Christiansted National Historic Site
US Virgin Islands

US Department of the Interior
National Park Service

Replace the Existing Wharf Bulkhead Environmental Assessment

May 2019

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Acronyms and Abbreviations

BMP	Best management practice
Christiansted NHS or park	Christiansted National Historic Site
CFMC	Caribbean Fishery Management Council
CFR	Code of Federal Regulations
cm	Centimeter
EA	Environmental Assessment
EFH	Essential Fish Habitat
ESA	Endangered Species Act
m	Meter
MOA	Memorandum of Agreement
NEPA	National Environmental Policy Act of 1969, as amended
NHPA	National Historic Preservation Act of 1966
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRHP	National Register of Historic Places
PBO	Programmatic Biological Opinion on Threatened Caribbean Coral Research, Restoration and Relocation
SHPO	State Historic Preservation Office
TSS	Total suspended solids
USACE	US Army Corps of Engineers
USC	US Code
USFWS	US Fish and Wildlife Service
VIDPNR	Virgin Islands Department of Planning and Natural Resources

CHAPTER 1: PURPOSE OF AND NEED FOR ACTION

The National Park Service (NPS) proposes to replace the existing wharf bulkhead along the Christiansted National Historic Site (Christiansted NHS or park) waterfront. Christiansted NHS is located in the historic town of Christiansted on the island of St. Croix, US Virgin Islands (figure 1). The goal of the proposed action is to prevent damage from more frequent and more powerful seasonal hurricanes and to mitigate and remediate the effects of historic and continuing storm damage to the Christiansted NHS waterfront landscape, associated historic buildings, visitor use, and marine vessel operations.

The existing wharf bulkhead structure, which had protected the historic waterfront from wind-driven wave action and storm damage has deteriorated considerably. Local failures in the bulkhead have rendered the artificial structure ineffective, unsound, and unsafe for vehicular or marine vessel use. Water movement is expected to continue to undermine the bulkhead, causing erosion of the shoreline. These issues, in conjunction with projected sea-level rise, would continue to exacerbate the deterioration of the existing bulkhead and further threaten the park historic landscape and cultural resources.

The proposed action would replace the existing bulkhead by encapsulating it; new steel sheet piling or new cast-in-place concrete would be installed seaward of the existing alignment. The proposed action would also include a new concrete cap (at a similar height to the existing bulkhead), new concrete fascia to protect the "splash zone," new mooring cleats, a new fendering system, and rehabilitation of the existing concrete apron (the sidewalk adjacent to the bulkhead).

This environmental assessment (EA) has been prepared in accordance with the National Environmental Policy Act of 1969, as amended (NEPA), and implementing regulations, 40 Code of Federal Regulations (CFR) Parts 1500–1508, NPS Director's Order 12: *Conservation Planning, Environmental Impact Analysis, and Decision-making* (NPS 2011) and the accompanying handbook (NPS 2015a). Compliance with Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended, is being conducted concurrently with the NEPA process.

PURPOSE OF AND NEED FOR ACTION

The purpose of this action is to replace the existing wharf bulkhead along the Christiansted NHS waterfront to protect the Christiansted NHS landscape and associated historic buildings and to restore visitor access to and appropriate use of the wharf. Action is needed at this time to prevent damage from more frequent and more powerful seasonal hurricanes and to mitigate and remediate the effects of historic and continuing storm damage to the park waterfront cultural landscape and visitor and marine vessel uses. The proposed action would ensure that the integrity of the historic resources is protected and would allow for safe and appropriate visitor opportunities within the historic landscape and along the waterfront. The bulkhead itself is not historic.

The existing bulkhead was constructed with an expected life cycle of 25 years and was last refurbished in 1985. The proposed action would incorporate climate resiliency in the design, including a proposed life cycle of 40 years, to ensure that the resulting design is adaptable to anticipated future storm events with potentially greater storm intensities. The design would allow the bulkhead to handle overtopping and sustain storm washover during future storm events. The proposed action would also provide opportunities to restore or enhance access to the waterfront site from both land and water.

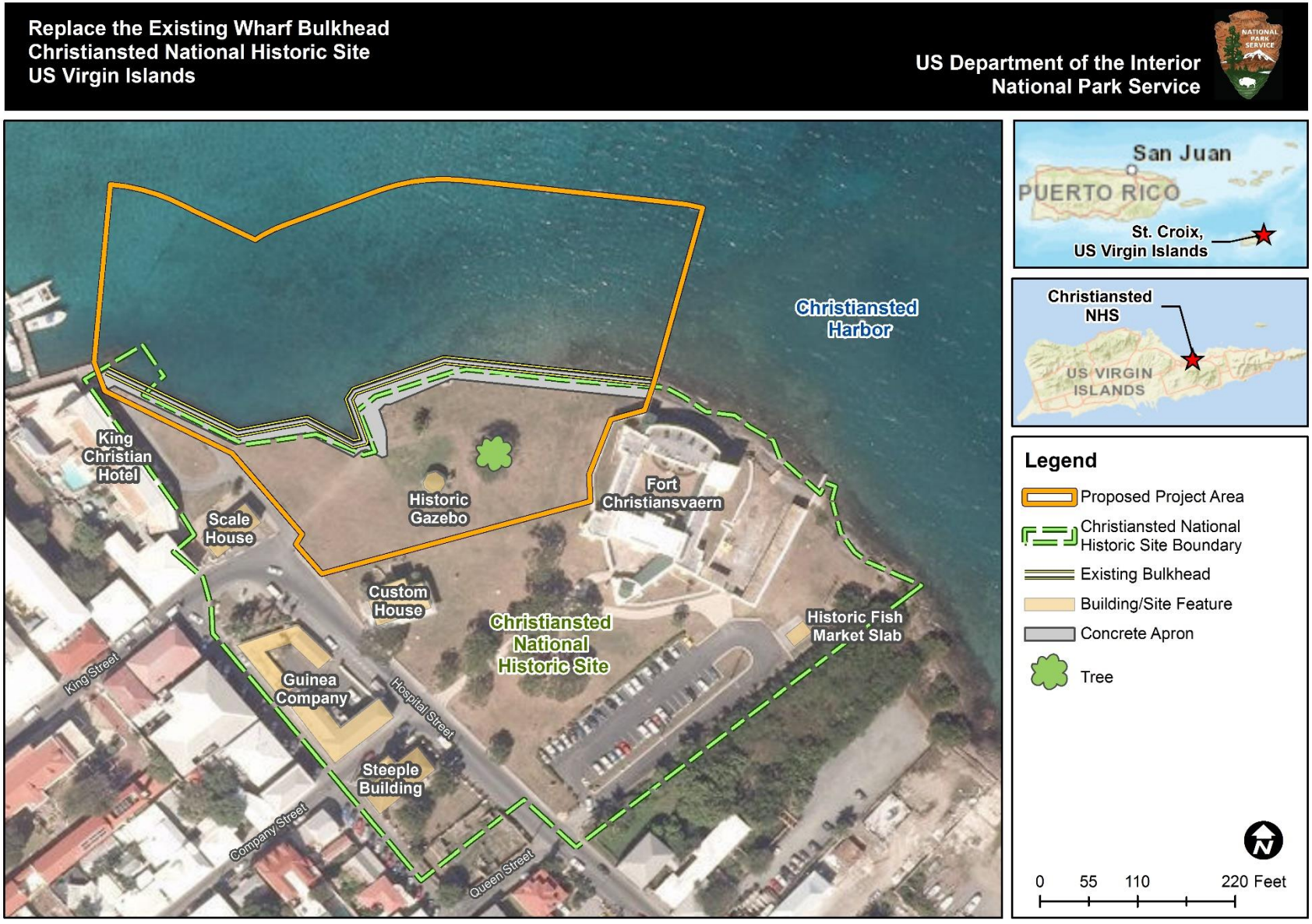

Figure 1. Project Location Map

GOALS AND OBJECTIVES

Throughout the planning process, the NPS considered the following: anticipated sea-level rise over the next 40 years, the regulatory implications of the potential approaches (design, materials, and construction phases), site access from both land and water, and ways to accommodate existing visitor uses during construction. The following guiding principles were used to evaluate the various alternatives analyzed in the EA:

- Ensuring consistency with the project purpose and need
- Choosing a design that could be permitted and would be acceptable within the current regulatory climate
- Ensuring the design proposed would be successful and appropriate for the setting
- Understanding that the shoreline has already been changed (hardened)
- Replacing the existing bulkhead while limiting impacts to the greatest extent possible
- Incorporating resiliency in the design to allow overtopping during future storm events

PROJECT AREA

The proposed project area (figure 1) includes the existing wharf bulkhead, concrete apron, and surrounding terrestrial areas. The proposed staging area for construction equipment would be located within the northeast portion of the parking lot and continue into the grass area adjacent to the parking lot (figure 2). Additionally, the barge work area extends 200 feet out (seaward) perpendicular to the face of existing bulkhead.

