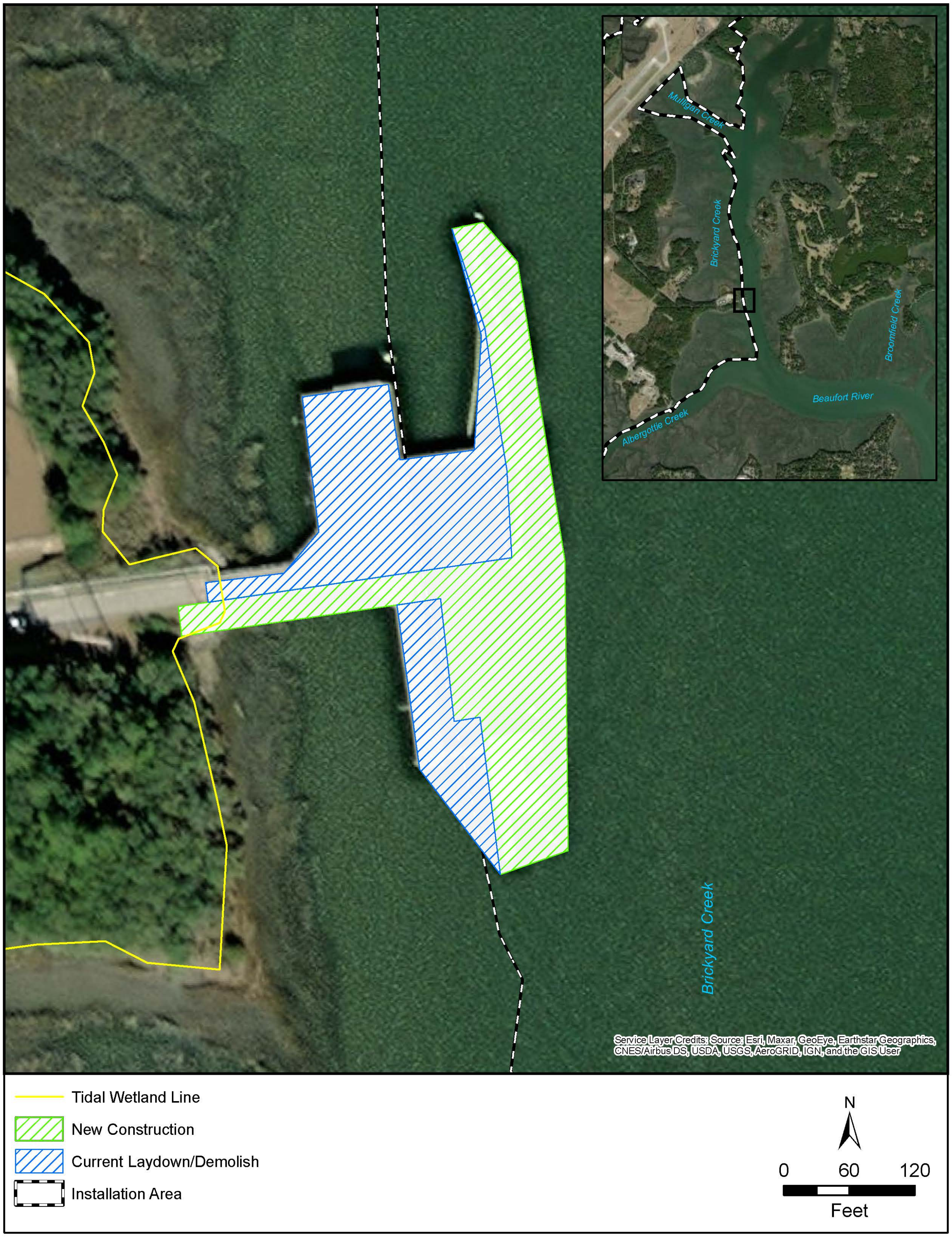

Figure 2. Proposed Action Design Layout

This project would provide Antiterrorism/ Force Protection (AT/FP) features and comply with AT/FP regulations and physical security mitigation in accordance with Unified Facilities Criteria 4-020-01 Department of Defense Security Engineering Facilities Planning Manual.

5.0 DETERMINATION OF POTENTIAL EFFECTS

In accordance with 15 CFR part 930; subpart C, the USMC reviewed its Proposed Action and has determined that certain activities that will be conducted as part of the Proposed Action may have an effect on a coastal use or resource of the State of South Carolina.

6.0 ASSESSMENT OF APPLICABILITY OF POLICIES OF THE SOUTH CAROLINA COASTAL ZONE MANAGEMENT PROGRAM

The South Carolina Coastal Zone Management Program is based on a network of agencies implementing a number of policies that protect and enhance the territory’s natural and economic coastal resources. The USMC reviewed each of South Carolina’s enforceable policies and determined that four polices are applicable to the Proposed Action. **Table 1** presents the policies and a brief description of potential impacts from the Proposed Action.

Table 1. Enforceable Polices of South Carolina's Coastal Zone Management Act and Potential Impacts	
SC CMP Enforceable Policy	**Potential Impacts from Proposed Action**
Part 1. Residential Development	The Proposed Action does not include residential development and would not affect any residential development programs.
Part 2. Transportation Facilities	The Proposed Action does not include development of ports, highways, airports, railways, or parking facilities and would not affect any transportation facilities or programs.
Part 3. Coastal Industries	The Proposed Action does not include development of agriculture, forestry (silviculture), mineral extraction, manufacturing, fish and seafood processing, or aquaculture and would not affect any such coastal industry.
Part 4. Commercial Development	The Proposed Action does not include any commercial development and would not affect any coastal development programs.
Part 5. Recreation and Tourism	The Proposed Action does not involve any development of public recreational lands. No new recreational lands would be developed, and no impacts to recreation or tourism would occur.
Part 6. Marine Related Facilities	The Proposed Action is to replace an existing pier. Any necessary permitting from the South Carolina Department of Health and Environmental Control Office of Ocean and Coastal Resource Management and the U.S. Army Corps of Engineers would be obtained prior to construction. Mitigations to lessen any impacts from pier construction as required by permitting would be adhered to. The Proposed Action involves no construction of marinas, boat ramps, or dock master plans, and would not affect any of those programs.
Part 7. Wildlife and Fisheries Management	The Proposed Action does not involve the creation of artificial reefs or impoundments and none would be altered or affected by the Proposed Action. Only minor, temporary impacts to coastal wildlife would occur during the construction and demolition activities associated with the Proposed Action. Fisheries management would not be negatively impacted.
Part 8. Dredging	The Proposed Action does not involve dredging, dredge material disposal, or underwater salvage.
Part 9. Public Services and Facilities	The Proposed Action does not involve an increase in population and would not require the construction of public services or facilities.
Part 10. Erosion Control	The Proposed Action would result in minor, temporary soil disturbance and increase the potential for erosion during construction. Best Management Practices (BMPs) including various State approved erosion and sediment control measures would be vigorously incorporated into all project plans to minimize potential impacts from erosion.
Part 11. Energy and Energy Related Facilities	The Proposed Action is the replacement of an existing facility. No increase in demand for energy or need for construction of energy related facilities would occur.
Part 12. Activities in Areas of Special Resource Significance	The Proposed Action includes the replacement of an existing pier that would span over a portion of estuarine tidelands, and any necessary permitting would be obtained prior to construction. If required, mitigation would occur per permit specifications. Additionally, the proposed pier footprint is smaller than the existing pier footprint. The Proposed Action would have no impact to barrier islands, dune areas, navigation channels, or public open spaces.
Part 13. Stormwater Management Guidelines	The Proposed Action would be constructed within the 100-year floodzone. Construction and operation of the replacement pier would incorporate necessary BMPs to reduce impacts to stormwater runoff volume and velocity.
Part 14. Mitigation Guidelines	The Proposed Action would incorporate numerous BMPs in order to fully protect coastal zone resources.

7.0 CONCLUSION

The USMC reviewed South Carolina's Coastal Zone Management Program and determined that while four of the polices could result in minor impacts from the Proposed Action, these impacts would not represent inconsistencies with the enforceable polices listed in Table 1. As described in Table 1, the Proposed Action would be consistent with the enforceable policies of the South Carolina CZMA.

The USMC will be consistent with the policies of the South Carolina Coastal Zone Management Program.

Appendix B
Acoustic Transmission Loss Modeling Workplan and Mitigation Strategy

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WORK PLAN
UNDERWATER ACOUSTIC TRANSMISSION LOSS MODELING
FOR THE
PIER REPLACEMENT
AT
MARINE CORPS AIR STATION
BEAUFORT, SOUTH CAROLINA

NAVAL FACILITIES ENGINEERING COMMAND

MID-ATLANTIC

NORFOLK, VIRGINIA

REVISED FINAL

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Acronyms and Abbreviations

ANSI	American National Standards Institute
dB	decibel(s)
dB re 1 µPa	dB referenced to a pressure of 1 microPascal (measures underwater sound pressure levels)
dB re 1 μPa^2-sec	dB referenced to a pressure of 1 microPascal squared per second (measures underwater sound level exposure)
dB_{pk}	peak pressure
dB SEL_{cum}	cumulative sound exposure level
DPS	Distinct Population Segment
ESA	Endangered Species Act
GIS	Geographical Information Systems
dB peak	instantaneous peak sound pressure level in decibels (can apply to either airborne or underwater sound)
kHz	kilohertz
MCAS	Marine Corps Air Station
MMPA	Marine Mammal Protection Act
Navy	Department of the Navy
NMFS	National Marine Fisheries Service
PTS	Permanent Threshold Shifts
rms	root mean square
SEL	Sound Exposure Level
SPL	Sound Pressure Level
TTS	Temporary Threshold Shift
USMC	United States Marine Corps
µPa	microPascal(s)
WFA	Weighting Factor Adjustment
ZOI	Zone Of Influence

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1.0 OVERVIEW

The United States Marine Corps (USMC) proposes to replace the operations pier at Marine Corps Air Station (MCAS) Beaufort in Beaufort County, South Carolina (**Figure 1**). The project would be conducted in four phases:

- **Phase 1** – The waterway side of the new pier would be constructed first. This would allow maintained access to the Response Boat Dock while the southern end of the existing pier is being demolished.
- **Phase 2** – The southern end of the existing pier would be demolished and construction of the remaining portions of the new pier would be completed.
- **Phase 3** – Final connections between the utility systems on the new pier and the shore would be made. A brief outage (i.e., period of weeks) would be permitted to make these final connections.
- **Phase 4 –** The remaining portions of the existing pier structure would be demolished along with removal of utility systems associated with the existing pier structure.

Figures 2 and 3 identify the pier structure footprints to be demolished, constructed, and what will remain. The acoustic model will analyze pile driving associated with the construction of the new pier (in Phases 1 and 2). The existing structure will be demolished using demolition jaws to cut/crush concrete with pile removal done by direct pull methods. Therefore, noise from demolition activities (pile extraction) is not included in this analysis.

The replacement is needed because the pier currently in use, and built in 1957 with an upgrade in 1999, was recently evaluated and received an undesirable engineering assessment. Advanced deterioration and overstressing observed on widespread portions of the structure has resulted in a downgraded capacity. This means the pier cannot support utilities for proper operation. Increased sustainment costs and eventual failure of the pier have been determined to be unacceptable.

The goal of this task is to develop a rigorous, defensible model of underwater transmission loss from project activities for the purpose of mapping zones of influence (ZOIs) within which “takes” of marine mammals, as defined under the Marine Mammal Protection Act (MMPA), can be anticipated. The Acoustic Transmission Loss Modeling effort will also support the analysis of project effects on Endangered Species Act (ESA)-listed fish and sea turtle species and Essential Fish Habitat.

