REQUEST FOR AN INCIDENTAL HARASSMENT AUTHORIZATION UNDER THE MARINE MAMMAL PROTECTION ACT FOR THE WHARF C-2 RECAPITALIZATION PROJECT AT NAVAL STATION MAYPORT, FLORIDA NAVY REGION SOUTHEAST

Submitted to:

Office of Protected Resources,
National Marine Fisheries Service,
National Oceanographic and Atmospheric Administration

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Table of Contents

List of Appendices iv

1. Description of Activities 1
   1.1. Proposed Action 1
   1.2. Project Description 1
2. Location and Duration of Activities 9
3. Marine Mammal Species and Numbers 13
4. Affected Species Status and Distribution 15
   4.1. North Atlantic Right Whale 15
   4.2. Humpback Whale 16
   4.3. Atlantic Spotted Dolphin 17
   4.4. Bottlenose Dolphin 17
5. Incidental Take Authorization Requested 19
6. Numbers and Species Taken 22
7. Impacts to Marine Mammal Species or Stocks 37
   7.1. Physiological Responses 37
   7.2. Behavioral Responses 38
   7.3. Conclusions Regarding Impacts to Species or Stocks 40
8. Impact on Subsistence Use 41
9. Impacts to Marine Mammal Habitat and the Likelihood of Restoration 42
10. Impacts to Marine Mammals from Loss or Modification of Habitat 43
11. Means of Affecting the Least Practicable Adverse Impacts – Minimization Measures 44
    Standard Conditions 46
    Data Collection 50
    Interagency Notification 50
    Reporting 51
12. Minimization of Adverse Effects on Subsistence Use 52
13. Monitoring and Reporting Measures 53
14. Research 54

References 55

List of Preparers 66

List of Figures

Figure 1-1. Lateral View of Project Plan 2

Figure 1-2. Vibratory Installation of Sheet Pile at NAVSTA Mayport 4

Figure 1-3. Sheet and King Piles at NAVSTA Mayport 6

Figure 1-4. Polymeric Fender Piles 6

Figure 2-1. Wharf C-2 Project Regional Overview 10

Figure 2-2. Wharf C-2 Recapitalization Project Area 11

Figure 2-3. 2012 Monthly Water Temperatures at Bar Pilot's Dock, Florida 11

Figure 6-1. Injury and Behavioral Zones of Influence for Marine Mammals - Vibratory Driving of Steel King and Sheet Piles 34

Figure 6-2. Injury and Behavioral Zones of Influence for Marine Mammals - Impact Driving of Steel King and Sheet Piles (Contingency Only) 35

Figure 6-3. Behavioral Zone of Influence for Marine Mammals - Vibratory Driving of Polymeric Piles 36

Figure 11-1. Shutdown Zones for Vibratory and (Contingency Only) Impact Pile Driving 48

List of Tables

Table 1-1. Pile Descriptions 5

Table 2-1. Minimum and Maximum Surface and Bottom Salinities 12

Table 3-1. Species Potentially Occurring in the Project Area 14

Table 5-1. Species Densities 19

Table 5-2. Estimated Marine Mammal Exposures 21

Table 6-1. Representative Levels of Noise from Anthropogenic Sources 27

Table 6-2. Comparison of Pile Sizes and Shapes for Estimating Source Sound Pressure Levels 29

Table 6-3. Vibratory Installation Underwater Sound Pressure Levels Expected Based on Similar In-Situ Monitored Construction Activities 30

Table 6-4. Impact Installation Underwater Sound Pressure Levels Expected Based on Similar In-Situ Monitored Construction Activities 31

Table 6-5. Calculated Distances to / Areas Encompassed by the Underwater Marine Mammal Noise Thresholds for Pile Driving 33

List of Appendices

Appendix A: Sample Photos of Wharf C-2 Deterioration
Appendix B: Contractor’s Project Schematic
Appendix C: Standard Manatee Conditions
Appendix D: Fundamentals of Acoustics
Appendix E: NAVSTA Mayport Turning Basin Map
Appendix F: Raw Survey Data Sheets

List of Acronyms

B	logarithmic loss
BMP	best management practice
C	linear (scattering and absorption) loss
C-2	Charlie 2
CFR	Code of Federal Regulations
CV	coefficient of variation
dB	decibel
dBA	decibel (A-weighted)
ft.	feet
FR	Federal Register
h	height
HDPE	high-density polyethylene
Hz	Hertz
in.	inch
km	kilometer
kHz	kiloHertz
µPa	microPascal
m	meter
MLLW	mean lower low water
MMPA	Marine Mammal Protection Act
MSDD	Marine Species Density Database
NAVFAC	Naval Facilities Engineering Command
NAVFAC SE	Naval Facilities Engineering Command, Southeast
n.d.	no date
NMFS	National Marine Fisheries Service
NS	Naval Station
POC	point of contact
PTS	permanent threshold shift
R_1	range from source in meters
R_2	range from driven pile to original measurement location
rms	root-mean-square
SPL	sound pressure level
SSP	steel sheet pile
TL	transmission loss
U.S.	United States
USFWS	United States Fish and Wildlife Service
W	width
YONAH	Years of the North Atlantic Humpback

Executive Summary

In accordance with the Marine Mammal Protection Act of 1972, as amended, the United States Navy is applying for an Incidental Harassment Authorization to perform recapitalization of Wharf C-2 at Naval Station Mayport, Florida. Five species of marine mammals may be present within the waters surrounding Naval Station Mayport: the North Atlantic right whale (*Eubalaena glacialis*), the humpback whale (*Megaptera novaeangliae*), the bottlenose dolphin (*Tursiops truncatus*), the Atlantic spotted dolphin (*Stenella frontalis*), and the West Indian manatee (*Trichechus manatus*). These species may occur year-round with the exception of North Atlantic right whales, which are more likely to occur between November and April due to close proximity of calving waters. The West Indian manatee is not regulated by National Marine Fisheries Service and therefore is not considered in this application.

The Navy proposes installation of approximately 120 single sheet piles, 119 king piles and 50 polymeric (plastic) fender piles as a part of the overall recapitalization project at Wharf C-2. The project may require up to 18 months for completion; in-water activities are limited to a maximum of 70 days. All piles will be driven with a vibratory hammer. Impact driving will be a contingency employed only if vibratory methods are inadequate; a similar project that has been completed at adjacent Wharf Charlie One required impact pile driving on only seven piles. Contingency dredging of up to 4,000 cubic yards of sediment may be conducted if needed; a clamshell dredge would be used if dredging were performed.

The Navy used National Marine Fisheries Service promulgated thresholds for assessing pile driving impacts (National Marine Fisheries Service 2005b; 2009), outlined in Chapter 6. The Navy used the practical spreading loss equation for underwater sounds and empirically measured source levels from other similar pile driving events to estimate potential marine mammal exposures. Predicted exposures are described in Chapter 5. Modeling predicted no Level A harassments (injury) would occur, but 365 Level B harassments (behavior) may occur for bottlenose dolphins and 95 Level B harassments may occur for Atlantic spotted dolphins as a result of pile driving activities associated with the Wharf C-2 recapitalization project. Conservative assumptions (including marine mammal densities) used to estimate the exposures have likely overestimated the potential number of exposures and their severity.

Pursuant to the Marine Mammal Protection Act Section 101(a)(5)(D), the Navy submits this application to the National Marine Fisheries Service for an Incidental Harassment Authorization for the incidental taking of bottlenose dolphins and Atlantic spotted dolphins during pile driving activities as part of the Wharf C-2 Recapitalization project between December 2013 and November 2014. Takes would be in the form of non-lethal, temporary harassment and are expected to have a negligible impact on these species. In addition, takes would not have an immitigable adverse impact on the availability of these species for subsistence use.

1. Description of Activities

A detailed description of the specific activity or class of activities that can be expected to result in incidental taking of marine mammals.

Pursuant to the Marine Mammal Protection Act (MMPA) Section 101(a)(5)(D), the Navy submits this application to National Marine Fisheries Service for an Incidental Harassment Authorization for the incidental, but not intentional, taking of marine mammal species during pile driving activities associated with the Wharf Charlie 2 (C-2) Recapitalization project (Project) at Naval Station (NAVSTA) Mayport between 1 December 2013 and 30 November 2014. 50 Code of Federal Regulations (CFR) 216.104 sets out 14 specific items that must be included in requests for take pursuant to Section 101(a)(5)(A) of the MMPA.

1.1. Proposed Action

The proposed action is the recapitalization, or renovation, of Wharf C-2 at NAVSTA Mayport. This recapitalization project includes the demolition and replacement of the existing concrete pile cap, wharf deck and utilities at Wharf C-2. The project will include installation of approximately 120 single sheet piles, 119 king piles and 50 polymeric (plastic) fender piles. Up to 30 existing timber piles will be removed by cutting or pulling with a crane prior to installation of the new piles. Details and pile descriptions are discussed in Section 1.2 below. Construction of the wharf will occur over an 18 month period projected to begin on or after 1 December 2013; however, in-water work is expected to be completed within 12 months. A maximum of 70 days of in-water pile driving work will take place over the twelve month period. Piles will be driven using vibratory driving methods, although the seldom use of impact driving may also be required when vibratory driving is insufficient (A similar project that has been completed at adjacent Wharf Charlie One required impact pile driving on only seven piles). Section 1.2 describes the elements of the proposed action in more detail.

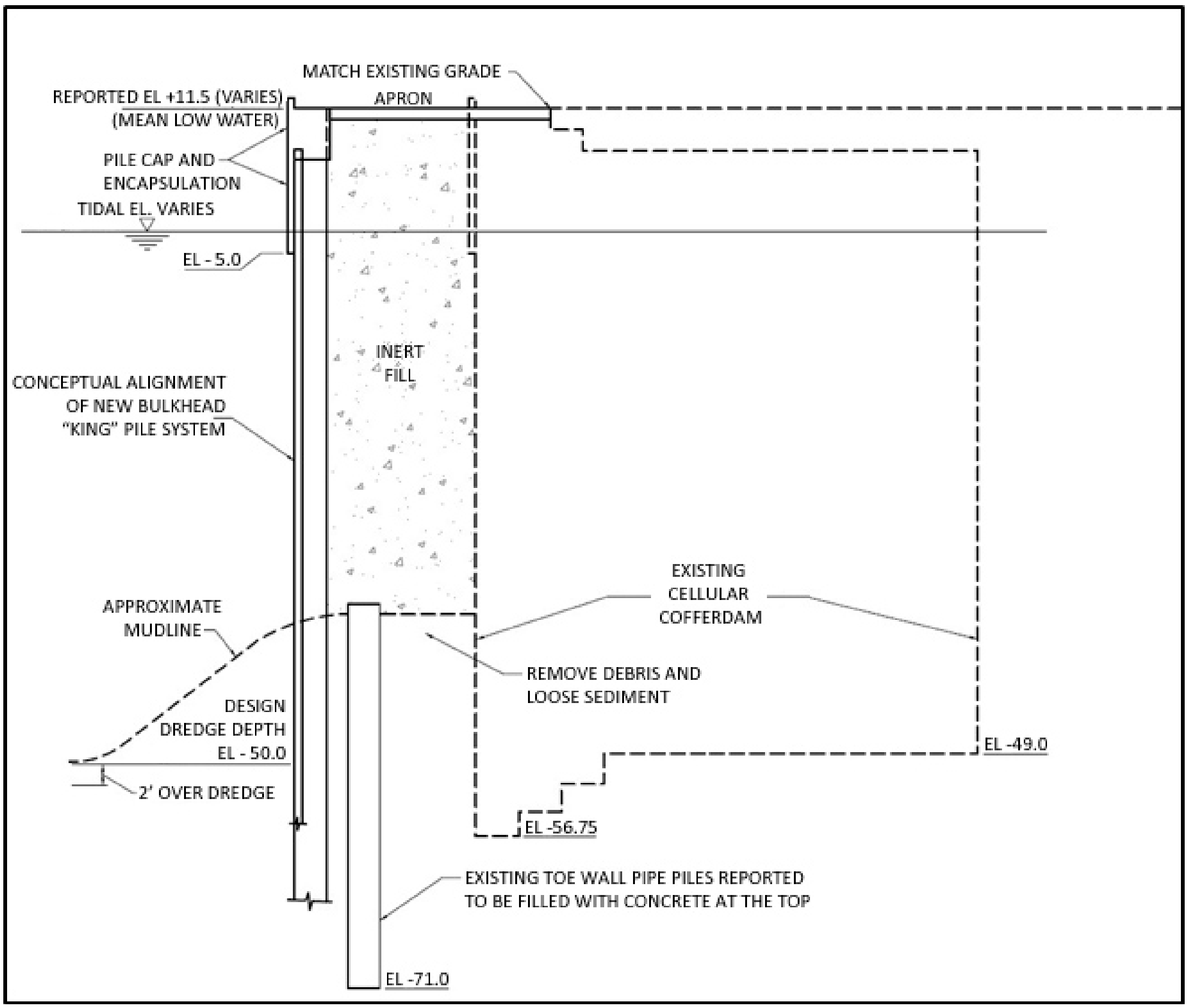
1.2. Project Description

Wharf C-2 is a single level, general purpose berthing wharf constructed in 1960. It is 608 feet (ft.) long, 125 ft. wide, and has a berthing depth of 52 ft. mean lower low water (MLLW). The wharf is one of two primary deep draft berths, and is one of the primary ordnance handling wharfs for NAVSTA Mayport. The wharf is a diaphragm steel sheet pile cell structure with a concrete apron, partial concrete encasement of the piling and an asphalt paved deck. Currently, the wharf is in poor condition due to the advanced deterioration of the steel sheeting and lack of corrosion protection. Due to the structural deterioration of the wharf, load restrictions have been instituted limiting loads to a maximum of 4,500 pounds within 60 ft. of the face of the wharf.

Appendix A contains photos of existing damage and deterioration at the wharf, and Appendix B is a contractor schematic of the Project plan.

The Navy will install a new steel king pile/sheet pile (SSP) bulkhead at Wharf C-2. An SSP system consists of large vertical king piles with paired steel sheet piles driven in between and connected to the ends of the king piles. The wall will be anchored at the top and fill consisting of clean gravel and /or flowable concrete fill is placed behind the wall. A concrete cap will be formed along the top and outside face of the wall to tie the entire structure together and provide a berthing surface for vessels (Figure 1-1). The new bulkhead will be designed for a 50-year service life.

FIGURE 1-1. LATERAL VIEW OF PROJECT PLAN



Construction activities include:

- demolition of the existing concrete pile cap, wharf deck and utilities (including laterals and igloos);
- removal of existing timber fender pilings;
- installation of a new steel combination wall with tieback anchors;
- placement of a combination of self-hardening fill, flowable fill, and clean fill between existing and new walls;
- installation of a new concrete cap which partially encases the new steel wall;
- installation of a sacrificial anode cathodic protection system for the new steel wall;
- installation of new polymeric fender piles;
- installation of new foam filled fenders;
- installation of new utilities (including lateral supply lines from utilities such as water, fuel and electrical);
- repair of the wharf deck by milling and re-paving;
- replacement of lighting fixtures on galvanized steel standards
- replacement of security fencing; and
- installation of a stormwater treatment basin.

The following steps describe the construction sequence for placing the new SSP system in front of the existing deteriorated wall.

Preparation and Demolition

Existing underwater obstructions and debris (such as broken timber piles or segments of ship rails) interfering with the installation of the new SSP wall will be removed utilizing divers and cranes. Up to 30 timber piles will be removed from the activity area using a crane. The points where the new SSP is to attach to the existing sheet pile wall will be demolished above and below the waterline to expose the existing steel and any marine growth is removed from the existing wall. Along the face of the existing wall, the curb and a portion of existing concrete cap will be removed to accommodate the new concrete pavement will be placed between the new wall and the existing wall. The concrete apron along the waterside perimeter of the wharf and the utilities (including laterals and igloos) will be removed. Utilities to be installed include water, steam, fuel, waste, electrical and communications.

Installation of a New Bulkhead

Barges will be used in lieu of shore-based equipment due to weight bearing and structural integrity issues on Wharf C-2. A crane barge with a pile installation suite (pile leads, vibratory hammer and an impact hammer) will mobilize to the project site with a material barge. A pile driving template (approximately 50 ft. in length) will be mounted to the crane barge; this allows the crane barge to control the alignment of the piles as they are driven. Once the crane barge is properly aligned, the king piles will be driven to the appropriate depth using the vibratory driver

(Figure 1-2). Sheet piles will be driven in pairs between the king piles to complete the template[1]. A total of approximately 120 single sheet piles and 119 king piles will be installed. Figures 1-3 and 1-4, and Table 1-1, illustrate pile types for the Wharf C-2 project. Installation of up to three templates per pile-driving day is anticipated. Impact pile driving would only be used as a contingency in cases when vibratory driving is insufficient (A similar project that has been completed at adjacent Wharf Charlie One required impact pile driving on only seven piles). Once all of the piles are driven, closure plates will be attached between the existing adjacent sheet pile wall and the new wall end terminations. Typically, these are welded in place using underwater welding techniques. Approximately 50 polymeric fender piles will also be installed using vibratory driving.

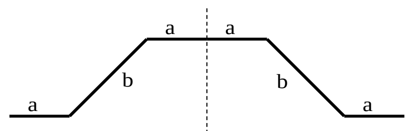
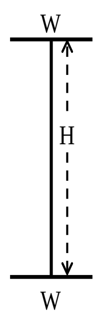
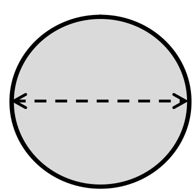
In general, the pile-driving process begins by placing a choker cable around a pile and lifting it into vertical position with a crane. The pile is then lowered into position inside the template and set in place at the mud line. During vibratory driving, the pile is stabilized by the template while the vibratory driver installs the pile to the required tip elevation. Once piles are in position, vibratory installation would take less than 60 seconds to reach the required tip elevation. Time intervals between driving of each pile pair will vary, but will be a minimum of several minutes due to time required for positioning, etc.

Impact hammers have guides holding the hammer in alignment with the pile while a heavy piston moves up and down, striking the top of the pile, driving the pile into the substrate from the downward force of the hammer.

FIGURE 1-2. VIBRATORY INSTALLATION OF SHEET PILE AT NAVSTA MAYPORT

[1] Templates are prefabricated or site constructed steel frames into which piles are set to hold piles in the proper position and alignment during driving (Hannigan 2011).

TABLE 1-1. PILE DESCRIPTIONS

PILE TYPE AND DETAILS	SHAPE AND DIMENSIONS	ESTIMATED DISTURBANCE FOOTPRINT
AZ19-700 SHEET PILE PAIR A pile in the form of a plank driven in close contact or interlocking with others to provide a tight wall to resist the lateral pressure of water, adjacent earth, or other materials. A sheet pile may be tongued and grooved if made of timber or concrete, or interlocking if made of metal. Linear length=4×a+2×b = 70.4 in a = 6.81 in b = 21.6 in		Area = W × H W = 55.12 in H = 16.56 in 55.12 in × 16.56 in = 912 in^2 = 0.59 m^2
HZ1080 MB KING PILE In strutted sheet pile excavation, a long guide pile driven at the strut spacing in the center of the trench before it is excavated. Linear length=2×W+H = 77.2 in W = 7.87 in H = 41.47 in		Area = W × H = 7.87 in × 47.47 in = 326 in^2 = 0.21 m^2
CIRCULAR POLYMERIC FENDER PILE Polymeric piles have been used primarily for corner protection, as secondary fender piles, and as primary fender piles for small craft facilities. Diameter = 12 in Circumference = Diameter×π = 37.7 in		Area = $\pi \times r^2$ = $\pi \times 36$ = 113 in^2 = 0.07 m^2

Sources: Dictionary of Construction 2013 and Integrated Publishing 2013.

FIGURE 1-3. SHEET AND KING PILES AT NAVSTA MAYPORT

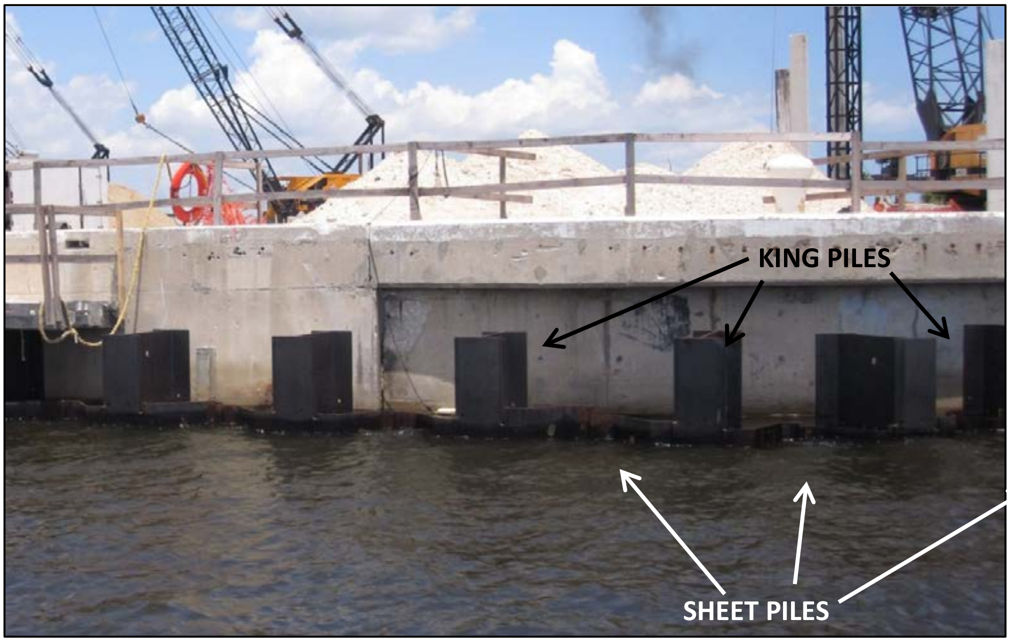


FIGURE 1-4. POLYMERIC FENDER PILES

Installation of Anchors

There are multiple types of anchoring systems utilized for a sheet pile wall, including a grouted soil anchor system and a tie back wall system. Anchor rods will be installed from the new SSP wall to the anchor system. This requires drilling through the old wall to the anchor location behind the wall. In general, this anchor location may lie 40-60 feet behind (shoreward) the existing wall. After the anchor holes are driven, the anchors are placed in the holes and either the end of the anchor is grouted into the soil or the end of the anchor is attached to the tie back wall system. The tie back wall system normally consists of sheet piles of shortened lengths that are buried below grade.

Placement of Fill

After the anchors are installed, fill operations will be conducted behind the new wall. This consists of placement of either gravel fill or concrete flowable fill into the space behind the wall; trapped water behind the wall is displaced.

Form and Placement of Pile Cap

After the fill operation has been completed, the concrete pile cap will be formed and placed along the top of the new SSP wall. This consists of installing either wood or steel forms along the top of the wall down to some point below mean low water elevation. Water is removed from the forms, steel reinforcement is placed in the forms, and concrete is poured to the required elevations. After the concrete has cured sufficiently, the forms are removed. A total of 50 polymeric (plastic) fender piles will then be installed.