SIGNIFICANCE OF THE PROJECT AREA

Christiansted NHS is in the National Register of Historic Places (NRHP), listed at the national level of significance, and is considered a historic maritime landscape. Christiansted NHS contains well-preserved architectural examples including Danish Neo Classic, Renaissance revival, and Danish West Indian vernacular structures (Gjessing 1976). Construction of Fort Christiansvaern was completed in 1749, and the historic buildings at the site are between 200 and 275 years old. The location of Fort Christiansvaern, which dominates the harbor, presents a typical 18th century military fortification, and the town of Christiansted retains the scale and feeling of a 19th century West Indian port and market (Gjessing 1976).

The wharf bulkhead was designed to protect the park landscape and historic buildings. If the bulkhead is not replaced and adapted for climate resiliency, historic buildings and archeological resources could potentially be lost. Both underwater and terrestrial archeological resources are present in the project area.

ISSUES AND RESOURCE TOPICS DISMISSED FROM DETAILED ANALYSIS

The following issues and topics are not potentially significant, are not critical to choosing between alternatives, and are not controversial. Therefore, they were eliminated from further analysis in this EA. A brief rationale for dismissal is provided for each topic.

Wetlands and Floodplains

Although the proposed project includes placing new sheet pile in portions of nearshore marine bottomlands in front of the existing wharf bulkhead, there would be no measurable change in the water

surface elevation adjacent to the wharf bulkhead. The flood waters displaced by the proposed project would be relatively small when compared to the total water in Christiansted Harbor, and therefore, the proposed action would not result in any measurable change in flood attenuation or storage. The same storm surge protection, floodwater protection, and energy dissipation provided by the current deepwater marine zone would be provided by the new bulkhead. The NPS would continue to advise visitors of safety issues related to flooding and the risk of storms that may develop quickly. As stated in Procedural Manual 77-2: *Floodplain Management*, historic or archeological structures or sites whose location is integral to their significance are considered excepted actions and do not need to comply with Director's Order 77-2: *Floodplain Management*. As the bulkhead supports and protects the historic wharf area, it meets the definition of an excepted action, and therefore, a Statement of Findings for floodplains is not required for this project. The impact topic of floodplains was considered but dismissed from further analysis in this EA.

The waters adjacent to the existing bulkhead are considered a subtidal deep-water marine system, consisting of the open ocean overlying the nearshore marine bottomlands and the associated shoreline. The project area is considered subtidal and the substrate in the immediate vicinity is continuously covered with tidal waters with nearshore soft marine bottomlands comprised of unconsolidated substrate, such as sand, mud, dead coral rubble with algae, cement pieces, and extensive manmade debris. As these waters are considered subtidal deepwater marine habitat, and therefore a deepwater habitat, an NPS Statement of Findings for wetlands is not required for this project (NPS 2002). Consequently, wetlands was dismissed from detailed analysis in this EA.

The wharf bulkhead project would occur within waters of the United States and US Virgin Islands territorial seas associated with Christiansted Harbor. US Army Corps of Engineers (USACE) has regulatory jurisdiction over the Caribbean Sea in the US Virgin Islands through Section 10 of the Rivers and Harbors Act of 1899. The NPS would coordinate with the USACE to obtain a permit pursuant to Section 10 of the Rivers and Harbors Act of 1899 (33 US Code [USC] §403) and with the US Virgin Islands Department of Planning and Natural Resources (VIDPNR) Coastal Zone Management in compliance with the Coastal Zone Management Plan.

Water Quality

Short-term impacts to water quality could occur in Christiansted Harbor during construction activities at the bulkhead and in the open-water portion of the proposed action in the barge work area. If water-based equipment is used, the placement and removal of barge spuds and tugboat propeller wash would disturb bottom sediments and may cause temporary increases in suspended sediment in the barge work area. Scouring on the marine bottomlands due to propeller wash from the barge tug propellers may also cause a temporary increase in suspended sediments. A small resulting sediment plume from the barge spuds and propeller wash would be expected to settle out of the water column within a few hours. Potential short-term impacts to water quality would be mitigated by installing a turbidity curtain around the immediate work area during in-water construction operations. This type of floating barrier is typically used to meet standards for silt control. The barrier would likely be installed in phases to contain only the immediate area of active construction in the water. The barrier would be secured to a portion of the wall, secured at either end to the existing bulkhead using a small section of steel or timber pile driven into the substrate. This anchor pile would likely be installed in the proposed footprint of the new sheet pile to avoid additional, temporary impacts to the marine bottomlands. The turbidity curtain would be repositioned as necessary as work progresses to always contain water-based construction work.

Sediment release from upland construction associated with the sidewalk and concrete apron would not occur because any runoff would be captured and contained. The NPS would work with the design team to determine appropriate mitigation and construction best management practices (BMPs). Turbidity control,

water quality management, and implementation of BMPs during construction would be carried out in accordance with all permitting and regulatory requirements (HDR 2018a). Adverse impacts on water quality, such as fuel or chemical spills and leaks, would be avoided and/or minimized through BMPs. For these reasons, water quality was dismissed from detailed analysis in this EA.

Air Quality

The 1963 Clean Air Act, as amended (42 USC § 7401 et seq.) requires federal land managers to protect air quality and to meet all federal state, and local air pollution standards. Christiansted NHS is subject to federal and US Virgin Island air regulations. National ambient air quality standards have been established by the US Environmental Protection Agency. Current standards are set for sulfur dioxide, carbon monoxide, nitrogen dioxide, ozone, particulate matter equal to or less than 10 microns in size, fine particulate matter equal to or less than 2.5 microns in size, and lead. St. Croix is currently in attainment for all criteria air pollutants (USEPA 2019). The proposed action could have a slight effect on air quality with vehicle, marine vessel, and heavy equipment operation during construction activities; however, the effects would be extremely localized. The proposed action would have negligible short-term effects on air quality; therefore, air quality is dismissed from further analysis in this EA.

Soundscape Management

During construction, human-caused sounds would increase as a result of construction activities, equipment, vehicular traffic, and construction crews. Sounds generated from construction would be temporary, lasting only as long as the construction activity. However, continuous noise abatement would be required to prevent disturbance and nuisance to visitors, residents, workers, and urban-associated wildlife. Project-related construction noise would be minimized through the use of best available noise control techniques as listed in appendix A. Construction work would be limited to daylight hours in the project area to avoid night-time noise disruption. In addition, BMPs (e.g., mufflers) would be implemented to properly maintain construction equipment to minimize noise from use of equipment. Contractors would use sound attenuated compressors and generators, as well as vibratory hammers, instead of impact hammers. Contractors would be required to start the vibratory action slowly by using a reduced energy setting on the equipment and then increasing the vibratory energy in a progressive, slow manner until the required oscillation/frequency is achieved, which would slowly work up to the full noise level of the equipment. This would allow marine wildlife to move away from the work area before construction noise reaches maximum levels. Equipment and machinery would not exceed 85 decibels when measured at a distance of 100 linear feet. Therefore, soundscape management was dismissed from detailed analysis.