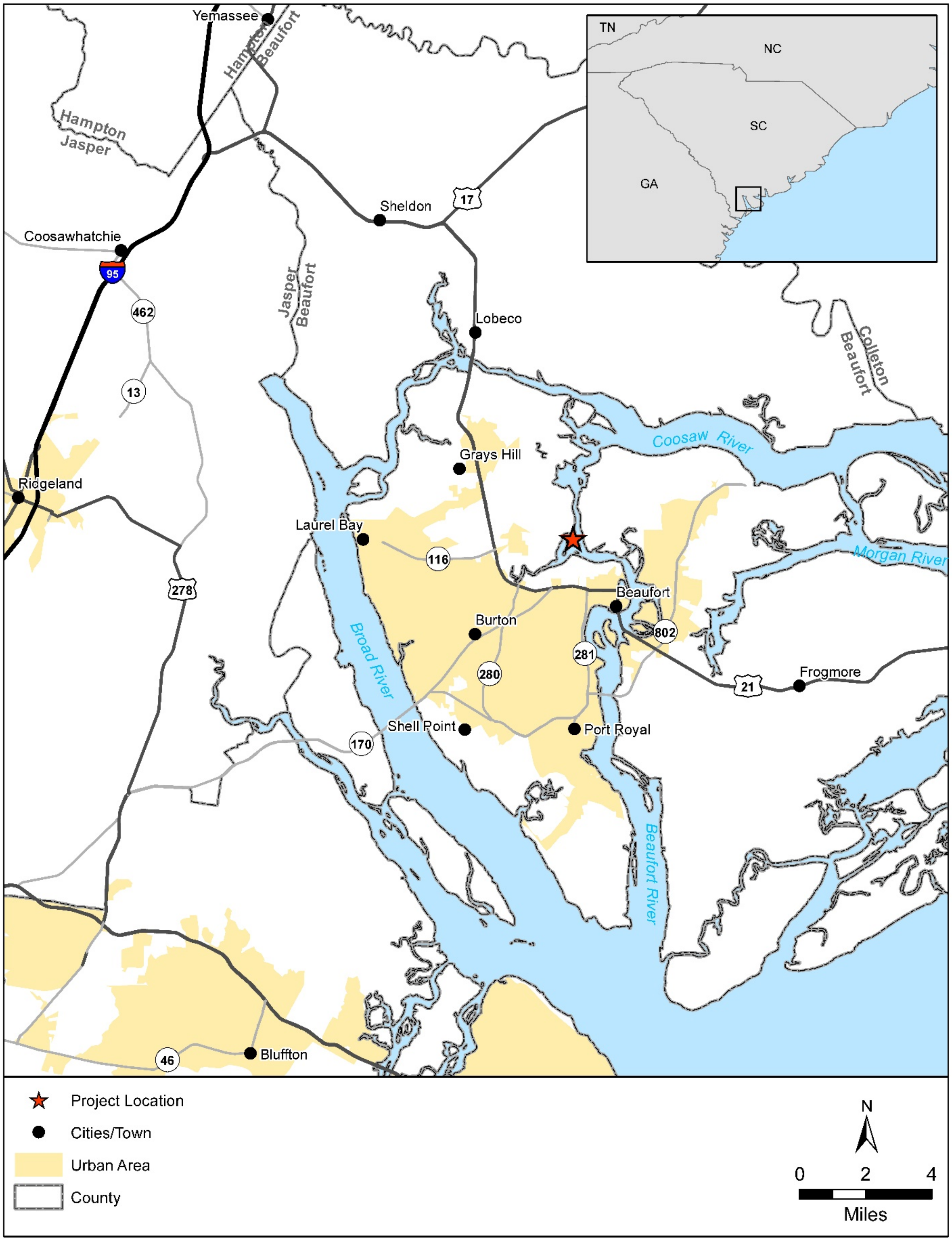

Figure 1. Project Location Map

Figure 2. Project Area Map

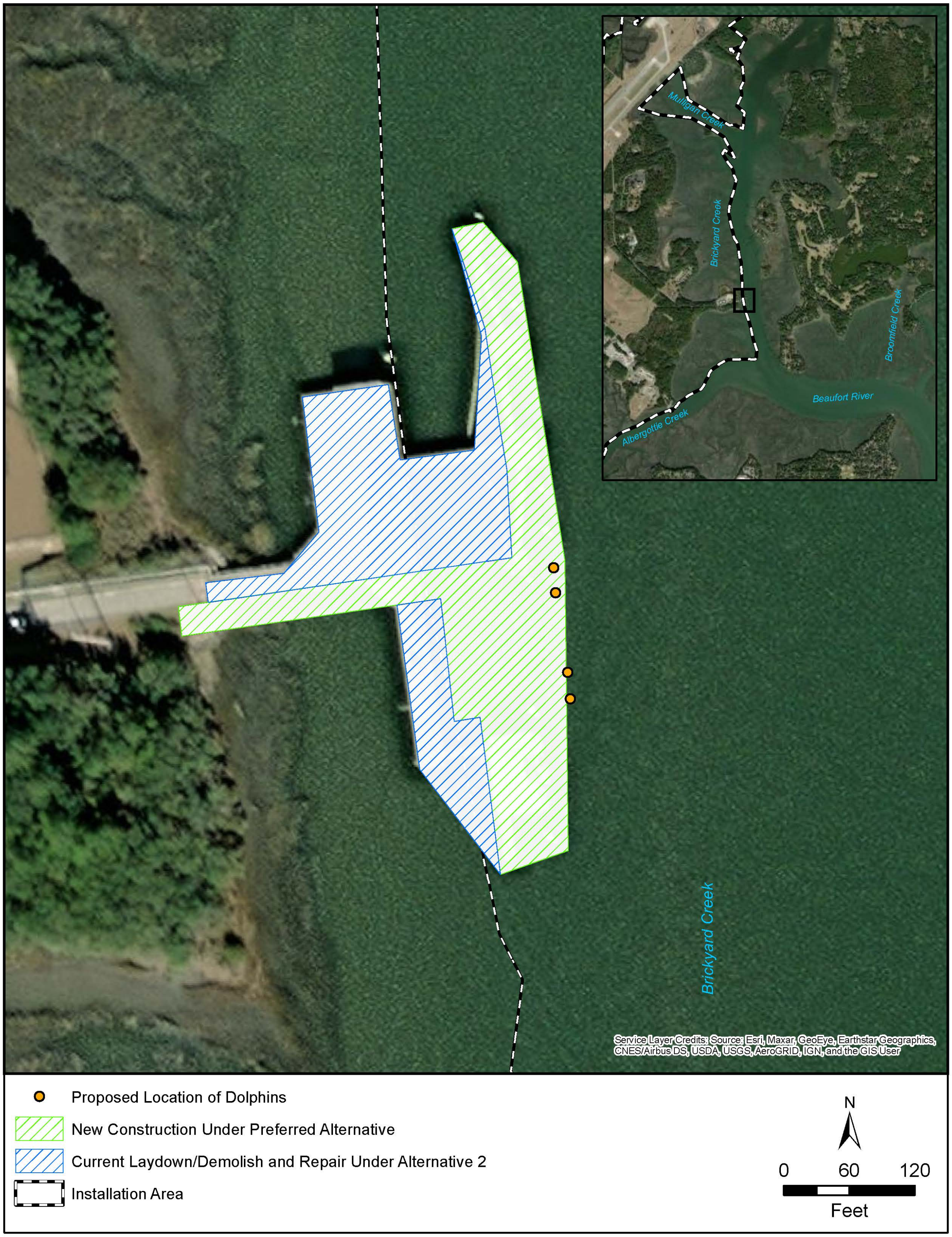

Figure 3. Proposed Construction and Demolition

The key components of this analysis include (1) the definition of acoustic source levels; (2) mathematical models and assumptions for acoustic transmission loss from the source; (3) the application of thresholds for different levels of effect on marine mammals and other species to determine the distances within which those thresholds are exceeded; (4) mapping the resulting model of acoustic transmission loss onto the project area using geographical information systems (GIS) to quantify the areas of ZOIs; and (5) use of appropriate density data to calculate the number of takes that may occur within the ZOIs.

This submittal presents Cardno's proposed Work Plan as well as preliminary results (See Appendix A). The proposed approach is consistent with that used in recent Navy applications for Incidental Harassment Authorizations and Letter of Authorizations for similar construction activities at Navy installations on the Atlantic and Pacific coasts. A glossary of acoustical terms is provided in Section 7 at the end of the plan.

2.0 Species to be Assessed

Species proposed to be assessed for impacts from acoustic sources are listed in **Table 1**. The list includes all ESA-listed or otherwise protected marine mammal, sea turtle, and fish species determined to have a reasonable possibility of presence within the project's acoustic ZOI where exposure to underwater sound could result in a "take" by harassment under the MMPA or ESA. The list includes all species that have the potential to occur within the water bodies of or vicinity of the project area (Brickyard Creek, Albergottie Creek, and Beaufort River). Potential presence of species is based on Marine Mammal Stock Assessment Reports in the Atlantic (Waring et al., 2016), South Carolina Environmental Index Maps-Atlas (NOAA 2015), U.S. Fish and Wildlife Service species information for West Indian Manatee (USFWS 2019), and South Carolina Department of Natural Resources (SCDNR 2020). The Navy's Marine Species Density Database (Navy 2017) was also reviewed. Further analysis will determine which of these species can be screened out based on extremely low density and discountable likelihood of take.

Table 1. Species to be Assessed for Impacts from Acoustic Sources

Common Name	Scientific Name	Regulatory Authority
Marine Mammals		
West Indian manatee (T)	*Trichechus manatus*	MMPA, ESA
Common bottlenose dolphin	*Tursiops truncatus*	MMPA
Sea Turtles		
Leatherback (E)	*Dermochelys coriacea*	ESA
Loggerhead (Northwest Atlantic Ocean DPS) (T)	*Caretta caretta*	ESA
Green (North Atlantic DPS) (T)	*Chelonia mydas*	ESA
Kemp's ridley (E)	*Lepidochelys kempii*	ESA
Fishes		
Atlantic sturgeon (E)	*Acipenser oxyrinchus*	ESA
Shortnose sturgeon (E)	*Acipenser brevirostrum*	ESA

Legend: T = Threatened, E = Endangered, MMPA = Marine Mammal Protection Act, ESA = Endangered Species Act; DPS = Distinct Population Segment.

3.0 Acoustic Source Levels

Replacing the pier will require demolition and construction activities. Demolition activities would involve removal of piles, pile caps, prestressed concrete deck beams, and concrete deck overlay. As previously stated, the demolition work is anticipated to be conducted using direct pull methods. Thus, underwater noise analysis from demolition activities is not necessary. Construction of the new pier would require installation of up to 250 14-inch square concrete piles using an impact pile driver and installation of up to 4 dolphins each composed of 3 30-inch steel pipe piles using both vibratory and impact pile driving methods (**Table 2**). Installation of a subset of the concrete piles will be installed during low tide (exposed mud). Tidal fluctuations vary in the proposed pile installation areas from less than 1 meter to greater than 2.4 meters, depending on tidal conditions. To be conservative, the total number of piles were assumed to be installed during high tide. In order to estimate sound source levels for pile driving activities proposed for this project, available documentation for projects that are most similar to the Proposed Action in terms of the type and size of pile, method of installation, and substrate conditions, were reviewed to identify the most relevant proxy sound source levels (**Table 3).**

Table 2. Construction of New Pier Pile Installation Activity

Facility	Method of Pile Driving	Pile Size and Type	Number of Sheets (pairs)/Piles	Pile Strikes per Pile	Minutes to drive a single pile	Maximum number of piles installed each day	Minimum number of days of pile driving required
Construction of New Pier	Impact	14-inch Square Concrete	250*	45	NA	25	10
	Impact	30-inch steel pipe	12	45	NA	3	4
	Vibratory	30-inch steel pipe	12	NA	30	3	4

Source: MCAS Beaufort, 2020. * Note this is the total proposed number of piles installed which includes those piles installed in the dry (exposed mud). This total number was used to be conservative. NA – Not applicable

Table 3. Underwater Sound Pressure Levels from Similar Construction Activities and Recommended Proxy Source Levels

Project and Location	Pile Size, Type	Installation Method		Sound Pressure Levels (SPL) or Sound Exposure Level (SEL) at 10 meters distance		
			Water Depth (meters)	Average Peak SPL, dB re 1 µPa	Average Root Mean Square SPL, dB re 1 µPa	Average SEL, dB re 1 µPa^2-sec
Noyo Harbor, Fort Bragg, CA[1]	14-inch square concrete	Impact	2-3	183	157	146
Naval Base Point Loma, CA[2]	30-inch steel pipe	Impact	NP	211	196	181
Naval Base Kitsap, WA[3]	30-inch steel pipe	Vibratory	NP	NA	167	167

Notes: [1] = Caltrans 2015; [2] = NAVFAC SW 2020; [3] = Navy 2015
Source: All sound pressure levels (SPLs) are unattenuated;
Legend: dB=decibels; rms = root mean square, SEL = sound exposure level; dB re 1 µPa = dB referenced to a pressure of 1 microPascal, measures underwater SPL. dB re 1 µPa^2-sec = dB referenced to a pressure of 1 microPascal squared per second. Single strike SEL are the proxy source levels presented for impact pile driving and are used to calculate distances to permanent threshold shift (PTS). NA = Not applicable; NP = Not provided

The proposed pile size and type that would be used for construction of the new pier is a 14-inch square concrete pile with up to approximately 250 piles installed via impact pile driving methods. Due to tidal fluctuation in the project area, the maximum depth at which underwater construction noise may occur is at 2 feet (or less than 1 meter). Only one proxy source level was found for the 14-inch square pile size and is provided for installation in water depths that are slightly deeper than the project area. Installation of dolphins will be composed of 30-inch steel pipe piles installed via both vibratory and impact pile driving methods. The most appropriate proxies are provided based on consistency with other NAVFAC MIDLANT pile driving projects.

4.0 ACOUSTIC TRANSMISSION LOSS MODELS

4.1 Model for Level A (PTS) Harassment of Marine Mammals

Acoustic transmission loss modeling for cumulative sound exposure that may result in Level A harassment to marine mammals will be conducted using National Marine Fisheries Service (NMFS) marine mammal acoustic technical guidance (*Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing—Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts, April 2018*) (NMFS 2018a). This guidance provides acoustic thresholds for the onset of permanent threshold shift (PTS), which would be considered Level A harassment under the MMPA. PTS from pile driving activities will be calculated for marine mammals in the project area using the *Optional User Spreadsheet* (herein referred to as NMFS spreadsheet) provided on the NMFS website (NMFS 2020a). A version of the updated spreadsheet has been modified by NMFS (2021a,b) (Appendix B) to include weighting function parameters and PTS and Temporary threshold shift (TTS) thresholds for Sirenians (manatees) based on Finneran (2016) and Southall et al. (2019).

For impact pile driving, the single strike SEL/pulse equivalent will be used, and for vibratory pile driving the root mean square (RMS) SPL source level will be used. An intermediate “practical spreading” value of 15 (referred to as “practical spreading loss”) is widely used for intermediate or spatially varying conditions when actual values for transmission loss are unknown. It is generally accepted by NMFS for use in pile driving applications and has been used in most Navy projects that involve pile driving. Per the NMFS spreadsheet, a default Weighting Factor Adjustment (WFA) of 2.0 kHz will be used for calculating PTS for impact and vibratory pile driving using 2.0 kilohertz (kHz) and 2.5 kHz, respectively. This WFA is acknowledged by NMFS as conservative.

The NMFS spreadsheet generates threshold distances to PTS for the situation in which an animal remains stationary for the entire 24-hour duration of activity. Although the USMC believes PTS is unlikely to occur due to animal avoidance during pile driver operations (Russell et al. 2016), some animals could habituate to the noise source and continue to occupy the area. The NMFS spreadsheet therefore provides a boundary condition for the maximum distance at which PTS could occur. In order to properly calculate the distances to PTS, number of pile strikes per pile and duration (in minutes) of vibratory pile driving in a day is required for the analysis. See **Tables 2 and 3** for pile installation activity that will be used in the NMFS spreadsheet.

4.2 Model for Level B (Behavioral) Harassment of Marine Mammals

Cardno proposes to use a general formula for underwater acoustic transmission loss in decibels (dB) as a function of distance from the source as follows:

$$TL = B * log10\left(\frac{R1}{R2}\right) + C * (R1 - R2)$$

Where:

B = logarithmic spreading loss (the value of B depends on the geometry of sound propagation),

C = linear (scattering and absorption) loss,

R1 = receiver distance, and

R2 = range at which the source measurement was made (standardized to a 10-meter distance for pile driving)

The B term has a value of 10 for cylindrical spreading, which is most applicable in shallow/confined waters where sound is reflected, and 20 for spherical spreading, which is most applicable in deep/unconfined waters where sound can propagate in all three dimensions. An intermediate "practical spreading" value of 15 is applicable where the environment contains elements of both (see Section 4.1). The amount of linear loss (C) is proportional to the frequency of sound. Due to the low frequencies of sound generated by impact pile driving, this factor would be conservatively assumed to equal zero for all calculations and transmission loss will be calculated using only logarithmic spreading. For this project we recommend the assumption of practical spreading loss, which with the conservative assumption that C = 0, simplifies to:

$$TL = 15\ log10\left(\frac{R1}{R2}\right)$$

Starts at 0 dB at the referenced source level distance (R2=10-meters) and increases at a declining logarithmic rate, at approximately 4.5 dB per doubling of distance with practical spreading loss. This formula would be used to estimate the distances to critical threshold levels that bound the ZOIs for MMPA Level B (Behavioral) Harassment due to impulsive underwater sound.

In modeling transmission loss from the proposed project area, the conventional assumption would be made that acoustic propagation from the source is impeded by natural and relatively dense manmade features that extend into the water, resulting in acoustic shadows behind such features.

4.3 Model for Fish

Cardno proposes to use the transmission loss (TL) formula below for determining distance to thresholds for ESA-listed sturgeon:

$$Transmission\ Loss\ (TL) = 15 * Log10[radius]$$

To calculate distance to thresholds (see Chapter 5), number of pile strikes per pile are required for the project. **Table 2** provides pile installation activity for the project.

4.4 Model for Sea Turtles

The hearing capabilities of sea turtles are poorly known and there is very little available information on the effects of noise on sea turtles, especially to determine impacts from natural and anthropogenic, sound sources (i.e., pile driving noise; Popper et al. 2014). Methods for analyzing acoustic impacts to sea turtles will be consistent with the Navy's Criteria and Thresholds for U.S. Navy Acoustic and Explosives Effects Analysis (Phase III) (Navy 2017).

To calculate distance to thresholds (see Chapter 5), number of pile strikes per pile are required for the project. **Table 2** provides pile installation activity for the project.

5.0 SOUND EXPOSURE CRITERIA AND THRESHOLDS

5.1 Marine Mammals

The MMPA defines "harassment" as: any act of pursuit, torment, or annoyance which: (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B harassment] (50 Code of Federal Regulations, Part 216, Subpart A, Section 216.3-Definitions). Level A is the more severe form of harassment because it may result in injury, whereas Level B only results in behavioral disturbance without the potential for injury.

As introduced in Chapter 4, NMFS finalized the acoustic threshold levels for determining the onset of PTS in marine mammals in response to underwater impulsive and non-impulsive/continuous sound sources (NMFS 2018b). The criteria use cumulative SEL metrics (dB SEL_{cum}) and peak pressure (dB_{pk}) rather than the dB rms metric. NMFS equates the onset of PTS, which is a form of auditory injury, with Level A harassment under the MMPA and "harm" under the ESA. Level B harassment is considered to occur when marine mammals are exposed to impulsive underwater sounds > 160 decibels referenced to a pressure of 1 microPascal (dB rms re 1 µPa) from impact pile driving and to non-impulsive underwater sounds > 120 dB rms re 1 µPa (**Table 4**). The application of the 120 dB rms threshold is considered precautionary (NMFS 2009, 74 Federal Register 41684) as it can sometimes be problematic because this threshold level can be either at or below the ambient noise level of certain locations. Behavioral harassment may or may not result in a stress response.

Acoustic disturbance levels from vibratory or impact pile driving have the potential to exceed the harassment levels defined in **Table 4** for both non-impulsive/continuous and impulsive sound levels. This table incorporates PTS thresholds in combination with prior existing thresholds for Level B exposure.

Table 4. PTS and Behavioral Disturbance Threshold Criteria for Underwater Noise

Marine Mammals	Underwater Vibratory Pile Driving Noise (non-impulsive sounds) (*re 1 µPa*)		Underwater Impact Pile Driving Noise (impulsive sounds) (*re 1 µPa*)	
	PTS Onset (Level A) Threshold	Level B Disturbance	PTS Onset (Level A) Threshold(1)	Level B Disturbance Threshold
Mid-Frequency Cetaceans (Bottlenose Dolphins)	198 dB SELcum[3]	120 dB rms	230 dB Peak(2) 185 dB SEL_{CUM}(3)	160 dB rms
Sirenians (Manatees)	206 dB SELcum[3]	120 dB rms	226 dB Peak(2) 190 dB SEL_{CUM}(3)	160 dB rms

Notes: [1]. Dual metric acoustic thresholds for impulsive sounds. Whichever results in the largest isopleth for calculating PTS onset is used in the analysis.
[2]. Flat weighted or unweighted peak sound pressure within the generalized hearing range.
[3]. Cumulative SEL over 24 hours.
Legend: µPa = micropascal; dB = decibel; PTS = permanent threshold shift; rms = root mean square; SEL = sound exposure level.