Deck and Utility Placement

After the pile cap is in place, a new reinforced concrete apron will be installed and the wharf deck repaired by milling and paving. A new high mast lighting system, new security fencing, and new utilities will be installed to replace those that were removed.

Stormwater Bioretention Basin

Construction will result in an increase to impervious surface of 10,100 square feet (.23 acres) located between the existing bulkhead and the new bulkhead. This would cause a slight decrease in infiltration of precipitation and result in localized impacts to stormwater flow in the basin. However, these minor impacts would be localized at the development site and minimized through adherence to best management practices and the Stormwater Pollution Prevention and Environmental Resource Permit conditions (required if total combined impervious surface associated with the proposed development is greater than 9,000 square feet).

Post development stormwater treatment will be required for the new impervious areas. The expanded wharf surface area will not provide any practical areas for the treatment of stormwater. Therefore, NAVSTA Mayport is proposing to collect and treat stormwater from an impervious storage and vehicle parking area located several hundred feet north of Wharf C-2. Stormwater will be directed to an adjacent grassy area where it will be treated in a dry retention biobasin prior to release into the St. Johns River. This location is the closest practical compensatory treatment area to Wharf C-2 and will be capable of treating an area of 16,770 square feet and have a volume of 2,307 cubic feet. The Stormwater Treatment Basin will include four ten foot wide riprap overflows and will be located approximately 50-75 feet from the existing riprap shoreline.

Summary

The Project will entail installation of approximately 120 single sheet piles and 119 king piles, requiring a maximum of 50 days of in-water vibratory pile driving work over a 12-month period. Fifty polymeric (plastic) fender piles will also be installed, requiring approximately five days of vibratory driving (included in the 50 day vibratory total). The acoustic analysis for vibratory pile driving used the assumption that a maximum of three templates (each consisting of five king piles and four sheet pile pairs) would be driven each day, for a maximum linear distance of approximately 75 ft. Polymeric fender piles to be installed later in the project will be vibratory driven individually, at an rate of approximately 10 piles per day. Impact pile driving would only be used as a contingency in cases when vibratory driving is insufficient (A similar project that has been completed at adjacent Wharf Charlie One required impact pile driving on only seven piles). Twenty days have been conservatively allotted for contingency impact driving even though only 2 days of impact pile driving occurred during the adjacent Wharf Charlie One project. Impact pile driving, if it were to be necessary, could occur on the same day as vibratory pile driving, but driving rigs would not be operated simultaneously. Because activities are for the repair of existing facilities only, no increase in level of use or operation is expected. No net change in the amount of vessel traffic in and around the turning basin is expected as a result of the project.

Contingency dredging may be required within the new wharf footprint. If so, a clamshell dredge would be used to remove no more than 4,000 cubic yards. Dredged sediments would be disposed of in accordance with applicable laws and regulations. Direct impacts to marine mammals from dredging typically result from vessel collisions rather than the dredging equipment itself. Indirect effects may include loss or reduction in the quality of foraging sites / resources and possible behavioral effects if the dredging is being performed in aggregation sites (Florida Fish and Wildlife Conservation Commission n.d.). Because the habitat in the turning basin is not considered high quality for any marine mammal species, they are not expected to aggregate in the vicinity of dredging operations. Further, dredging – if conducted at all - may take place behind the bulkhead wall, essentially shielding marine mammals from much of the sound and exposure to equipment. Contingency dredging is not expected to result in any physiological or behavioral effects that would meet the Level A or Level B definitions. Therefore, dredging is not addressed further in this IHA Application.

2. Location and Duration of Activities

The dates and duration of such activity and the specific geographical region where it will occur.

NAVSTA Mayport is located in northern Florida, east of Jacksonville and adjacent to the St. Johns River and the Atlantic Ocean (Figure 2-1). Ship berthing facilities are provided at 16 locations along wharves A through F around the turning basin perimeter. The turning basin is approximately 2,000 by 3,000 feet in area, and is connected to the St. Johns River by a 500-ft-wide entrance channel. Wharf C-2 is located in the northeastern corner of the Mayport turning basin (Figure 2-2).

The project area is defined as the immediate vicinity of Wharf C-2 out to the limit of the most distant of the underwater threshold for all marine mammal species being addressed. The most distant underwater threshold is the marine mammal behavioral disturbance (120 dB re 1 µPa rms) threshold. Under certain conditions, areas in and outside of the turning basin may have average ambient noise levels exceeding the 120 dB threshold. However, given the lack of actual ambient sound recording data for this location, the Navy has assumed ambient noise levels are below 120 dB re 1 µPa rms. The distance to the 120 dB threshold is therefore the maximum range at which the Navy expects to exert an environmental impact under water, and represents a reasonable boundary for the project area (Figure 2-2).

The Project is scheduled to begin on 1 December 2013. A maximum of 50 days of in-water vibratory pile driving work will take place over a 12-month period. Twenty additional days were modeled in case contingency impact pile driving becomes necessary, but this duration is an extremely conservative estimate; a similar project that has been completed at adjacent Wharf Charlie One required impact pile driving on only seven piles, which required just two days. Contingency dredging with a clamshell rig would be conducted only if necessary.

FIGURE 2-1. WHARF C-2 PROJECT REGIONAL OVERVIEW

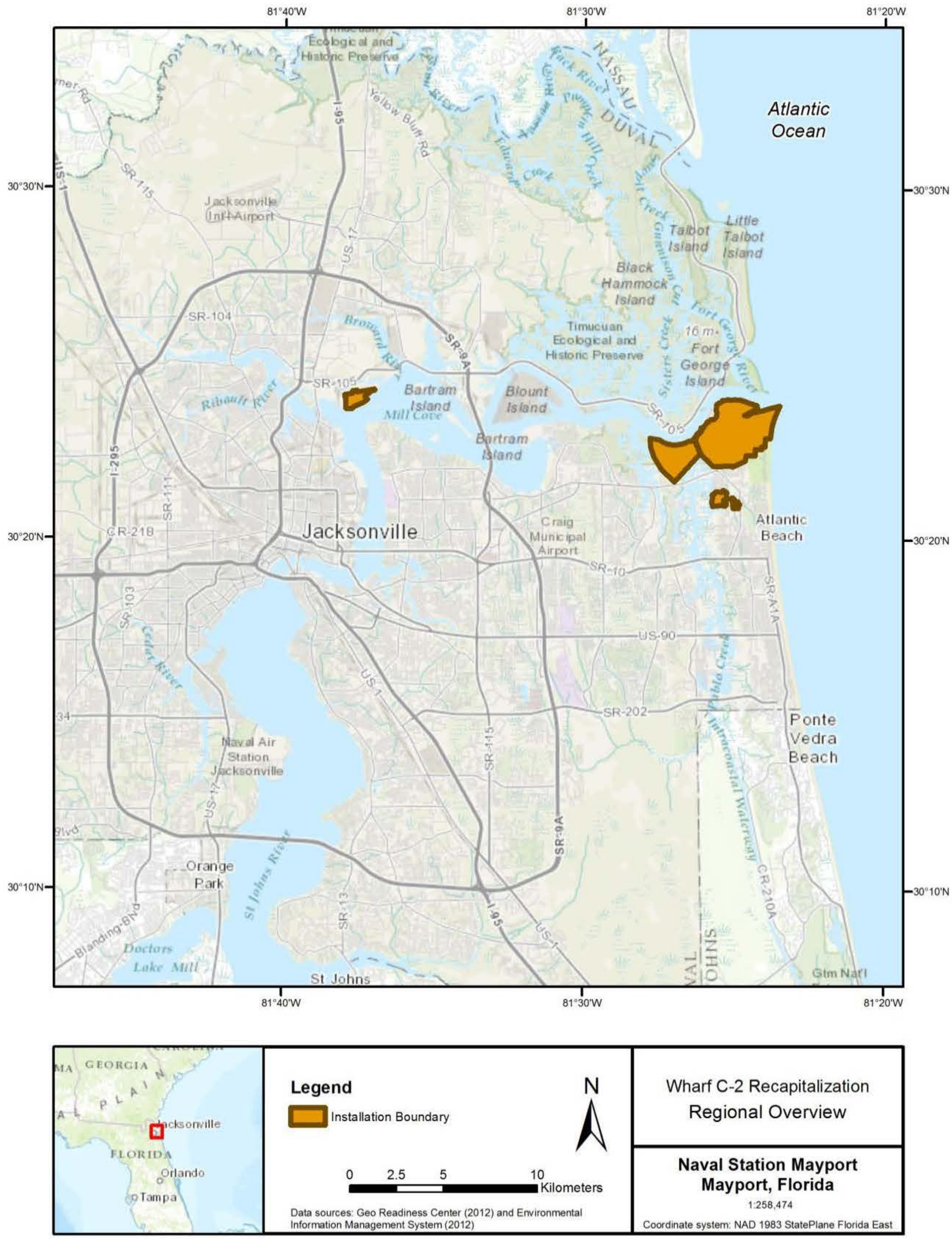
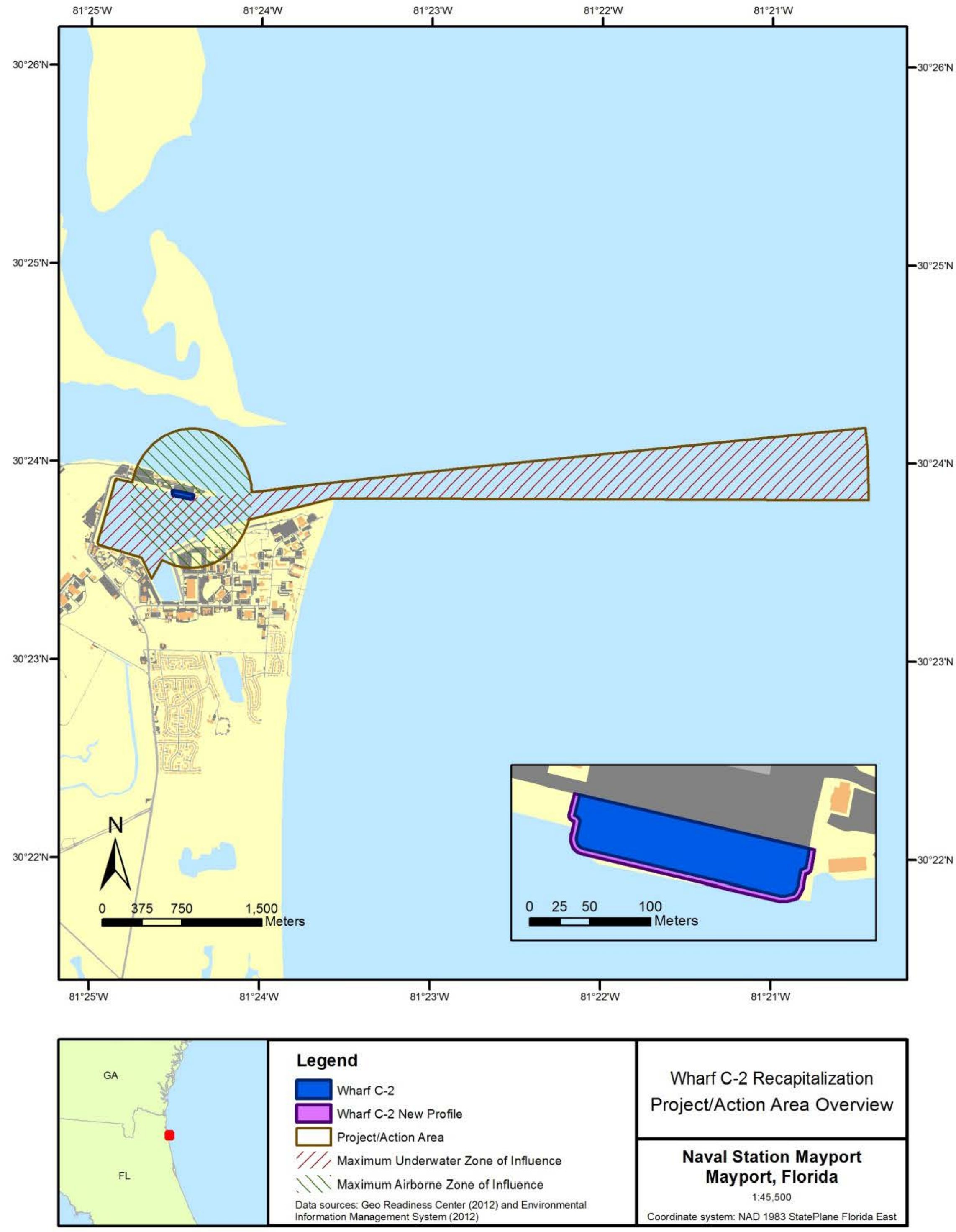


FIGURE 2-2. WHARF C-2 RECAPITALIZATION PROJECT AREA



The Mayport turning basin is regularly dredged to a depth of 50 ft. to allow for berthing of large military vessels. Salinity and temperature data for the project area are summarized in Table 2-1 and Figure 2-3, respectively.

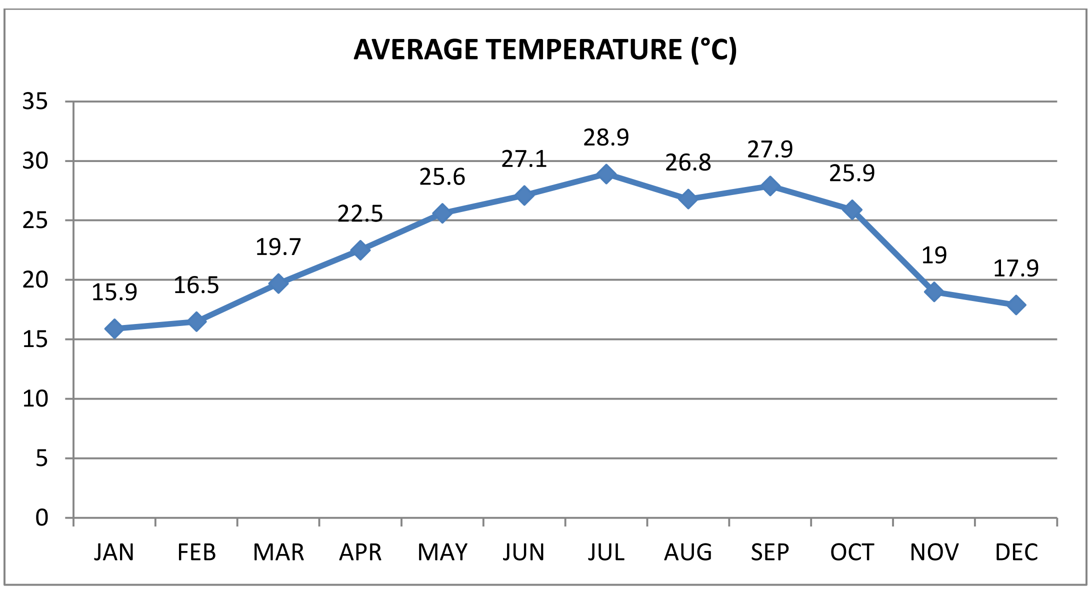
TABLE 2-1. MINIMUM AND MAXIMUM SURFACE AND BOTTOM SALINITIES

LOCATION	TIDE	WATER COLUMN	SALINITY
NAVSTA Mayport Turning Basin	Ebb	surface	30.6
		bottom	33.8
	Flood	surface	30.2
		bottom	33.6
NAVSTA Mayport Entrance Channel	Ebb	surface	30.0
		bottom	32.4
	Flood	surface	33.4
		bottom	34.7
Federal Navigation Channel	Ebb	surface	32.5
		bottom	33.8
	Flood	surface	33.3
		bottom	35.2

Source: U.S. Department of the Navy 2008a

While water temperatures for the project area are not regularly recorded, average monthly temperatures at the closest NOAA station (Bar Pilot's Dock) ranged from 15.9 degrees Celsius (°C) (60.6 degrees Fahrenheit [°F]) in January to 28.9 °C (84°F) in August (Figure 2-3).

FIGURE 2-3. 2012 MONTHLY WATER TEMPERATURES AT BAR PILOT'S DOCK, FLORIDA



Source: National Oceanic and Atmospheric Administration 2012

3. Marine Mammal Species and Numbers

The species and numbers of marine mammals likely to be found within the activity area

The Navy has reviewed marine mammal species occurring in the western Atlantic along the east coast of Florida, and has determined that those listed in Table 3-1 may occur in the vicinity of the Project. The West Indian manatee (*Trichechus manatus*) is not regulated by NMFS and therefore is not considered further in this application. The responsible regulator for manatees is the U.S. Fish and Wildlife Service (USFWS). USFWS has promulgated guidance for protecting manatee occurring in the vicinity of near shore construction. The Navy and its contractors shall comply with the conditions intended to protect manatees from in-water work as outlined in Appendix C.

North Atlantic right whale, humpback whale, and Atlantic spotted dolphin densities were calculated from the Navy's Marine Species Density Database and Technical Report (U.S. Department of the Navy 2012). Bottlenose dolphin density was calculated based on preliminary surveys of the Mayport turning basin during late 2012 and early 2013. Dolphin group sizes observed ranged between 1 and 6 animals. The Navy has estimated bottlenose dolphin density by assuming daily use of the Mayport turning basin by the average number of individuals (group size) observed during surveys conducted to date (2.53 resident animals / km^2).

TABLE 3-1. SPECIES POTENTIALLY OCCURRING IN THE PROJECT AREA

SPECIES and ESTIMATED DENSITY	STOCK	OCCURRENCE[1] and ABUNDANCE BEST (CV) / MIN	STATUS	
			MMPA	ESA
North Atlantic right whale 0.00005 / km^2	Western Atlantic	Rare / Seasonal – November to April 444 (0) / 444[2]	depleted	endangered
humpback whale 0.000113 / km^2	Gulf of Maine	Extralimital[1] 823 (0) / 823[2]	depleted	endangered
Atlantic spotted dolphin 0.680256 / km^2	Western North Atlantic	Rare / Seasonal – November to May 26,798 (0.66) / 16,151[2]	n/a	n/a
bottlenose dolphin 2.53 / km^2	Western North Atlantic Offshore	Rare 81,588 (0.17) / 70,775	n/a	n/a
	Western North Atlantic Northern Florida Coastal	Likely – year round 3,064 (0.24) / 2,511[2]		
	Jacksonville Estuarine System	Likely - year round, numbers may be slightly lower in winter 412 (0.06) / unknown[4]		
	Western North Atlantic Southern Migratory Coastal	Seasonal - January to March 12,482 (0.32) / 9,591[6]		

Sources: U. S. Department of the Navy 2012; U.S. Department of the Navy Turning Basin Bottlenose Dolphin Surveys (*in progress*); [1]Extralimital: there may be a small number of sighting or stranding records, but the activity area is outside the species' range of normal occurrence; Rare: there may be a few confirmed sightings, or the distribution of the species is near enough to the area of concern that the species could occur there; the species may occur but only infrequently or in small numbers; Likely: confirmed and regular sightings of the species occur year-round; [2]Waring et al. 2013; [4]National Marine Fisheries Service 2009; this is an overestimate of the stock abundance in the area covered by the study because it includes non-resident and seasonally resident dolphins; [5]National Marine Fisheries Service 2010; [6]National Marine Fisheries Service 2010a

4. Affected Species Status and Distribution

A description of the status, distribution, and seasonal distribution (when applicable) of the affected species or stocks of marine mammals likely to be affected by such activities.

4.1. North Atlantic Right Whale

The North Atlantic Right Whale was listed as endangered in 1970 (35 FR 18319) under the Endangered Species Conservation Act of 1969; its listing was revised in 2008 (73 FR 12024). A five year review was completed in August 2012 with a recommendation to maintain the species' classification as endangered (National Marine Fisheries Service 2012). North Atlantic right whales are designated as depleted under the MMPA.

The western North Atlantic minimum stock size is based on a census of individual whales identified using photo-identification techniques. A review of the photo-ID recapture database as it existed on 21 October 2011 indicated that 425 individually recognized whales in the catalog were known to be alive during 2009. Whales catalogued by this date included 20 of the 39 calves born during that year. Thus adding the 19 calves not yet catalogued brings the minimum number alive in 2009 to 444. This number represents a minimum population size. This count has no associated coefficient of variation (Waring et al. 2013).

North Atlantic right whales are most often seen as individuals or pairs (New England Aquarium 2013). They migrate annually between the north and south Atlantic coasts of the United States. They can generally be found in calving grounds off Georgia and Florida from mid-November to mid-April; and then move to feeding grounds in the Gulf of Maine and Cape Cod in the summer (though sightings may occur year-round in this area) (National Marine Fisheries Service n.d.). North Atlantic right whale calves are born during December through March after 12 to 13 months of gestation (Kraus et al. 2001)

Dives of 5 to 15 min or longer have been reported (Cetacean and Turtle Assessment Program 1982; Baumgartner and Mate 2003), but can be much shorter when feeding (Winn et al. 1995) Longer surface intervals have been observed for reproductively-active females and their calves (Baumgartner and Mate 2003). In the Cape Cod Bay foraging area, this species has been observed feeding in the top 5 meters of the water column for long periods of time (Parks et al. 2011).

Based on annual surveys conducted from December through March between 1996 -2009, North Atlantic right whales are relatively common visitors to waters offshore from NAVSTA Mayport and the adjacent federal navigation channel (New England Aquarium 2013a; Loop pers. comm. 2012). Incidental sightings of North Atlantic right whales are a regular, although infrequent, occurrence in the St. Johns River and NAVSTA Mayport turning basin, with the most recent sighting of two individuals occurring at the mouth of the St. Johns River in December 2012 (Gibbons 2011, Loop pers. comm. 2012).

Based on data in the Navy's Marine Species Density Database (MSDD), a density of 0.00005 individuals / square kilometer (km^2) has been estimated for the activity area.

4.2. Humpback Whale

Humpback whales were also listed as endangered in 1970 (35 FR 18319) under the Endangered Species Conservation Act of 1969. A status review was initiated in 2009 (74 FR 40568). Humpback whale abundance is increasing through much of the species' range. Individuals that may occur in the vicinity of Wharf C-2 are from the Gulf of Maine stock. Humpback whales are designated as depleted under the MMPA.

The most recent line-transect survey, which did not include the Scotian Shelf portion of the stock, produced an estimate of abundance for Gulf of Maine humpback whales of 331 animals (CV=0.48) with a resultant minimum population estimate for this stock of 228 animals. The line-transect based minimum estimate is unrealistic because at least 500 uniquely identifiable individual whales from the Gulf of Mexico stock were seen during the calendar year of that survey and the actual population would have been larger because re-sighting rates have historically been <1. Using the minimum count from at least 2 years prior to the year of a stock assessment report has allowed NMFS time to resight whales known to be alive prior to and after the focal year. Thus the minimum population estimate is set to the 2008 mark-recapture based count of 823.Current data suggest the Gulf of Maine stock is steadily increasing in numbers (Waring et al. 2013)

Humpback whales feed on a variety of invertebrates and small schooling fishes. The most common invertebrate prey are krill; the most common fish prey are herring, mackerel, sand lance, sardines, anchovies, and capelin (Clapham and Mead 1999). Feeding occurs both at the surface and in deeper waters, wherever prey is abundant. The humpback whale is the only species of baleen whale that shows strong evidence of cooperation when feeding in large groups (D'Vincent et al. 1985).