Wildlife and Wildlife Habitat – Raptors

Management goals for wildlife include maintaining components and processes of naturally evolving park ecosystems, including natural abundance, diversity, and ecological integrity of plants and animals (NPS 2006). The project area supports raptor species, including American kestrel (*Falco sparverius*), red-tailed hawk (*Buteo jamaicensis*), osprey (*Pandion haliaetus*), and occasionally peregrine falcon (*Falco peregrinus*). The construction activities of the proposed action would have short-term effects on raptors, as the noise would disrupt foraging. Construction would be limited to approximately one year and noise would be minimized to the extent possible using properly maintained equipment and sound attenuated compressors and generators. The portion of Christiansted Harbor that would be affected by the proposed project is small in comparison to the shoreline available for these raptor species for foraging. Therefore, this topic was dismissed from further analysis in this EA.

Historic Structures

The proposed action would allow for the continued use of this historic site and structures. The proposed action would not adversely affect the aspects of integrity or character-defining features that make the site eligible for listing in the NRHP. The existing bulkhead was last refurbished in 1985 and is not considered a historic structure. A pre-construction site inspection would be completed, and photographic documentation would be specified to document site conditions. Vibration monitoring would also be conducted during construction to protect the historic structures. Vibration/crack monitors would be placed on historic structures in the park, and the structures would be inspected on a daily basis prior to the onset of construction activities. The historic structures would retain their character, integrity, and data potential, and no new visual impacts on the historic properties would result from the proposed action. Because there would be no new impacts on the historic setting of the historic site, this topic is dismissed from further analysis.

Cultural Landscape and Viewshed

The cultural landscape and viewshed would not change long-term at Christiansted NHS, as the height of the bulkhead would not change, and the color(s) of the new wharf installation would be selected to blend with the color effect at Christiansted NHS. Once completed, the project would have no effect on the scale and visual relationships among landscape features in the historic district, and the spatial arrangement, circulation features, and land use patterns of the historic district would remain unaltered. Short-term impacts could occur in Christiansted NHS during construction activities due to the presence of fencing, the barge, and other construction equipment, as well as the addition of construction noise. Staging areas would be established to confine storage of materials and equipment to specific locations on the site, construction would only occur during the day to reduce light pollution, and acoustic monitoring would be employed to minimize potential damage from vibration. For these reasons, cultural landscape and viewshed have been dismissed from further analysis in this EA.

Human Health and Safety

The wharf bulkhead closed in 2005 to boat operations, marine traffic, large crowds, and vehicle traffic due to safety concerns. The sidewalk at the bulkhead is closed to vehicular traffic, including vehicles for maintenance, law enforcement, and emergency response due to the degraded conditions of the concrete apron. No health or safety concerns currently exist at the site since the bulkhead is closed to marine and terrestrial vehicles. During construction, vehicle access on NPS property could be temporarily disrupted, as a portion of the parking lot at Fort Christiansvaern would be periodically closed to accommodate deliveries or movement of construction vehicles. Visitors would be excluded from the construction area but would retain access to the remaining areas of the park, including the historic buildings. These disturbances would be short-term and minor, but the NPS would prepare a traffic plan, to include pedestrians, vehicles, and marine vessels, to reduce the potential impacts on visitors, as well as businesses that use the existing wharf. As a result, human health and safety has been dismissed from further analysis in this EA.

CHAPTER 2: ALTERNATIVES

Two alternatives were chosen for detailed evaluation in this EA: the no-action alternative and the proposed action/preferred alternative. The chapter also describes other alternatives that were initially considered but dismissed from detailed analysis and presents mitigation measures for the proposed action.

DESCRIPTION OF THE ALTERNATIVES

No-Action Alternative

The no-action alternative is analyzed in the NEPA process for the review and comparison of feasible alternatives to the existing baseline conditions. Under the no-action alternative, the NPS would not replace the existing bulkhead, which was refurbished in 1985 with a life cycle of 25 years. The existing wharf bulkhead consists of approximately 500 linear feet of steel sheet piles that are in an advanced state of degradation and corrosion and approximately 200 linear feet of cast-in-place concrete that is generally in sound condition. The existing cast-in-place section of the wharf bulkhead is the section located immediately adjacent to and to the west of Fort Christiansvaern. Under the no-action alternative, the NPS would continue to use and maintain the existing facilities. Maintenance, such as mowing, wharf repair, concrete walkway repair, and management of the historic site would continue. The site's emergency response to floods would remain unchanged, and post-flood cleanup after storm events would continue. Some maintenance activities are common to both alternatives, such as periodic clearing of debris, clearing or cutting of vegetation, and clearing of sediment and debris along existing drainage culverts.

The NPS closed the bulkhead in 2005 to boat operations and marine traffic due to safety concerns. The current fendering system is failing, which precludes any current boat accessibility, including emergency marine response. The bulkhead was also closed to large crowds and vehicle traffic in 2005 due to safety concerns and would remain closed under the no-action alternative. The concrete apron is unable to support heavy vehicles in the current condition; therefore, the sidewalk at the bulkhead would remain closed to vehicular traffic, including vehicles for maintenance, law enforcement, and emergency response. Under the no-action alternative, Christiansted NHS and the associated historic structures would not be protected from future storm events, including greater-intensity storm events. If the bulkhead is not replaced and adapted for climate resiliency, the existing historic buildings and the terrestrial archeological site could be permanently lost.

Proposed Action/NPS Preferred Alternative

The proposed action would replace 700 linear feet of the existing bulkhead. The new bulkhead design would have a 40-year life cycle. The existing bulkhead would be encapsulated and enclosed by the new bulkhead instead of removed. This would reduce the amount of construction debris generated that would require disposal at an upland site. Any debris removed from the construction site would be properly disposed of at an approved upland site.

Replacement of the wharf bulkhead would include: 1) removal and relocation of corals on the bulkhead and on the marine bottomlands within 15 feet of the bulkhead; 2) relocation of two isolated artifacts from the project area; 3) replacing approximately 500 linear feet of the existing steel sheet pile bulkhead with new steel sheet piles; 4) repairing approximately 200 linear feet of existing cast-in-place concrete bulkhead by pouring a new cast-in-place reinforced concrete gravity wall; 5) installing new mooring cleats and marine fenders; 6) extending the existing decking on the western end of the bulkhead to be flush with the new concrete cap; and 7) rehabilitating the existing concrete apron. These actions are described in the following paragraphs.

Coral Relocation and Archeological Resource Protection. The proposed action would remove and relocate all coral colonies that are 5 centimeters (cm) or larger attached to the existing bulkhead and on the marine bottomlands within 15 feet of the bulkhead prior to construction. Live corals would be salvaged to the extent practicable and relocated to a designated recipient site. Corals that exhibit outward symptoms of disease would not be relocated to prevent the risk of disease transmission at the recipient site.

The proposed action would also remove and relocate two isolated artifacts from within the project area to a location outside the area of potential effects as determined by the Virgin Islands State Historic Preservation Office (VISHPO). Moving these artifacts would resolve any adverse effects from construction activities.

Bulkhead Replacement. Under the proposed action, the NPS would replace approximately 500 linear feet of existing steel sheet pile bulkhead with new steel sheet piles driven immediately (24 inches) seaward of the face of the existing bulkhead; approximately 200 linear feet of cast-in place concrete bulkhead would be repaired by pouring a new cast-in-place reinforced concrete gravity wall on top and seaward of the existing concrete bulkhead (32 inches seaward) (figure 2). The new gravity wall would be self-supported and would not require internal tiebacks (figure 3). The new steel sheet pile bulkhead would be a cantilever structural design and would have a reinforced concrete fascia and cap. The bulkhead would maintain the existing bulkhead height of +5.26 feet, which would allow the new bulkhead to handle washover during future storm events (figure 4) (HDR 2018a).