5.2 Fish

Criteria and thresholds to estimate impacts from sound produced by impact pile driving activities are presented below in **Table 5**. Consistent with Popper et al. 2014, dual metric sound exposure criteria are utilized. It is assumed that a specified effect would occur when either metric (cumulative SEL or peak SPLs) is met or exceeded. Guidelines were developed for mortality and the lowest level where injury was found (recoverable injury). In addition, Popper et al. (2014) developed guidance for the onset of TTS. **Table 5** lists the impact pile driving guidance for the lowest level where injury was found and the onset of TTS.

Table 5. Fish Impact Pile Driving Injury Guidance

Fish Hearing Group	Onset of Mortality		Recoverable Injury	
	SEL_{cum}	SPL_{peak}	SEL_{cum}	SPL_{peak}
Fishes without a swim bladder	> 219	> 213	> 216	> 213
Fishes with a swim bladder not involved in hearing	210	> 207	203	> 207
Fishes with a swim bladder involved in hearing	207	> 207	203	> 207
Fishes with a swim bladder and high-frequency hearing	207	> 207	203	> 207

Legend: SEL_{cum} = Cumulative sound exposure level (decibel referenced to 1 micropascal squared seconds [dB re 1 μPa^2-s]), SPL_{peak} = Peak sound pressure level (decibel referenced to 1 micropascal [dB re 1 μPa]), ">" indicates that the given effect would occur above the reported threshold.

In addition, if the received SEL from an individual pile strike is below a certain level, then the accumulated energy from multiple strikes would not contribute to injury, regardless of how many pile strikes occur. This SEL is referred to as "effective quiet", and is assumed to be 150 dB (referenced to a pressure of 1 microPascal squared per second [re: 1 μPa2-sec]). Effective quiet establishes a limit on the maximum distance from the pile where injury to fishes is expected – the distance at which the single strike SEL attenuates to 150 dB. Beyond this distance, no physical injury is expected, regardless of the number of pile strikes. Underwater sound would likely cause behavioral changes to fish, which can vary from impaired startle response, freeze response, and increased swimming speed to avoidance (Lafrate et al. 2016)

In summary, based on the best available information for other fish species, underwater noise at or above the levels presented in **Table 5** have the potential to cause injury or behavioral modification to fish.

5.3 Sea Turtles

Unweighted peak pressure thresholds for TTS and PTS were developed for sea turtles based on auditory sensitivity in marine mammals (Navy 2017, 2018) (**Table 6**). Sea turtle behavioral criteria was derived for impact pile driving based on exposure to air guns where 175 dB re 1 μPa SPL RMS is the expected sound level at which sea turtles would actively avoid exposure to pile driving noise (Navy 2017). Because vibratory pile driving has a relatively low source level, it is highly unlikely, based on best available science, for sea turtles to experience PTS or TTS, even if exposed to a full day of pile driving.

Table 6. PTS, TTS, and Behavior Thresholds for Sea Turtles Exposed to Impulsive Sounds

Auditory Effect	Unweighted SPL Threshold re 1 µPa	Weighted SPL Threshold re µPa2-s
TTS	226 dB Peak	189 dB SEL_{cum}
PTS	232 dB Peak	204 dB SEL_{cum}
Behavioral	175 dB RMS	NA

Legend: PTS = permanent threshold shift, TTS = temporary threshold shift, SEL = sound exposure level, SPL = sound pressure level, SEL_{cum} = cumulative SEL over 24 hours, NA = Not Applicable.

5.4 GIS Mapping of ZOIs

To create a GIS map of the modeled ZOIs, the following are proposed: (1) use of a high-resolution ArcGIS aerial image of the project area so that the shoreline boundaries of ZOIs can be accurately drawn; (2) define a modeled sound source location that provides a reasonable approximation for project activities with the greatest potential for effects; (3) the application of rules for sound propagation and acoustic shadowing along bearing angles that intersect shoreline obstructions; and (4) the translation of the TL Model into a graphical depiction of diminishing sound pressure isopleths as a function of the sound source level and TL over distance.

The calculations are made in an Excel workbook, which is used to create a multi-ring buffer of isopleths (i.e., sound contours) diminishing in 1 dB increments from the sound source location. The sound contours are created in GIS and clipped to the boundary of the respective ZOI and then displayed on a map. The graphical outputs will be modified based on different source levels.

5.5 Description of Take Calculation

Consistent with other Navy projects, take estimates associated with pile installation activity are typically calculated using the following general formula:

$$Take\ estimate\ =\ species\ density\ *\ area\ of\ ZOI\ for\ the\ activity\ *\ days\ of\ activity$$

To date, there are no available marine mammal surveys for the project area and surrounding waterbodies (Brickyard Creek, Albergottie Creek, and Beaufort River). Species density estimates were obtained from the Navy’s Marine Species Density Database (Navy 2017) but data shown in the extracted polygons are cut off at the mouth of St. Helena Sound and Port Royal Sound and do not include upriver portions where the project area is located. An alternative approach is to calculate takes by assuming a reasonable worst case for the number of animals likely to occur in the immediate project area which may be exposed to incidental harassment, as follows:

Exposure estimate= N × Total Days of Pile Driving

where

N = 1 bottlenose dolphin

Total Days of Pile Driving = 14

1 bottlenose dolphin X 14 Days = 14 bottlenose dolphin takes. Each animal can be "taken" via incidental harassment once every 24 hours.

and,

N = 1 manatee

Total Days of Pile Driving = 14

1 manatee X 14 Days = 14 manatee takes. Again, each animal can be "taken" via incidental harassment once every 24 hours.

6.0 PROPOSED MITIGATION APPROACH FOR MARINE MAMMALS

As shown in Appendix A, for impact pile driving of 30-inch steel pipe, the ZOIs to potential Level A (PTS onset) are 6.9 and 12.3 meters to injurious thresholds for bottlenose dolphins and manatees, respectively. For Level B (Behavioral harassment), the ZOI would extend out 2,512 meters from a driven pile.

For vibratory pile driving of 30-inch steel pipe, the ZOIs to potential Level A (PTS onset) are 2 and 2.2 meters to injurious thresholds for bottlenose dolphins and manatees, respectively. For Level B (Behavioral harassment), the ZOI would extend out 5,412 meters from a driven pile.

For impact pile driving of 14-inch square concrete piles, the ZOIs to potential Level A (PTS onset) are less than 1 meter to injurious thresholds for bottlenose dolphins and manatees. For Level B (Behavioral harassment), the ZOI would extend out 6 meters from a driven pile.

These areas, as shown in Figures A-1, A-2, and A-3, could be efficiently monitored to ensure zero take of marine mammals. It should also be noted that the PTS ZOIs are based on installing 3 steel pipe or 25 concrete piles in a day. Should this number be reduced, these ZOIs would also reduce to smaller areas to be monitored. Additional mitigation to consider is conducting the pile installation during a time of year when these species are least likely to be present (fall and winter months).

7.0 GLOSSARY

Table 7. Glossary of Acoustical Terms

Term	Definition
Decibel (dB)	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for water is 1 microPascal (µPa) and for air is 20 µPa (approximate threshold of human audibility).
Sound Pressure Level (SPL)	Sound pressure is the force per unit area, usually expressed in microPascals where 1 Pascal equals 1 Newton exerted over an area of 1 square meter. The SPL is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressure exerted by the sound to a reference sound pressure. SPL is the quantity that is directly measured by a sound level meter.
Frequency, hertz (Hz)	Frequency is expressed in terms of oscillations, or cycles, per second. Cycles per second are commonly referred to as hertz (Hz). Typical human hearing ranges from 20 Hz to 20 kHz.
Peak Sound Pressure, dB re 1 microPascal (µPa)	Peak sound pressure is based on the largest absolute value of the instantaneous sound pressure over the frequency range from 20 Hz to 20 kHz. This pressure is expressed in this application as dB re 1 µPa.
Root Mean Square (rms), dB re 1µPa	The rms level is the square root of the mean of the squared pressure level(s) as measured over a specified time period. For pulses, the rms has been defined as the average of the squared pressures over the time that comprise that portion of waveform containing 90 % of the sound energy for one impact pile driving impulse.
Sound Exposure Level (SEL), dB re 1 µPa^2 sec	Sound exposure level is a measure of energy. Specifically, it is the dB level of the time integral of the squared-instantaneous sound pressure, normalized to a 1-second period. It can be an extremely useful metric for assessing cumulative exposure because it enables sounds of differing duration, to be compared in terms of total energy.
Frequency Spectrum, dB over frequency range	The amplitude of sound at various frequencies, usually shown as a graphical plot of the mean square pressure per unit frequency (µPa^2/Hz) over a frequency range (e.g., 10 Hz to 10 kHz in this application).
Ambient Noise Level	The background sound level, which is a composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.

8.0 REFERENCES

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Appendix A
ZOI Tables and Figures

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Table A-1. Injury and Disturbance Zones for Underwater Marine Mammals – Impact Pile Driving Noise

Pile Size and Type	Injury (PTS Onset) Level A		Behavioral Disturbance Level B	
	Radial Distance/ Area Mid-Frequency Cetaceans	Radial Distance/ Area Sirenians	Radial Distance to 160 dB RMS[1]	Area Encompassed by Threshold
14-inch Square Concrete[2]	0.1 m/0.03 sq m	0.2 m/0.13 sq m	6 m	112.52 sq m
30-inch Steel Pipe[3]	6.9 m/ 148.81 sq m	12.3 m/ 472.88 sq m	2,512 m	x sq m

Notes: [1]Distance to behavioral disturbance thresholds calculated using practical spreading loss model.
[2]Assumes concrete piles are installed using an impact pile driver with a maximum of 45 strikes per pile with 25 piles installed per day.
[3]Assumes steel pipe piles are installed using an impact pile driving with a maximum of 45 strikes per pile and 3 piles installed per day.

Legend: PTS= permanent threshold shift; dB RMS= decibel root mean square; m = meters; sq m = square meters.

Table A-2. Injury and Disturbance Zones for Underwater Marine Mammals – Vibratory Pile Driving Noise

Pile Size and Type	Injury (PTS Onset) Level A		Behavioral Disturbance Level B	
	Radial Distance/ Area Mid-Frequency Cetaceans	Radial Distance/ Area Sirenians	Radial Distance to 120 dB RMS[1]	Area Encompassed by Threshold
30-inch steel pipe[2]	2 m/12.5 sq m	2.2 m/15.13 sq m	5,412 m	x sq m

Notes: [1]Distance to behavioral disturbance thresholds calculated using practical spreading loss model.
[2]Assumes vibratory pile driver requiring 30 minutes to install 1 pile at 3 piles installed per day.

Legend: PTS= permanent threshold shift; dB RMS= decibel root mean square; m = meters; sq m = square meters.

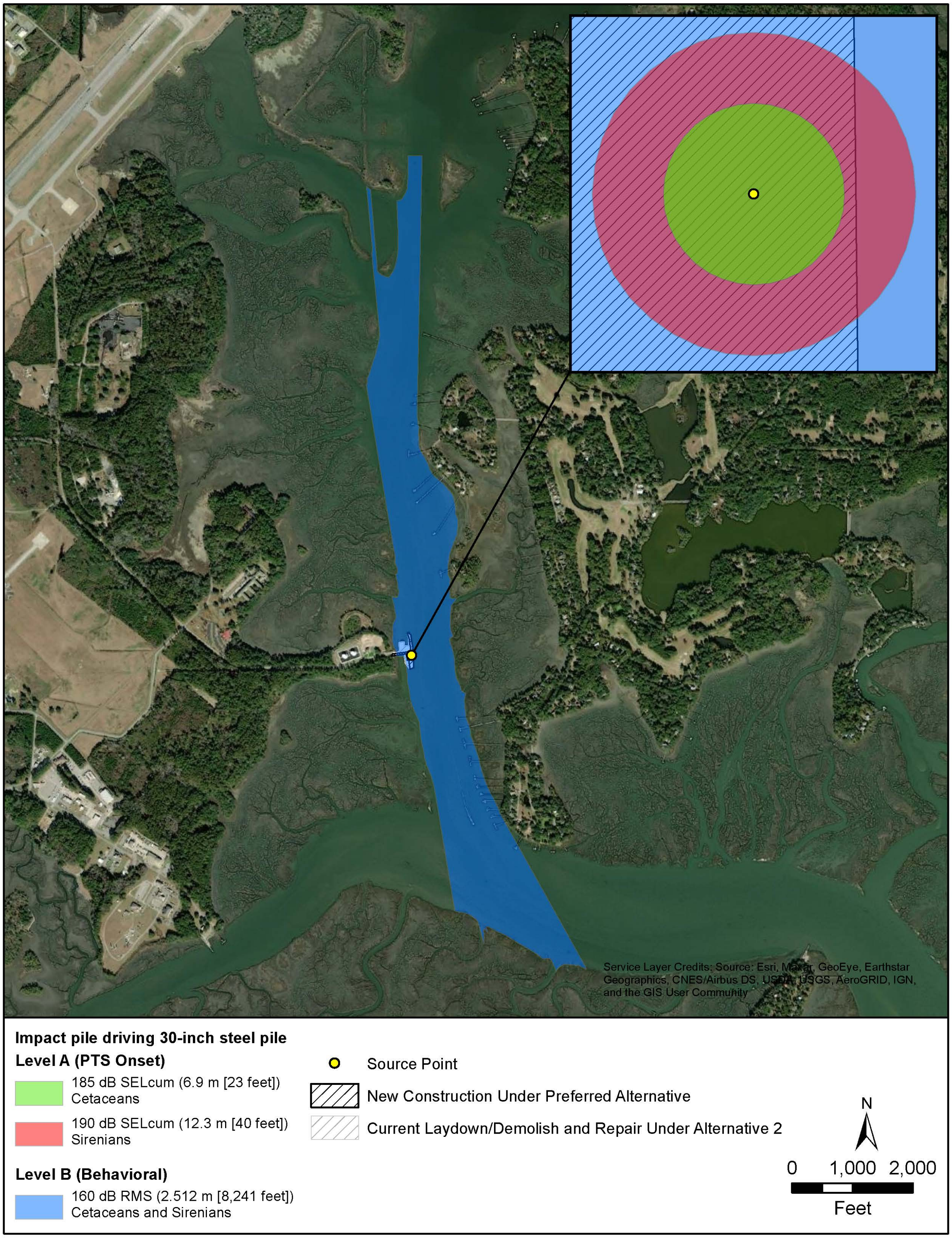

Figure A-1. ZOIs for Level A (PTS Onset) and Level B (Behavioral) Harassment from Impact Pile Driving 30-inch Steel Pipe Piles