During the winter, most of the North Atlantic population of humpback whales is believed to migrate south to calving grounds in the West Indies region (Whitehead and Moore 1982; Smith et al. 1999; Stevick et al. 2003b), over shallow banks and along continental coasts, where calving occurs. Calving peaks from January through March, with some animals arriving as early as December and a few not leaving until June. Individuals from the U.S. and Canada are typically sighted in the West Indies in mid-February (Stevick et al. 2003b). Since humpback whales migrate south to calving grounds during the fall and make return migrations to the northern feeding grounds in spring, they are not expected off the coast of Florida during summer. There has been an increasing occurrence of humpbacks, which appear to be primarily juveniles, during the winter along the U.S. Atlantic coast from Florida north to Virginia (Clapham et al. 1993; Swingle et al. 1993; Wiley et al. 1995; Laerm et al. 1997).

The coastal region of Florida is not designated as an area of concentrated occurrence for humpback whales (U.S. Department of the Navy 2008). Examination of whaling catches revealed both northward and southward migrations are characterized by a staggering of sexual and maturational classes; lactating females are among the first to leave summer feeding grounds in the fall, followed by subadult males, mature males, non-pregnant females, and pregnant females (Clapham 1996). On the northward migration, this order is broadly reversed, with newly pregnant females among the first to begin the return migration to high latitudes. Based on sightings, strandings, and life history, humpbacks would be expected to occur in waters off NAVSTA Mayport during fall, winter, and spring. The likelihood of occurrence is low, however, and even lower for the turning basin and Wharf C-2 activity area.

Based on data in the Navy's MSDD, a year-round density of 0.000113 individuals / km^2 has been estimated for the activity area.

4.3. Atlantic Spotted Dolphin

Atlantic spotted dolphins occurring in the Wharf C-2 activity area belong to the Western North Atlantic Stock.

The Atlantic spotted dolphin is found in nearshore tropical to warm-temperate waters, predominantly over the continental shelf and upper slope. In the western Atlantic, this species is distributed from New England to Brazil and is found in the Gulf of Mexico as well as the Caribbean Sea (Perrin 2002).

Atlantic spotted dolphins in the Gulf of Mexico were observed feeding cooperatively on clupeid fishes and are known to feed in association with shrimp trawlers (Fertl and Leatherwood 1997; Fertl and Wursig 1995). In the Bahamas, this species was observed to chase and catch flying fish (MacLeod et al. 2004). The diet of the Atlantic spotted dolphin varies depending on location, and can include burrowing and schooling fish, and squid (Jefferson et al. 2008; Herzing and Elliser 2013).

While specific seasonal occurrence information for Atlantic spotted dolphins on Florida's Atlantic coast does not exist, studies have indicated that higher numbers of individuals reported over the west Florida continental shelf from November to May than during the rest of the year, suggesting that this species may migrate seasonally (Griffin and Griffin 2003). Atlantic spotted dolphins are typically observed in deeper offshore waters. They could potentially occur in shallower coastal waters in and around the activity area, but the likelihood is low.

Based on data in the Navy's MSDD, a year-round density of 0.680256 individuals / km^2 has been estimated for the activity area.

4.4. Bottlenose Dolphin

Bottlenose dolphins occurring in the Wharf C-2 activity area may be individuals belonging to any of the following stocks: the Western North Atlantic Offshore Stock, the Western North Atlantic Northern Florida Coastal Stock, the Jacksonville Estuarine System Stock; and the Western North Atlantic Southern Migratory Coastal Stock.

Along the Atlantic coast of the U.S., where the majority of detailed work on bottlenose dolphins has been conducted, male and female bottlenose dolphins reach physical maturity at 13 years, with females reaching sexual maturity as early as seven years (Mead and Potter 1990). Bottlenose dolphins are flexible in their timing of reproduction. Seasons of birth for bottlenose dolphin populations are likely responses to seasonal patterns of availability of local resources (Urian et al. 1996). Thayer et al. (2003) found bottlenose dolphins in North Carolina to exhibit a strong calving peak in spring, particularly May and June, and a diffuse peak from late spring to early fall. There is a gestation period of one year (Caldwell and Caldwell 1972). Calves are weaned as early as one and a half years of age (Reynolds et al. 2000), and typically remain with their mothers for a period of three to eight years (Wells et al. 1987), although longer periods are documented (Reynolds et al. 2000). There are no specific breeding locations for this species.

Dive durations as long as 15 min are recorded for trained individuals (Ridgway et al. 1969). Typical dives, however, are shallower and have a much shorter duration. Mean dive durations of Atlantic bottlenose dolphins typically range from 20 to 40 seconds at shallow depths (Mate et al. 1995)

Bottlenose dolphins typically occur in groups of 2 – 15 individuals, but significantly larger groups have also been reported (Shane et al. 1986; Kerr et al. 2005). Coastal bottlenose dolphins typically exhibit smaller group sizes than larger forms, as water depth appears to be a significant influence on group size (Shane et al. 1986). Shallow, confined water areas typically support smaller group sizes, some degree of regional site fidelity, and limited movement patterns (Shane et al. 1986; Wells et al. 1987).

Recent surveys have shown that bottlenose dolphins in the vicinity of Wharf C-2 occur in groups of 5 or more, pairs, and individually. Larger groups, observed infrequently, are generally seen at the entrance of the turning basin. These groups navigate into the basin, but generally not very far. A mother / calf pair was observed regularly during the winter and early spring of 2012 / 2013. Bottlenose dolphins are rarely observed lingering in a particular area in the turning basin; rather, they appear to move purposefully through the basin and then leave (Peters pers. comm. 2013). Based on incidental sightings in the turning basin as well as initial results from a current survey taking place there, bottlenose dolphins are expected to be frequent visitors to the project area (U.S. Department of the Navy 2008, 2012).

Based on surveys being conducted in the NAVSTA Mayport turning basin during late 2012 and early 2013 (U.S. Department of the Navy n.d.), a density of 2.53 individuals / km^2 has been estimated for the project area.

5. Incidental Take Authorization Requested

The type of incidental taking authorization that is being requested (i.e., takes by harassment only, takes by harassment, injury, and/or death), and the method of incidental taking.

Under the 1994 Amendments to the MMPA, harassment is statutorily defined as, any act of pursuit, torment, or annoyance which:

- **Level A Harassment** has the potential to injure a marine mammal or marine mammal stock in the wild; or,
- **Level B Harassment** 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 but which does not have the potential to injure a marine mammal or marine mammal stock in the wild (National Marine Fisheries Service 2013).

The marine mammal density data used for this analysis was retrieved from the Navy's Marine Species Density Database, and the current turning basin survey effort at NAVSTA Mayport. Table 5-1 summarizes the species densities. The estimated number of exposures that could result for the one year period of construction for the Project from 1 December 2013 to 30 November 2014 is summarized in Table 5-2.

TABLE 5-1. SPECIES DENSITIES

Species	Highest Density (season)	Source Method[1]
North Atlantic right whale	0.00005 / km^2 (all)	Kaschner GDE
humpback whale	0.000113 / km^2 (all)	Kaschner GDE
Atlantic spotted dolphin	0.680256 / km^2 (spring)	SMRU Ltd.
bottlenose dolphin	2.53 / km^2 (all)	2012 / 2013 Turning Basin surveys[2]

[1]Refer to Commander Task Force 20, 4th and 6th Fleet Navy Marine Species Density Database Technical Report, 30 March 2012; [2]Average group size observed during surveys conducted in December 2012 and March 2013, extrapolated to km^2

Estimation of bottlenose dolphin density was performed as follows:

Turning Basin = 176 acres (refer to Appendix E)

$$176 \text{ acres} = 0.712 \text{ km}^2$$

Through March 2013, the raw survey data indicated an average group size of 1.8 dolphins sighted during any five minute interval (Appendix F).

$$1.8 / 0.712 = 2.53 \text{ individuals / km}^2$$

In order to estimate the density of bottlenose dolphins in the project area, observations from surveys conducted on four days in December 2012 and four days in March 2013 were analyzed. A total of 135 individuals were counted over the eight days, and the average group size was 1.8 individuals, which can be extrapolated to 2.53 animals / km^2. The largest group size observed was 6 individuals.

Assumptions to be considered for the bottlenose dolphin incidental take estimate:

1) Individual animals may have been counted more than once.
2) The number of animals per square kilometer is assumed to be static, therefore indicating a resident population with no “refreshment” of new animals entering or leaving the area. This is not a reasonable real world assumption, but in the absence of specific data on bottlenose dolphin movements in and out of the project area it has been applied for modeling purposes and represents a conservative approach.
3) Animals with a Level B exposure can be re-exposed every 24 hours, according to the standard of analysis for incidental takes. Therefore, while 375 incidental takes are being requested, some could occur to a single animal more than once rather than 375 different dolphins being exposed a single time. For example, 75 animals could each be exposed to noise levels that reach Level B criteria five times over the course of the 70 day in-water work period).

The density of each species was multiplied by the size of the relevant zone of influence to determine the estimated number of exposures. The Navy is requesting authorization for a total of 365 Level B (behavioral) incidental takes of bottlenoses dolphins, and 101 Level B (behavioral) incidental takes of Atlantic spotted dolphins over the course of the Project (Table 5-2). Exposures may be to any age / reproductive class of the species. No incidental takes are requested for any other marine mammal species.

The Navy has committed to avoiding Level A takes during this project and will monitor the entire injury zone for both types of driving; in-water work will be shut down should a protected species approach or enter these zones. Therefore, no Level A exposures are anticipated or requested.

Methods for developing the incidental take estimate are detailed in Chapter 6 and Appendix D.

TABLE 5-2. ESTIMATED MARINE MAMMAL EXPOSURES

SPECIES	DENSITY (per km^2)	CALCULATED EXPOSURES		TOTALS
		Level A	Level B	
VIBRATORY DRIVING – STEEL PILES				
North Atlantic right whale	0.00005 / km^2	0	0	0
humpback whale	0.000113 / km^2	0	0	0
Atlantic spotted dolphin	0.680256 / km^2	0	90	90
bottlenose dolphin	2.53 / km^2	0	315	315
VIBRATORY DRIVING – POLYMERIC PILES				
North Atlantic right whale	0.00005 / km^2	0	0	0
humpback whale	0.000113 / km^2	0	0	0
Atlantic spotted dolphin	0.680256 / km^2	0	5	5
bottlenose dolphin	2.53 / km^2	0	10	10
CONTINGENCY IMPACT DRIVING – STEEL PILES (IF NEEDED)				
North Atlantic right whale	0.00005 / km^2	0	0	0
humpback whale	0.000113 / km^2	0	0	0
Atlantic spotted dolphin	0.680256 / km^2	0	0	0
bottlenose dolphin	2.53 / km^2	0	40	40
SPECIES CALCULATED EXPOSURE TOTALS		**0**	**460**	**460**

Sources: U.S. Department of the Navy 2012; U.S. Department of the Navy Turning Basin Bottlenose Dolphin Surveys (*in progress*)

6. Numbers and Species Taken

By age, sex, and reproductive condition (if possible), the number of marine mammals (by species) that may be taken by each type of taking identified in Section 5, and the number of times such takings by each type of taking are likely to occur.

The methods for estimating the number and types of exposure are described in the sections below, followed by the method for quantifying exposures of marine mammals to sources of energy exceeding those threshold values. Exposure of each was determined by:

- The potential of each species to be impacted by the acoustic sources as determined by the acoustic criterion for marine mammals.
- The potential presence of each species and their estimated density in the zone of influence for the Project.
- The area of impact for each pile driving sound source (estimated by taking into account the source levels, propagation loss and thresholds at which each acoustic criterion are met).

Potential exposures were calculated by multiplying the density of each marine mammal species potentially present by the total impacted area for each threshold value by the potential number of days of pile driving.

An introduction to the fundamentals of acoustics and use of the decibel unit can be found in Appendix D.

Assessing whether a sound may disturb or injure a marine mammal involves understanding the characteristics of the acoustic source and the potential effects that sound may have on the animal's physiology and behavior. Although it is known that sound is important for marine mammal communication, navigation, and foraging (National Research Council 2003, 2005), there are many unknowns in assessing impacts such as the potential interaction of different effects and the biological significance of responses by marine mammals to sound exposures (Nowacek et al. 2007; Southall et al. 2007). Furthermore, many factors other than the received level of sound may affect an animal's reaction, such as the animal's physical condition, prior experience with the sound, and proximity to the source of the sound (Nowacek et al. 2007).

Acoustically-mediated behaviors, including social interactions, foraging, and navigation, may be particularly vulnerable to disturbance during pile-driving activities, and it is important to understand the source characteristics of marine mammal vocalizations in order to address potential masking (see Appendix D) and disturbance. The following sections address hearing and sound production of all marine mammals that may be present in the project area during pile driving.

6.1. Hearing and Vocalization for North Atlantic Right Whales

Hearing in North Atlantic right whales and other large baleen whales is poorly understood due to the difficulty of performing experimental tests on live whales. Mathematical models and anatomical studies of whale ears have been used to estimate hearing in baleen whales. Recent morphometric analyses of North Atlantic right whale inner ears estimates a hearing range of approximately 0.01 to 22 kHz based on established marine mammal models (Parks et al. 2004; Parks and Tyack 2005; Parks et al. 2007).

North Atlantic right whales produce a variety of sounds, including moans, screams, gunshots, blows, upcalls, downcalls, and warbles that are often linked to specific behaviors (Matthews et al. 2001; Laurinolli et al. 2003; Vanderlaan et al. 2003; Parks et al. 2005; Parks and Tyack 2005). Sounds can be divided into three main categories: (1) blow sounds; (2) broadband impulsive sounds; and (3) tonal call types (Parks and Clark 2007). Blow sounds are those coinciding with an exhalation; it is not known whether these are intentional communication signals or just produced incidentally (Parks and Clark 2007). Broadband sounds include non-vocal slaps (when the whale strikes the surface of the water with parts of its body) and the "gunshot" sound; data suggests that the latter serves a communicative purpose (Parks and Clark 2007; Parks et al. 2012). Tonal calls can be divided into simple, low-frequency, stereo-typed calls and more complex, frequency-modulated, higher frequency calls (Parks and Clark 2007). Most of these sounds range in frequency from 0.02 to 15 kHz (dominant frequency range from 0.02 to less than 2 kHz; durations typically range from 0.01 to multiple seconds) with some sounds having multiple harmonics (Parks and Tyack 2005). Source levels for some of these sounds have been measured as ranging from 137 to 192 dB root-mean-square (rms) re: 1 μPa-m (decibels at the reference level of one micro Pascal at one meter) (Parks et al. 2005; Parks and Tyack 2005). In certain regions (i.e., northeast Atlantic), preliminary results indicate that right whales vocalize more from dusk to dawn than during the daytime (Leaper and Gillespie 2006; Mussoline et al. 2012; Parks et al. 2012). Vocalization rates of North Atlantic right whales are also highly variable, and individuals have been known to remain silent for hours (Gillespie and Leaper 2001). Baumgartner et al. (2005) noted that downsweep calls by North Atlantic right whales in the 16 to 160 Hz frequency band exhibited a diel pattern (fewer calls at night) that corresponded strongly to the diel vertical migration of zooplankton.

6.2. Hearing and Vocalization for Humpback Whales

While no measured data on hearing ability are available for humpback whales, Ketten (1997) hypothesized that mysticetes have acute infrasonic hearing. Houser et al. (2001) produced the first humpback whale audiogram (using a mathematical model), which was u-shaped and conformed to the typical mammalian presentation. The area of best hearing, or sensitivity, according to the model was observed between frequencies from 700 Hz to 10 kHz but the maximum range of hearing was identified between 200 Hz to 14 kHz. Au et al. (2006) noted that if the popular notion that animals generally hear the totality of the sounds they produce is applied to humpback whales, this suggests that its upper frequency limit of hearing is as high as 24 kHz.

Humpback whales are known to produce three classes of vocalizations: (1) "songs" in the late fall, winter, and spring by solitary males; (2) sounds made within groups on the wintering (calving) grounds; and (3) social sounds made on the feeding grounds (Thomson and Richardson 1995). The best-known types of sounds produced by humpback whales are songs, which are thought to be breeding displays used only by adult males (Helweg et al. 1992). Singing is most common on breeding grounds during the winter and spring months but is occasionally heard outside breeding areas and out of season (Mattila et al. 1987; Gabriele et al. 2001; Gabriele and Frankel 2002; Clark and Clapham 2004). Humpback song is an elaborate series of patterned vocalizations which are hierarchical in nature (Payne and McVay 1971). There is geographical variation in humpback whale song, with different populations singing different songs and all members of a population using the same basic song. However, the song evolves over the course of a breeding season but remains nearly unchanged from the end of one season to the start of the next (Payne et al. 1983). Components of the song range from under 20 Hz to 4 kHz and occasionally 8 kHz, with source levels measured between 151 and 189 dB re 1 μPa-m and high-frequency harmonics extending beyond 24 kHz (Au et al. 2001; Au et al. 2006).

Social calls range in frequency from 50 Hz to over 10 kHz, with dominant frequencies below 3 kHz (Silber 1986). Female vocalizations appear to be simple; Simão and Moreira (2005) noted little complexity. "Feeding" calls, unlike song and social sounds, are highly stereotyped series of narrow-band trumpeting calls. They are 20 Hz to 2 kHz, less than 1 sec in duration, and have source levels of 162 to 192 dB re 1 μPa-m. The fundamental frequency of feeding calls is approximately 500 Hz (D'Vincent et al. 1985; Thompson et al. 1986).

6.3. Hearing and Vocalization for Atlantic Spotted Dolphins

A variety of sounds including whistles, echolocation clicks, squawks, barks, growls, and chirps have been recorded for the Atlantic spotted dolphin (Thomson and Richardson 1995). Whistles have dominant frequencies below 20 kHz (range: 7.1 to 14.5 kHz) but multiple harmonics extend above 100 kHz, while burst pulses consist of frequencies above 20 kHz (dominant frequency of approximately 40 kHz) (Lammers et al. 2003). Other sounds, such as squawks, barks, growls, and chirps, typically range in frequency from 100 Hz to 8 kHz (Thomson and Richardson 1995). Recently recorded echolocation clicks have two dominant frequency ranges at 40 to 50 kHz and 110 to 130 kHz, depending on source level (i.e., lower source levels typically correspond to lower frequencies and higher frequencies to higher source levels (Au and Herzing 2003).

Echolocation click source levels as high as 210 dB re 1 μPa-m peak-to-peak have been recorded (Au and Herzing 2003). Spotted dolphins in The Bahamas were frequently recorded during agonistic / aggressive interactions with bottlenose dolphins (and their own species) to produce squawks (200 Hz to 12 kHz broad band burst pulses; males and females), screams (5.8 to 9.4 kHz whistles; males only), barks (200 Hz to 20 kHz burst pulses; males only), and synchronized squawks (100 Hz - 15 kHz burst pulses; males only in a coordinated group) (Herzing 1996).

There have been no data collected on Atlantic spotted dolphin hearing abilities. However, odontocetes are generally adapted to hear high-frequencies (Ketten 1997) and it can be assumed that vocalization frequencies are generally within the hearing range of a species.

6.4. Hearing and Vocalization for Bottlenose Dolphins

Bottlenose dolphins can typically hear within a broad frequency range of 200 Hz to 160 kHz (Au 1993; Turl 1993), though with exposure during testing some dolphins might receive information as low as 50 Hz (Turl 1993). Electrophysiological experiments suggest the bottlenose dolphin brain has a dual analysis system: one specialized for ultrasonic clicks and another for lower-frequency sounds, such as whistles (Ridgway 2000). Scientists have reported a range of highest sensitivity between 25 and 70 kHz, with peaks in sensitivity at 25 and 50 kHz (Nachtigall et al. 2000). Recent research on the same individuals indicates auditory thresholds obtained by electrophysiological methods correlate well with those obtained in behavior studies, except at the some lower (10 kHz) and higher (80 and 100 kHz) frequencies (Finneran and Houser 2006).

Sounds emitted by bottlenose dolphins have been classified into two broad categories: pulsed sounds (including clicks and burst-pulses) and narrow-band continuous wave sounds (whistles), which usually are frequency modulated. Clicks and whistles have dominant frequency ranges of 110 to 130 kHz and source levels of 218 to 228 dB re 1 μPa-m (Au 1993) and 3.4 to 14.5 kHz and 125 to 173 dB re 1 μPa-m, respectively (Ketten 1998). Whistles are primarily associated with communication and can serve to identify specific individuals (i.e., signature whistles) (Caldwell and Caldwell 1965; Janik et al. 2006). Up to 52% of whistles produced by bottlenose dolphin groups with mother-calf pairs have been classified as signature whistles (Cook et al. 2004).

Sound production is also influenced by group type (single or multiple individuals), habitat, and behavior (Nowacek 2005). Bray calls (low-frequency vocalizations; majority of energy below 4 kHz), for example, are used when capturing fishes, specifically sea trout (*Salmo trutta*) and Atlantic salmon (*Salmo salar*), in some regions (i.e., Moray Firth, Scotland) (Janik 2000). Additionally, whistle production has been observed to increase while feeding (Acevedo-Gutiérrez and Stienessen 2004; Cook et al. 2004). Both whistles and clicks have been demonstrated to vary geographically in terms of overall vocal activity, group size, and specific context (e.g., feeding, milling, traveling, and socializing) (Jones and Sayigh 2002; Zaretsky et al. 2005; Baron 2006). For example, preliminary research indicates characteristics of whistles from populations in the northern Gulf of Mexico significantly differ (i.e., in frequency and duration) from those in the western north Atlantic (Zaretsky et al. 2005; Baron 2006).

6.5. Sound Exposure Criteria and Thresholds

Under the MMPA, NMFS has defined levels of harassment for marine mammals. Level A harassment is defined as “any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or marine mammal stock in the wild.” Level B harassment is defined as “Any act of pursuit, torment, or annoyance which 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.”

Since 1997, NMFS has used generic sound exposure thresholds to determine when an activity in the ocean that produces sound might result in impacts to a marine mammal such that a take by harassment might occur (70 FR 1871). Current NMFS practice regarding exposure of marine mammals to pile driving sounds is that cetaceans exposed to impulsive sounds ≥180 re 1 μPa rms are considered to have been taken by Level A (i.e., injurious) harassment. Level A injury thresholds have not been established for non-impulsive sounds such as vibratory pile driving, but the Navy has applied the threshold values for impulsive sounds to vibratory sound in this analysis.

Behavioral harassment (Level B) is considered to have occurred when marine mammals are exposed to underwater sounds below the injury threshold, but ≥ 160 dB re 1 μPa rms for impulsive sounds (e.g., impact pile driving) and 120 dB re 1 μPa rms for non-impulsive noise (e.g., vibratory pile driving).