The replacement of the bulkhead would be accomplished through a combination of in-water and land-based construction. Both methods would allow the NPS to replace the bulkhead and to minimize impacts to the historic wharf. In the eastern portion of the project area, the water is shallow (approximately 2- to 3-feet deep but less than 2-feet deep in places), and there is a high prevalence of seagrasses, as well as unconsolidated dead coral rubble with algae and scattered small coral colonies (3 to 5 cm). Repair of the concrete bulkhead would be completed from the existing concrete wharf apron in this area to the extent possible. Some work would occur in a temporary work area that would extend approximately 3 feet seaward of the footprint of the new bulkhead and could include placement of the temporary form and support structures for the concrete wall. In-water construction would be used to install new steel sheet piles in the central and western portion of the study area, where the water depth is sufficient, using a vibratory hammer. Subsurface predrilling and preforming methods could be used to penetrate subsurface cemented bedrock where necessary. Construction equipment would likely consist of standard concrete placement equipment and possible land-based pile driving equipment (e.g., crane).

New mooring cleats would be installed along the top of the new bulkhead cap. Spacing of the cleats would generally match that of the existing mooring cleats (15-feet center-to-center) or as appropriate based on operational feedback provided from park staff in a future design phase. New marine fenders would also be installed. The proposed fender system would consist of typical marine fender materials affixed directly to the concrete fascia of the new bulkhead (see figure 4).

A portion of the public Christiansted boardwalk, which is comprised of timber and composite materials, at the western end of the project area would be removed; the composite decking would be stored for reuse during construction. After installation of the steel sheet piles, the timber decking would be extended to match the extent of the bulkhead's new concrete cap. The composite decking would be used to rebuild the deck in the same location.

Figure 2. Proposed Action

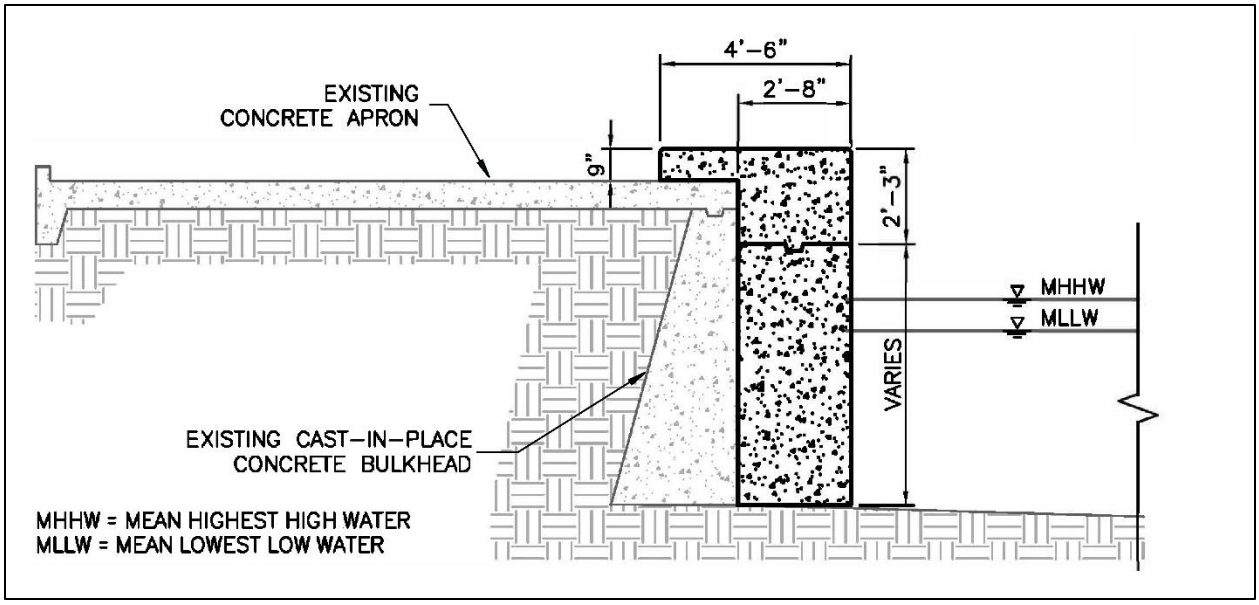

Figure 3. Cast-in-Place Concrete Bulkhead Design

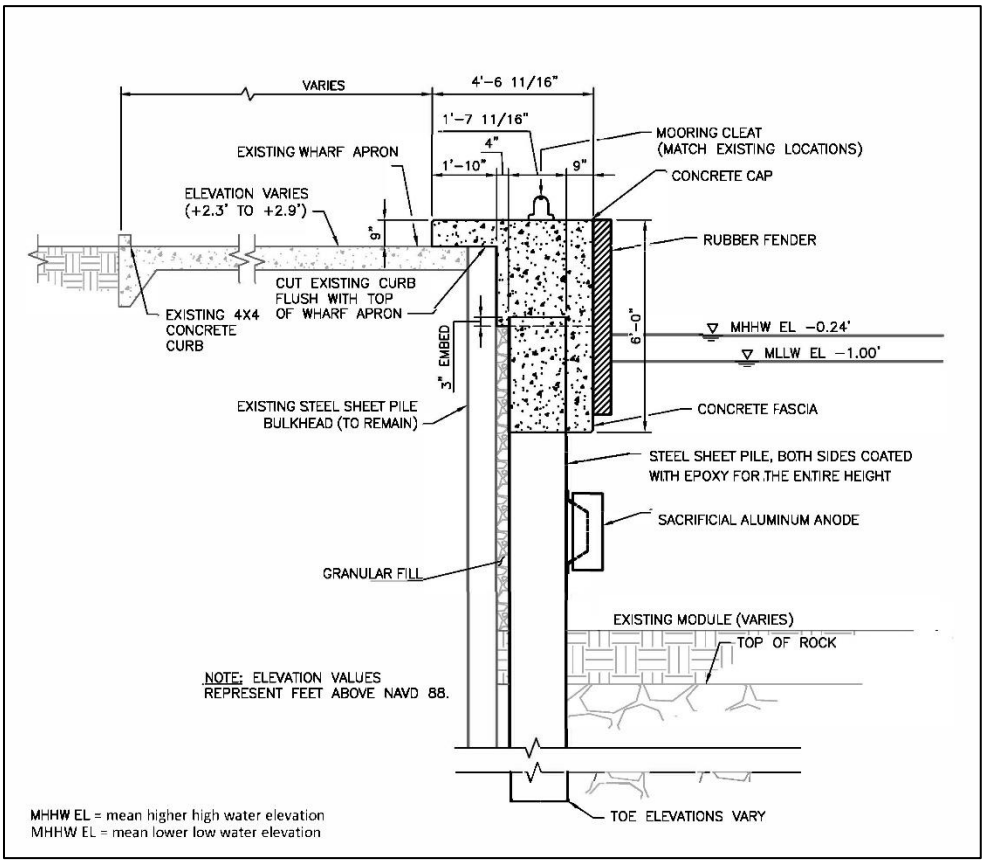

Figure 4. Steel Sheet Pile Bulkhead Design

The concrete sidewalk is structurally sound; however, the proposed action would rehabilitate the existing concrete apron to improve the condition of and increase the design life of the concrete sidewalk. This would include locating any potential voids beneath the existing concrete and creating a detailed plan to fill and repair the voids. Additionally, the concrete apron would be thoroughly cleaned, visible concrete damage (e.g. cracks, chips, spall, etc.) would be repaired, and an overall surface treatment would be applied during the concrete apron rehabilitation. BMPs would be employed during surface treatment application to prevent spills.

Construction Equipment, Timing, and Detours. Coral removal and relocation would occur prior to the start of construction; however, relocation would not be conducted during peak hard coral spawning or coral bleaching periods (July 1 through October 31), as established through consultation with National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) and the VIDPNR Coastal Zone Management. Construction is anticipated to take approximately 12 months. Ground protection measures would be used in all locations where equipment would operate within the uplands along the wharf area or where materials would be placed off of paved surfaces. Areas of resource sensitivity would be marked as avoidance areas and protected from disturbance. All areas where construction equipment would be used along the historic waterfront would have ground protection to ensure minimal to no ground disturbance. Construction staging areas would be located within existing developed or disturbed areas (figure 2). Staging areas could be used for materials and construction equipment, such as a crane mounted drill rig, a vibratory hammer, a concrete mixer, and a barge.