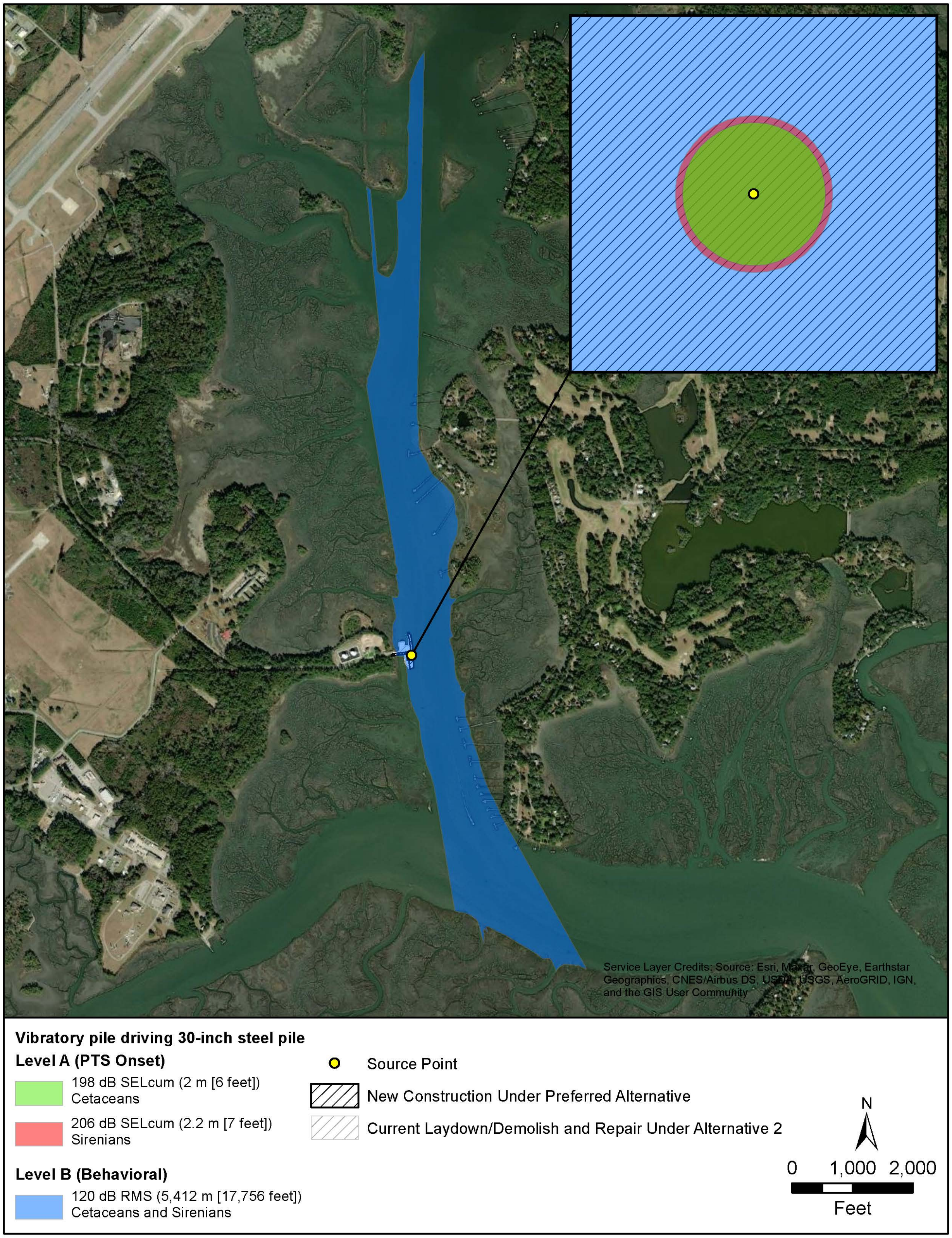

Figure A-2. ZOIs for Level A (PTS Onset) and Level B (Behavioral) Harassment from Vibratory Pile Driving 30-inch Steel Pipe Piles

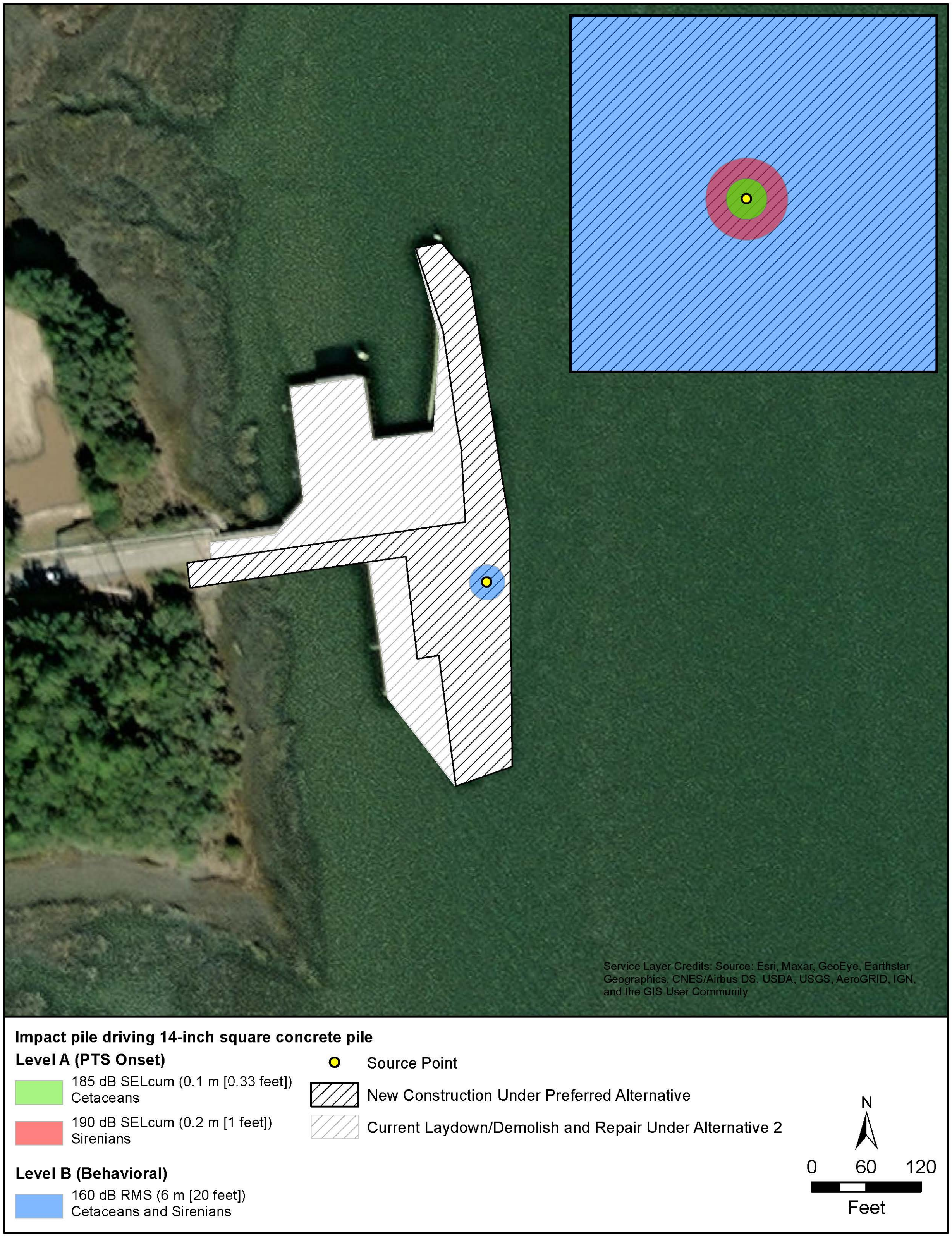

Figure A-3. ZOIs for Level A (PTS Onset) and Level B (Behavioral) Harassment from Impact Pile Driving 14-inch Square Concrete Piles

Table A-3 Sound Exposure Criteria for Fish Mortality, Recoverable Injury, and TTS from Impact Pile Driving 14-inch Square Concrete Piles

Fish Hearing Group	Onset of Mortality				Recoverable Injury				TTS	
	Threshold SEL_{cum}	Distance to Threshold	Threshold SPL_{peak}	Distance to Threshold	Threshold SEL_{cum}	Distance to Threshold	Threshold SPL_{peak}	Distance to Threshold	Threshold SEL_{cum}	Distance to threshold
Fishes without a swim bladder	> 219	0	> 213	0	> 216	0	> 213	0	NC	0
Fishes with a swim bladder not involved in hearing	210	0	> 207	0	203	0	203	0	> 186	2 m
Fishes with a swim bladder involved in hearing	207	0	>207	0	203	0	> 207	0	186	2 m

Source: Popper et al. 2014

Legend: m = meters; SEL_{cum} = Cumulative sound exposure level (decibel referenced to 1 micropascal squared seconds [dB re 1 µPa^2-s]), SPL_{peak} = Peak sound pressure level (decibel referenced to 1 micropascal [dB re 1 µPa]), ">" indicates that the given effect would occur above the reported threshold. NC = effects from exposure to sound produced by impact pile driving is considered to be unlikely, therefore no criteria are reported, TTS = Temporary Threshold Shift > indicates that the given effect would occur above the reported threshold. Distances are for 14-inch square concrete pile; A maximum of 1,125 strikes in a day and 25 piles installed/day.

Table A-4 Sound Exposure Criteria for Fish Mortality, Recoverable Injury, and TTS from Impact Pile Driving 30-inch steel pipe

Fish Hearing Group	Onset of Mortality				Recoverable Injury				TTS	
	Threshold SEL_{cum}	Distance to Threshold	Threshold SPL_{peak}	Distance to Threshold	Threshold SEL_{cum}	Distance to Threshold	Threshold SPL_{peak}	Distance to Threshold	Threshold SEL_{cum}	Distance to threshold
Fishes without a swim bladder	> 219	1 m	> 213	7 m	> 216	1 m	> 213	7 m	NC	0
Fishes with a swim bladder not involved in hearing	210	3 m	> 207	18 m	203	9 m	203	34 m	> 186	122 m
Fishes with a swim bladder involved in hearing	207	5 m	>207	18 m	203	9 m	> 207	18 m	186	122 m

Source: Popper et al. 2014

Legend: m = meters; SEL_{cum} = Cumulative sound exposure level (decibel referenced to 1 micropascal squared seconds [dB re 1 μPa^2-s]), SPL_{peak} = Peak sound pressure level (decibel referenced to 1 micropascal [dB re 1 μPa]), “>” indicates that the given effect would occur above the reported threshold. NC = effects from exposure to sound produced by impact pile driving is considered to be unlikely, therefore no criteria are reported, TTS = Temporary Threshold Shift > indicates that the given effect would occur above the reported threshold. Distances are for 30-inch steel pile; A maximum of 135 strikes in a day and 3 piles installed/day.

Table A-5. Ranges to PTS and TTS for Sea Turtles Exposed to Impact Pile Driving

Pile Size and Type	PTS	TTS	Behavior
14-inch Square Concrete Pile	0 m	0 m	1 m
30-inch Steel Pipe Pile	0.2 m	1.8 m	251 m

Legend: Weighted SEL_{cum} Threshold in dB re µPa^2s; PTS = permanent threshold shift, TTS = temporary threshold shift; m = meters.

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Appendix B
NMFS Spreadsheet

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E.1: IMPACT PILE DRIVING (STATIONARY SOURCE: Impulsive, Intermittent)

VERSION 2.1: 2020

KEY

(green)	**Action Proponent Provided Information**
(pink)	**NMFS Provided Information (Technical Guidance)**
(blue)	**Resultant Isopleth**

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	MCAS Beaufort Pier Construction
PROJECT/SOURCE INFORMATION	30-inch steel pipe piles (dolphins) at 3 installed/day for 4 days

Please include any assumptions

PROJECT CONTACT	

STEP 2: WEIGHTING FACTOR ADJUSTMENT

		Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value
Weighting Factor Adjustment (kHz)[¥]	2	

[¥] Broadband: 95% frequency contour percentile (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 73), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

STEP 3: SOURCE-SPECIFIC INFORMATION

NOTE: METHOD E.1-1 is PREFERRED method when SEL-based source levels are available (because pulse duration is not required). Only use method E.1-2 if SEL-based source levels are not available.

E.1-1: METHOD TO CALCULATE PK AND SEL_{cum} (SINGLE STRIKE EQUIVALENT) **PREFERRED METHOD (pulse duration not needed)**

Unweighted SEL_{cum} (at measured distance) = SEL_{ss} + 10 Log (# strikes)	**202.3**

SEL_{cum}

Single Strike SEL_{ss} ($L_{E,p,\text{ single strike}}$) specified at "x" meters (Cell B32)	181
Number of strikes per pile	45
Number of piles per day	3
Transmission loss coefficient	15
Distance of single strike SEL_{ss} ($L_{E,p,\text{ single strike}}$) measurement (meters)	10

PK

$L_{p,0\text{-pk}}$ specified at "x" meters (Cell G29)	211
Distance of $L_{p,0\text{-pk}}$ measurement (meters)	10
$L_{p,0\text{-pk}}$ Source level	226.0

RESULTANT ISOPLETHS*

*Impulsive sounds have dual metric thresholds (SELcum & PK). Metric producing largest isopleth should be used.

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	MANATEE
SEL_{cum} Threshold	183	185	155	185	190
PTS Isopleth to threshold (meters)	**193.3**	**6.9**	**230.3**	**103.5**	**12.3**
PK Threshold	219	230	202	218	226
PTS PK Isopleth to threshold (meters)	**2.9**	**NA**	**39.8**	**3.4**	**NA**

"NA": PK source level is ≤ to the threshold for that marine mammal hearing group.

E.1-2: METHOD TO CALCULATE PK AND SEL_{cum} (USING RMS SPL SOURCE LEVEL)

SEL_{cum}

Sound Pressure Level (L_{rms}), specified at "x" meters (Cell B53)	
Number of piles per day	
Strike (pulse) Duration[Δ] (seconds)	
Number of strikes per pile	
Duration of Sound Production (seconds)	0
10 Log (duration of sound production)	#NUM!
Transmission loss coefficient	
Distance of sound pressure level (L_{rms}) measurement (meters)	

[Δ]Window that makes up 90% of total cumulative energy (5%-95%) based on Madsen 2005

PK

$L_{p,0\text{-}pk}$ specified at "x" meters (Cell G47)	
Distance of $L_{p,0\text{-}pk}$ measurement (meters)	
$L_{p,0\text{-}pk}$ Source level	#NUM!

NOTE: The User Spreadsheet tool provides a means to estimates distances associated with the Technical Guidance's PTS onset thresholds. Mitigation and monitoring requirements associated with a Marine Mammal Protection Act (MMPA) authorization or an Endangered Species Act (ESA) consultation or permit are independent management decisions made in the context of the proposed activity and comprehensive effects analysis, and are beyond the scope of the Technical Guidance and the User Spreadsheet tool.

RESULTANT ISOPLETHS*

*Impulsive sounds have dual metric thresholds (SELcum & PK). Metric producing largest isopleth should be used.

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	MANATEES
SEL_{cum} Threshold	183	185	155	185	190
PTS Isopleth to threshold (meters)	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
PK Threshold	219	230	202	218	226
PTS PK Isopleth to threshold (meters)	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!

"NA": PK source level is ≤ to the threshold for that marine mammal hearing group.

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	MANATEE
a	1	1.6	1.8	1	1.8
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	4.3
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	2.62
Adjustment (-dB)†	-0.01	-19.74	-26.87	-2.08	-10.93

NOTE: If user decided to override these Adjustment values, they need to make sure to download another copy to ensure the built-in calculations function properly.

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}$$

A.1: Vibratory Pile Driving (STATIONARY SOURCE: Non-Impulsive, Continuous)

VERSION 2.2: 2020

KEY

(green)	**Action Proponent Provided Information**
(pink)	**NMFS Provided Information (Technical Guidance)**
(blue)	**Resultant Isopleth**

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	MCAS Beaufort Pier Construction
PROJECT/SOURCE INFORMATION	30-inch steel pipe piles (dolphins) at 3 installed/day for 4 days

Please include any assumptions

PROJECT CONTACT	

STEP 2: WEIGHTING FACTOR ADJUSTMENT

		Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value
Weighting Factor Adjustment (kHz)[¥]	2.5	

[¥] Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 48), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

STEP 3: SOURCE-SPECIFIC INFORMATION

Sound Pressure Level (L_{rms}), specified at "x" meters (Cell B30)	167
Number of piles within 24-h period	3
Duration to drive a single pile (minutes)	30
Duration of Sound Production within 24-h period (seconds)	5400
10 Log (duration of sound production	37.32
Transmission loss coefficient	15
Distance of sound pressure level (L_{rms}) measurement (meters)	10

NOTE: The User Spreadsheet tool provides a means to estimates distances associated with the Technical Guidance's PTS onset thresholds. Mitigation and monitoring requirements associated with a Marine Mammal Protection Act (MMPA) authorization or an Endangered Species Act (ESA) consultation or permit are independent management decisions made in the context of the proposed activity and comprehensive effects analysis, and are beyond the scope of the Technical Guidance and the User Spreadsheet tool.

RESULTANT ISOPLETHS

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	MANATEES
SEL_{cum} Threshold	199	198	173	201	206
PTS Isopleth to threshold (meters)	**22.5**	**2.0**	**33.2**	**13.7**	**2.2**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	MANTEES
a	1	1.6	1.8	1	1.8
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	4.3
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	2.62
Adjustment (-dB)†	**-0.05**	**-16.83**	**-23.50**	**-1.29**	**-8.22**

NOTE: If user decided to override these Adjustment values, they need to make sure to download another copy to ensure the built-in calculations function properly.