6.6. Limitations of Existing Noise Criteria

To date, there is no research or data supporting a response by odontocetes to non-impulsive sounds from vibratory pile driving as low as the 120 dB re 1 μPa rms threshold. The application of the 120 dB rms re 1μPa threshold can be problematic because this threshold level can be either at or below the ambient noise level of certain locations. For example, noise levels at some industrialized ports in Puget Sound, WA, have been measured at between 120 and 130 dB re 1μPa (Washington State Department of Transportation 2012). Assuming a 120 dB disturbance threshold in such environments implies any animals in the area will be disturbed with or without additional pile driving noise. This has led to analyses that may be overly conservative, and as a result of these issues, the threshold level is subject to ongoing discussion (74 FR 41684). NMFS is developing new science-based thresholds to improve and replace the current generic exposure level thresholds, but the criteria have not been finalized (Southall et al. 2007). The 120 dB re 1 μPa rms threshold level for non-impulsive noise originated from research conducted by Malme et al. (1984, 1988) for California gray whale response to non-impulsive industrial sounds such as drilling operations. Note: The 120 dB re 1 μPa rms *non-impulsive* sound threshold should not be confused with the 120 dB re 1 μPa rms *impulsive* sound criterion established for migrating bowhead whales in the Arctic as a result of research in the Beaufort Sea (Richardson et al. 1995; Miller et al. 1999).

6.7. Ambient Noise

The baseline noise level in the turning basin is referred to as the “ambient noise level”. Ambient noise is comprised of sounds produced by a number of natural and anthropogenic sources. Natural noise sources can include wind, waves, precipitation, and biological sources such as shrimp, fish, and cetaceans. These sources produce sound in a wide variety of frequency ranges (Urick 1983; Richardson et al. 1995) and can vary over both long (days to years) and short (seconds to hours) time scales. In shallow waters, precipitation may contribute up to 35 dB to the existing sound level, and increases in wind speed of 5 to 10 knots can cause a 5 dB increase in ambient ocean noise between 20 Hz and 100 kHz (Urick 1983). High noise levels may also occur in near shore areas during heavy surf, which may increase low frequency (200 Hz – 2 kHz) underwater noise levels by 20 dB or more within 200 yards of the surf zone (Wilson et al. 1985). At Mayport, vessel wakes in the St. Johns River may cause breaking waves on shore, contributing to the ambient acoustic environment.

Anthropogenic noise sources also contribute to ambient noise levels, particularly in ports and other high use areas in coastal regions. Normal port activities include vessel traffic (from large ships, support vessels, and security boats), loading and maintenance operations, and other activities (sonar and echo-sounders from commercial and recreational vessels, construction, etc.) which all generate underwater sound (Urick 1983). Additionally, noise produced by mechanized equipment on wharves or adjacent shorelines may propagate underwater and contribute to underwater ambient noise levels.

The underwater acoustic environment in the Mayport turning basin is likely to be dominated by noise from day-to-day port and vessel activities. The basin is sheltered from most wave noise, but is a high-use area for naval ships, tugboats, and security vessels. When underway, these sources can create noise between 20 Hz and 16 kHz (Lesage et al. 1999), with broadband noise levels up to 180 dB re 1 µPa rms (Table 6-1). Normal port operations, including transits, docking, and maintenance by multiple tugboats and ships would continue. While there are no current measurements of ambient noise levels in the turning basin, the high levels of anthropogenic activity in the basin are likely to have elevated ambient noise levels within the basin above "quiet" habitats in which marine mammal reactions to 120 dB sounds were observed (Malme et al. 1984, 1988).

The existing sources of anthropogenic noise in the Mayport turning basin are generally non-impulsive (see Appendix D), intermittent sources such as vessel engines; this category also includes noise from vibratory pile driving. Impact pile driving noise differs from these sources in that it is impulsive, with a fast rise time and multiple short-duration (50 – 100 millisecond; Illingworth & Rodkin 2001) events. The use of impact driving during the proposed project is limited to instances when vibratory driving fails, and will be limited to a maximum of 20 strikes per day. Because of the very limited use of impact pile driving during the proposed action, the Navy expects no long-term change in the average ambient noise environment with respect to impulsive sounds as a result of impact pile driving.

TABLE 6-1. REPRESENTATIVE LEVELS OF NOISE FROM ANTHROPOGENIC SOURCES

Noise Source	Frequency Range (Hz)	Underwater Noise Level (dB re 1 µPa)
Small vessels[1]	250–6,000	151 dB rms at 1 m
Large vessels[2]	20 – 1,500	170 – 180 dB rms at 1 m
Tug docking barge[3]	200–1,000	149 dB rms at 100 m
Vibratory driving of 24-inch steel pipe pile[4]	50 – 1,500	159 dB rms at 10 m
Impact driving of 24-inch steel pipe pile[5]	50 – 1,500	186 dB rms at 10 m

m = meter ; Sources: [1]Lesage et al. 1999; [2]Richardson et al. 1995; [3]Blackwell and Greene 2002; [4]Illingworth & Rodkin 2012; [5]Washington Department of Transportation 2005

Airborne ambient noise in industrial areas such as the Mayport turning basin is comprised of sounds from trucks, cranes, compressors, generators, pumps, ship engines, and other equipment. While there are no current measurements of airborne ambient noise in the basin or wharf areas, expected noise levels range from a daytime minimum of 55 dBA to a maximum of 99 dBA, assuming that multiple sources will be operating simultaneously (Washington State Department of Transportation 2007).

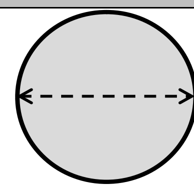
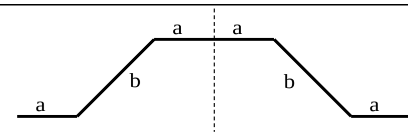
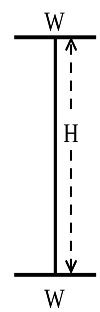
6.8. Underwater Noise from Pile Driving

Noise levels produced by pile driving are greatly influenced by factors including pile type, driving method, and the physical environment in which the activity takes place. A number of studies have examined sound pressure levels recorded from underwater pile driving projects in California and Washington, creating a large body of data for impact driving of steel pipe piles, concrete piles, and some timber piles. Data for vibratory pile driving is similarly concentrated on steel pipe piles of a range of diameters, and on single 24-inch wide sheet piles at a project in California (California Department of Transportation 2009). There have been no measurements of sound pressure levels produced by the types of piles (paired steel sheet piles and king piles) that will be installed in the Mayport turning basin, and it was therefore necessary to extrapolate from available data to determine reasonable source levels for this project.

Because of the differences between the proposed action (driving of steel king piles, paired 27-inch wide steel sheet piles, and 12-inch diameter polymeric piles) and available measured sound pressure levels, the Navy evaluated potential source levels for modeling of steel piles based on two methods. The first method examined measured sound pressure levels for single 24-inch wide sheet piles; the second was a comparison of the linear length of piles with the circumference of steel pipe piles for which source levels have been measured. Linear length was calculated as the sum of the lengths of all sides of each pile type (Table 6-2). Both the king and paired sheet pile linear lengths were comparable to the circumference of a 24-inch diameter pipe pile.

Source levels for polymeric piles were estimated based on a comparison of the material properties of timber, concrete, and steel piles. Data from timber piles were selected to model vibratory driving of HDPE polymer piles; there will be no impact driving of polymeric piles.

TABLE 6-2. COMPARISON OF PILE SIZES AND SHAPES FOR ESTIMATING SOURCE SOUND PRESSURE LEVELS

Pile Type	Shape and Dimensions
CIRCULAR STEEL PIPE PILE Diameter = 24 in. Circumference = Diameter*π = 75.4 in.	
AZ19-700 SHEET PILE PAIR Linear length = 4*a+2*b =70.4 in. a = 6.81 in. b= 21.6 in. (total width = 55.12 in.)	
HZ1080 MB KING PILE Linear length = 2*W +H = 77.2 in. W = 17.87 in. H= 41.47 in.	

Measured sound pressure levels for 24 in. diameter steel sheet piles, 24 in. diameter steel pipe piles, and timber piles are available for both vibratory and impact driving methods. To determine the most appropriate sound pressure levels for this project, data from studies which met the following parameters were considered:

- Pile size and type: steel pipe piles (24 in. diameter), steel sheet piles (24 in. wide), and/or timber piles
- Installation method: vibratory and impact hammer
- Physical environment - water depth 15 ft. (4.5 m) or greater, sediment similar to sandy bottom in Mayport turning basin.

Tables 6-3 and 6-4 below detail representative pile driving sound pressure levels measured from 24 in. steel pipe piles, 24 in. wide steel sheet piles, and 12 in. timber piles. Comparison of measured sound pressure levels from the 24-inch steel pipe piles and 24-inch steel sheet piles revealed that levels from sheet pile driving were higher than those from pipe pile driving; the Navy has therefore used the more conservative sound pressure levels from 24-inch steel sheet piles to model both king and sheet pile pairs for the proposed action. The selected sound pressure levels used for modeling in this application were 163 dB re 1 µPa rms for vibratory driving and 189 dB re 1µPa rms for impact driving; sources are indicated by footnotes in the relevant tables.

TABLE 6-3. VIBRATORY INSTALLATION UNDERWATER SOUND PRESSURE LEVELS EXPECTED BASED ON SIMILAR IN-SITU MONITORED CONSTRUCTION ACTIVITIES

Project and Location	Pile Size and Type	Water Depth	Range to pile	RMS	Peak	Sediment
Portage Bay, WA[b]	24 inch steel pipe	3 – 7 m	10 m	157	170	Unknown
Berth 23 Port of Oakland, CA[c]	24 inch steel sheet pile	6.1 m	10 m	163[1]	177	Unknown
Berth 30 Port of Oakland, CA[c]	24 inch steel sheet pile	4.9 m	10 m	162	175	Unknown
Berth 35/37 Port of Oakland, CA[c]	24 inch steel sheet pile	6.1 m	10 m	163	177	Unknown
Port Townsend Ferry, WA[d]	12 inch timber pile	10 m	16 m	153[2]	167	Unknown

Sound levels expressed as dB re 1 µPa rms and dB re 1 µPa peak for RMS and Peak SPL measurements, respectively. Average and Max values for Test Pile Program data are based on 10-second rms measurements over the 60 second driving time for the pile. 1- This data point was selected for use in acoustic modeling based on similarity to physical environment at NAVSTA Mayport and measurement location in mid-water column; 2- Data selected for use in modeling polymeric fender piles based on similarity of material properties between timber and polymeric piles; there are no existing measurements for polymeric piles of any size and shape. Sources: a – Illingworth & Rodkin 2012; b- Washington Department of Transportation 2010; c- California Department of Transportation 2009 ; d – Washington Department of Transportation 2011

TABLE 6-4. IMPACT INSTALLATION UNDERWATER SOUND PRESSURE LEVELS EXPECTED BASED ON SIMILAR IN-SITU MONITORED CONSTRUCTION ACTIVITIES

Project and Location	Pile Size and Type	Water Depth	Range to pile	RMS	Peak	SEL	Sediment
Friday Harbor Ferry Terminal, WA[a]	24 inch steel pipe	12.8 m	10 m	170	183	180	Sandy silt/clay
		13.4 m		186	205	179	
		14.3 m		186	204	179	
		10 m		194	210	185	Sandy silt/rock
		10 m		195	215	187	
		10 m		193	212	184	
Typical values, Caltrans compendium summary table[b]	24 inch steel pipe	15	NA	194	207	178	Unknown
Berth 23 Port of Oakland[b]	24 inch steel sheet pile	12 – 14 m	10 m	189[1]	205	179	Unknown

Sound levels expressed as dB re 1 µPa rms and dB re 1 µPa peak for RMS and Peak SPL measurements, respectively; 1- This data point was selected for use in acoustic modeling based on similarity to physical environment at NAVSTA Mayport and measurement location in mid-water column; 2- Data selected for use in modeling polymeric fender piles based on similarity of material properties between timber and polymeric piles; there are no existing measurements for polymeric piles of any size and shape. Sources: [a]Washington State Department of Transportation 2005; [b]California Department of Transportation 2009

6.9. Underwater Sound Propagation

Pile driving can generate underwater noise that may result in disturbance to marine mammals within the project area. Modeling sound propagation is useful in evaluating noise levels to determine which marine mammals may be exposed at a given distance from the pile driving activity. The decrease in acoustic intensity as a sound wave propagates outward from a source is known as transmission loss (TL).

The formula for transmission loss is:

$$TL = B * log_{10}\left(\frac{R_1}{R_2}\right) + C * R_1, \text{ where}$$

B = logarithmic (predominantly spreading) loss

C = linear (scattering and absorption) loss

R_1 = range from source in meters

R_2 = range from driven pile to original measurement location (generally 10 m)

The amount of linear loss (C) is proportional to the frequency of a sound. Due to the low frequencies of sound generated by impact and vibratory pile driving, this factor was assumed to be zero for all calculations in this assessment and transmission loss was calculated using only logarithmic spreading. Therefore, using practical spreading (B=15), the revised formula for transmission loss is TL = 15 log_{10} (R_1/10).

6.10. Calculated Zones of Influence

The practical spreading loss model discussed above was used to calculate the propagation of pile driving sound in and around the Mayport turning basin. A total of 70 days of pile driving were modeled; 50 days of vibratory driving (45 days for steel piles, 5 days for polymeric fender piles), and 20 days of contingency impact driving (steel piles only). No sound mitigation methods (bubble curtains, cofferdams, etc.) are proposed and therefore no attenuation was included in the acoustic model.

For vibratory driving, the acoustic analysis used the assumption that a maximum of three templates (each consisting of five king piles and four sheet pile pairs) would be driven each day.

For impact driving, modeling assumed a maximum of 20 strikes of the impact hammer per day, which is expected to take no more than five to ten minutes to complete.

TABLE 6-5. CALCULATED DISTANCES TO / AREAS ENCOMPASSED BY THE UNDERWATER MARINE MAMMAL NOISE THRESHOLDS FOR PILE DRIVING

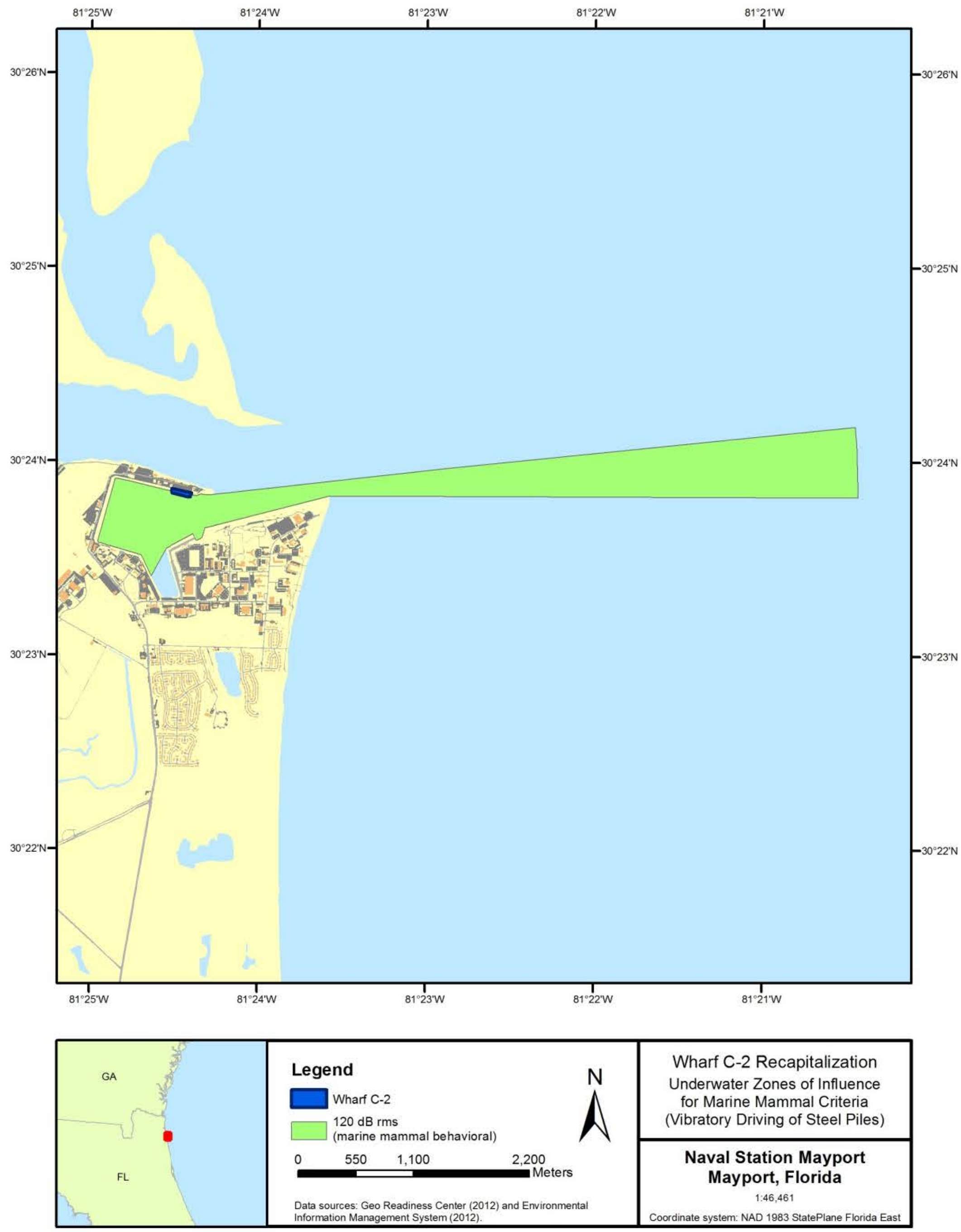
Pile Type	Driving Method	Threshold (dB re 1µPa rms)	Distance (m)[1]	Area (km^2)
Steel (sheet and king piles)	vibratory	Level A (injury): 180	0.74	0
		Level B (behavior): 120	7,356	2.9
	impact (contingency only)	Level A (injury): 180	39.8	0.004
		Level B (behavior): 160	858	0.67
Polymeric (fender piles)	vibratory	Level A (injury): 180	0.16	0
		Level B (behavior): 120	1,585	0.88

All sound levels expressed in dB re 1 µPa rms. dB = decibel; rms = root-mean-square; µPa = micro Pascal
Practical spreading loss (15 log, or 4.5 dB per doubling of distance) used for calculations.
[1]Sound pressure levels used for calculations are given in Table 6-3 and 6-4.

The calculations presented in Table 6-5 assume a field free of obstruction, which is unrealistic because the Mayport turning basin does not represent open water conditions (free field) and sounds will attenuate as they encounter land or other solid obstacles. As a result, the distances calculated may not actually be attained at the project area. The actual distances to the behavioral disturbance thresholds for impact and vibratory pile driving are likely to be shorter than those calculated due to the irregular contour of the waterfront and the maximum fetch (farthest distance sound waves travel without obstruction [i.e. line of sight]) at the project area. Table 6-5 also depicts the actual areas encompassed by the marine mammal thresholds during the project. Figure 6-1 through Figure 6-3 depict the areas of each underwater sound threshold that are predicted to occur at the project area due to pile driving for marine mammals during each stage of the project. Note: injury zone for vibratory pile driving is not visible due to the size of the zone (> 1 m) and map scale.

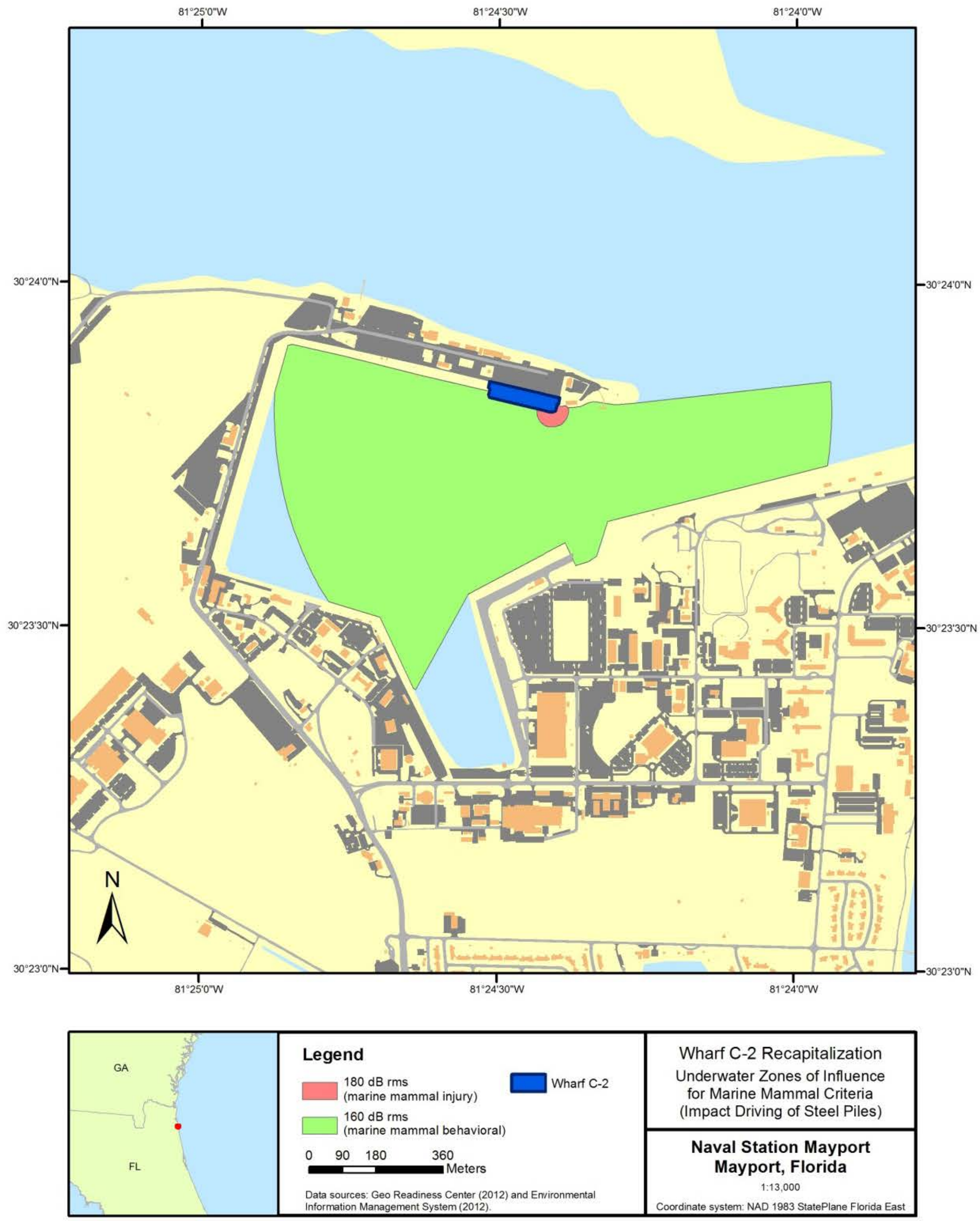
Marine mammal densities were multiplied by the size of the applicable zone of influence to estimate number of incidental takes (see Chapter 5).