Overall project scheduling, which would likely result in removal of the coral and archeological artifacts prior to the start of construction, could be considered a mitigation measure. With the implementation of these mitigation measures, project related impacts would be minimized. Construction would require intermittent closures of a portion of the Fort Christiansvaern parking area and the driveway to the King Christian Hotel in the western end of the site (figure 2). Vehicular access, including emergency vehicle access, would be maintained throughout the entire construction period by implementing traffic control measures, including detours and protection of open lanes. A traffic plan to include vehicles, marine vessels, and pedestrians would be prepared to manage traffic during closures.

ALTERNATIVES CONSIDERED BUT DISMISSED FROM DETAILED ANALYSIS

During the initial design process for this project, the NPS reviewed a previous engineering study (Moffatt & Nichol 2014), which had determined that repairs to the bulkhead would not be cost effective due to the stage of deterioration. This review validated that attempting to repair the bulkhead would not be cost effective at the bulkhead's current stage of deterioration (HDR 2018b). Five design alternatives were reviewed and considered during a Value Analysis Workshop conducted in May 2018 (HDR 2018c). The following alternatives were considered for project implementation but were dismissed from further analysis because none individually met NPS objectives for replacing the bulkhead.

- **Cantilever Bulkhead with a 20-year Design Life:** Under this alternative, the full length of the existing bulkhead (700 linear feet) would be replaced with a cantilever metal sheet pile and would have a design life of 20 years. One of the key advantages to the cantilever design is that installation minimizes disturbance to the existing bulkhead and terrestrial resources on the upland side of the bulkhead (no anchoring required). This alternative was dismissed because bulkhead replacement would be required once every 20 years. This could cause an adverse effect on marine bottomlands during each replacement phase of the construction.
- **Anchored Bulkhead with a 40-year Design Life:** In contrast to a cantilever bulkhead, this alternative considered an anchored bulkhead, which uses an anchor rod as a tie-back into the soil instead of driving sheet pile into the sediment like a cantilever bulkhead. This alternative had a

40-year design life but was dismissed because the tie-back rods would disturb additional terrestrial resources landward of the existing bulkhead. Ground excavation would be required to set the rods during construction beyond the existing concrete walkway. This would potentially cause an adverse effect on cultural resources under Section 106 of the NHPA.

- **Anchored Bulkhead with a 20-year Design Life:** Similar to the anchored bulkhead discussed above, this alternative had only a 20-year design life. In addition to disturbing terrestrial resources while setting the rods for the anchors and potentially causing an adverse effect on cultural resources from ground disturbance, bulkhead replacement would be required once every 20 years. For these reasons, this alternative was dismissed.
- **Cantilever Bulkhead with a 20-year Design Life and a Reduced Overall Length:** This alternative considered a cantilevered bulkhead to replace approximately 490 linear feet of the existing sheet pile bulkhead with a 20-year design life. This alternative was dismissed because bulkhead replacement would be required once every 20 years. This would potentially cause an adverse effect on marine bottomlands during each replacement phase of the construction; therefore, this alternative was dismissed.

MITIGATION MEASURES

To minimize impacts related to the proposed action alternative, the NPS would implement mitigation measures whenever feasible. Subject to the final design and approval of plans by relevant agencies, mitigation measures would include, but would not be limited to, the items in appendix A.

CHAPTER 3: AFFECTED ENVIRONMENT

This chapter describes the affected environment associated with the proposed action. The descriptions of the resources provided in this chapter serve as an account of the baseline conditions against which the potential impacts of the alternatives considered in this environmental assessment are compared. The resource topics evaluated in this chapter are: marine resources, special-status species, archeological resources, and visitor use and experience.

MARINE RESOURCES

The study area for marine resources is the barge work area, approximately 140,000 square feet (3.2 acres) located in the marine bottomlands directly in front of the Christiansted NHS wharf (figure 2). Coral, benthic habitat, and essential fish habitat within the project area were evaluated through database searches, a coral survey, a protocol-level seagrass delineation, and a technical visual snorkel survey along the existing wharf bulkhead.

Coral

In September 2018 scientific divers performed in-situ coral surveys along the bulkhead fronting the Christiansted NHS wharf (figure 2). In addition to the in-situ surveys, the entire portion of the submerged bulkhead was video-graphed. A photo-mosaic of the bulkhead panels was then developed to map individual colony locations on the bulkhead.

Example of photomosaic of the bulkhead wall with lobed star coral location identified


Close-up photograph of lobed star coral colony

The underwater survey identified 18 scleractinian coral species (stony corals) present on the bulkhead (table 1). In total, the survey identified approximately 500 corals greater than or equal to 5 centimeters (cm) in size. Because of their small size, cryptic nature, and high mortality, corals less than 5 cm were noted but not tallied. Club finger coral (*Porites porites*) recruits and numerous small colonies of lesser starlet coral *(Siderastrea radians)* and golf ball coral *(Favia fragum)* smaller than 5 cm were present. The *Pseudodiploria* species, symmetrical brain coral (*Pseudodiploria strigosa*) and knobby brain coral (*Pseudodiploria clivosa*) were the most common corals present, accounting for more than 50% of all corals observed (Dial Cordy 2019a). In April 2019, the NPS and NOAA agency partners conducted a technical visual snorkel survey along and adjacent to the wharf bulkhead and confirmed the findings of the 2018 survey. The only federally listed coral species found on the bulkhead included the lobed star coral species complex. The lobed star coral species complex is comprised of three closely related species, lobed star coral (*Orbicella annularis*), boulder star coral (*O. franksi*), and mountainous star coral (*O. faveolata*). Outward colony morphology is generally used to differentiate species in the field, but this is often difficult when colonies are small or encrusting (as in the case of the corals growing on the bulkhead). For this reason, and because all three star coral species are listed as federally threatened species, the discussion of the three *Orbicella* species is combined in this document (Dial Cordy 2019a). It should be noted that corals on the bulkhead are attached to an artificial substrate, not hardbottom substrate.

Table 1. Size Distribution and Abundance of Coral Species Observed on Bulkhead

Species	Size <5cm	Size 5-10cm	Size >10-50cm	Size >50 cm
Blushing Star Coral (*Stephanocoenia intersepta*)	-	1	-	-
Boulder Brain Coral (*Colpophyllia natans*)	-	3	10	5
Club Finger Coral (*Porites porites*)	numerous	24	50	-
Elliptical Star Coral (*Dichocoenia stokesi*)	1	4	-	-
Flower Coral (*Eusmilia fastigiata*)	-	-	1	-
Golf Ball Coral (*Favia fragum*)	numerous	3	-	-
Knobby Brain Coral (*Pseudodiploria clivosa*)	2	-	84	13
Lesser Starlet Coral (*Siderastrea radians*)	numerous	9	-	-
Lettuce Coral (*Agaricia agaricites*)	few	1	-	-
Lobed, Boulder Star, Mountainous Star Coral* (*Orbicella annularis* species complex)	-	-	19	7
Massive Starlet Coral (*Siderastrea siderea*)	few	5	20	2
Maze Coral (*Meandrina meandrites*)	-	3	-	-
Mustard Hill Coral (*Porites astreoides*)	numerous	10	63	2
Rose Coral (*Manicina areolata*)	-	1	-	-
Symmetrical Brain Coral (*Pseudodiploria strigosa*)	4	20	126	11
Whitestar Sheet Coral (*Agaricia lamarcki*)	-	-	-	1
Totals	**Dozens**	**84**	**373**	**41**

Source**:** Dial Cordy 2019a
* Indicates federally listed species

Benthic Habitat

On September 18-19, 2018 scientific divers performed benthic community resource surveys of the barge work area and mapped approximately 113,000 square feet (2.6 acres) of marine bottomlands habitat fronting the Christiansted NHS bulkhead (figure 5) (Dial Cordy 2019a). These benthic surveys documented submerged aquatic vegetation, seagrasses and calcareous marine algae. The existing bulkhead and surrounding area are replete with a diverse benthic community that includes multiple species of scleractinian corals, seagrasses, urchins, and other invertebrates, as well as reef fish. However, the area does not contain any NMFS-designated critical habitat for seagrass. Table 2 and figure 5 present the benthic habitat identified during the survey.