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}$$

E.1: IMPACT PILE DRIVING (STATIONARY SOURCE: Impulsive, Intermittent)

VERSION 2.1: 2020

KEY

(green)	**Action Proponent Provided Information**
(pink)	**NMFS Provided Information (Technical Guidance)**
(blue)	**Resultant Isopleth**

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	MCAS Beaufort Pier Construction
PROJECT/SOURCE INFORMATION	14-inch square concrete piles installed at 25 piles/day for 10 days.

Please include any assumptions

PROJECT CONTACT	

STEP 2: WEIGHTING FACTOR ADJUSTMENT

		Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value
Weighting Factor Adjustment (kHz)[¥]	2	

[¥] Broadband: 95% frequency contour percentile (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 73), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

STEP 3: SOURCE-SPECIFIC INFORMATION

NOTE: METHOD E.1-1 is PREFERRED method when SEL-based source levels are available (because pulse duration is not required). Only use method E.1-2 if SEL-based source levels are not available.

E.1-1: METHOD TO CALCULATE PK AND SEL_{cum} (SINGLE STRIKE EQUIVALENT) **PREFERRED METHOD (pulse duration not needed)**

Unweighted SEL_{cum} (at measured distance) = SEL_{ss} + 10 Log (# strikes)	**176.5**

SEL_{cum}

Single Strike SEL_{ss} ($L_{E,p,\text{ single strike}}$) specified at "x" meters (Cell B32)	146
Number of strikes per pile	45
Number of piles per day	25
Transmission loss coefficient	15
Distance of single strike SEL_{ss} ($L_{E,p,\text{ single strike}}$) measurement (meters)	10

PK

$L_{p,0\text{-pk}}$ specified at "x" meters (Cell G29)	183
Distance of $L_{p,0\text{-pk}}$ measurement (meters)	10
$L_{p,0\text{-pk}}$ Source level	198.0

RESULTANT ISOPLETHS*

*Impulsive sounds have dual metric thresholds (SELcum & PK). Metric producing largest isopleth should be used.

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	MANATEE
SEL_{cum} Threshold	183	185	155	185	190
PTS Isopleth to threshold (meters)	**3.7**	**0.1**	**4.4**	**2.0**	**0.2**
PK Threshold	219	230	202	218	226
PTS PK Isopleth to threshold (meters)	**NA**	**NA**	**NA**	**NA**	**NA**

"NA": PK source level is ≤ to the threshold for that marine mammal hearing group.

E.1-2: METHOD TO CALCULATE PK AND SEL_{cum} (USING RMS SPL SOURCE LEVEL)

SEL_{cum}

Sound Pressure Level (L_{rms}), specified at "x" meters (Cell B53)	
Number of piles per day	
Strike (pulse) Duration[Δ] (seconds)	
Number of strikes per pile	
Duration of Sound Production (seconds)	0
10 Log (duration of sound production)	#NUM!
Transmission loss coefficient	
Distance of sound pressure level (L_{rms}) measurement (meters)	

[Δ]Window that makes up 90% of total cumulative energy (5%-95%) based on Madsen 2005

PK

$L_{p,0\text{-}pk}$ specified at "x" meters (Cell G47)	
Distance of $L_{p,0\text{-}pk}$ measurement (meters)	
$L_{p,0\text{-}pk}$ Source level	#NUM!

NOTE: The User Spreadsheet tool provides a means to estimates distances associated with the Technical Guidance's PTS onset thresholds. Mitigation and monitoring requirements associated with a Marine Mammal Protection Act (MMPA) authorization or an Endangered Species Act (ESA) consultation or permit are independent management decisions made in the context of the proposed activity and comprehensive effects analysis, and are beyond the scope of the Technical Guidance and the User Spreadsheet tool.

RESULTANT ISOPLETHS*

*Impulsive sounds have dual metric thresholds (SELcum & PK). Metric producing largest isopleth should be used.

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	MANATEES
SEL_{cum} Threshold	183	185	155	185	190
PTS Isopleth to threshold (meters)	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
PK Threshold	219	230	202	218	226
PTS PK Isopleth to threshold (meters)	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!

"NA": PK source level is ≤ to the threshold for that marine mammal hearing group.

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	MANATEE
a	1	1.6	1.8	1	1.8
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	4.3
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	2.62
Adjustment (-dB)†	-0.01	-19.74	-26.87	-2.08	-10.93

NOTE: If user decided to override these Adjustment values, they need to make sure to download another copy to ensure the built-in calculations function properly.

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}$$

Appendix C
Essential Fish Habitat Assessment

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ESSENTIAL FISH HABITAT ASSESSMENT

PIER REPLACEMENT:
MARINE CORPS AIR STATION BEAUFORT, SOUTH CAROLINA

United States Marine Corps Air Station

Beaufort, South Carolina

July 2021

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REVISED FINAL
ESSENTIAL FISH HABITAT ASSESSMENT FOR
PIER REPLACEMENT MCAS BEAUFORT, SOUTH CAROLINA

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ACRONYMS AND ABBREVIATIONS

ac	acre
CFR	Code of Federal Regulation
°C	Degrees Celsius or Centigrade
dB	Decibels
DO	Dissolved Oxygen
EEZ	Exclusive Economic Zone
ESA	Endangered Species Act
EFH	Essential Fish Habitat
FMC	Fishery Management Council
ft	Feet
FY	Fiscal Year
FMP	Fishery Management Plan
HAPC	Habitat Areas of Particular Concern
MCAS	Marine Corps Air Station
m	Meter
mg/L	Milligrams per Liter
Magnuson-Stevens Act	Magnuson-Stevens Fishery Management and Conservation Act
Navy	Department of the Navy
NMFS	NOAA Fisheries
NOAA	National Oceanic and Atmospheric Administration
ppt	Parts per Thousand
psu	Practical Salinity Unit
SAFMC	South Atlantic Fisheries Management Council
SEL	Sound Exposure Level
SPL	Sound Pressure Level
sq ft	Square Feet
TTS	Temporary Threshold Shift
TSS	total suspended solids
U.S.	United States

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1.0 INTRODUCTION/BACKGROUND

The below Essential Fish Habitat (EFH) assessment for the proposed demolition of an existing pier and the construction of a new pier at the Marine Corps Air Station (MCAS) Beaufort, South Carolina has been prepared in accordance with the Magnuson-Stevens Fishery Conservation and Management Act of 1976, as amended (Magnuson-Stevens Act). The objective of this EFH Assessment is to evaluate whether the Proposed Action may affect EFH designated by the National Marine Fisheries Service (NOAA Fisheries) and South Atlantic Fisheries Management Council (SAFMC). According to the SAFMC, designated EFH in the South Atlantic includes all estuarine and marine waters and substrates from the shoreline to the seaward limit of the Exclusive Economic Zone (EEZ). The Zone of Influence (ZOI) for the Proposed Action includes the water and substrate adjacent to the MCAS Beaufort pier on Brickyard Creek, as well as the limits of turbidity, sound, and vessel traffic associated with the demolition and construction of the pier.

The replacement is needed because the pier currently in use, and built in 1957 with an upgrade in 1999, was recently evaluated and received an undesirable engineering assessment. Advanced deterioration and overstressing observed on widespread portions of the structure has resulted in a downgraded capacity. This means the pier cannot support utilities for proper operation. Increased sustainment costs and eventual failure of the pier have been determined to be unacceptable.

2.0 PROPOSED ACTION

2.1 DESCRIPTION, OBJECTIVES, AND SCHEDULE

The Proposed Action is to replace all of the existing pier at MCAS Beaufort. The existing Boat Dock would be kept and connected to the new pier. The existing pier would be demolished using demolition jaws to cut/crush concrete. Existing pilings would be left in place and cut below the mud line where possible. Pilings that require removal would be demolished by the direct pull method. All materials and waste would be disposed in accordance with applicable federal and state requirements. Demolition and construction would take approximately 36 months, of which approximately 18 months would consist of in-water work. The new pier would have an expected life cycle of 50-75 years if properly maintained. The Proposed Action would be conducted in four phases:

- Phase 1 – The waterway side of the new pier would be constructed first. This would allow maintained access to the Response Boat Dock while the southern end of the existing pier is being demolished.
- Phase 2 – The southern end of the existing pier would be demolished and construction of the remaining portions of the new pier would be completed.
- Phase 3 – Final connections between the utility systems on the new pier and the shore would be made. A brief outage (i.e., period of weeks) would be permitted to make these final connections.
- Phase 4 – The remaining portions of the existing pier structure would be demolished along with removal of utility systems associated with the existing pier structure.

The existing pier is located at MCAS Beaufort in Beaufort, South Carolina (**Figure 1)**. Two alternatives for replacement of the existing pier were considered; the first alternative considered was to replace portions of the existing pier; however, the preferred and selected alternative (Proposed Action) is to replace the entire pier (**Figure 2)**.

Construction of the new pier would require installation of up to 250 14-inch square concrete piles using an impact pile driver and installation of up to 4 dolphins each composed of 3 30-inch steel pipe piles using both vibratory and impact pile driving methods. For load-bearing structures, an impact hammer is typically required to strike a pile several times to ensure it has met the load-bearing specifications; this is referred to as "proofing." Once the pile is properly positioned, pile installation typically takes between 1 and 60 minutes depending on pile type, pile size, and substrate (e.g., mud, bedrock and loose soils) to reach the required tip elevation (Caltrans 2009). To drive the pile, a pile is first moved into position and set into the proper location by placing a choker cable around a pile and lifting it into vertical position with the crane. Once it is placed, the impact hammer begins to strike the pile. Impact hammers have guides that hold the hammer in alignment with the pile while a heavy piston moves up and down striking the top of the pile and driving the pile into the substrate from the downward force of the hammer.

Support activities would include new utility connections (lighting, power, piping, and potable water lines), minor site civil work (riprap and fill), and site demolition. Site demolition would include removing the existing decking, beams, vertical pilings when necessary, utility lines, piping, and mooring. Existing equipment would be reused if available and in good condition.

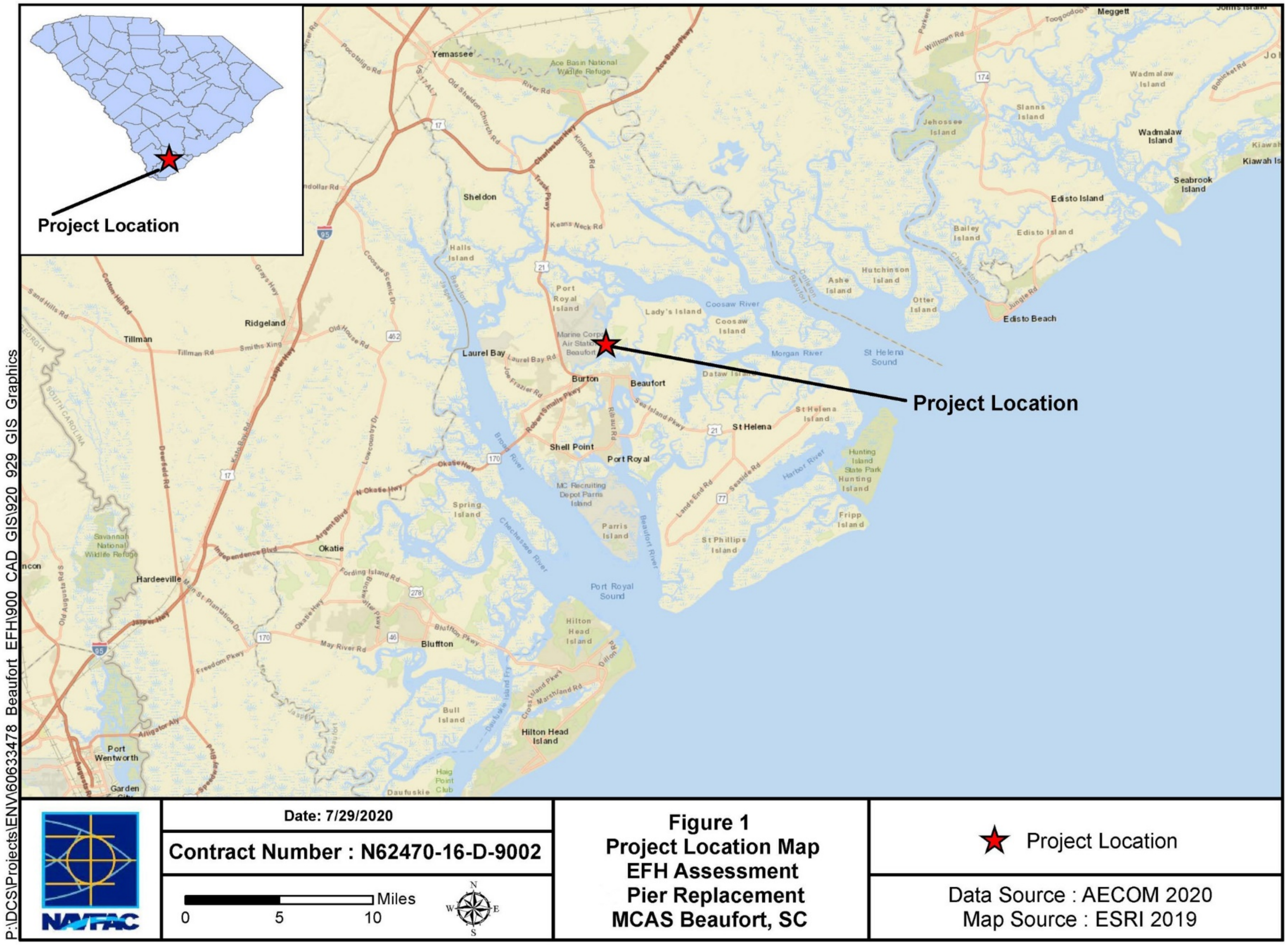

Figure 1. Location of the Pier at the Marine Corps Air Station in Beaufort, South Carolina

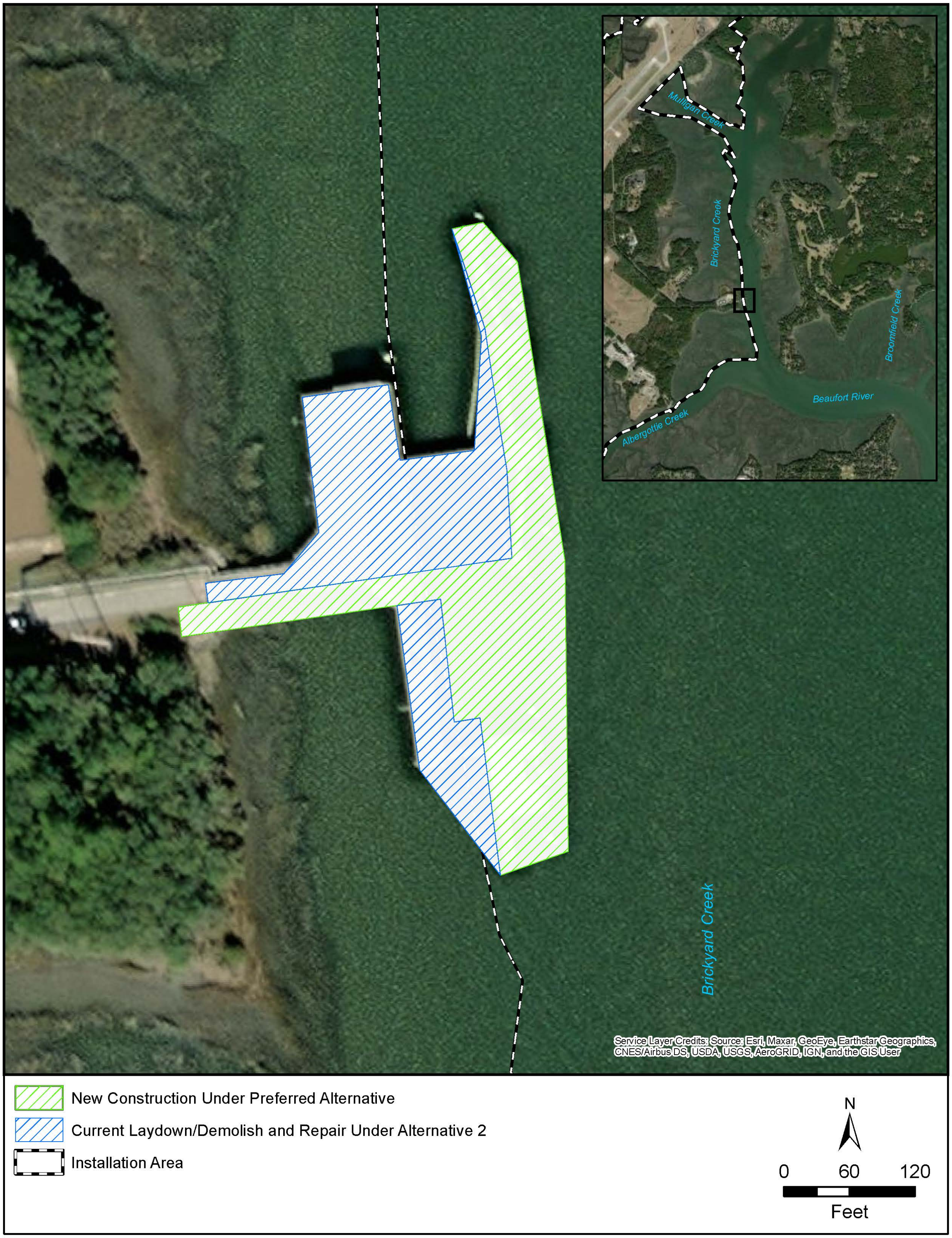

Figure 2. Pier Replacement Alternatives at Marine Corps Air Station Beaufort, South Carolina