FIGURE 6-1. INJURY AND BEHAVIORAL ZONES OF INFLUENCE FOR MARINE MAMMALS[2] - VIBRATORY DRIVING OF STEEL KING AND SHEET PILES



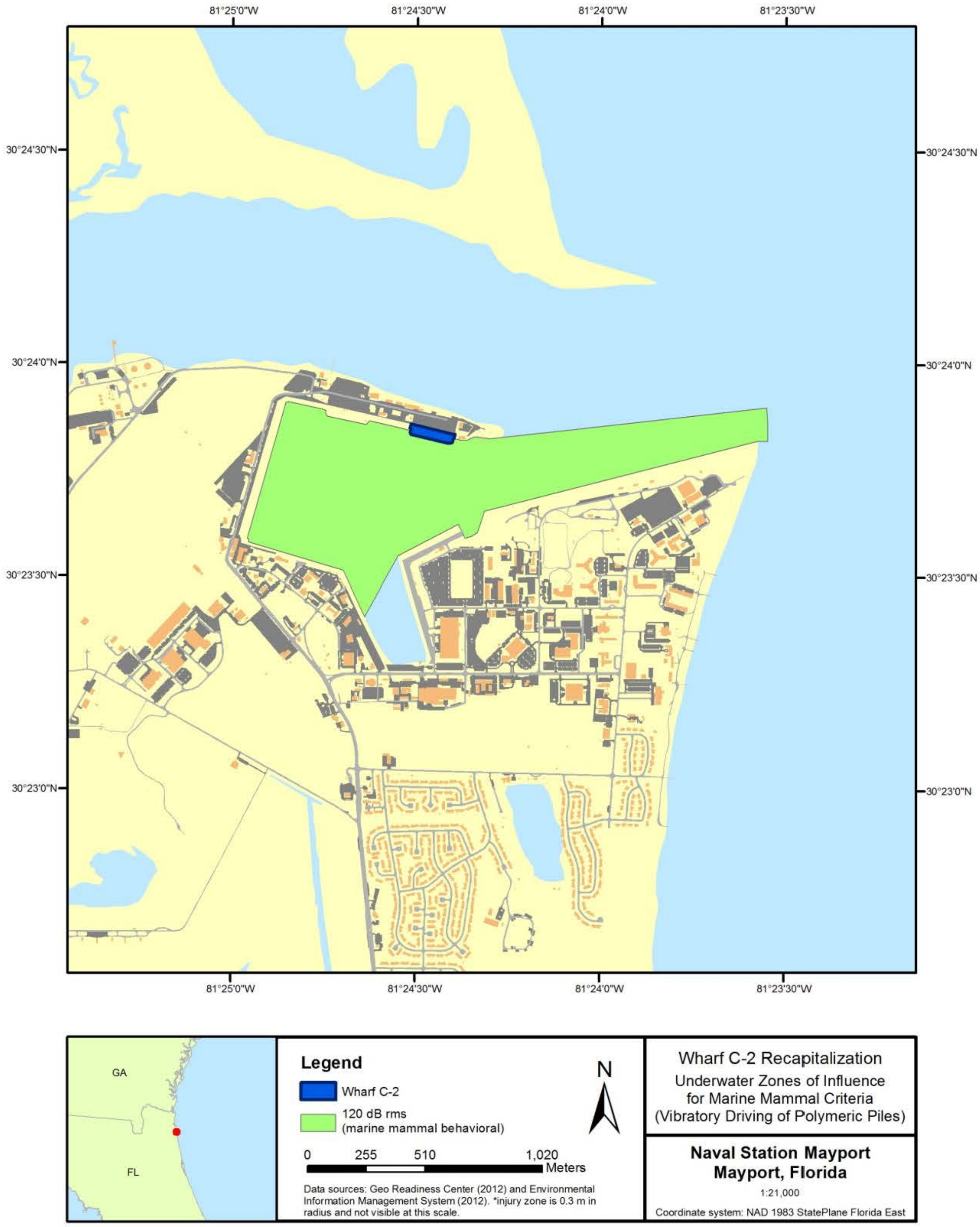
[2] Official criteria have not been established for West Indian manatees

FIGURE 6-2. INJURY AND BEHAVIORAL ZONES OF INFLUENCE FOR MARINE MAMMALS[3] - IMPACT DRIVING OF STEEL KING AND SHEET PILES (CONTINGENCY ONLY)



[3] Official criteria have not been established for West Indian manatees; marine mammal injury zone of influence illustrated represents a notional template location

FIGURE 6-3. BEHAVIORAL ZONE OF INFLUENCE FOR MARINE MAMMALS[4] - VIBRATORY DRIVING OF POLYMERIC PILES



[4] Official criteria have not been established for West Indian manatees

7. Impacts to Marine Mammal Species or Stocks

The anticipated impact of the activity upon the species or stock of marine mammals

The effects of pile driving noise on marine mammals depend on several factors, including:

- Type, depth, intensity, and duration of the pile driving sound,
- the species,
- size of the animal and its proximity to the source,
- depth of the water column,
- substrate of the habitat, and
- sound propagation properties of the environment.

Impacts to marine mammals from pile driving activities are expected to result primarily from acoustic pathways. As such, the degree of effect is intrinsically related to the received level and duration of the sound exposure, which are in turn influenced by the distance between the animal and the source. The farther away from the source, the less intense the exposure will be. The substrate and depth of the habitat affect the sound propagation properties of the environment. Shallow environments are typically more structurally complex, which leads to rapid sound attenuation. In addition, substrates that are soft (i.e., sand), such as those in the turning basin, will absorb and attenuate the sound more readily than hard substrates (rock) which may reflect the acoustic wave. Soft porous substrates will also likely require less time to drive the pile, and possibly less forceful equipment, which would ultimately decrease the intensity of the acoustic source to other locations

Behavioral impacts are expected to occur, but the type and severity of these effects are difficult to define due to individual differences in response and limited studies addressing the behavioral effects of sounds on marine mammals. The behavioral responses most likely to occur during the proposed Project are habituation and temporary relocation (Ridgway et al. 1997; Finneran et al. 2003; Wartzok et al. 2003). The time required to drive each pile by vibratory methods would be less than sixty seconds, so the behavioral disturbances are anticipated to be discreet and brief. Injurious impacts to marine mammal species are not expected, but would be the result of physiological responses to both the type and strength of the acoustic signature (Viada et al. 2008).

7.1. Physiological Responses

No Level A exposures are expected because of the mitigation measures outlined in Chapter 11 and the conservative modeling assumptions discussed in Chapter 5. The only real potential for Level A exposures would be as a result of impact pile driving, and that method would only be used as a contingency in cases when vibratory driving is insufficient (a similar project that has been completed at adjacent Wharf Charlie One required impact pile driving on only seven piles, which required less than two days). Physiological responses to impact/impulsive sound stimulation range from non-injurious vibration or compression of tissue to injurious tissue trauma, although mitigations would prevent such occurrences during this Project. The Navy is aware of how important such mitigations are and understands the risks of injury associated with impulsive sounds. Sound-related trauma can be lethal or sub lethal; lethal impacts are those resulting in immediate death or serious debilitation in or near an intense sound source (Ketten 1995). Ears are the most sensitive organ to pressure and are the organs most sensitive to injury (Ketten 2000). Sub lethal damage to the ear from a pressure wave can rupture the tympanum, fracture the ossicles, and damage the cochlea, cause hemorrhage, or cause leakage of cerebrospinal fluid into the middle ear (Ketten 1995). Sub lethal impacts also include hearing loss, which is caused by exposure to perceptible sounds. Moderate injury implies partial hearing loss. Permanent hearing loss (also called permanent threshold shift or PTS) can occur when the hair cells of the ear are damaged by a very loud event, as well as by prolonged exposure to noise. Instances of temporary threshold shifts and/or auditory fatigue are well documented in marine mammal literature as being one of the primary avenues of acoustic impact. Temporary loss of hearing sensitivity has been documented in controlled settings using captive marine mammals exposed to strong sound exposure levels at various frequencies (Ridgway et al. 1997; Kastak et al. 1999; Finneran et al. 2005). While injuries to other sensitive organs are possible, they are less likely since pile driving impacts are almost entirely acoustically mediated, versus explosive sounds which also include a shock wave resulting in damage.

7.2. Behavioral Responses

The intent of the proposed project is to accomplish all pile driving using vibratory pile driving. Impact pile driving would only be used as a contingency in cases when vibratory driving is insufficient (a similar project that has been completed at adjacent Wharf Charlie One required impact pile driving on only seven piles, which required less than two days). The time required to drive each pile by vibratory methods would be less than sixty seconds, so behavioral disturbances are anticipated to be discreet and brief.

Studies of marine mammal responses to non-impulsive noise, such as vibratory pile driving, are limited. Marine mammal monitoring at the Port of Anchorage marine terminal redevelopment project found no response by marine mammals swimming within the threshold distances to noise impacts from construction activities including pile driving (both impact hammer and vibratory driving) (Integrated Concepts & Research Corporation 2009). Background noise levels at this port are typically at 125 dB. Most marine mammals observed during the two lengthy construction seasons - beluga whales, harbor seals, harbor porpoises, and Steller sea lions - were observed in smaller numbers.

Responses to impulsive impact pile driving (if it were to be needed) are expected to be more acute than response to continuous vibratory driving. Controlled experiments with captive marine mammals showed pronounced behavioral reactions, including avoidance of loud sound sources (Ridgway et al. 1997; Finneran et al. 2003). Observed responses of wild marine mammals to loud impulsive sound sources (typically seismic guns or acoustic harassment devices) have been varied, but often consist of avoidance behavior or other behavioral changes suggesting discomfort (Morton and Symonds 2002; also see reviews in Gordon et al. 2004; Wartzok et al. 2003; and Nowacek et al. 2007).

Regardless of the source of the sound sound, behavioral responses to sound are highly variable. The magnitude of each potential behavioral change ultimately determines the severity of the response. A number of factors may influence an animal's response to noise, including its previous experience, its auditory sensitivity, its biological and social status (including age and sex), and its behavioral state and activity at the time of exposure.

A comprehensive review of acoustic and behavioral responses to noise exposure by Nowacek et al. (2007) concluded one of the most common responses is displacement. To assess the significance of displacements, it is necessary to know the areas to which the animals relocate, the quality of that habitat, and the duration of the displacement in the event they return to the pre-disturbance area. Short-term displacement may not be of great concern unless the disturbance happens repeatedly. Similarly, long-term displacement may not be of concern if adequate replacement habitat is available.

Marine mammals exposed to pile driving sound over the course of the Project would likely avoid affected areas if they experience noise-related discomfort. As described in the section above, individual responses to pile driving noise are expected to be variable. Some individuals may occupy the Project area during pile driving without apparent discomfort while others may be displaced with undetermined long-term effects. Avoidance of the affected area during pile driving operations would reduce or eliminate the likelihood of injury impacts, but would also reduce access to foraging areas. Noise-related disturbance may also inhibit some marine mammals from entering / exiting the turning basin. Given the duration of the project there is a potential for displacement of marine mammals from the affected area due to these behavioral disturbances during the in-water work period. However, the time required to drive each pile by vibratory methods would be less than sixty seconds, so behavioral disturbances are anticipated to be discreet and brief. Further, since pile driving will only occur during daylight hours, marine mammals transiting the activity area or foraging or resting in the project area at night will not be affected.

Habituation is a response that occurs when an animal's reaction to a stimulus wanes with repeated exposure, usually in the absence of unpleasant associated events (Wartzok et al. 2003). Animals are most likely to habituate to sounds that are predictable and unvarying. The opposite process is sensitization—when an unpleasant experience leads to subsequent responses, often in the form of avoidance, at a lower level of exposure. Behavioral state or differences in individual tolerance levels may affect the type of response as well. For example, animals that are resting may show greater behavioral change in response to disturbing noise levels than animals that are highly motivated to remain in an area for feeding (Richardson et al. 1995; National Research Council 2003; Wartzok et al. 2003). Indicators of disturbance may include sudden changes in the animal's behavior or avoidance of the affected area. A marine mammal may show signs that it is startled by the noise and/or it may swim away from the sound source and avoid the area. Increased surfacing time and temporary cessation of foraging in the project area could indicate disturbance or discomfort in marine mammals.

Effects of pile driving activities will be experienced by individual marine mammals, but will not cause population-level impacts or affect the continued survival of the species.

7.3. Conclusions Regarding Impacts to Species or Stocks

Individual marine mammals may be exposed to high sound pressure levels during pile removal and installation, which may result in Level B behavioral harassment. Any marine mammals exposed (harassed) may change their normal behavior patterns (i.e., swimming speed, foraging habits, etc.) or be temporarily displaced from the area of construction. Any exposures will likely have only a minor effect on individuals and no effect on their populations. The sound generated from vibratory pile driving is non-impulsive, which is not known to cause injury to marine mammals. Each discreet vibratory pile driving action is also brief, requiring less than sixty seconds to completely drive a pile. Impact pile driving is anticipated to be seldom used, and only when vibratory driving is insufficient (a similar project that has been completed at adjacent Wharf Charlie One required impact pile driving on only seven piles, which required less than two days) and mitigation is expected to prevent adverse physiological underwater impacts to marine mammals from impact pile driving. Nevertheless, some exposure is unavoidable. The expected level of unavoidable exposure (defined as acoustic harassment) is presented in Chapter 6. This level of effect is not anticipated to have any adverse impact to North Atlantic right whales', humpback whales', Atlantic spotted dolphins', or bottlenose dolphins' population recruitment, survival, or recovery (in the case of listed species).

8. Impact on Subsistence Use

The anticipated impact of the activity on the availability of the species or stock of marine mammals for subsistence uses.

Potential marine mammal impacts resulting from the Project will be limited to populations for which there is no known historic or current subsistence use. Therefore, no impacts on the availability of species or stocks for subsistence use are considered.

9. Impacts to Marine Mammal Habitat and the Likelihood of Restoration

The anticipated impact of the activity upon the habitat of the marine mammal populations, and the likelihood of restoration of the affected habitat.

Activities associated with the Project are expected to result in removal of a small amount of low-quality habitat in the turning basin (approximately 1,322 m^2), and disturb sediments, and benthic and forage fish communities, on a temporary, highly localized scale. The turning basin is dredged regularly to allow for deep draft naval ships' berthing; the last dredging took place during the summer of 2012. This, combined with the amount of vessel traffic in the relatively confined space of the turning basin and the transition to the federal navigation channel, has resulted in a determination the Wharf C-2 project area encompasses relatively low quality habitat for most marine species.

Pile extraction and installation, contingency dredging, and deployment of anchors and / or spuds from barges may result in temporary, small scale disturbance of benthic communities and marine vegetation in the immediate vicinity of the project. Benthic organisms may be disturbed, buried or crushed by anchors and / or spuds and removal of piles; this may result in a temporary degradation or loss of isolated foraging habitat for marine mammals. However, sediments and marine vegetation are expected to return to their prior conditions and cover within a short time of the conclusion of the in-water work.

The new surfaces associated with the piles and exposed concrete will likely result in establishment of fouling communities on Wharf C-2 itself, and may attract fish and benthic organisms resulting in very small scale shifts in prey distribution.

Overall, small-scale, temporary changes to habitat and community assemblages in the immediate project area are expected to occur, but natural sedimentation and succession / recruitment will likely return the project footprint to pre-construction conditions within a short amount of time after in-water work is completed.

10. Impacts to Marine Mammals from Loss or Modification of Habitat

The anticipated impact of the loss or modification of the habitat on the marine mammal populations involved.

The Project is not expected to have any habitat-related effects that could cause significant or long-term consequences for individual or populations of marine mammals because of the relatively small footprint and existing disturbed conditions. Further, all impacts will be temporary, with in-water pile driving work being completed in a maximum of 70 days. Information provided in Chapter 9 (Impacts on Marine Mammal Habitat and the Likelihood of Restoration) indicates there may be temporary impacts, but those impacts would be limited to the immediate area within the turning basin. Impacts will cease upon the completion of activities associated with the Project.

11. Means of Affecting the Least Practicable Adverse Impacts – Minimization Measures

The availability and feasibility (economic and technological) of equipment, methods, and manner of conducting such activity or other means of affecting the least practicable adverse impact upon the affected species or stocks, their habitat, and on their availability for subsistence uses, paying particular attention to rookeries, mating grounds, and areas of similar significance.

The Navy shall employ the measures listed in this section to avoid and minimize impacts to marine mammals and their habitats. Best Management Practices (BMPs) are intended to avoid and minimize potential environmental impacts. BMPs and minimization measures are included in the construction contract plans and specifications and must be agreed upon by the contractor prior to any construction activities. Upon signing the contract, it becomes a legal agreement between the contractor and the Navy. Failure to follow the prescribed BMPs and minimization measures is a contract violation.

General Construction Best Management Practices

1. All work shall adhere to performance requirements of the Clean Water Act, Section 404 permit and Section 401 Water Quality Certification. No in-water work shall begin until after issuance of regulatory authorizations.
2. The construction contractor is responsible for preparation of an Environmental Protection Plan. The plan shall be submitted and implemented prior to the commencement of any construction activities and is a binding component of the overall contract. The plan shall identify construction elements and recognize spill sources at the site. The plan shall outline BMPs, responsive actions in the event of a spill or release, and notification and reporting procedures. The plan shall also outline contractor management elements such as personnel responsibilities, project site security, site inspections, and training.
3. No petroleum products, lime, chemicals, or other toxic or harmful materials shall be allowed to enter surface waters.
4. Washwater resulting from washdown of equipment or work areas shall be contained for proper disposal, and shall not be discharged unless authorized.
5. Equipment that enters surface waters shall be maintained to prevent any visible sheen from petroleum products.
6. No oil, fuels, or chemicals shall be discharged to surface waters, or onto land where there is a potential for re-entry into surface waters shall occur. Fuel hoses, oil drums, oil or fuel transfer valves, fittings, etc. shall be checked regularly for leaks, and be maintained and stored properly to prevent spills.
7. No cleaning solvents or chemicals used for tools or equipment cleaning shall be discharged to ground or surface waters.
8. Construction materials shall not be stored where high tides, wave action, or upland runoff could cause materials to enter surface waters.

9. Barge operations shall be restricted to tidal elevations adequate to prevent grounding of a barge.

Pile Removal and Installation Best Management Practices

1. A containment boom surrounding the work area shall be used during creosote-treated pile removal to contain and collect any floating debris and sheen. The boom may be lined with oil-absorbing material to absorb released creosote.
2. Oil-absorbent materials shall be used in the event of a spill if any oil product is observed in the water.
3. All creosote-treated material and associated sediments shall be disposed of in a landfill that meets Florida environmental standards.
4. Removed piles and associated sediments (if any) shall be contained on a barge. If a barge is not utilized, piles and sediments may be stored in a containment area near the construction site.
5. Pilings that break or are already broken below the waterline may be removed by wrapping the piles with a cable or chain and pulling them directly from the sediment with a crane. If this is not possible, they shall be removed with a clamshell bucket. To minimize disturbance to bottom sediments and splintering of piling, the contractor shall use the minimum size bucket required to pull out piling based on pile depth and substrate. The clam shell bucket shall be emptied of piling and debris on a contained barge before it is lowered into the water. If the bucket contains only sediment, the bucket shall remain closed and be lowered to the mud line and opened to redeposit the sediment. In some cases (depending on access, location, etc.), piles may be cut below the mud line and the resulting hole backfilled with clean sediment.
6. Any floating debris generated during installation shall be retrieved. Any debris in a containment boom shall be removed by the end of the work day or when the boom is removed, whichever occurs first. Retrieved debris shall be disposed of at an upland disposal site.
7. Whenever activities that generate sawdust, drill tailings, or wood chips from treated timbers are conducted, tarps or other containment material shall be used to prevent debris from entering the water.
8. If excavation around piles to be replaced is necessary, hand tools or a siphon dredge shall be used to excavate around piles to be replaced.

Timing Restrictions

All in-water construction activities shall occur during daylight hours (one hour post sunrise to one hour prior to sunset[5]). Non in-water construction activities could occur between 6:00 AM and 10:00 PM during any time of the year.

[5] Sunrise and sunset are to be determined based on the National Oceanic and Atmospheric Administration data which can be found at http://www.srrb.noaa.gov/highlights/sunrise/sunrise.html.

Additional Minimization Measures for Marine Mammals

The following minimization measures shall be implemented during pile driving to avoid marine mammal exposure to Level A injurious noise levels generated from impact pile driving and to reduce to the lowest extent practicable exposure to Level B disturbance noise levels.

Coordination

The Navy shall conduct a pre-construction briefing with the contractor. During the briefing, all personnel working in the Project area shall watch the Navy's Marine Species Awareness Training video.

Acoustic Minimization Measures

Vibratory installation shall be used to the extent possible to drive steel piles to minimize higher sound pressure levels associated with impact pile driving.

Soft Start

The objective of a soft-start is to provide a warning and / or give animals in close proximity to pile driving a chance to leave the area prior to an impact driver operating at full capacity; thereby, exposing fewer animals to loud underwater and airborne sounds. A soft start procedure shall be used at the beginning of each day's in-water pile driving or if pile driving has ceased for more than 1 hour, for impact driving only.

The contractor shall provide 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 they vary 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").

Standard Conditions

Conditions in this section include those that will be followed for the protection of all ESA-listed species, not only those being addressed in this application. The contractor will adhere to all requirements of the following:

- 2009 Standard Manatee Conditions for In-Water Work
- Sea Turtle and Smalltooth Sawfish Construction Conditions
- Southeast Regional Marine Mammal and Sea Turtle Viewing Guidelines

Sea Turtle Lighting Conditions

- Lighting on construction equipment shall be minimized through reduction, shielding, lowering, and appropriate placement to avoid excessive illumination of the nearby marine turtle nesting beach while still being consistent with human safety requirements.

- All permanent exterior lighting fixtures associated with the wharf redevelopment should be assessed by NAVSTA Mayport Environmental Department and designed according to the NAVSTA Mayport Light Management Plan to minimize light contribution to urban sky glow which could be visible from the marine turtle nesting beach.

Visual Monitoring and Shutdown Procedures

A separate Marine Species Monitoring Plan will be submitted to NMFS and USFWS; it includes all details for monitoring. Major components of the monitoring plan are summarized below.