Table 2. Benthic Habitat Cover

Benthic Habitat Cover	Acres of Survey Area	Percent of Survey Area
Sand/rubble with attached and/or drift algae	1.41	54.2
Exotic paddle grass *(Halophila stipulacea)* with attached and/or drift algae	0.74	28.3
Sand/rubble	0.23	8.8
Turtle grass (*Thalassia testudinum*) with attached and/or drift algae	0.21	8.2
Turtle grass (*Thalassia testudinum*) and exotic paddle grass *(Halophila stipulacea)* with attached algae	0.01	0.5

Source: Dial Cordy 2019a

Note: Attached algae included calcareous green algae (*Penicillus capitatus, Halimeda incrassata,* and *Udotea flabellum*) and drift algae was comprised mainly of brown algae (*Dictyota* sp.).

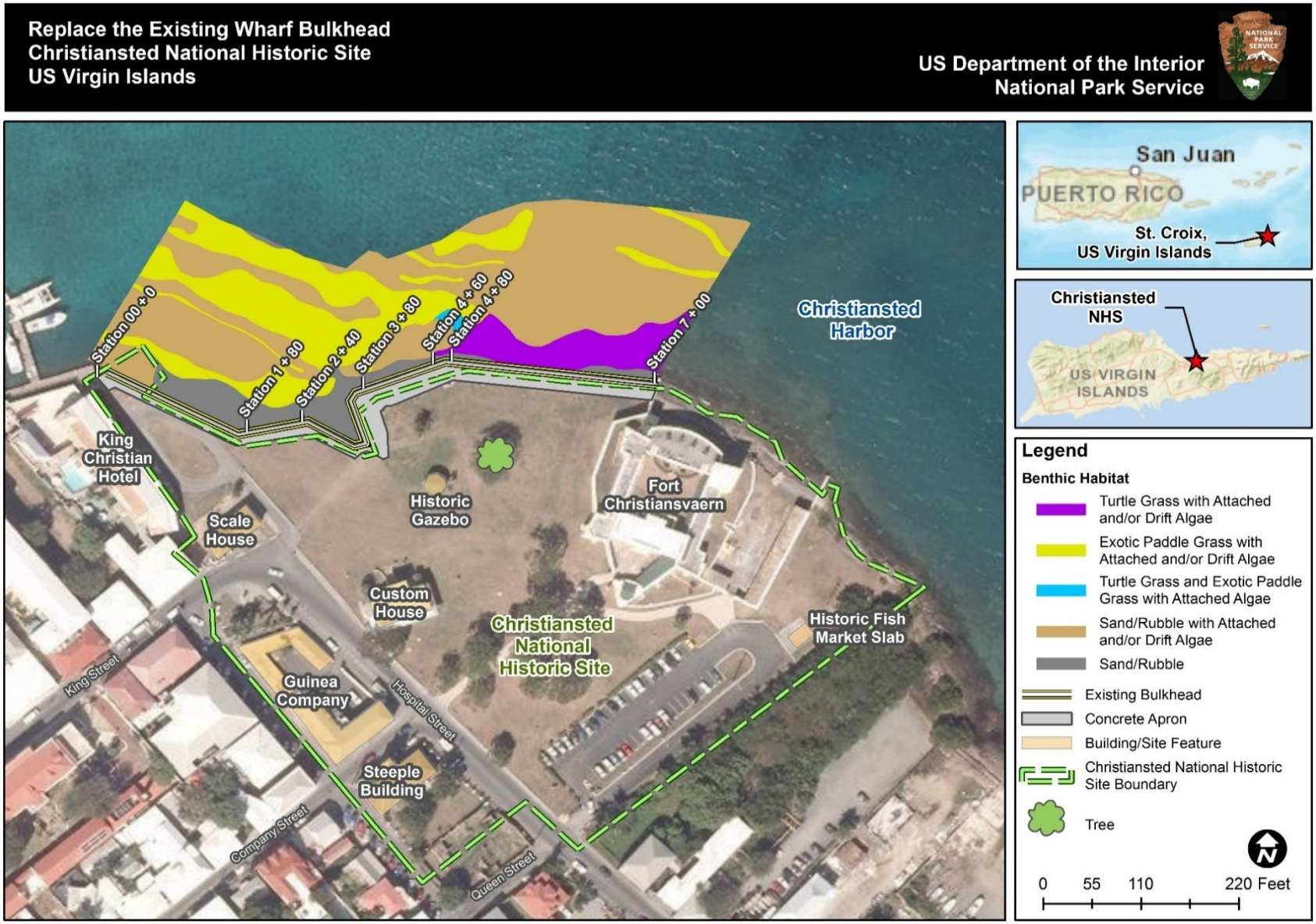

Figure 5. Benthic Habitat Cover

Seagrass beds in the marine bottomland habitat in the project area are dominated by exotic paddle grass (*Halophila stipulacea*), an exotic invasive seagrass. Turtle grass (*Thalassia testudinum)* and paddle grass *(Halophila decipiens)* are also present within this marine bottomland habitat, though only a very small amount of native paddle grass was observed. In addition to these species, there are three main species of calcareous green algae in the marine bottomland seagrass beds, *Penicillus capitatus, Halimeda incrassata,* and *Udotea flabellum.*

Large areas of seagrass dominated by monospecific beds of exotic paddle grass were observed throughout the western half of the project area. An area of turtle grass was also found in very shallow water (less than 6 feet deep) in the easternmost portion of the study area. This area of turtle grass is presently mixed with exotic paddle grass. A technical visual snorkel survey of the bulkhead wall and adjacent marine bottomland habitat noted that patchy submerged aquatic vegetation occurs starting at station 4 + 80 (figure 5) that becomes thicker moving eastward along the concrete portion of the wall. This seagrass bed is dominated by turtle grass that is anchored amongst rubble, stone, and various trash (NPS 2019a).

Eight of the 18 species of stony corals identified on the wharf bulkhead were also documented on the marine bottomlands (mustard hill coral, finger coral, massive starlet coral, lesser starlet coral, golf ball coral, blushing star coral, mountainous star coral, and symmetrical brain coral); only one colony of the federally listed mountainous star coral was noted. Large amounts of trash and debris were found throughout the marine bottomlands within the project area and most of the stony corals were found on this debris (Dial Cordy 2019a).

Large areas of sand and rubble covered with calcareous green algae, as well as drift algae comprised mainly of brown algae (*Dictyota* sp.), are also found throughout the project site. Urchins were also noted in the grassbeds, specifically lime urchin (*Diadema antillarum)*, variegated sea urchin (*Lytechinus variegatus*), and white sea urchin (*Tripneustes ventricosus*). Hermit crabs were plentiful and one giant hermit crab (*Petrochirus diogenes)* was observed. The variegated feather duster worm (*Bispira variegata)* was present but not common.

Another common feature of both the sand areas and grassbeds were volcano shaped sediment structures built by the burrowing of the ghost shrimp (*Callianassa* sp.). Numerous bearded fireworms (*Hermodice carunculata*) were also observed, and presence of the giant anemone (*Condylactis gigantea*) was noted. Benthic invertebrates were observed on the bulkhead walls, including lime urchin, variegated sea urchin, white sea urchin, reef urchin (*Echinometra viridis*), and slate pencil urchin (*Eucidaris tribuloides*), as well as the variegated feather duster worm and the social feather duster worm (*Bispira brunnea)*. Benthic species play important roles in ecosystem function, such as providing a food source for commercially important marine fish species, restructuring sediments, and facilitating the decomposition of organic matter.