3.0 EFH AND MANAGED SPECIES

3.1 BACKGROUND

NOAA Fisheries and its eight regional fisheries management councils (FMC) are responsible for the management and protection of fisheries and habitat essential for the survival of managed species. In the Southeastern U.S., the U.S. Secretary of Commerce, acting through NOAA Fisheries and in coordination with the SAFMC has been delegated this authority under the provisions of the Magnuson-Stevens Act (Public Law 104-208). The SAFMC is responsible for the management of fish stocks EFH within the federal 200-mile EEZ limit of the Atlantic Ocean coastline from North Carolina through Florida. The Magnuson-Stevens Act, as amended by the Sustainable Fisheries Act of 1996, sets forth several mandates for NOAA Fisheries and the SAFMC to identify and protect important marine and fish habitat, and to delineate EFH for all managed species within the EEZ and highly migratory species that make extended migrations beyond the EEZ. The U.S. Congress defined EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" [16 U.S.C. 1802 (10)]. In this context, "substrate" includes the associated benthic communities that make these areas suitable fish habitats. Water column habitat (estuarine and marine) is defined in terms of preferred levels in the physiochemical factors for marine species, such as temperature, salinity, density, nutrients, and light availability. Most marine species rely on certain habitat during a specific life-stage or for their entire life cycle (eggs–adult stage). Designated EFH for the managed fisheries is often based on the seasonal and year-round occurrence of species, which is generally linked to their life-stage

Section 303(a)(7) of the amended Magnuson-Stevens Act directs NOAA Fisheries and the SAFMC to describe and identify EFH in each Fishery Management Plan (FMP); minimize to the extent practicable the adverse effects of fishing on EFH; and, identify other actions to encourage the conservation and enhancement of EFH. The SAFMC has since designated EFH for most species under its jurisdiction and has identified ways to minimize adverse impacts to EFH in the Fisheries Management Plans provided within the Final Habitat Plan for the South Atlantic Region (October 1998). Additionally, the SAFMC has designated several Habitat Areas of Particular Concern (HAPCs; subsets of EFH), which include areas that hold an especially important ecological function, are sensitive to human induced environmental degradation, are particularly vulnerable to development activities, or are particularly rare habitat.

3.2 ESSENTIAL FISH HABITAT

The SAFMC manages eight fisheries with FMPs in the South Atlantic that consist of Coastal Migratory Pelagics (mackerel & cobia); Coral and Live Bottom Habitat; Dolphin and Wahoo; Golden Crab; Shrimp; Snapper grouper; Spiny Lobster, and Sargassum. Given the geographical location for the Proposed Action, the SAFMC designates EFH for eight specific species, which includes all life-stages (eggs, larvae, juvenile, adult; **Figure 3; Table 1**).

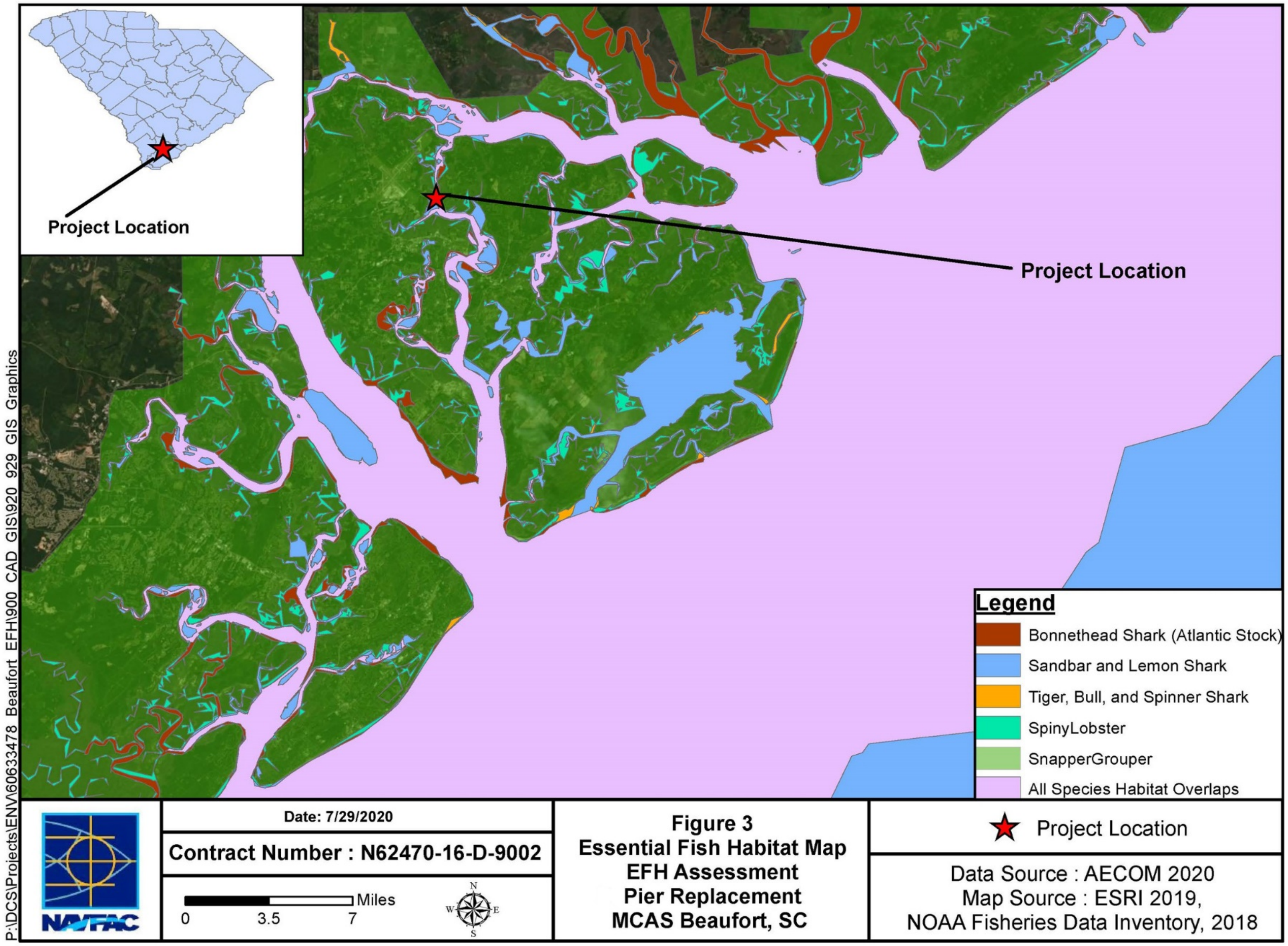

Figure 3. Designated Essential Fish Habitat Within the Proposed Action Area.

Table 1 provides a list of federally managed species with designated EFH that are known to, or may potentially use, the Proposed Action area given their geographical distribution, life-history, and physiological tolerances (SAFMC 1998a; SAFMC 1998b).

Table 1. Marine Resources with Designated Essential Fish Habitat Within the Proposed Action Area

Common name	Scientific name	Life-Stage (Eggs, Larvae, Juvenile, and Adult)
Penaeid Shrimp (Brown, Pink, and White)	*Farfantepenaeus aztecus, Farfantepenaeus aduorarum, Litopenaeus setiferus*	All
Snapper-Grouper	*Lutjanidae, Epinephelinae*	All
Spiny Lobster	*Panulirus argus*	All
Lemon Shark	*Negaprion brevirostris*	All
Bonnethead Shark	*Sphyrna tiburo*	All
Sandbar Shark	*Carcharhinus plumbeus*	All
Spinner Shark	*Carcharhinus brevipinna*	All
Tiger Shark	*Galeocerdo cuvier*	All

NOAA Fisheries also designates specific habitat for managed species that may change South Atlantic food webs and connectivity should they be negatively impacted by anthropogenic activities, such as coastal development. NOAA Fisheries divides EFH into estuaries, nearshore, and offshore. NOAA Fisheries also separates EFH into estuarine and marine components because they each can support specific life-stages. The estuarine component, defined as "all estuarine waters and substrates (mud, sand, shell, rock and associated biological communities), including the sub-tidal vegetation (grasses and algae) and adjacent inter-tidal vegetation (marshes and mangroves)," is the only habitat expected to be impacted as a result of the Proposed Action. In estuaries, the EFH of each species is based on their relative abundance (common, abundant, highly abundant). Estuaries are important habitat for many species in South Carolina. The primary bottom type in South Atlantic estuaries is soft sediment, which supports a variety of diverse infaunal invertebrates; infauna are prey for many commercial finfish. Oysters (*Crassostrea virginica*) are another key component of the estuarine food web that form large reefs and function to filter algae and particulates from the water column in South Carolina. Various types of EFH are found within and adjacent to the Proposed Action area, such as wetlands (estuarine and marine emergent wetlands and tidal palustrine forested wetlands), tidal influenced reaches, submerged aquatic vegetation (estuarine and marine submerged aquatic vegetation), shell bottom (oyster reefs and shell banks), intertidal flats, aquatic beds, soft bottom, and the estuarine water column. These habitats support managed species, such as shrimp or snapper/grouper.

3.2.1 Designated Habitat Within the Proposed Action Area

3.2.1.1 Estuarine Emergent Wetland (Tidal/Salt Marsh)

Estuarine emergent (salt and tidal marshes) is the dominant (50−70%) habitat of the South Carolina coast (Holland et al. 2004); estuarine emergent wetland is found within the Proposed Action area (**Photographs 1-2**). Saltmarshes are found in the intertidal zone within coastal and estuarine waters and tidal creeks connect salt marshes to estuaries. Estuarine emergent wetlands are characterized by the presence of erect, rooted, herbaceous hydrophytes dominated by salt-tolerant perennial plants (SAFMC 1998). In the southeastern U.S., saltmarsh cordgrass (*Spartina alterniflora*), saltmeadow cordgrass (*Spartina patens*), big cordgrass (*Spartina cynosuroides*), needlerush (*Juncus roemerianus*), and narrow-leaved cattail (*Typha angustifolia*) dominate the estuarine emergent plant community (SAFMC 1998); *Spartina* spp. is found within the Proposed Action area. Tidal/salt marsh habitats serve many important ecological functions and are highly productive (energy) as tidal marshes trap significant amounts of nutrients. The dense plant growth in the marsh also provides excellent cover for many aquatic species, and provides spawning grounds, nurseries, shelter, and food for many finfish, shellfish, birds, and other types of wildlife.

Photo 1. Tidal Marsh Habitat Within the Proposed Action Area.

Photo 2. Tidal Marsh Habitat Within the Proposed Action Area.

3.2.1.2 Oyster Reefs and Shell Banks

Oyster reefs and shell banks are defined by SAFMC as being the, "natural structures found between and beneath tide lines, that are composed of oyster shell, live oysters and other organisms". Shellfish habitats have three major features in common that are the basis for their ecological value for managed species: hard substrate (for settlement/refuge/prey), complex vertical (3-D) structure (for settlement/refuge/prey), and food (feeding sites for larger predators). The most fundamental characteristic of shellfish habitat is hard substrate (SAFMC 1998). Hard substrate provides attachment surfaces for algae and sessile invertebrates, such as polychaetes. This habitat is usually found adjacent to emergent marsh vegetation and provides three-dimensional structural relief to soft-bottom habitat (Wenner et al. 1996). Optimal salinity for the eastern oyster (*Crassostrea virginica*) ranges from 12 to 25 parts per thousand (ppt), and in South Carolina this species is 95% intertidal (Lunz 1952). Oyster reefs are important to the aquatic ecosystem in South Carolina because they remove particulate matter, release inorganic and organic nutrients, stabilize sediments, and provide habitat for various invertebrates and finfish. Within the action area, oysters are found attached to the existing pier piles (**Photograph 3**).

Photo 3. Oysters Attached to the Existing Pier Piles in the Proposed Action Area.

3.2.1.3 Intertidal Flats

The SAFMC defines Intertidal flats as unvegetated bottoms of estuaries and sounds that lie between the high and low tide lines. These flats occur along mainland or barrier island shorelines or can emerge in areas unconnected to dry land. Intertidal flats are most extensive where tidal range is greatest, such as near inlets and in the southern portion of the coast. Intertidal flats support many marine and estuarine species at different life-stages; some species rely on intertidal flats for their entire life cycle. Many species whose larval stages are planktonic but are benthically oriented as juveniles utilize intertidal flats as primary nursery ground. The estuarine intertidal flats serve as a foraging ground, refuge, and nursery area for many mobile species, including the microalgal community, which can function as a nutrient (nitrogen and phosphorus) stabilizer between the substrate and water column (SAFMC 1998). The intertidal flat benthic community is comprised of various invertebrates, such as worms, bivalves, and gastropods. Intertidal flats provide feeding grounds for predators, refuge and feeding grounds for juvenile and forage fish species, and nursery grounds for estuarine dependent benthic species (SAFMC 1998). Species that transition from a pelagic larval to a benthic juvenile life-stage rely on intertidal flats for development. These flats provide a comparatively low energy area that are influenced by tidal phases, which allow various species (as southern flounder (*Paralichthys lethostigma*), red drum (*Sciaenops ocellatus*), spotted seatrout (*Cynoscion nebulosus*), striped mullet (*Mugil cephalus*), gray snapper (*Lutjanus griseus*), blue crab (*Callinectes sapidus*), and shrimp) to use shallow water habitat and relatively deeper water within a small spatial area (SAFMC 1998; Holland et al. 2004). These flats also serve as refuge areas for species avoiding predators (SAFMC 1998). Intertidal flats are found within the Proposed Action area only during lower stages of the tidal cycle (**Photograph 4**).

Photo 4. Intertidal Flat Habitat Within the Proposed Action Area.

3.2.1.4 Estuarine Water Column

Water column habitat is defined as ―the water covering a submerged surface and its physical, chemical, and biological characteristics. Differences in the chemical and physical properties of the water affect the biological components of the water column, including fish distribution. Because of this, estuarine water column habitat is EFH for a variety of species and supports many species depending on their specific requirements, which can change throughout their life cycle. Most marine-spawning species use the water column during their egg and larvae life-stages. This habitat provides nursery, foraging, and refuge for many ecologically and commercially important shellfish and finfish. Water column properties that may affect fisheries resources include temperature, salinity, dissolved oxygen (DO), total suspended solids (TSS), nutrients (nitrogen, phosphorus), and chlorophyll a (SAFMC 1998). Other factors, such as depth, pH, water velocity and movement, and water clarity, also affect the distribution of aquatic organisms. Depending on the geographical distance to marine waters, water flow, and tides, salinity levels are wide-ranging (18−30 ppt). Saline environments have moving boundaries but are generally maintained by sea water transported through inlets by tide and wind mixing with fresh water supplied by land runoff. The water column has both horizontal and vertical components that cause seasonal variations in salinity, phytoplankton, oxygen content, and nutrients conditions (SAFMC 1998). For example, in Charleston Harbor, South Carolina watershed, water temperature varied from 4.1 in winter to 37.2°C in summer, and pH was 7.2 in summer and 7.6 in winter (Holland et al. 2004). The salinity also varied widely from 2.2 in winter to 34.4 psu in summer, which possibly was linked to evapotranspiration (Holland et al. 2004). The DO also varied by season with conditions lower in summer (51.3%) than in winter (88.9%). Estuarine water column habitat is found within the Proposed Action area.