Observers and Procedures

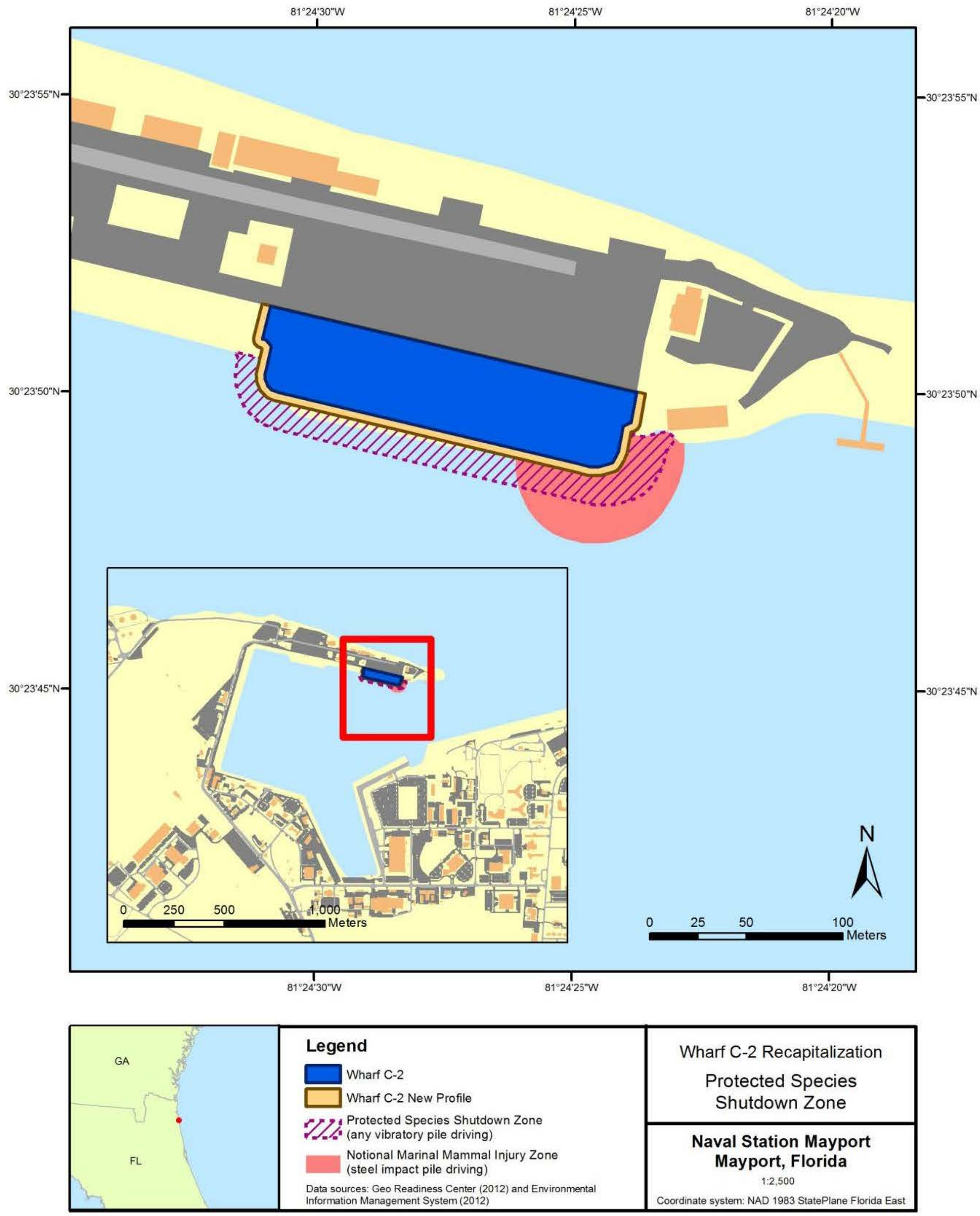
The Navy shall conduct a pre-construction briefing with the contractor. During the briefing, all contractor personnel working in the Project area will watch the Navy's Marine Species Awareness Training video. An informal guide will be included with the Monitoring Plan to aid in identifying species should they be observed in the vicinity of the Project.

Marine species observers ("observers") designated by the contractor will be placed at the best vantage point(s) practicable to monitor for protected species and implement shutdown/delay procedures when applicable by calling for the shutdown to equipment operators. The observers shall have no other construction related tasks while conducting monitoring.

Methods

The observer(s) will monitor the entire shutdown zone (Figure 11-1) before, during, and after pile driving and removal. The shutdown zone for contingency only impact pile driving was calculated based on acoustic modeling at a notional pile location on the wharf. The zone to be monitored is 40 m (130 ft.) in each direction from the pile being driven. However, the shutdown zone for the vast majority of in-water work (i.e. during vibratory pile driving) will be 15 m (50 ft.) from the pile being driven. The observer(s) will have full visibility of the shutdown zone regardless of the type of driving taking place, and will be able to immediately report a marine mammal observation and initiate shutdown procedures.

FIGURE 11-1. SHUTDOWN ZONES FOR VIBRATORY AND (CONTINGENCY ONLY) IMPACT PILE DRIVING



The observer(s) will be placed at the best vantage point practicable (e.g. from a small boat, construction barges, on shore, or any other suitable location) to monitor for marine species and implement shutdown/delay procedures when applicable by calling for the shutdown to the equipment operator(s). Elevated positions are preferable; it shall be the contractor's responsibility to ensure that appropriate safety measures are implemented to protect observers on elevated observation points. If a boat is used for monitoring, the boat will maintain minimum distances from all species (should they occur) as described in the Southeast Region Marine Mammal and Sea Turtle Viewing Guidelines.

During all observation periods, observers would use binoculars and the naked eye to search continuously for ESA-listed species (with the exception of fish, which are not likely to be visible from the surface). If the shutdown zone is obscured by fog or poor lighting conditions, pile driving will not be initiated until the entire shutdown zone is visible.

Pre-Activity Monitoring

The shutdown zone will be monitored for 15 minutes prior to in-water construction/demolition activities. If a protected species is observed in or approaching the shutdown zone, the activity shall be delayed until the animal(s) leaves the shutdown zone. Activity would resume only after the observer has determined, through re-sighting or by waiting approximately 15 minutes that the animal(s) has moved outside the shutdown zone. The observer(s) will notify the monitoring coordinator/construction foreman / point of contact (POC) when construction activities can commence.

Activity Monitoring

The shutdown zone will always be a minimum of 15 m (50 ft.) to prevent injury from physical interaction of protected species with construction equipment (Figure 11-1). For contingency impact pile driving, the larger 40 m (130 ft.) shutdown zone (indicated by red polygon in Figure 11-1 for a notional pile location) shall be implemented; the standard shutdown zone will continue to be applied for all other protected species.

If a protected species approaches or enters a shutdown zone during any in-water work, activity will be halted and delayed until either the animal has voluntarily left and been visually confirmed beyond the shutdown zone or 15 minutes have passed without re-detection of the animal. Note: protected fish species will not likely be visible to observers at the surface.

Bulkhead sheet pile installation shall be completed only after confirmation that no manatees or marine turtles will be trapped in the area to be filled between the existing and new bulkheads.

Post-Activity Monitoring

Monitoring of the shutdown zone will continue for 15 minutes following the completion of the activity.

Data Collection

The following information will be collected on sighting forms used by observers:

- Date and time that pile driving or removal begins or ends
- Construction activities occurring during each observation period
- Weather parameters identified in the acoustic monitoring (e.g., wind, temperature, percent cloud cover, and visibility)
- Tide and sea state

If a protected species approaches or enters the shutdown zone, the following information will be recorded once shutdown procedures have been implemented:

- Species, numbers, and if possible sex and age class of the species
- Behavior patterns observed, including bearing and direction of travel
- Location of the observer and distance from the animal(s) to the observer

If possible, photographs of the animal(s) will be taken and forwarded to the Naval Facilities Engineering Command Southeast Environmental point of contact.

Data collection forms shall be furnished to the Environmental point of contact within a mutually agreeable timeframe.

Interagency Notification

If the Navy encounters an injured, sick, or dead marine mammal, NMFS will be notified immediately. Such sightings will be called into the NMFS Stranding Coordinator for the Southeast:

Erin Fougeres, Ph.D.
Marine Mammal Stranding Program Administrator
NOAA Fisheries
Southeast Regional Office
263 13th Avenue South
St. Petersburg, FL 33701
e-mail: erin.fougeres@noaa.gov
office: 727-824-5323
fax: 727-824-5309

The Navy will provide NMFS with the species or description of the animal(s), the condition of the animal (including carcass condition if the animal is dead), location, the date and time of first discovery, observed behaviors (if alive), and photo or video (if available).

In preservation of biological materials from a dead animal, the finder (i.e. marine mammal observer) has the responsibility to ensure that evidence associated with the specimen is not unnecessarily disturbed. Observers should not handle dead animals.

Reporting

A draft report of any incidents of marine mammals entering the shutdown zone will be forwarded to NMFS / USFWS no later than 17 January 2015. A final report would be prepared and submitted to NMFS within 30 days following receipt of comments on the draft report from NMFS.

12. Minimization of Adverse Effects on Subsistence Use

Where the proposed activity would take place in or near a traditional Arctic subsistence hunting area and/or may affect the availability of a species or stock of marine mammal for Arctic subsistence uses, the applicant must submit either a plan of cooperation or information that identifies what measures have been taken and/or will be taken to minimize any adverse effects on the availability of marine mammals for subsistence uses. A plan must include the following:

(i) A statement that the applicant has notified and provided the affected subsistence community with a draft plan of cooperation;

(ii) A schedule for meeting with the affected subsistence communities to discuss proposed activities and to resolve potential conflicts regarding any aspects of either the operation or the plan of cooperation;

(iii) A description of what measures the applicant has taken an/or will take to ensure that proposed activities will not interfere with subsistence whaling or sealing; and

(iv) What plans the applicant has to continue to meet with the affected communities, both prior to and while conducting activity, to resolve conflicts and to notify the communities of any changes in the operation.

As detailed in Chapter 8, no impacts on the availability of species or stocks for subsistence use are considered. Therefore, no minimization efforts are applicable.

13. Monitoring and Reporting Measures

The suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species, the level of taking or impacts on populations of marine mammals that are expected to be present while conducting activities and suggested means of minimizing burdens by coordinating such reporting requirements with other schemes already applicable to persons conducting such activity. Monitoring plans should include a description of the survey techniques that would be used to determine the movement and activity of marine mammals near the activity site(s) including migration and other habitat uses, such as feeding.

A separate Marine Species Monitoring Plan is being submitted to NMFS it includes all details for Project monitoring efforts.

14. Research

Suggested means of learning of, encouraging, and coordinating research opportunities, plans, and activities relating to reducing such incidental taking and evaluating its effects.

At this time the Navy does not anticipate any specific research conducted in conjunction with the Project.

The Navy strives to be a world leader in marine species research and has provided more than $100 million over the past five years to universities, research institutions, federal laboratories, private companies, and independent researchers around the world to increase the understanding of marine species physiology and behavior with several projects ongoing in Washington.

The Navy sponsors 70 percent of all U.S. research concerning the effects of human-generated sound on marine mammals and 50 percent of such research conducted worldwide. Major topics of Navy-supported research include the following:

- Gaining a better understanding of marine species distribution and important habitat areas
- Developing methods to detect and monitor marine species before and during training
- Understanding the effects of sound on marine mammals
- Developing tools to model and estimate potential effects of sound

The Navy has sponsored several workshops to evaluate the current state of knowledge and potential for future acoustic monitoring of marine mammals. The workshops brought together acoustic experts and marine biologists from the Navy and outside research organizations to present data and information on current acoustic monitoring research efforts and to evaluate the potential for incorporating similar technology and methods into Navy activities. The Navy supports research efforts on acoustic monitoring and will continue to investigate the feasibility of passive acoustics as a potential monitoring tool. Overall, the Navy will continue to research and contribute to university/external research to improve the state of the science regarding marine species biology and acoustic effects. These efforts include monitoring programs, data sharing with NMFS from research and development efforts, and future research as previously described.

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Appendix A

Sample Photos of Wharf C-2 Deterioration

FIGURE A-1. VIEW OF A MINOR AREA OF CONCRETE DETERIORATION IN THE CONCRETE CAP ALONG THE CONSTRUCTION JOINT NEAR STATION 5+50, LOOKING NORTH

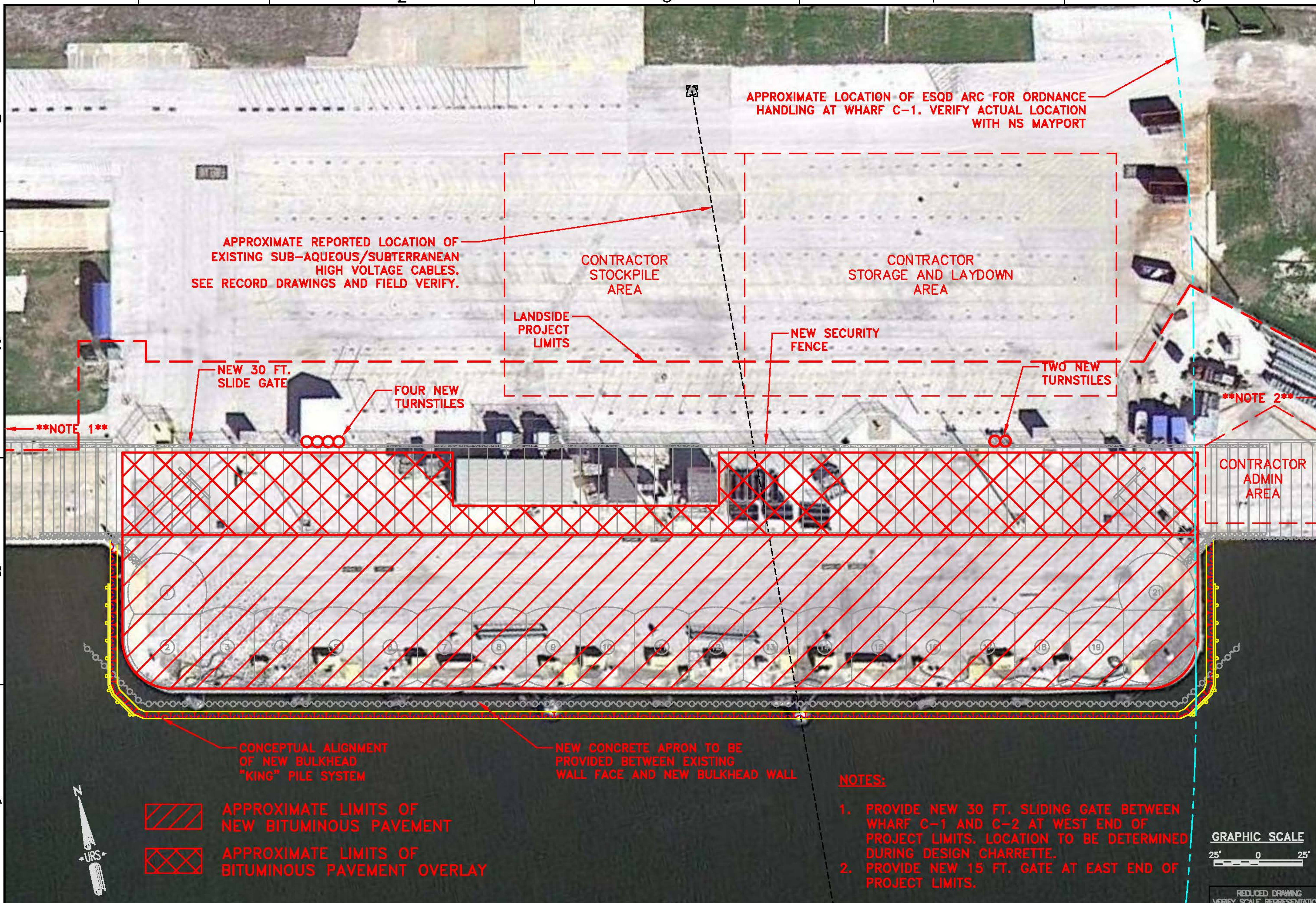
FIGURE A-2. VIEW OF THE TYPICAL SECTION LOSS ALONG THE EDGES OF THE PRECAST CONCRETE PANELS OF THE WHARF CAP NEAR STATION 0+90, LOOKING NORTHEAST

FIGURE A-3. VIEW OF THE SPALL ALONG THE CONCRETE CURB AT STATION 4+40 THAT WAS 3 FT LONG BY 12 IN. WIDE BY 8 IN. HIGH WITH EXPOSED AND CORRODED REINFORCING STEEL, LOOKING SOUTH

FIGURE A-4. VIEW OF SOUTHEASTERN CORNER OF DECK – NOTE DISLOCATION OF THE BULL RAIL

Appendix B

Contractor's Project Schematic



FILE NAME: N:\NAVY\MAYPORT\WHARF C2 IMPROVEMENTS\PLAN VIEW - Aerial Photo_Rev2.dwg LAYOUT NAME: Plan View - Asphalt PLOTTED: Tuesday, July 03, 2012 - 9:20am USER: vasco_duke

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Tampa, FL 33607
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FOR COMMANDER NAVFAC / B.I.T.
ACTIVITY
SATISFACTORY TO DATE
DES KQG | DRW IZ | CHK JC
PROJECT MANAGER
FT TECH. BRANCH HEAD
CHIEF ENG/ARCH (CODE)

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NAVAL FACILITIES ENGINEERING COMMAND SOUTHEAST
IPT SOUTH ATLANTIC NAVAL AIR STATION JACKSONVILLE
NAVAL STATION MAYPORT, FLORIDA
WHARF C-2 REPLACEMENT
SITE PLAN – BULKHEAD, PAVING AND FENCING

SCALE AS SHOWN
EPROJECT NO.:
CONSTR. CONTR. NO.
NAVFAC DRAWING NO.
SHEET OF
C-109
DRAWFORM REVISION: 1 AUGUST 2000

STANDARD MANATEE CONDITIONS FOR IN-WATER WORK

July 2005

The permittee shall comply with the following conditions intended to protect manatees from direct project effects:

a. All personnel associated with the project shall be instructed about the presence of manatees and manatee speed zones, and the need to avoid collisions with and injury to manatees. The permittee shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing manatees which are protected under the Marine Mammal Protection Act, the Endangered Species Act, and the Florida Manatee Sanctuary Act.

b. All vessels associated with the construction project shall operate at "Idle Speed/No Wake" at all times while in the immediate area and while in water where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will follow routes of deep water whenever possible.

c. Siltation or turbidity barriers shall be made of material in which manatees cannot become entangled, shall be properly secured, and shall be regularly monitored to avoid manatee entanglement or entrapment. Barriers must not impede manatee movement.

d. All on-site project personnel are responsible for observing water-related activities for the presence of manatee(s). All in-water operations, including vessels, must be shutdown if a manatee(s) comes within 50 feet of the operation. Activities will not resume until the manatee(s) has moved beyond the 50-foot radius of the project operation, or until 30 minutes elapses if the manatee(s) has not reappeared within 50 feet of the operation. Animals must not be herded away or harassed into leaving.

e. Any collision with or injury to a manatee shall be reported immediately to the FWC Hotline at 1-888-404-FWCC. Collision and/or injury should also be reported to the U.S. Fish and Wildlife Service in Jacksonville (1-904-232-2580) for north Florida or Vero Beach (1-561-562-3909) for south Florida.

f. Temporary signs concerning manatees shall be posted prior to and during all in-water project activities. All signs are to be removed by the permittee upon completion of the project. Awareness signs that have already been approved for this use by the Florida Fish and Wildlife Conservation Commission (FWC) must be used. One sign measuring at least 3 ft. by 4 ft. which reads *Caution: Manatee Area* must be posted. A second sign measuring at least 81/2" by 11" explaining the requirements for “Idle Speed/No Wake” and the shut down of in-water operations must be posted in a location prominently visible to all personnel engaged in water-related activities.

FWC Approved Manatee Educational Sign Suppliers

ASAP Signs & Designs
624-B Pinellas Street
Clearwater, FL 33756
Phone: (727) 443-4878
Fax: (727) 442-7573

Vital Signs
104615 Overseas Highway
Key Largo, FL 33037
Phone: (305) 451-5133
Fax: (305) 451-5163

Wilderness Graphics, Inc.
P.O. Box 1635
Tallahassee, FL 32302
Phone: (850) 224-6414
Fax: (850) 561-3943
www.wildernessgraphics.com

Universal Signs & Accessories
2912 Orange Avenue
Ft. Pierce, FL 34947
Phone: (800) 432-0331
or (772) 461-0665
Fax: (772) 461-0669

Cape Coral Signs & Designs
1311 Del Prado Boulevard
Cape Coral, FL 33990
Phone: (239) 772-9992
Fax: (239) 772-3848

New City Signs
1829 28th Street North
St. Petersburg, FL 33713
Phone: (727) 323-7897
Fax: (727) 323-1897

Municipal Supply & Sign Co.
1095 Fifth Avenue, North
P.O. Box 1765
Naples, FL 33939-1765
Phone: (800) 329-5366
or (239) 262-4639
Fax: (239) 262-4645
www.municipalsigns.com

United Rentals Highway Technologies
309 Angle Road
Ft. Pierce, FL 34947
Phone: (772) 489-8772
or (800) 489-8758 (FL only)
Fax: (772) 489-8757

CAUTION: MANATEE HABITAT

All project vessels

IDLE SPEED / NO WAKE

When a manatee is within 50 feet of work
all in-water activities must

SHUT DOWN

Report any collision or injury to:

1-888-404-FWCC (1-888-404-3922)

Florida Fish and Wildlife Conservation Commission

Appendix D

Fundamentals of Acoustics

Bioacoustics, or the study of how sound affects living organisms, is a complex and interdisciplinary field that includes the physics of sound production and propagation, the source characteristics of sounds, and the perceptual capabilities of receivers. This appendix is intended to introduce the reader to the basics of sound measurements and sound propagation, as well as the hearing and vocal production abilities of species that may occur in the project area. The potential for noise from pile driving to cause auditory masking for marine mammals within the project area is also considered.

D.1 Fundamentals of Acoustics

Sound is an oscillation in pressure, particle displacement, or particle velocity, as well as the auditory sensation evoked by these oscillations, although not all sound waves evoke an auditory sensation (i.e., they are outside of an animal's hearing range) (ANSI S1.1-1994). Sound may be described in terms of both physical and subjective attributes. Physical attributes may be directly measured. Subjective (or sensory) attributes cannot be directly measured and require a listener to make a judgment about the sound. Physical attributes of a sound at a particular point are obtained by measuring pressure changes as sound waves pass. The following material provides a short description of some of the basic parameters of sound.

Sound can be characterized by several factors, including frequency, intensity, and pressure (Richardson et al. 1995). Sound frequency (measured in Hertz [Hz]) and intensity (amount of energy in a signal [Watts per meter^2]) are physical properties of the sound which are related to the subjective qualities of pitch and loudness (Kinsler et al. 1999). Sound intensity and sound pressure (measured in Pascals [Pa]) are also related; of the two, sound pressure is easier to measure directly, and is therefore more commonly used to evaluate the amount of disturbance to the medium caused by a sound ("amplitude").