In close proximity to the bulkhead, the marine bottomlands contain a diversity of species. Approximately two thirds of the project do not provide high quality marine bottomlands habitat. The western portion of the project area (between stations 0 + 00 to 3 + 80) contains poor conditions for marine life with silty sandy mucky dark sediments with substantial trash component. The central portion of the project area (between stations 3 + 80 and 4 + 60) also contains poor habitat conditions with silty sandy bottom with small to large unconsolidated bottom and trash and is poorly colonized by marine life. The remaining third of the project area in eastern portion (between stations 4 + 80 and 7 + 00) provides the valuable marine bottomlands habitat with sparse to thick beds of seagrass containing turtle grass intermixed with unconsolidated dead coral rubble with algae and scattered small (3 to 5 cm) coral colonies (NPS 2019a). Turtle grass is an important food for a variety of marine wildlife, including sea turtles, manatees, fish, and invertebrate species (IUCN 2010). Exotic paddle grass, which grows in monospecific beds in the western

and central portions of the project area and is intermixed with the turtle grass in the eastern portion, provides lower quality habitat. Exotic paddle grass is able to expand rapidly and outcompete native species, such as turtle grass. Exotic paddle grass is less firmly rooted in the sediment, providing less stability. Additionally, the smaller leaves of exotic paddle grass provide less shelter for fauna (Smulders et al. 2017). Species composition in areas of exotic paddle grass is likely to differ from that in areas of native seagrass beds, resulting in changes to coastal protection, productivity, habitat structure, and food availability (Smulders et al. 2017). Beds of turtle grass typically form thick mats, which stabilize the sediment, but the grasses in the project area are anchored amongst rubble, stone, and trash (NPS 2019a).

Specific water quality data are not available for the project area; however, the quality of the water column is expected to vary due to scouring and suspension of marine bottom sediments by tides and currents, and mixing of biological, chemical, and oxygen levels throughout the water column. These factors influence the phytoplankton production, as well as any potential contamination from point and non-point sources, which influence the variability of the quality of the water column in the vicinity of the project area.

Essential Fish Habitat

Essential Fish Habitat (EFH) describes the waters and substrates necessary to fish for spawning, breeding, feeding, or growing to maturity (CFMC 1998), as determined by regional fishery management councils. The Caribbean Fishery Management Council (CFMC) manages EFH in Puerto Rico and the US Virgin Islands, and considers mangrove estuary, seagrass bed, coral reef, algal plain, sand/mud bottom, shelf break, and overlying pelagic EFH (CFMC 1998). EFH is designated within the project area for 18 coral, 2 marine invertebrate, 12 reef fish, and 7 highly migratory species. Many of these species are also of commercial importance. An EFH assessment has been prepared as part of this EA to evaluate in detail potential project-related impacts to these species.

Table 3 lists the managed species identified as potentially occurring within the project area. The species listed in table 3 were screened to evaluate the potential for those species to occur within the project area. Identification of species of concern was accomplished in four steps: 1) EFH species were identified from the regional list encompassing Christiansted Harbor; 2) life history and EFH descriptions were compiled for each species; 3) information on the distribution of species in the project vicinity was compiled; and 4) screening of EFH species/life stages was completed based on species distribution, habitat preferences, and site conditions.

Habitat preferences can vary significantly for different species during the various life stages. To assess whether suitable habitat is present in the project area for the various marine invertebrates and fish species and their life stages with EFH designation, habitat preferences for the different life stages were identified for each species. This information is presented in appendix B for the full list of EFH species identified for Christiansted Harbor. Appendix B also presents the following information for each species, where available: general habitat type, the depth at which each is likely to occur, diets, whether the species would be seasonally present, and habitat specifics for each life stage. Current research provides limited information for certain life stages of nine species managed by the Magnuson–Stevens Fishery Conservation and Management Act. Those species for which the marine habitat within the project area is unlikely to constitute EFH were eliminated from further consideration based on parameters such as depth, benthic habitat, and habitat preferences. Table 3 presents those species that are likely to occur within the project area and the life stages in which they may occur, as well as their habitat preferences, generally defined as coastal demersal and reef-associated species. Some pelagic species were considered but eliminated from the analysis due to lack of habitat.

Coral. Corals and coral reefs are identified as EFH by the CFMC for reef fish, queen conch, spiny lobster, and corals. Corals and coral reef communities are identified as valuable habitat for reef-associated and

reef-dependent organisms, as a buffer against coastal erosion, and having an aesthetic significance for tourism and related activities (CFMC 2004). The project area does not contain hardbottom or coral reef habitat, but the existing wharf bulkhead and the areas of rocky substrate have provided suitable habitat for corals to attach. The technical visual snorkel survey conduction in April 2019 confirmed that the marine bottomlands within the eastern portion of the project area provide EFH for corals (NPS 2019a). The corals identified in table 3 and appendix B are those that were identified during the 2018 coral survey. Due to slow regeneration and limited distribution, coral is considered a non-renewable resource.

Marine Invertebrates. EFH for spiny lobster and queen conch includes seagrass, benthic algae, coral, and live/hardbottom substrates. Additionally, sand/shell substrates provide EFH for queen conch EFH. Based on habitat availability, spiny lobsters (larvae, juveniles, and adults) and queen conch (juveniles and adults) could occur within the project area. The technical visual snorkel survey conduction in April 2019 confirmed that the marine bottomlands within the eastern portion of the project area provide EFH for marine invertebrates (NPS 2019a).

Fish. Most reef fish use a variety of habitats through their life stages. Data gaps exist in the available literature on all life stages of the reef fish managed by the CFMC. Generally, reef fish spawn in open waters and eggs and larvae are pelagic, depending on ocean currents for movement. Pelagic eggs and larvae of reef fish could settle into the sandy and muddy substrate of the project area. One exception is the redtail parrotfish (*Sparisoma chrysopterum*) that migrates from reef habitat to mangroves or seagrass beds for spawning. The project area does not contain any mangrove habitat. Juveniles and adults of some species are known to use seagrasses, coral, sandy bottom, and rubble habitats, all of which are present within the project area. The project area does not contain reef habitat, but the available habitat is used by reef fish. Those reef fish identified in table 3 will be carried forward for detailed analysis in chapter 4.

Highly migratory species include a wide variety of fish, such as tuna, swordfish, billfish, and sharks. These fish are managed by the CFMC, as they are important as both sport and food fishes; however, most highly migratory species would not be expected to use the habitat within the project area due to their preference for deeper waters. Reef-associated sharks (blacktip, Caribbean reef, dusky, lemon, nurse, sand tiger, and tiger) and rays (southern stingray) are identified as potentially using the shallow coastal waters and seagrass bed habitats in the project area for various life stages. Although sharks and rays could use the habitat throughout the project area, sharks should be considered transient species within the project area and unlikely to use the habitat adjacent to the bulkhead wall.