3.2.1.5 Soft Bottom

Soft bottom habitat is unconsolidated, unvegetated sediment that occurs in freshwater, estuarine, and marine systems. Soft bottom supports a variety of macroinvertebrates, which are often the prey of demersal fish species (SAFMC 1998). This habitat type often lacks large stable surfaces for plant and animal attachment, such as rocks. In general, these areas include all wetland and deepwater habitats with at least 25 percent cover of particles smaller than stones and a vegetative cover less than 30 percent. In the tidal creeks and creek-marsh areas of the Charleston Harbor, South Carolina watershed, most of the sediment was classified as mixed bottom types (15-50 percent clays) (Sanger et al. 1999). Unconsolidated bottom consists of organic matter and the total organic content ranged from 0.7 to 6.6 percent within the Charleston Harbor watershed (Sanger et al. 1999). Shallow soft bottom habitat, usually adjacent to wetlands, is used as a nursery, refuge, and corridor/connectivity between areas for many juvenile and adult fish, such as Atlantic croaker, spot, and flounder. Soft bottom habitat is found within the Proposed Action area (**Photograph 5**).

Photo 5. Soft Bottom Habitat Within the Proposed Action Area.

3.3 HABITAT AREAS OF PARTICULAR CONCERN (HAPC)

Defined by the Magnuson-Stevens Act, HAPCs are subsets of EFH that include areas that hold a particularly important ecological function, are sensitive to human induced environmental degradation, are particularly vulnerable to development activities, or are particularly rare. The SAFMC designated HAPCs broadly to include both general habitat types (e.g., seagrass beds) and geographic areas of ecological importance. In general, HAPCs typically include high value intertidal and estuarine habitats, offshore areas of high habitat value or vertical relief, and habitats used for migration, spawning, and rearing of fish and shellfish (SAFMC 1998). In the South Atlantic region, the SAFMC designates five HAPCs: Coral Reefs/Hard Bottom, Dolphin/Wahoo, Penaeid Shrimp, Snapper/Grouper, and Spiny Lobster. Based on the geographical location, the Proposed Action is located within designated HAPC for only one species, penaeid shrimp. Habitat areas that meet the criteria for HAPC for penaeid shrimp include all coastal inlets, all state-designated nursery habitats of importance to shrimp, and state-identified overwintering areas. In South Carolina, shrimp nursery habitat is marsh areas with shell hash and mud bottom; HAPC encompasses the entire estuarine system.

3.4 FEDERALLY MANAGED SPECIES

NOAA Fisheries' authority to manage EFH is directly connected to species covered under FMPs. EFH sections of FMPs include detailed life-history and habitat information used to describe and identify EFH for federally managed species. The FMPs provided within the SAFMC's Final Habitat Plan for the South Atlantic Region describes EFH for species under the Agency's jurisdiction. Of the 80 fish and macroinvertebrates that are managed by the SAFMC, 17 species may be found within the Proposed Action area (**Table 2**). NOAA Fisheries manages EFH on the basis it can support the life-stages of managed species not the actual presence of those life-stages or species.

Table 2. Federally Managed Species That May Be Found Within the Proposed Action Area	
Common name	**Scientific name**
Shrimp	
Brown Shrimp	*Farfantepenaeus aztecus*
Pink Shrimp	*Farfantepenaeus aduorarum*
White Shrimp	*Litopenaeus setiferus*
Snapper Grouper Complex	
Jack crevalle	*Caranx hippos*
Gag grouper	*Mycteroperca microlepis*
Black sea bass	*Centropristis striata*
Mutton snapper	*Lutjanus analis*
Lane snapper	*Lutjanus synagris*
Gray snapper	*Lutjanus griseus*
Sheepshead	*Archosargus probatocephalus*
Atlantic Spadefish	*Chaetodipterus faber*
Federally Implemented FMP	
Spiny Lobster	*Panulirus argus*
Lemon Shark	*Negaprion brevirostris*
Bonnethead Shark	*Sphyrna tiburo*
Sandbar Shark	*Carcharhinus plumbeus*
Spinner Shark	*Carcharhinus brevipinna*
Tiger Shark	*Galeocerdo cuvier*

3.4.1 Penaeid Shrimp

In the southeastern United States, connecting waterbodies and inshore estuarine nursery areas are important habitat for larvae and juvenile shrimp (white, brown, and pink), while offshore marine areas are used by adult shrimp (SAFMC 1998).

Shrimp are found in estuarine and nearshore waters and depending on their life-stage can be either pelagic or demersal. In inshore waters, shrimp prefer muddy or peaty bottom that are rich in organic matter and decaying vegetation, such as the habitat found within or near the Proposed Action Area. For example, post-larval white shrimp are found near the bottom in estuary nursery areas. As juveniles, they migrate from estuarine nursery habitat to coastal water habitat. Nearshore, shrimp are most abundant on soft muddy bottom sediments. Shrimp are usually more active at night and bury into the sediment during the day. In general, adult shrimp generally inhabit nearshore waters (>27 m). Shrimp are found in South Carolina, Georgia, and northeast Florida, including the Proposed Action area.

3.4.2 Snapper/Grouper Complex

Species classified under the snapper grouper complex use pelagic and benthic habitat throughout their life cycle. Larvae are free swimming within the water column, and commonly feed on zooplankton. However, during their juvenile and adult life-stage they are primarily demersal, found in hard structure areas with moderate to high relief (SAFMC 1998). Available information indicates many species spawn throughout the year at low levels, with peak spawning occurring during the warmer months, while other species, such as gag grouper (*Mycteroperca microlepis*) (Keener et al. 1988), spawn during winter and spring. Under the Snapper/Grouper Complex, the SAFMC manages 73 species classified under 10 families. EFH for these species in South Carolina includes estuarine emergent wetlands, estuarine scrub/shrub wetlands, unconsolidated bottom, live/hard bottom, and oyster beds. Coastal inlets and oyster beds are considered

HAPC. These areas are critical for spawning, feeding, and daily movements. In South Carolina, gag grouper migrate to coastal inlets (e.g., Price Inlet) on flood tide during their post-larval stage between April and May suggesting estuarine ingress and residence is an important segment of their early life (Keener et al. 1988).

3.4.3 Sharks

Various species of small (80.01% of the catch) and large (10.79% of the catch) coastal sharks use the nearshore waters of South Carolina as nursery and foraging grounds (Ulrich et al. 2007). Ulrich et al. (2007) reported that various small coastal sharks (e.g., Atlantic sharpnose, finetooth, bonnethead, and blacknose sharks) and large coastal sharks (e.g., sandbar, blacktip, and scalloped hammerhead sharks) are found in South Carolina estuaries (Ulrich et al. 2007). In general, most sharks in South Carolina are only found in nearshore waters during the summer and fall (April−December). For instance, bonnethead sharks are found in South Carolina coastal waters from March to mid-November (Driggers III et al. 2014). Water temperature and salinity are the key environmental factors influencing presence/absence, and the relative abundance of sharks. In South Carolina, most sharks migrate from estuaries to nearshore waters in the fall and from nearshore waters to estuaries in spring when water temperatures are 28°C or colder or warmer, respectively (Ulrich et al. 2007). Although tiger sharks are common in shallow habitats (seagrasses) where they forage on various prey (Meithaus et al. 2002), they are relatively uncommon in South Carolina estuaries. Ulrich et al. (2007) reported juvenile (568-2286 mm FL) tiger shark catches in South Carolina (Bulls Bay−Port Royal Sound) represented less than one percent (n = 40) of the total catch. Overall, the results showed finetooth, blacktip, sandbar, Atlantic sharpnose, and scalloped hammerhead sharks use various South Carolina estuarine areas (Bulls Bay−Port Royal Sound) as primary nursery habitat, and lemon and spinner sharks use estuarine areas on a limited basis. Given the average mean size of bonnethead sharks, Ulrich et al. (2007) suggested South Carolina estuaries were not a primary nursery area; however, Driggers III et al. (2014) indicated the estuaries are an important feeding ground for gravid females given blue crab abundance, which are primary bonnethead prey (Ulrich et al. 2007). In fact, Driggers III et al. (2014) reported bonnethead sharks migrate to specific South Carolina estuaries on annual basis.

3.4.4 Spiny Lobster

The spiny lobster occurs throughout the Caribbean Sea, and along the shelf waters of the southeastern United States from Florida to North Carolina. Although spiny lobster are found in South Carolina waters and have designated EFH, spiny lobsters are not likely to be found in the Proposed Action area because they prefer hard substrate and more saline water habitat rather than the estuarine environment with soft substrate (i.e., mud).

4.0 ASSESSMENT OF IMPACTS

Construction and demolition related activities have the potential to impact managed species and/or EFH. Potential effects to fish and fish habitat directly related to the demolition or construction activities include water quality impairment, alteration of bottom habitat, elevated underwater sound, and displacement. Various potential impacts considered negligible or non-exist, such as permanent changes to bathymetry, hydrology, or shading of aquatic vegetation, are not analyzed in this EFH assessment.

4.1 WATER QUALITY

Construction and demolition related activities may temporarily lower surface water quality. Demolition or pile installation may briefly cause sediment resuspension and turbidity (i.e., TSS) to increase within the Proposed Action area, which could lower DO levels. Elevated turbidity plumes may last from a few minutes to several hours depending on various factors, such as sediment type and water hydrology. Potential impacts associated with elevated turbidity vary widely depending on the duration, concentration, sediment type, specific species, and life-stage (Wilber and Clarke 2007). For instance, TSS can impact (e.g., burial) benthic communities when concentrations exceed 390 mg/l (EPA 1986). NOAA Fisheries (2020) reported pile driving activities in the Hudson River caused TSS concentrations to temporarily increase between 5.0 and 10.0 milligrams per liter (mg/L) above background levels within approximately 300 ft (91.4 m) of the pile being driven. Based on available information (FHWA 2012), pile driving activities may produce similar elevated TSS concentrations in the Proposed Action Area. If piles cannot be cut at the mud-line and the direct removal method (e.g., clamshell) is used to extract piles then sediment attached to the pile will cause it to slough off under its own weight. The small resulting sediment plume would likely settle out of the water column within 24 hours. Despite this consequence, research suggest concentrations of suspended sediment must reach thousands of milligrams per liter before an acute toxic reaction is expected to fish (Burton 1993). The TSS levels expected for pile driving or removal (5.0 to 10.0 mg/L) are below those shown to have adverse effect on fish (typically up to 1,000.0 mg/L; see summary of scientific literature in Burton 1993; Wilber and Clarke 2001) and benthic communities (390.0 mg/L (EPA 1986)).

Turbidity and DO are inversely related. Thus, the DO may decrease temporarily when bottom sediments are resuspended by the Proposed Action but should return to ambient levels shortly after construction ends. In general, changes in turbidity and DO are expected to be minimal during demolition since this will occur at low tide; however, levels could be elevated during pile driving. Based on water hydrology (tidal range) in the Proposed Action area, the potential sediment plume caused by construction activities would likely settle out of the water column within a day or even sooner after completing operations. Resuspended sediments would be anticipated to disperse and dilute rapidly because of tidal mixing and the proximity to the navigation channel. It is likely the navigational channel will aid diluting any suspended sediments given the depth in the channel (~8-10 ft) and the water flow. Most of the construction and demolition activities would occur within relative proximity to the navigation channel, minimizing impacts to riverbanks and coves.

An increase in turbidity and associated lower DO has the potential to have direct effects on fish behavior, such as avoidance. However, most estuarine fish are subject to periodically short-term pulses of high suspended sediment, given the estuarine tidal environment. Most fish can tolerate some increases in turbidity, which sometimes occurs after rain events. In fact, sensitive fish can tolerate turbidity around 580.0 mg/L, with a typical value of 1,000.0 mg/L for durations of one to two days (Burton 1993; Wilber and Clark 2001). Therefore, physical impairment and injury to EFH species from increased turbidity associated with construction and demolition activities are not expected. Turbidity would decrease water clarity, which may alter fish foraging behavior and success (Breitburg 1988); however, turbidity is predicted to return to pre-construction levels within 24 hours following disturbance. Therefore, increased turbidity and lower DO levels are anticipated to be short-term and localized. Fertilization success of individual pelagic spawners and survivorship of individual pelagic larvae within the Proposed Action area could be affected by turbidity, but fish spawning occurs over broad areas and the construction footprint is small, therefore population-level adverse impacts to pelagic spawners would not be expected. Pelagic species and life stages are expected to continue using unaffected portions of the water column during and after construction. Pelagic larval and egg life stages would be carried through the Proposed Action area on prevailing currents and tides, resulting in limited exposure to construction disturbed areas with no impact expected. Despite these potential consequences associated with Proposed Action activities, most fish are mobile and will likely temporarily avoid the Proposed Action area and relocate to similar habitat within the general area, which should minimize potential impacts.

The Proposed Action activities would not alter the salinity, tidal height, water temperature, or permanently impact DO. Also, Proposed Action activities would not impact other water column properties, such as nutrients (nitrogen, phosphorus) and chlorophyll a. Overall, no permanent impacts to water quality from increased turbidity are expected in the Proposed Action area.

4.2 Benthic Habitat

The new pier would cover approximately 144 square feet (sq ft) of benthic habitat (i.e. soft bottom) permanently; however, the footprint is smaller than that of the existing pier. Based on previous research, benthic populations disturbed by major riverbed alteration (dredging) generally recover in three to five years (Navy 2019). Therefore, while direct impacts to benthic habitat (soft bottom) from in water construction would occur, it is likely it would be minor, recovering within one year (Brooks et al. 2006).

Direct impact (e.g., suffocation, burial) to the benthic community within and immediately adjacent to the pier would likely occur during the installation and demolition of the pier (piles) when direct pull methods are used to remove the piles. However, once the Proposed Action is completed, the unaffected benthic community adjacent to the Proposed Action area would likely recolonize the disturbed area in about a year given the demolition and pile driving activities are much less invasive than dredging; benthic communities can generally recover in less than one year after minor bottom alterations (Diaz et al. 2004; Brooks et al. 2006).

Indirect impacts on benthic habitat and organisms during construction are likely to result from turbidity and resuspended sediments caused by pile installation/removal, and excavation. Finer sediments, such as silt and clay, would be suspended in the water column and settle on the benthic community in adjacent and undisturbed areas. Suspension feeders (i.e., bivalves) and surface deposit feeders (i.e., polychaetes) would be the most susceptible to burial. Re-colonization of the substrate within the buried areas would occur via larval recruitment and movement of benthic organisms from the surrounding area (Navy 2019). Soft-bottom benthic communities are very resilient to habitat disturbance from anthropogenic activities (Diaz et al. 2004; Brooks et al. 2006). Therefore, indirect impacts from turbidity and resuspended sediments may temporarily, but not permanently affect benthic habitat. Permanent shading impacts from increased overwater coverage is not expected since the new pier is smaller than the existing pier.

4.3 MARINE VEGETATION

The closest marine intertidal vegetation to the existing pier is approximately 120 feet (36.6 m) to the west of the Proposed Action area. Increased turbidity and associated sedimentation from Proposed Action construction/demolition has the potential to impact salt marsh habitat if sediment deposition smothers or covers the salt marsh for an extended time period. However, the expected turbidity and sedimentation is comparable to what might be circulated through a typical storm event; it is estimated 27% of sediment deposited is attributed to storm events (Christiansen 1998). Even if some sediments are deposited on the salt marsh within the Proposed Action area, it is likely it will have no impact since salt marshes can tolerate elevated sedimentation. In general, nutrients and organic matter are often transported during the tidal flow, which generally temporarily elevates turbidity. Appropriate BMPs to minimize turbidity within the area would be used. Given the relatively fast transitioning tidal phase, it is likely many Proposed Action activities will occur on ebb tide (i.e. falling tide), which should minimize impacts to marine vegetation within the Proposed Action area since sediment concentrations are generally higher on a rising tide than on a falling tide (Christiansen 1998). Overall, Proposed Action activities would not alter marine vegetation within the Proposed Action area.