Because of the wide range of pressures and intensities encountered during measurements of sound, a logarithmic scale known as the decibel is used to evaluate these properties; in acoustics, "level" indicates a sound measurement in decibels. The decibel [dB] scale expresses the logarithmic strength of a signal (pressure or intensity) relative to a reference value of the same units. This document reports sound levels with respect to sound pressure only. Each increase of 20 dB reflects a ten-fold increase in signal pressure, i.e., an increase of 20 dB means ten times the pressure, 40 dB means one hundred times the pressure, 60 dB means one thousand times the pressure, and so on.

The sound levels in this document are given as sound pressure levels [SPL]. For measurements of underwater sound, the standard reference pressure is 1 microPascal [μPa, or 10^{-6} Pascals], and is expressed as "dB re 1μPa". For airborne sounds, the reference value is 20 μPa, expressed as "dB re 20 μPa". Sound levels measured in air and water are not directly comparable, and it is important to note which reference value is associated with a given sound level.

Airborne sounds are commonly referenced to human hearing using a method which weights sound frequencies according to measures of human perception, de-emphasizing very low and very high frequencies which are not perceived well by humans. This is called A-weighting, and the decibel level measured is called the A-weighted sound level [dBA]. A similar method has been proposed for evaluating underwater sound levels with respect to marine mammal hearing. While preliminary weighting functions for marine mammal hearing have been developed

(Southall et al. 2007), they are not yet applied to sound exposure from pile driving activities. Therefore, underwater sound levels given in this document are not weighted and evaluate all frequencies equally.

Table D-1 summarizes common acoustic terminology. Two of the most common descriptors are the instantaneous peak SPL and the root-mean-square [rms] SPL. The peak SPL is the instantaneous maximum or minimum over- or underpressure observed during each sound event and is presented in dB re 1 µPa peak. The rms level is the square root of the energy divided by a defined time period, given as dB re 1 µPa rms.

Table D-1. Definitions 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 or intensity of the sound measured to the appropriate standard reference value. This document uses only sound pressure measurements to calculate decibel levels. 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 (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. Sound pressure level is the quantity that is directly measured by a sound level meter, and is expressed in decibels referenced to the appropriate air or water standard.
Frequency, 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 20,000 Hz; hearing ranges in non-humans are widely variable and species specific.
Peak Sound Pressure (unweighted), dB re 1µPa peak	The maximum absolute value of the instantaneous sound pressure expressed as dB re 1µPa peak.
Root-Mean-Square [rms], dB re 1µPa	The rms level is the square root of the pressure divided by a defined time period, expressed in decibels. For impulsive sounds, the rms has been defined as the average of the squared pressures over the time that comprise that portion of waveform containing 90 percent of the sound energy for one impact pile driving impulse. For non-impulsive sounds, rms energy represents the average of the squared pressures over the measurement period and is not limited by the 90 percent energy criterion. Expressed as dB re 1µPa.
Sound Exposure Level [SEL], dB re 1µPa^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.
Waveforms, µPa over time	A graphical plot illustrating the time history of positive and negative sound pressure of individual pile strikes shown as a plot of µPa over time (i.e., seconds).
Frequency Spectra, dB over frequency range	A graphical plot illustrating the frequency content over a given frequency range. Bandwidth is generally defined as linear (narrowband) or logarithmic (broadband) and is stated in frequency (Hz).
A-Weighted Sound Level, dBA	A frequency-weighted measure used for airborne sounds only. A-weighting de-emphasizes the low and high frequency components of a given sound in a manner similar to the frequency response of the human ear and correlates well with subjective human reactions to noise. A-weighted levels are referenced to 20 µPa unless otherwise noted.

Term	Definition
Ambient Noise Level	The background noise level, which is a composite of sounds from all sources near and far. The normal or existing level of environmental noise at a given location, given in dB referenced to the appropriate pressure standard.

Adapted and derived from URS Corporation (2007)

D.2 Sound vs. Noise

Sound may be purposely created to convey information, communicate, or obtain information about the environment. Examples of such sounds are sonar pings, marine mammal vocalizations/echolocations, tones used in hearing experiments, and small sonobuoy explosions used for submarine detection.

Noise is undesired sound (ANSI S1.1-1994). Whether a sound is noise depends on the receiver (i.e., the animal or system that detects the sound). For example, small explosives and sonar used to locate an enemy submarine produce *sound* that is useful to sailors engaged in anti-submarine warfare, but is likely to be considered undesirable *noise* by marine mammals. Sounds produced by naval aircraft and vessel propulsion are considered noise because they represent possible energy inefficiency and increased detectability, which are undesirable.

Noise also refers to all sound sources that may interfere with detection of a desired sound and the combination of all of the sounds at a particular location (ambient noise).

D.3 Description of Noise Sources

Ambient noise in the project area is a composite of sounds from natural sources, normal port activities, and temporary projects such as maintenance dredging or pile driving. Ambient noise in the Mayport turning basin is addressed in Chapter 5 of the IHA Application.

In-water construction activities associated with this project include vibratory and impact pile driving. The sounds produced by these activities fall into two sound types: impulsive (impact driving) and non-impulsive (vibratory driving). Distinguishing between these two general sound types is important because of each sound type may cause different types of physical effects, particularly with regard to hearing (Ward 1997).

Impulsive sounds (e.g., explosions, seismic airgun pulses, and impact pile driving) are referred to as pulsed sounds in Southall et al. (2007), and are brief, broadband, atonal transient sounds which can occur as isolated events or be repeated in some succession (Southall et al. 2007). Impulsive sounds are characterized by a relatively rapid rise from ambient pressure to a maximal pressure value followed by a decay period that may include a period of diminishing, oscillating maximal and minimal pressures (Southall et al. 2007). Impulsive sounds generally have a greater capacity to induce physical injury compared with sounds that lack these features (Southall et al. 2007).

Non-impulsive sounds ("non-pulsed" in Southall et al. 2007) can be tonal, broadband, or both. They lack the rapid rise time and can have longer durations than impulsive sounds. Non-impulsive sounds can be either intermittent or continuous sounds. Examples of non-impulsive sounds include vessels, aircraft, and machinery operations such as drilling, dredging, and vibratory pile driving (Southall et al. 2007).

In environments with non-porous boundaries (i.e. rock seafloor, rigid sides, etc.), reverberation may extend the duration of both impulsive and non-impulsive sounds.

D.4 Vocalization and Hearing of Marine Mammals

All marine mammals that have been studied can produce sounds and use sounds to forage, orient, detect and respond to predators, and facilitate social interactions (Richardson et al., 1995). Measurements of marine mammal sound production and hearing capabilities provide some basis for assessing whether exposure to a particular sound source may affect a marine mammal behaviorally or physiologically. Marine mammal hearing abilities are quantified using live animals either via behavioral audiometry or electrophysiology (see Schusterman 1981; Au 1993; Wartzok and Ketten 1999; Nachtigall et al. 2007). Behavioral audiograms, which are plots of animals' exhibited hearing threshold versus frequency, are obtained from captive, trained live animals using standard testing procedures with appropriate controls, and are considered to be a more accurate representation of a subject's hearing abilities. Behavioral audiograms of marine mammals are difficult to obtain because many species are too large, too rare, and too difficult to acquire and maintain for experiments in captivity. Consequently, our understanding of a species' hearing ability may be based on the behavioral audiogram of a single individual or small group of animals. In addition, captive animals may be exposed to local ambient sounds and other environmental factors that may impact their hearing abilities and may not accurately reflect the hearing abilities of free-swimming animals. For animals not available in captive or stranded settings (including large whales and rare species), estimates of hearing capabilities are made based on anatomical and physiological structures, the frequency range of the species' vocalizations, and extrapolations from related species.

Electrophysiological audiometry measures small electrical voltages produced by neural activity when the auditory system is stimulated by sound. The technique is relatively fast, does not require a conscious response, and is routinely used to assess the hearing of newborn humans. It has recently been adapted for use on non-humans, including marine mammals (Dolphin, 2000). For both methods of evaluating hearing ability, hearing response in relation to frequency is a generalized U-shaped curve or audiogram showing the frequency range of best sensitivity (lowest hearing threshold) and frequencies above and below with higher threshold values.

Direct measurement of hearing sensitivity exists for approximately 25 of the nearly 130 species of marine mammals. Table D-2 provides a summary of sound production and hearing capabilities for marine mammal species in the Project Area. For purposes of this analysis, marine mammals are arranged into the following functional hearing groups based on their generalized hearing sensitivities: high-frequency cetaceans, mid-frequency cetaceans, low-frequency cetaceans (mysticetes), phocid pinnipeds (true seals), otariid pinnipeds (sea lions and fur seals); of these, only mid- and low-frequency cetaceans occur in the Project Area.

Table D-2. Hearing and Vocalization Ranges for Marine Mammal Functional Hearing Groups and Species Potentially Occurring within the Project Area

Functional Hearing Group	Species	Sound Production		General Hearing Ability Frequency Range
		Frequency Range	Source Level (dB re 1 µPa @ 1 m)	
Mid-Frequency Cetaceans	bottlenose dolphin; Atlantic spotted dolphin	100 Hz to 100kHz	137 to 236	150 Hz to 160 kHz
Low-Frequency Cetaceans	North Atlantic right whale; humpback whale	10 Hz to 20 kHz	137 to 192	7 Hz to 22 kHz

Adapted and derived from Southall et al. (2007) and Richardson et al. (1995)
dB re 1 µPa @ 1 m: decibels (dB) referenced to (re) 1 micro (µ) Pascal (Pa) at 1 meter; Hz: Hertz; kHz: kilohertz

D.4.1 Auditory Masking

Natural and artificial sounds can disrupt behavior by auditory masking, or interfering with a marine mammal's ability to detect and interpret other relevant sounds, such as communication and echolocation signals (Wartzok et al. 2004). Masking occurs when both the signal and masking sound have similar frequencies and either overlap or occur very close to each other in time. A signal is very likely to be masked if the noise is within a certain "critical bandwidth" around the signal's frequency and its energy level is similar or higher (Holt 2009). Noise within the critical band of a marine mammal signal will show increased interference with detection of the signal as the level of the noise increases (Wartzok et al. 2004). In delphinid subjects, for example, relevant signals needed to be 17 to 20 dB louder than masking noise at frequencies below 1 kHz in order to be detected and 40 dB greater at approximately 100 kHz (Richardson et al. 1995). Noise at frequencies outside of a signal's critical bandwidth will have little to no effect on the detection of that signal (Wartzok et al. 2004).

Additional factors influencing masking are the temporal structure of the noise and the behavioral and environmental context in which the signal is produced. Continuous noise is more likely to mask signals than intermittent noise of the same amplitude; quiet "gaps" in the intermittent noise allow detection of signals which may not be detectable during continuous noise (Brumm and Slabbekoorn, 2005). The behavioral function of a vocalization (e.g. contact call, group cohesion vocalization, echolocation click, etc.) and the acoustic environment at the time of signaling may both influence call source level (Miksis-Olds and Tyack, 2009; Holt et al. 2011), which directly affects the chances that a signal will be masked (Nemeth and Brumm, 2010).

Noise from anthropogenic sources could cause masking of vocalizations which may rise to the level of behavioral harassment (as defined by the MMPA) if it disrupts communication, echolocation, or other hearing-dependent behaviors. Impact pile driving produces high-amplitude low-frequency noise (10 – 2,000 Hz), which is likely to be audible to all three marine mammal species considered, and is likely to overlap the vocalizations of low-frequency cetaceans (North Atlantic right and humpback whales; Table D-2). While the amplitude of impact pile driving noise may exceed marine mammal vocalization amplitudes within an unknown range of the driven pile, impact pile driving noise is unlikely to entirely mask social (non-echolocation) signals due to the intermittent nature impact pile driving noise and the limited duration of impact pile driving associated with this project. Impact pile driving will be conducted only in the rare event that an obstruction is encountered during vibratory pile driving, and will be limited to a maximum of 20 strikes per day. We therefore estimate that the likelihood of noise from impact pile driving masking signals important to the behavior and survival of any of the three marine mammal species in the project area is negligible.

Vibratory pile driving produces frequencies from 10 Hz to 2 kHz, which would be within the range of audible sound and vocal production (see Table D-2) for all marine mammal species that may occur in the project area. Given the source levels (151 – 180 dB rms re 1 μPa at 10m) and frequency range (10 – 2,000 Hz) of vibratory pile driving noise (Illingworth & Rodkin 2012), we estimate that any masking event that could rise to Level B harassment under the MMPA would occur within the zones of behavioral harassment estimated for vibratory pile driving (see Chapter 5 in the IHA Application) (Parks et al. 2011). Therefore, potential masking effects are not considered separately in this IHA application.

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Appendix E

NAVSTA Mayport Turning Basin Map

N
W
E
S
Mayport
Legend
Sea Wall Length (15,280 ft)
Berthing wharf (9181 ft)
Bulkhead (1658 ft)
Pier (2045 ft)
Rip rap (1743 ft)
Tug wharf (653 ft)
Turning Basin (176 ac.)
653 ft
779 ft
613 ft
774 ft
441 ft
1145 ft
176 ac.
1786 ft
2668 ft
4960 ft
544 ft
0
500
1,000
2,000 Feet

Appendix F

Turning Basin Survey Raw Data Sheets
Fall 2012

NS Mayport Dolphin Surveys - Data Collection Sheet

Seasonal, Shore-based, Visual Surveys

Seasonal Quarter: Winter 2012 (December 10 - 13, 2013)
Date: Monday, December 10, 2012
Observation Point: Forth Story of the Harbor Operations Building
Survey Period: 2 (Afternoon)

Marine Species Observer:
Printed Name: Todd Wilkinson

Signature:

Visual Suvey (#)	Start Time (24 hrs)	End Time (24 hrs)	Dolphin Observations (#/Grid) (X = No Visual Area-of-Sight [Grid Obscured])												Observation Notes (Group Size, Behavior, Calves, Other Marine Species)	Beaufort SS	Tide Data (Ref: MLLW)
			1	2	3	4	4a	5	6	7	8	9	10	11		(0 - 12)	(Ft)
1	1230	1235	0	0	0	0	0	0	X	X	0	X	X	X	at least 3 were observed in Grid #4a after the survey period ended	0	0.62
2	1300	1305	0	0	0	0	0	0	X	X	0	X	X	X		1	1.01
3	1330	1335	0	0	0	0	0	1	X	X	0	X	X	X	1 was observed in Grid #4 after the survey period ended (likely the same one observed in Grid #5)	1	1.51
4	1400	1405	0	0	0	0	0	1	X	X	4	X	X	X	1 of the 4 in Grid #8 was a young calf	1	2.08
5	1430	1435	0	0	0	0	0	0	X	X	0	X	X	X		1	2.58
6	1500	1505	0	0	0	0	0	0	X	X	0	X	X	X	1 in Grid #8 @ 1515, and 1 in Grid #3 @ 1522	1	3.10
7	1530	1535	0	0	0	1	0	0	X	X	2	X	X	X		2	3.54
8	1600	1605	-	-	-	-	-	-	-	-	-	-	-	-	survey skipped; thunder storm w/ heavy rain	2	3.97
9	1630	1635	0	0	0	4	0	0	X	X	1	0	0	X	moving into the basin	1	4.27
10	1700	1705	0	0	0	0	3	0	X	X	0	0	0	X		0	4.51
11	1730	1735	0	0	0	2	0	0	X	X	0	0	0	X	dark conditions; Sunset = 1726	0	4.77
12																	
13																	
14																	
15																	
16																	
17																	
18																	

Meterological Data

(Source: Mayport [Bar Pilots Dock], FL; Station ID: 8720218)

Visual Period	Start Time (24 hrs)	End Time (24 hrs)	Cloud Cover (%)	Rain Fall (cm)	Air Temp (°F)	Water Temp (°F)	Wind Speed (knots)	Wind Gusts (knots)	Wind Dierction (true)	Barametric Pressure (Mb)	NOTES
1	1230	1235	75		74.48	65.30	8.16	11.47	231.00	1015.10	
6	1500	1505	85		67.82	66.02	6.80	9.14	148.00	1012.50	
11	1730	1735	50		67.82	64.58	2.53	5.25	214.00	1012.10	

Other General Notes

NS Mayport Dolphin Surveys - Data Collection Sheet

Seasonal, Shore-based, Visual Surveys

Seasonal Quarter: Winter 2012 (December 10 - 13, 2013)
Date: Monday, December 10, 2012
Observation Point: Ground Level at the Northwest Corner of B-3 and C-1 Pier
Survey Period: 2 (Afternoon)

Marine Species Observer:
Printed Name: Dennis Peters

Signature:

Visual Suvey (#)	Start Time (24 hrs)	End Time (24 hrs)	Dolphin Observations (#/Grid) (X = No Visual Area-of-Sight [Grid Obscured]) 1	2	3	4	4a	5	6	7	8	9	10	11	Observation Notes (Group Size, Behavior, Calves, Other Marine Species)	Beaufort SS (0 - 12)	Tide Data (Ref: MLLW) (Ft)
1	1230	1235	0	0	0	0	X	0	0	0	X	0	0	0	surface birds resting, no presence of bait fish; sea gate is open	0	0.62
2	1300	1305	0	0	0	0	X	0	0	0	X	0	0	0	surface birds resting, no presence of bait fish; sea gate is open; helo doing touch and goes, destroyer #64 departed	1	1.01
3	1330	1335	0	0	0	0	X	0	0	2	X	0	0	0	two adults close to closed sea gate	1	1.51
4	1400	1405	0	0	0	1	X	0	0	0	X	0	0	0	one adult close to closed sea gate & patrol boat	1	2.08
5	1430	1435	0	0	0	0	X	0	0	0	X	0	0	0	opened sea gate	1	2.58
6	1500	1505	0	0	0	1	X	0	0	0	X	0	0	0	one adult close to closed sea gate & patrol boat; light drizzle	1	3.10
7	1530	1535	0	0	0	1	X	0	0	1	X	0	0	0	Destrioyer # 68 departed; winds building	2	3.54
8	1600	1605	-	-	-	-	-	-	-	-	-	-	-	-	survey skipped; thunder storm w/ heavy rain; sea gate closed	2	3.97
9	1630	1635	0	0	0	0	X	0	1	0	X	0	0	0	one adult; drizzle; small boat pulling boom; calm waters	1	4.27
10	1700	1705	0	0	0	0	X	0	0	0	X	0	0	0	flat calm	0	4.51
11	1730	1735	0	0	0	1	X	0	0	0	X	0	0	0	dark conditions, poor visability; Sunset = 1726	0	4.77
12																	
13																	
14																	
15																	
16																	
17																	
18																	

Meterological Data

(Source: Mayport [Bar Pilots Dock], FL; Station ID: 8720218)

Visual Period	Start Time (24 hrs)	End Time (24 hrs)	Cloud Cover (%)	Rain Fall (cm)	Air Temp (°F)	Water Temp (°F)	Wind Speed (knots)	Wind Gusts (knots)	Wind Dierction (true)	Barametric Pressure (Mb)	NOTES
1	1230	1235	75		74.48	65.30	8.16	11.47	231.00	1015.10	
6	1500	1505	85		67.82	66.02	6.80	9.14	148.00	1012.50	
11	1730	1735	50		67.82	64.58	2.53	5.25	214.00	1012.10	

Other General Notes

Only a portion of Grid #4 was visable from this observation point; observations made from atop a 4 foot high power block

NS Mayport Dolphin Surveys - Data Collection Sheet

Seasonal, Shore-based, Visual Surveys

Seasonal Quarter: Winter 2012 (December 10 - 13, 2013)
Date: Tuesday, December 11, 2012
Observation Point: Forth Story of the Harbor Operations Building
Survey Period: 1 (Morning)

Marine Species Observer:
Printed Name: Todd Wilkinson

Signature:

Visual Suvey (#)	Start Time (24 hrs)	End Time (24 hrs)	Dolphin Observations (#/Grid) (X = No Visual Area-of-Sight [Grid Obscured]) 1	2	3	4	4a	5	6	7	8	9	10	11	Observation Notes (Group Size, Behavior, Calves, Other Marine Species)	Beaufort SS (0 - 12)	Tide Data (Ref: MLLW) (Ft)
1	0700	0705	-	-	-	-	-	-	-	-	-	-	-	-	too dark & foggy; no survey; Sunrise = 0712	0	5.63
2	0730	0735	0	0	0	0	0	0	X	X	0	0	0	X	fog lifting, visability good	0	5.33
3	0800	0805	0	0	0	0	0	0	X	X	0	0	0	X	sky clearing, fog is gone	0	4.92
4	0830	0835	0	0	0	0	0	0	X	X	0	0	0	X		1	4.27
5	0900	09005	0	0	0	0	0	0	X	X	0	0	0	X	fog moving back in	1	3.42
6	0930	0935	0	0	0	0	0	0	X	X	0	0	0	X		1	2.35
7	1000	1005	0	0	0	0	5	0	X	X	0	0	0	X		1	1.63
8	1030	1035	0	0	0	0	0	0	X	X	0	0	0	X		1	0.91
9	1100	1105	0	0	0	0	0	0	X	X	0	0	0	X		1	0.29
10																	
11																	
12																	
13																	
14																	
15																	
16																	
17																	
18																	

Meterological Data

(Source: Mayport [Bar Pilots Dock], FL; Station ID: 8720218)

Visual Period	Start Time (24 hrs)	End Time (24 hrs)	Cloud Cover (%)	Rain Fall (cm)	Air Temp (°F)	Water Temp (°F)	Wind Speed (knots)	Wind Gusts (knots)	Wind Dierction (true)	Barametric Pressure (Mb)	NOTES
1	0700	0705	100		66.20	64.40	4.08	7.19	195.00	1014.90	
6	0930	0935	80		67.64	64.94	4.67	7.39	185.00	1016.40	
9	1100	1105	80		71.60	65.48	2.92	4.47	238.00	1017.20	

Other General Notes

NS Mayport Dolphin Surveys - Data Collection Sheet

Seasonal, Shore-based, Visual Surveys

Seasonal Quarter: Winter 2012 (December 10 - 13, 2013)
Date: Tuesday, December 11, 2012
Observation Point: Ground Level at the Northwest Corner of B-3 and C-1 Pier
Survey Period: 1 (Morning)

Marine Species Observer:
Printed Name: Dennis Peters
Signature:

Visual Suvey (#)	Start Time (24 hrs)	End Time (24 hrs)	Dolphin Observations (#/Grid) (X = No Visual Area-of-Sight [Grid Obscured])												Observation Notes (Group Size, Behavior, Calves, Other Marine Species)	Beaufort SS (0 - 12)	Tide Data (Ref: MLLW) (Ft)
			1	2	3	4	4a	5	6	7	8	9	10	11			
1	0700	0705	-	-	-	-	-	-	-	-	-	-	-	-	too dark & foggy; no survey; Sunrise = 0712	0	5.63
2	0730	0735	0	0	0	0	X	0	0	0	X	0	0	0	some fog remaining	0	5.33
3	0800	0805	0	0	0	0	X	0	0	0	X	2	0	0	mother & calf, headed towards corner of B/C; fog lifted	0	4.92
4	0830	0835	0	0	0	0	X	2	1	0	X	2	0	0	mother & calf, adult pair, plus a single adult (heading towards corner of B/C)	1	4.27
5	0900	09005	0	0	0	0	X	2	0	0	X	0	0	0	mother & calf, circling between ships	1	3.42
6	0930	0935	0	0	0	4	X	0	0	0	X	0	0	0	four adults leaving harbor towards sea gate	1	2.35
7	1000	1005	0	0	0	0	X	0	0	0	X	0	0	0	sea birds and cormorants feeding	1	1.63
8	1030	1035	0	0	0	0	X	0	0	0	X	0	0	0	cormorants feeding	1	0.91
9	1100	1105	0	0	0	0	X	0	0	0	X	0	0	0	cormorants feeding	1	0.29
10																	
11																	
12																	
13																	
14																	
15																	
16																	
17																	
18																	

Meterological Data

(Source: Mayport [Bar Pilots Dock], FL; Station ID: 8720218)

Visual Period	Start Time (24 hrs)	End Time (24 hrs)	Cloud Cover (%)	Rain Fall (cm)	Air Temp (°F)	Water Temp (°F)	Wind Speed (knots)	Wind Gusts (knots)	Wind Dierction (true)	Barametric Pressure (Mb)	NOTES
1	0700	0705	100		66.20	64.40	4.08	7.19	195.00	1014.90	
6	0930	0935	80		67.64	64.94	4.67	7.39	185.00	1016.40	
9	1100	1105	80		71.60	65.48	2.92	4.47	238.00	1017.20	

Other General Notes

Only a portion of Grid #4 was visable from this observation point; observations made from atop a 4 foot high power block

NS Mayport Dolphin Surveys - Data Collection Sheet

Seasonal, Shore-based, Visual Surveys

Seasonal Quarter: Winter 2012 (December 10 - 13, 2013)
Date: Tuesday, December 11, 2012
Observation Point: Forth Story of the Harbor Operations Building
Survey Period: 2 (Afternoon)

Marine Species Observer:
Printed Name: Todd Wilkinson
Signature:

Visual Suvey (#)	Start Time (24 hrs)	End Time (24 hrs)	Dolphin Observations (#/Grid) (X = No Visual Area-of-Sight [Grid Obscured])												Observation Notes (Group Size, Behavior, Calves, Other Marine Species)	Beaufort SS	Tide Data (Ref: MLLW)
			1	2	3	4	4a	5	6	7	8	9	10	11		(0 - 12)	(Ft)
1	1300	1305	0	0	0	0	0	0	X	X	0	0	0	X		1	-0.13
2	1330	1335	0	0	0	0	0	0	X	X	0	0	0	X		2	0.13
3	1400	1405	0	0	0	1	2	0	X	X	0	0	0	X		2	0.60
4	1430	1435	0	0	0	0	3	0	X	X	0	0	0	X		2	1.15
5	1500	1505	0	0	0	0	1	0	X	X	0	0	0	X		2	1.73
6	1530	1535	0	0	0	1	0	0	X	X	0	0	0	X		1	2.36
7	1600	1605	0	0	0	2	2	0	X	X	0	0	0	X		1	2.99
8	1630	1635	0	0	0	0	1	0	X	X	0	0	0	X		1	3.51
9	1700	1705	0	0	0	2	0	0	X	X	0	0	0	X		1	3.93
10	1730	1735	0	0	0	0	0	0	X	X	0	0	0	X		1	4.36
11																	
12																	
13																	
14																	
15																	
16																	
17																	
18																	

Meterological Data

(Source: Mayport [Bar Pilots Dock], FL; Station ID: 8720218)

Visual Period	Start Time (24 hrs)	End Time (24 hrs)	Cloud Cover (%)	Rain Fall (cm)	Air Temp (°F)	Water Temp (°F)	Wind Speed (knots)	Wind Gusts (knots)	Wind Dierction (true)	Barametric Pressure (Mb)	NOTES
1	1300	1305	85		72.50	66.02	7.78	10.50	136.00	1016.50	
5	1500	1505	100		71.24	66.74	7.58	12.25	153.00	1015.90	
10	1730	1735	50		67.82	64.58	2.53	5.25	214.00	1012.10	

Other General Notes

NS Mayport Dolphin Surveys - Data Collection Sheet

Seasonal, Shore-based, Visual Surveys

Seasonal Quarter: Winter 2012 (December 10 - 13, 2013)
Date: Tuesday, December 11, 2012
Observation Point: Ground Level at the Northwest Corner of B-3 and C-1 Pier
Survey Period: 2 (Afternoon)

Marine Species Observer:
Printed Name: Dennis Peters
Signature:

Visual Suvey (#)	Start Time (24 hrs)	End Time (24 hrs)	Dolphin Observations (#/Grid) (X = No Visual Area-of-Sight [Grid Obscured]) 1	2	3	4	4a	5	6	7	8	9	10	11	Observation Notes (Group Size, Behavior, Calves, Other Marine Species)	Beaufort SS (0 - 12)	Tide Data (Ref: MLLW) (Ft)
1	1300	1305	0	0	0	0	X	0	0	0	X	0	0	0	wind picked up; definite windrow diagonally through the center of the basin	1	-0.13
2	1330	1335	0	0	0	0	X	0	0	0	X	0	0	0	steady wind; definite windrow diagonally through the center of the basin; sea gate open	2	0.13
3	1400	1405	0	0	0	0	X	0	0	0	X	0	0	0	steady wind; definite windrow diagonally through the center of the basin; sea gate open	2	0.60
4	1430	1435	0	0	0	0	X	0	0	0	X	0	0	0	"Big Horn" departed from the basin; C2 empty	2	1.15
5	1500	1505	0	0	0	1	X	0	0	0	X	0	0	0	one adult close to sea gate near the Harbor Ops side	2	1.73
6	1530	1535	0	0	0	2	X	0	0	0	X	0	0	0	two adults near center of sea gate area	1	2.36
7	1600	1605	0	0	0	1	X	0	0	0	X	0	0	0	one adult close to sea gate area	1	2.99
8	1630	1635	0	0	0	0	X	0	0	0	X	0	0	0	"Hugo" arrived at B3	1	3.51
9	1700	1705	0	0	0	1	X	0	0	0	X	0	0	0	one adult close to sea gate area	1	3.93
10	1730	1735	0	0	0	2	X	0	0	0	X	0	0	0	two adults near center of sea gate area; Sunset = 1726	1	4.36
11																	
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Meterological Data

(Source: Mayport [Bar Pilots Dock], FL; Station ID: 8720218)

Visual Period	Start Time (24 hrs)	End Time (24 hrs)	Cloud Cover (%)	Rain Fall (cm)	Air Temp (°F)	Water Temp (°F)	Wind Speed (knots)	Wind Gusts (knots)	Wind Dierction (true)	Barametric Pressure (Mb)	NOTES
1	1300	1305	85		72.50	66.02	7.78	10.50	136.00	1016.50	
5	1500	1505	100		71.24	66.74	7.58	12.25	153.00	1015.90	
10	1730	1735	50		67.82	64.58	2.53	5.25	214.00	1012.10	

Other General Notes

Only a portion of Grid #4 was visable from this observation point; observations made from atop a 4 foot high power block

NS Mayport Dolphin Surveys - Data Collection Sheet
Seasonal, Shore-based, Visual Surveys

Seasonal Quarter: Winter 2012 (December 10 - 13, 2013)
Date: Wednesday, December 12, 2012
Observation Point: Forth Story of the Harbor Operations Building
Survey Period: 1 (Morning)

Marine Species Observer:
Printed Name: Todd Wilkinson
Signature:

Visual Suvey (#)	Start Time (24 hrs)	End Time (24 hrs)	Dolphin Observations (#/Grid) (X = No Visual Area-of-Sight [Grid Obscured]) 1	2	3	4	4a	5	6	7	8	9	10	11	Observation Notes (Group Size, Behavior, Calves, Other Marine Species)	Beaufort SS (0 - 12)	Tide Data (Ref: MLLW) (Ft)
1	0700	0705	-	-	-	-	-	-	-	-	-	-	-	-	too dark & light drizzle; no survey; Sunrise = 0713	1	5.83
2	0730	0735	X	0	0	0	0	X	X	X	0	X	0	X	too hazy to see the far end of the basin	1	5.81
3	0800	0805	-	-	-	-	-	-	-	-	-	-	-	-	survey skipped due to poor visability	1	5.63
4	0830	0835	X	X	0	0	0	X	X	X	0	X	0	X		1	5.39
5	0900	09005	X	X	0	4	0	X	X	X	0	X	0	X		1	4.95
6	0930	0935	X	X	0	1	0	X	X	X	1	X	0	X		1	4.27
7	1000	1005	X	0	0	0	0	X	X	X	0	X	0	X		1	3.43
8	1030	1035	X	0	0	3	1	X	X	X	0	X	0	X	mother and calf in Grid #4	0	2.52
9	1100	1105	X	0	0	0	0	X	X	X	0	X	0	X		0	1.68
10	1130	1135	X	0	0	0	0	X	X	X	0	X	0	X		0	1.02
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Meterological Data
(Source: Mayport [Bar Pilots Dock], FL; Station ID: 8720218)

Visual Period	Start Time (24 hrs)	End Time (24 hrs)	Cloud Cover (%)	Rain Fall (cm)	Air Temp (°F)	Water Temp (°F)	Wind Speed (knots)	Wind Gusts (knots)	Wind Dierction (true)	Barametric Pressure (Mb)	NOTES
1	0700	0705	100		60.08	64.58	6.42	10.30	20.00	1020.40	
5	0900	09005	100		58.46	64.58	5.64	7.97	23.00	1021.10	
10	1130	1135	100		60.08	65.30	6.42	8.55	329.00	1021.10	

Other General Notes

NS Mayport Dolphin Surveys - Data Collection Sheet

Seasonal, Shore-based, Visual Surveys

Seasonal Quarter: Winter 2012 (December 10 - 13, 2013)
Date: Wednesday, December 12, 2012
Observation Point: Ground Level at the Northwest Corner of B-3 and C-1 Pier
Survey Period: 1 (Morning)

Marine Species Observer:
Printed Name: Dennis Peters
Signature:

Visual Suvey (#)	Start Time (24 hrs)	End Time (24 hrs)	Dolphin Observations (#/Grid) (X = No Visual Area-of-Sight [Grid Obscured]) 1	2	3	4	4a	5	6	7	8	9	10	11	Observation Notes (Group Size, Behavior, Calves, Other Marine Species)	Beaufort SS (0 - 12)	Tide Data (Ref: MLLW) (Ft)
1	0700	0705	-	-	-	-	-	-	-	-	-	-	-	-	too dark & light drizzle; no survey; Sunrise = 0713	1	5.83
2	0730	0735	0	0	0	0	X	4	0	0	X	0	0	0	mother and calf, plus an adult pair; circling birds feeding; no rain yet	1	5.81
3	0800	0805	-	-	-	-	-	-	-	-	-	-	-	-	lightning and heavy rain; no survey conducted	1	5.63
4	0830	0835	0	0	0	0	X	0	0	0	X	0	0	0	light rain	1	5.39
5	0900	09005	-	-	-	-	-	-	-	-	-	-	-	-	heavy rain, white-out; no survey conducted	1	4.95
6	0930	0935	0	0	0	1	X	0	0	0	X	0	0	0	light rain; cormorants feeding, wind died down significantly	1	4.27
7	1000	1005	0	0	0	0	X	0	0	0	X	0	0	0	light rain	1	3.43
8	1030	1035	0	0	0	0	X	0	0	0	X	0	0	0	light rain; no wind	0	2.52
9	1100	1105	0	0	0	0	X	0	0	0	X	0	0	0	rain stopped; cormorants feeding	0	1.68
10	1130	1135	0	0	0	0	X	0	0	0	X	0	0	0	no rain; cormorants feeding	0	1.02
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Meterological Data

(Source: Mayport [Bar Pilots Dock], FL; Station ID: 8720218)

Visual Period	Start Time (24 hrs)	End Time (24 hrs)	Cloud Cover (%)	Rain Fall (cm)	Air Temp (°F)	Water Temp (°F)	Wind Speed (knots)	Wind Gusts (knots)	Wind Dierction (true)	Barametric Pressure (Mb)	NOTES
1	0700	0705	100		60.08	64.58	6.42	10.30	20.00	1020.40	
5	0900	09005	100		58.46	64.58	5.64	7.97	23.00	1021.10	
10	1130	1135	100		60.08	65.30	6.42	8.55	329.00	1021.10	

Other General Notes

Only a portion of Grid #4 was visable from this observation point; observations made from atop a 4 foot high power block

NS Mayport Dolphin Surveys - Data Collection Sheet

Seasonal, Shore-based, Visual Surveys

Seasonal Quarter: Winter 2012 (December 10 - 13, 2013)
Date: Wednesday, December 12, 2012
Observation Point: Forth Story of the Harbor Operations Building
Survey Period: 2 (Afternoon)

Marine Species Observer:
Printed Name: Todd Wilkinson
Signature:

Visual Suvey (#)	Start Time (24 hrs)	End Time (24 hrs)	Dolphin Observations (#/Grid) (X = No Visual Area-of-Sight [Grid Obscured]) 1	2	3	4	4a	5	6	7	8	9	10	11	Observation Notes (Group Size, Behavior, Calves, Other Marine Species)	Beaufort SS (0 - 12)	Tide Data (Ref: MLLW) (Ft)
1	1330	1335	X	0	0	0	0	X	X	X	0	X	0	X		0	-0.29
2	1400	1405	X	0	0	0	0	X	X	X	0	X	0	X		0	-0.06
3	1430	1435	X	0	0	0	0	X	X	X	0	X	0	X		1	0.33
4	1500	1505	X	0	0	0	1	X	X	X	0	X	0	X	2 more in St. John's River	1	0.88
5	1530	1535	X	0	0	1	0	X	X	X	0	X	0	X		1	1.37
6	1600	1605	X	0	0	0	0	X	X	X	0	X	0	X		1	2.17
7	1630	1635	X	0	0	0	0	X	X	X	0	X	0	X		1	2.69
8	1700	1705	X	0	0	0	0	X	X	X	0	X	0	X		1	3.41
9	1730	1735	X	0	0	0	0	X	X	X	0	X	0	X	low light; Sunset = 1726	1	3.97
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15																	
16																	
17																	
18																	

Meterological Data

(Source: Mayport [Bar Pilots Dock], FL; Station ID: 8720218)

Visual Period	Start Time (24 hrs)	End Time (24 hrs)	Cloud Cover (%)	Rain Fall (cm)	Air Temp (°F)	Water Temp (°F)	Wind Speed (knots)	Wind Gusts (knots)	Wind Dierction (true)	Barametric Pressure (Mb)	NOTES
1	1330	1335	100		60.80	65.48	10.50	13.02	355.00	1020.20	
5	1530	1535	100		57.56	66.20	6.61	8.75	9.00	1020.40	
9	1730	1735	100		58.82	65.48	6.61	13.41	340.00	1021.60	

Other General Notes

NS Mayport Dolphin Surveys - Data Collection Sheet

Seasonal, Shore-based, Visual Surveys

Seasonal Quarter: Winter 2012 (December 10 - 13, 2013)
Date: Wednesday, December 12, 2012
Observation Point: Ground Level at the Northwest Corner of B-3 and C-1 Pier
Survey Period: 2 (Afternoon)

Marine Species Observer:
Printed Name: Dennis Peters

Signature:

Visual Suvey (#)	Start Time (24 hrs)	End Time (24 hrs)	Dolphin Observations (#/Grid) (X = No Visual Area-of-Sight [Grid Obscured]) 1	2	3	4	4a	5	6	7	8	9	10	11	Observation Notes (Group Size, Behavior, Calves, Other Marine Species)	Beaufort SS (0 - 12)	Tide Data (Ref: MLLW) (Ft)
1	1330	1335	0	0	0	0	X	0	0	0	X	0	0	0	no rain; no to light wind	0	-0.29
2	1400	1405	0	0	0	0	X	0	0	0	X	0	0	0	no rain; light wind	0	-0.06
3	1430	1435	0	0	0	0	X	0	0	0	X	0	0	0	drizzle; temperature dropping; light wind	1	0.33
4	1500	1505	0	0	0	0	X	0	0	0	X	0	0	0	no rain; much cooler	1	0.88
5	1530	1535	0	0	0	3	X	0	0	0	X	0	0	0	rain; down pour just started	1	1.37
6	1600	1605	0	0	0	0	X	0	0	0	X	0	0	0	light to heavy rain	1	2.17
7	1630	1635	0	0	0	1	X	0	0	0	X	0	0	0	rain stopped; cool temperatures	1	2.69
8	1700	1705	0	0	0	0	X	0	0	0	X	0	0	0	rain stopped; cool temperatures	1	3.41
9	1730	1735	0	0	0	0	X	0	0	0	X	0	0	0	Sunset = 1726	1	3.97
10																	
11																	
12																	
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14																	
15																	
16																	
17																	
18																	

Meterological Data

(Source: Mayport [Bar Pilots Dock], FL; Station ID: 8720218)

Visual Period	Start Time (24 hrs)	End Time (24 hrs)	Cloud Cover (%)	Rain Fall (cm)	Air Temp (°F)	Water Temp (°F)	Wind Speed (knots)	Wind Gusts (knots)	Wind Dierction (true)	Barametric Pressure (Mb)	NOTES
1	1330	1335	100		60.80	65.48	10.50	13.02	355.00	1020.20	
5	1530	1535	100		57.56	66.20	6.61	8.75	9.00	1020.40	
9	1730	1735	100		58.82	65.48	6.61	13.41	340.00	1021.60	

Other General Notes

Only a portion of Grid #4 was visable from this observation point; observations made from atop a 4 foot high power block

NS Mayport Dolphin Surveys - Data Collection Sheet
Seasonal, Shore-based, Visual Surveys

Seasonal Quarter: Winter 2012 (December 10 - 13, 2013)
Date: Thursday, December 13, 2012
Observation Point: Forth Story of the Harbor Operations Building
Survey Period: 1 (Morning)

Marine Species Observer:
Printed Name: Todd Wilkinson
Signature:

Visual Suvey (#)	Start Time (24 hrs)	End Time (24 hrs)	Dolphin Observations (#/Grid) (X = No Visual Area-of-Sight [Grid Obscured]) 1	2	3	4	4a	5	6	7	8	9	10	11	Observation Notes (Group Size, Behavior, Calves, Other Marine Species)	Beaufort SS (0 - 12)	Tide Data (Ref: MLLW) (Ft)
1	0700	0705	-	-	-	-	-	-	-	-	-	-	-	-	too dark & light drizzle; no survey; Sunrise = 0713	1	5.92
2	0730	0735	X	0	0	0	0	X	X	X	0	X	X	X	low visability	1	6.20
3	0800	0805	0	0	0	0	0	X	X	X	0	X	X	X		1	6.40
4	0830	0835	0	0	0	0	0	X	X	X	0	X	X	X		1	6.45
5	0900	09005	0	0	0	0	0	X	X	X	0	X	X	X		2	6.37
6	0930	0935	0	0	0	1	0	X	X	X	0	X	X	X	moving towards harbor entrance	2	6.13
7	1000	1005	0	0	0	1	0	X	X	X	0	X	X	X		1	5.65
8	1030	1035	0	0	0	1	0	X	X	X	0	X	X	X		1	5.05
9	1100	1105	0	0	0	0	0	X	X	X	0	X	X	X		1	4.35
10																	
11																	
12																	
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16																	
17																	
18																	

Meterological Data
(Source: Mayport [Bar Pilots Dock], FL; Station ID: 8720218)

Visual Period	Start Time (24 hrs)	End Time (24 hrs)	Cloud Cover (%)	Rain Fall (cm)	Air Temp (°F)	Water Temp (°F)	Wind Speed (knots)	Wind Gusts (knots)	Wind Dierction (true)	Barametric Pressure (Mb)	NOTES
1	0700	0705	100		51.98	64.76	11.08	15.36	352.00	1024.00	
5	0900	09005	100		52.16	64.76	12.83	18.08	1.00	1025.60	
9	1100	1105	100		50.90	64.94	9.53	14.97	352.00	1026.50	

Other General Notes

NS Mayport Dolphin Surveys - Data Collection Sheet

Seasonal, Shore-based, Visual Surveys

Seasonal Quarter: Winter 2012 (December 10 - 13, 2013)
Date: Thursday, December 13, 2012
Observation Point: Ground Level at the Northwest Corner of B-3 and C-1 Piers
Survey Period: 1 (Morning)

Marine Species Observer:
Printed Name: Dennis Peters
Signature:

Visual Suvey (#)	Start Time (24 hrs)	End Time (24 hrs)	Dolphin Observations (#/Grid) (X = No Visual Area-of-Sight [Grid Obscured]) 1	2	3	4	4a	5	6	7	8	9	10	11	Observation Notes (Group Size, Behavior, Calves, Other Marine Species)	Beaufort SS (0 - 12)	Tide Data (Ref: MLLW) (Ft)
1	0700	0705	-	-	-	-	-	-	-	-	-	-	-	-	too dark & light drizzle; no survey; Sunrise = 0713	1	5.92
2	0730	0735	0	0	0	0	X	0	0	0	X	0	0	0		1	6.20
3	0800	0805	2	1	2	0	X	0	0	0	X	0	0	0	mother and calf in Grid #1, plus an adult pair in Grid 3	1	6.40
4	0830	0835	2	0	0	0	X	0	0	0	X	0	0	0	mother and calf first seen in Grid #1, then traveled into Grid #5, then into Grid #9	1	6.45
5	0900	09005	0	0	0	0	X	2	0	0	X	0	0	0	mother and calf first seen in Grid #5, then traveled into Grid #9; breezy	2	6.37
6	0930	0935	2	0	0	0	X	0	0	0	X	0	0	0	mother and calf first seen in Grid #1, then traveled into Grid #5, then into Grid #9	2	6.13
7	1000	1005	0	0	0	0	X	2	0	0	X	0	0	0	mother and calf first seen in Grid #5, then traveled into Grid #1	1	5.65
8	1030	1035	0	0	2	0	X	0	0	0	X	0	0	0	mother and calf first seen in Grid #3, then traveled into Grid #2, then into Grid #1	1	5.05
9	1100	1105	0	0	0	0	X	0	0	0	X	2	0	0	mother and calf first seen in Grid #9, then traveled into Grid #5, then into Grid #1	1	4.35
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18																	

Meterological Data

(Source: Mayport [Bar Pilots Dock], FL; Station ID: 8720218)

Visual Period	Start Time (24 hrs)	End Time (24 hrs)	Cloud Cover (%)	Rain Fall (cm)	Air Temp (°F)	Water Temp (°F)	Wind Speed (knots)	Wind Gusts (knots)	Wind Dierction (true)	Barametric Pressure (Mb)	NOTES
1	0700	0705	100		51.98	64.76	11.08	15.36	352.00	1024.00	
5	0900	09005	100		52.16	64.76	12.83	18.08	1.00	1025.60	
9	1100	1105	100		50.90	64.94	9.53	14.97	352.00	1026.50	

Other General Notes

Only a portion of Grid #4 was visable from this observation point; observations made from atop a 4 foot high power block