4.4 UNDERWATER SOUND

The existing structure will be demolished using demolition jaws to cut/crush concrete with pile removal done by direct pull methods. Therefore, noise from demolition activities would be minimal. However, pile installation using an impact hammer would generate temporary construction-related underwater noise that may impact estuarine fishes. Construction-related noise will permeate both aquatic (underwater) and terrestrial (in-air) environments and may carry into the surrounding environment beyond the Proposed Action site. The peak sound pressure levels from driving piles varies by pile size and material. In general, levels at 10 m range from 177 decibels (dB) for a 12- to 14-inch wood pile to 220 dB for a 96-inch steel pile; driving concrete piles generates sound less than steel (Caltrans 2009). The peak sound pressure level for a 24-inch concrete pile is approximately 183/193 dB or 171/175 sound pressure level (Caltrans 2009). Iafrate et al. (2016) reported high-pressure jetting and impact hammer driving 16-inch concrete piles into fine sediment sand or muddy sand averaged around 157 dB re 1 uPa (peak). Construction of the new pier would require installation of up to 250 14-inch square concrete piles using an impact pile driver (**Table 3**).

	Table 3. Construction of New Pier Pile Installation Activity						
Facility	**Method of Pile Driving**	**Pile Size and Type**	**Number of Sheets (pairs)/Piles**	**Pile Strikes per Pile**	**Minutes to drive a single pile**	**Maximum number of piles installed each day**	**Minimum number of days of pile driving required**
Construction of New Pier	Impact	14-inch Square Concrete	250*	45	NA	25	10
	Impact	30-inch steel pipe	12	45	NA	3	4
	Vibratory	30-inch steel pipe	12	NA	30	3	4

Source: Cardno 2021. * Note this is the total proposed number of piles installed which includes those piles installed in the dry (exposed mud). This total number was used to be conservative. NA – Not applicable

To estimate sound source levels for pile driving activities proposed for the Proposed Action, available documentation for proposed actions that are most similar to the Proposed Action in terms of the type and size of pile, method of installation, and substrate conditions were reviewed to identify the most relevant proxy sound source levels (**Table 4).**

Table 4. Underwater Sound Pressure Levels from Similar Construction Activities and Recommended Proxy Source Levels						
			Sound Pressure Levels (SPL) or Sound Exposure Level (SEL) at 10 meters distance			
Proposed Action and Location	**Pile Size, Type**	**Installation Method**	**Water Depth (meters)**	**Average Peak SPL, dB re 1 µPa**	**Average Root Mean Square SPL, dB re 1 µPa**	**Average SEL, dB re 1 μPa^2-sec**
Noyo Harbor, Fort Bragg, CA[1]	14-inch square concrete	Impact	2-3	183	157	146
Naval Base Point Loma, CA[2]	30-inch steel pipe	Impact	NP	211	196	181
Naval Base Kitsap, WA[3]	30-inch steel pipe	Vibratory	NP	NA	167	167

Sources: [1] = Caltrans 2015; [2] = NAVFAC SW 2020; [3] = Navy 2015
Notes: All sound pressure levels (SPLs) are unattenuated;
Legend: dB=decibels; rms = root mean square, SEL = sound exposure level; dB re 1 µPa = dB referenced to a pressure of 1 microPascal, measures underwater SPL. dB re 1 µPa2-sec = dB referenced to a pressure of 1 microPascal squared per second. Single strike SEL are the proxy source levels presented for impact pile driving and are used to calculate distances to permanent threshold shift (PTS). NA = Not applicable; NP = Not provided

The proposed pile size and type that would be used for construction of the new pier is a 14-inch square concrete pile with up to approximately 250 piles installed via impact pile driving methods. Due to tidal fluctuation in the project area, the maximum depth at which underwater construction noise may occur is at 2 feet (or less than 1 meter). Only one proxy source level was found for the 14-inch square pile size and is provided for installation in water depths that are slightly deeper than the project area. Installation of dolphins will be composed of 30-inch steel pipe piles installed via both vibratory and impact pile driving methods. The Transmission Loss (TL) formula was applied to estimate the distance to thresholds for fish:

$$Transmission\ Loss\ (TL) = 15 * Log10[radius]$$

To calculate distance to thresholds, the number of pile strikes per pile were incorporated.

Underwater noise can cause a variety of impacts and injuries to marine fauna depending on the sound level, duration, and other factors (Hastings and Popper 2005). Also, sensitivity to underwater sound differs among fishes, and impacts can vary by body size; smaller fish are more vulnerable (Caltrans 2009). Underwater sound can cause a variety of direct and indirect (hemorrhage, embolism, visceral damage, and stress) impacts, such as barotrauma injury to the swim bladder, resulting from quick changes in the ambient pressure (Hastings and Popper 2005). Swim bladders are the most common organ damaged because most fish have swim bladders that are filled with gas and thus a rapid change in pressure (pressure wave) from a blast can directly damage (e.g., tear, rupture, and over inflation) it by forcing it to burst outward (Hastings and Popper 2005). Generally, the greatest risk associated with underwater sound from pile driving is the distance to the sound source, but often underwater sound can cause behavioral changes, such as avoiding or moving away from the sound source (Iafrate et al. 2016).

To assess potential impacts associated with underwater noise generated by Proposed Action activities, the model for fish, and criteria and thresholds from the *ANSI Sound Exposure Guideline* technical report (Popper et al. 2014) was used to calculate the estimated distance to thresholds for fish (Cardno 2021). Criteria and thresholds to estimate impacts from sound produced by impact pile driving activities are presented in **Tables 5 and 6**. Consistent with Popper et al. (2014), dual metric sound exposure criteria were used and it was assumed that a specified effect would occur when either the cumulative sound exposure level (SEL) or peak sound pressure level (SPL) was met or exceeded. Using this approach, guidelines (**Table 5**) were developed for mortality, the lowest level where injury (i.e. recoverable injury) could occur, and the onset of temporary threshold shift (TTS).

Table 5. Sound Exposure Criteria for Fish Mortality, Recoverable Injury, and TTS from Impact Pile Driving 14-inch Square Concrete Piles										
Fish Hearing Group	**Onset of Mortality**				**Recoverable Injury**				**TTS**	
	Threshold SEL_{cum}	**Distance to Threshold**	**Threshold SPL_{peak}**	**Distance to Threshold**	**Threshold SEL_{cum}**	**Distance to Threshold**	**Threshold SPL_{peak}**	**Distance to Threshold**	**Threshold SEL_{cum}**	**Distance to threshold**
Fishes without a swim bladder	> 219 dB	0	> 213 dB	0	> 216 dB	0	> 213 dB	0	NC	0
Fishes with a swim bladder not involved in hearing	210 dB	0	> 207 dB	0	203 dB	0	203 dB	0	> 186 dB	2 m
Fishes with a swim bladder involved in hearing	207 dB	0	>207 dB	0	203 dB	0	> 207 dB	0	186 dB	2 m

Source: Popper et al. 2014; Cardno 2021.

Legend: m = meters; SELcum = Cumulative sound exposure level (decibel referenced to 1 micropascal squared seconds [dB re 1 µPa2-s]), SPLpeak = Peak sound pressure level (decibel referenced to 1 micropascal [dB re 1 µPa]), ">" indicates that the given effect would occur above the reported threshold. NC = effects from exposure to sound produced by impact pile driving is considered to be unlikely, therefore no criteria are reported, TTS = Temporary Threshold Shift > indicates that the given effect would occur above the reported threshold. Distances are for 14-inch square concrete pile; a maximum of 1,125 strikes in a day and 25 piles installed/day.

Table 6. Sound Exposure Criteria for Fish Mortality, Recoverable Injury, and TTS from Impact Pile Driving 30-inch steel pipe

Fish Hearing Group	Onset of Mortality				Recoverable Injury				TTS	
	Threshold SEL_{cum}	Distance to Threshold	Threshold SPL_{peak}	Distance to Threshold	Threshold SEL_{cum}	Distance to Threshold	Threshold SPL_{peak}	Distance to Threshold	Threshold SEL_{cum}	Distance to threshold
Fishes without a swim bladder	> 219	1 m	> 213	7 m	> 216	1 m	> 213	7 m	NC	0
Fishes with a swim bladder not involved in hearing	210	3 m	> 207	18 m	203	9 m	203	34 m	> 186	122 m
Fishes with a swim bladder involved in hearing	207	5 m	>207	18 m	203	9 m	> 207	18 m	186	122 m

Source: Popper et al. 2014

Legend: m = meters; SEL_{cum} = Cumulative sound exposure level (decibel referenced to 1 micropascal squared seconds [dB re 1 μPa^2-s]), SPL_{peak} = Peak sound pressure level (decibel referenced to 1 micropascal [dB re 1 μPa]), ">" indicates that the given effect would occur above the reported threshold. NC = effects from exposure to sound produced by impact pile driving is considered to be unlikely, therefore no criteria are reported, TTS = Temporary Threshold Shift > indicates that the given effect would occur above the reported threshold. Distances are for 30-inch steel pile; A maximum of 135 strikes in a day and 3 piles installed/day.

As part of the assessment, it was assumed that if the received SEL from an individual pile strike was below a certain level, then the accumulated energy from multiple strikes would not contribute to injury, regardless of how many pile strikes occur (Cardno 2021). This SEL is referred to as "effective quiet" and is assumed to be 150 dB (referenced to a pressure of 1 microPascal squared per second [re: 1 µPa2-sec]). Effective quiet establishes a limit on the maximum distance from the pile where injury to fishes is expected – the distance at which the single strike SEL attenuates to 150 dB. Beyond this distance, no physical injury is expected, regardless of the number of pile strikes.

Based on acoustic models for the Proposed Action (Cardno 2021) and BMPs (e.g., a soft start for impact pile driving), the sound generated from driving concrete piles will likely be lower than thresholds to impact fishes. Thus, it is anticipated the underwater sound generated from impact driving 14-inch concrete piles will not adversely impact marine fishes because they will not likely detect the sound or temporarily move away from the underwater sound.

4.5 DISPLACEMENT

Fish will likely be temporarily displaced from various demolition and construction activities associated with the Proposed Action. For example, underwater sound may cause behavioral changes in marine fishes, which can vary from impaired startle response, freeze response, and increased swimming speed to avoid the source. However, potential impacts can be wide-ranging. Iafrate et al. (2016) found that the underwater sound generated from driving 16-inch concrete piles (35-day event) did not adversely impact sheepshead. In fact, the mean number of sheepshead per day was similar before, during, and after pile driving. The researchers reported that some sheepshead remained in the exposure area during pile driving, while a few departed and did not return until 21 days after pile driving. In contrast, the number of grey snapper declined from 5.6 per day before pile driving to 1.8 per day after. Most grey snapper departed the exposure area, but one remained until after pile driving ended. Overall, Iafrate et al. (2016) concluded sheepshead were not displaced from prolong exposure to pile driving (157 dB re 1 uPa (peak) per pile strike or 162 dB re 1 μPa^2 s cumulative SEL per pile), but there was some evidence that gray snapper were temporarily displaced. Although statistical power was low (limited number of monitored fish), the researchers indicated it was unlikely pile driving caused mortality or injury to sheepshead and grey snapper. They indicated that moderate to high behavioral impacts extended around 225 m from the source. Iafrate et al. (2016) suggested snapper were more likely to depart an area with pile driving disturbance than sheepshead but were less at risk for behavioral impact since the species has a lower site fidelity; grey snapper were more transient in the area.

Construction and demolition-related activities may temporarily cause marine fishes to move away from the site. Fish present in the Proposed Action area may move away or avoid the area and could have short-term effects on the ecological dynamics within the existing habitat; however, these potential changes will likely be short-term and not have any long-term or permanent effects following Proposed Action completion. Most of the aquatic organisms are highly mobile and would move away or avoid the impacted area during periods of elevated underwater sound. Potential indirect effects from in-water construction disturbances are predominantly related to short-term predator prey relationships with altered fish behavior potentially occurring within the action area during the Proposed Action activities. Displaced species would find suitable habitat in adjacent areas to rest and forage. Based on available information, it is likely fish displaced temporarily from the habitat would return to the area post construction at about 30 days (Iafrate et al. 2016).

Overall, the Proposed Action may have some potential impacts and EFH (**Table 6**) but expected impacts will be minimal and temporary. Essential fish habitats are expected to recover, with timing of recovery depending on the impact (See discussion in proceeding sections). Proposed mitigation measures are also expected to reduce potential impacts (**Table 7**).

Table 7. Potential Effects of the Proposed Action Activities on FMP Species

Proposed Action Activity	Impact Assessment
Pile Driving	Water Column Underwater Noise
	Displacement from Water Column
	Displacement from Benthic Foraging Habitat
	Water Column Turbidity/Sedimentation
	Alteration of Benthic Habitat
	Alteration of Benthic Habitat from Sedimentation
Pile Removal	Displacement from Water Column
	Displacement from Benthic Foraging Habitat
	Alteration of Benthic Habitat from Sedimentation
	Water Column Turbidity/Sedimentation

5.0 PROPOSED MITIGATION

Impacts to EFH would be minimized through the design and sequencing of the proposed in-water activities to avoid impacts on EFH and managed species to the extent practicable. Impacts on sensitive habitats, including EFH, would also be avoided to the extent practical by implementing BMPs during construction and following all state and federal requirements (**Table 7**).

Table 8. Best Management Practices

BMP	Description	Impacts Reduced/Avoided
General Construction BMPs	These requirements are incorporated into the Proposed Action work contract and include adherence to Clean Water Act permit requirements, spill containment, spill response, construction equipment requirements.	Reduces potential water column EFH impacts.
General Piling Removal BMPs	Contractor will assess the condition of the piling and either remove it using a barge or upland equipment. The work plan must include procedures for extracting and handling pilings that break off and limit partial removal. Contractor should slowly remove piling. Pilings should not be shaken, or material removed during demolition. If clamshell bucket is used, extraction should be conducted during the best tidal conditions.	Reduces potential water column EFH impacts

Table 8. Best Management Practices		
BMP	**Description**	**Impacts Reduced/Avoided**
Soft start for impact pile driving	A soft start procedure will be used for impact pile driving at the beginning of each day's in-water pile driving or any time pile driving has ceased for more than 30 minutes. Soft start will consist of an initial set of strikes from the impact hammer at reduced energy, followed by a 30-second waiting period, then two subsequent sets. (The reduced energy of an individual hammer cannot be quantified because it varies by individual drivers. Also, the number of strikes will vary at reduced energy because raising the hammer at less than full power and then releasing it results in the hammer "bouncing" as it strikes the pile, resulting in multiple "strikes"). This will allow for animals to leave the Proposed Action vicinity before sound pressure increases.	Minimizes impacts to managed fish species and water column EFH.

6.0 THE EFFECTS OF THE ACTION: SUMMARY AND CONCLUSIONS

A summary of the EFH impact evaluation process is summarized in **Table 6**. Potential impacts are listed by type and nature (i.e., significance of effects). Based on the assessment, potential impacts are expected to be temporary. The potential impacts are expected to be minimized by the proposed BMPs or are negligible considering the localized effects of the Proposed Action.

The potential for adverse impacts to fish with EFH designated in the Proposed Action area is likely to differ from species to species, depending upon life history, habitat use (demersal vs. pelagic), and distribution and abundance. It is anticipated that short-term impacts to older life-stages (e.g., juveniles and adults) of fish (both pelagic and demersal) will be limited to temporary displacement from the Action Area. Juvenile and adult stages would likely leave the construction areas and move to nearby unaffected habitat during construction given the minimal increase in turbidity, sedimentation, and underwater sound. Impacts to these life stages would consist of a temporary displacement and a temporary loss of a very small portion of food/foraging area. Potential impacts could impact species (fish and invertebrates) with demersal eggs/larvae as they would be subjected to sedimentation or potential crushing from the new piles, but it is likely this will be minimal given the small footprint. In contrast, species with pelagic larvae and eggs are not expected to be impacted because they will continue be carried through the Proposed Action area with prevailing tides, currents, and wave action should spawning take place during the Proposed Action period and within or vicinity of the Proposed Action area.

Overall, the Proposed Action will not substantially adversely affect EFH. The Proposed Action may cause minimal and temporary impacts, but they will not have any lasting direct or indirect effect upon the status or sustainability of managed species or their habitat.

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