Table 3. Life Stage Presence for Species with Designated EFH in the Vicinity of the Project Area

Species	Eggs / Gametes	Larvae / Neonates	Juveniles	Adults	Occurrence
Corals					
Blushing Star Coral (*Stephanocoenia intersepta*)	X		X	X	Reef-Associated
Boulder Brain Coral (*Colpophyllia natans*)	X		X	X	Reef-Associated
Club Finger Coral (*Porites porites*)	X		X	X	Reef-Associated
Elkhorn Coral (*Acropora palmata*)*	X		X	X	Reef-Associated
Elliptical Star Coral (*Dichocoenia stokesi*)	X		X	X	Reef-Associated
Flower Coral (*Eusmilia fastigiata*)	X		X	X	Reef-Associated
Golf Ball Coral (*Favia fragum*)	X		X	X	Reef-Associated
Knobby Brain Coral (*Diploria clivosa*)	X		X	X	Reef-Associated
Lesser Starlet Coral (*Siderastrea radians*)	X		X	X	Reef-Associated
Lettuce Coral (*Agaricia agaricites*)	X		X	X	Reef-Associated

Species	Eggs / Gametes	Larvae / Neonates	Juveniles	Adults	Occurrence
Lobed, Boulder Star, Mountainous Star Coral (*Orbicella annularis* species complex)*	X		X	X	Reef-Associated
Massive Starlet Coral (*Siderastrea siderea*)	X		X	X	Reef-Associated
Maze Coral (*Meandrina meandrites*)	X		X	X	Reef-Associated
Mustard Hill Coral (*Porites astreoides*)	X		X	X	Reef-Associated
Rose Coral (*Manicina areolata*)	X		X	X	Reef-Associated
Staghorn Coral (*Acropora cervicornis*)*	X		X	X	Reef-Associated
Symmetrical Brain Coral (*Diploria strigosa*)	X		X	X	Reef-Associated
Whitestar Sheet Coral (*Agaricia lamarcki*)	X		X	X	Reef-Associated
Marine Invertebrates					
Queen Conch (*Lobatus gigas*)			X	X	Coastal Demersal
Spiny Lobster (*Panulirus argus*)		X	X	X	Coastal Demersal
Reef Fish					
Buffalo Trunkfish (*Lactophrys trigonus*)				X	Reef-Associated
Grey Snapper (*Lutjanus griseus*)			X	X	Reef-Associated
Mutton Snapper (*Lutjanus analis*)			X	X	Reef-Associated
Nassau Grouper (*Epinephelus striatus*)*			X	X	Reef-Associated
Queen Triggerfish (*Balistes vetula*)				X	Reef-Associated
Red Hind (*Epinephelus guttatus*)			X	X	Reef-Associated
Redtail Parrotfish (*Sparisoma chrysopterum*)	X	X	X	X	Reef-Associated
Sand Tilefish (*Malacanthus plumieri*)				X	Reef-Associated
Schoolmaster Snapper (*Lutjanus apodus*)			X		Reef-Associated
Scrawled cowfish (*Acanthostracion quadricornis*)				X	Reef-Associated
Squirrelfish (*Holocentrus adscensionis*)				X	Reef-Associated
Striped Croaker (Corvula sanctaeluciae)			X	X	Reef-Associated
White Grunt (*Haemulon plumieri*)			X	X	Reef-Associated
Yellowtail Snapper (*Ocyurus chrysurus*)			X		Reef-Associated
Highly Migratory Species					
Blacktip Shark (*Carcharhinus limbatus*)		X	X	X	Reef-Associated
Caribbean Reef Shark (*Carcharhinus perezi*)		X	X	X	Reef-Associated
Dusky Shark (*Carcharhinus obscurus*)		X	X		Reef-Associated
Lemon Shark (*Negaprion brevirostris*)		X		X	Reef-Associated
Nurse Shark (*Ginglymostoma cirratum*)		X	X	X	Reef-Associated
Sand tiger shark (*Carcharias taurus*)				X	Reef-Associated
Southern Stingray (*Hypanus americanus*)				X	Reef-Associated
Tiger Shark (*Galeocerdo cuvier*)		X	X	X	Coastal Demersal

Notes:
* Indicates federally listed species
Coral present on the existing bulkhead are attached to artificial structure, not hardbottom substrate.
Most reef fish have pelagic eggs and larvae that depend on ocean currents for movement; habitat is varied.
Due to lack of habitat in the project area during all life cycles, the following species were eliminated from analysis: Atlantic sailfish (*Istiophorus platypterus*), bigeye tuna (*Thunnus obesus*), blue marlin (*Makaira nigricans*),butterfly fish (*Chaetodon striatus*), coney (*Epinephelus fulvus*), longbill spearfish (*Tetrapturus pfluegeri*), night shark (*Carcharhinus signatus*), oceanic whitetip shark (*Carcharhinus longimanus*)*, silk snapper (*Lutjanus vivanus*), swordfish (*Xiphias gladius*), white marlin (*Kajikia albida*), and yellowfin tuna (*Thunnus albacares*).

SPECIAL-STATUS SPECIES

Habitat for 11 federally listed species (five corals, one fish, one marine mammal, and four sea turtles), one fish species of concern, and five territory-listed seabirds is potentially present in the project area. Table 4 presents these species, their federal and/or territory protection status, and the rationale for retaining them for analysis in this EA.

Table 4. Special-Status Species Potentially Present in the Project Area

Species	Status	Summary of Habitat Characteristics	Occurrence
Coral			
Boulder Star Coral (*Orbicella franksi*)	FT	Found down to a depth of 50 meters (m) (164 feet [ft]); often the most abundant coral species on shallow fore-reef environments from 15-30 m (49.2-98.4 ft)	Species documented in the project area during the 2018 coral survey
Elkhorn Coral (*Acropora palmata*)	FT	Turbulent shallow water on the seaward face of reefs in water ranging from 1-15 m (3.3-49.2 ft) in depth; require hard, consolidated substrate	Species not documented during the 2018 or 2019 surveys; project area does not provide essential feature for critical habitat
Lobed Star Coral (*Orbicella annularis*)	FT	Marine waters ranging from 0.5-82 m (1.6-269 ft); more abundant in reef environments from 1 to 10 m (3.3-32.8 ft) deep; also found in lagoons and upper reef slopes.	Species documented in the project area during the 2018 coral survey
Mountainous Star Coral (*Orbicella faveolata*)	FT	Wide range of depths from 0.5-40 m (1.6-131 ft); usually found on the back reef and fore reef slopes of fringing reefs 10-20 m (32.8-65.6 ft) below the surface	Species documented in the project area during the 2018 coral survey
Staghorn Coral (*Acropora cervicornis*)	FT	Commonly in more protected, deeper water ranging from 15-60 m (49.2-196.9 ft); settle and metamorphose on appropriate substrates; require hard, consolidated substrate	Species not documented during the 2018 or 2019 survey; project area does not provide essential feature for critical habitat
Fish			
Nassau Grouper (*Epinephelus striatus*)	FT	Juveniles use mangrove creeks, seagrass beds, and shallow reefs; adults occur from the shoreline to at least 90 m (295.3 ft) depth; usually close to caves	Juveniles could use seagrass beds within the project area for foraging and refuge; adults could use rocky habitat for foraging
Striped Croaker (*Corvula sanctaeluciae*)	FSC*	Common over muddy and sandy bottoms in nearshore areas; juveniles also found in rocky areas; found at depths up to 35 m (114.8 ft)	Juveniles and adults could forage within the sandy and rocky bottoms in the project area
Marine Mammals			
Antillean Manatee (*Trichechus manatus manatus*)	FE	Prefer large, slow-moving rivers, river mouths, and shallow coastal areas such as coves and bays	Potential foraging habitat but is most likely a transient species in the harbor
Sea Turtles			
Green Sea Turtle (*Chelonia mydas*)	FT	Generally found in fairly shallow waters (except when migrating) inside reefs, bays, and inlets; attracted to lagoons and shoals with an abundance of marine grass and algae.	Potential transient species due to lack of large seagrass beds and coral reefs; project area does not contain breeding or nesting habitat

Species	Status	Summary of Habitat Characteristics	Occurrence
Hawksbill Sea Turtle (*Eretmochelys imbricata*)	FE	Associated with coral reef habitats; also, sometimes found in rocky areas, shallow coastal areas, lagoons or oceanic islands, and narrow creeks and passes	Potential transient species due to lack of large seagrass beds and coral reefs; project area does not contain breeding or nesting habitat
Leatherback Sea Turtle (*Dermochelys coriacea*)	FE	Most pelagic of the sea turtle species; adult females require sandy nesting beaches backed with vegetation and sloped sufficiently so the crawl to dry sand is not too far	Long-distance migratory species; only found at St. Croix during breeding season (February-May); unlikely to be found in project area as no suitable nesting area available
Loggerhead Turtle (*Caretta caretta*)	FT	Widely distributed within its range; can be found hundreds of miles out to sea, as well as in inshore areas such as bays, lagoons, salt marshes, creeks, ship channels, and the mouths of large rivers; coral reefs, rocky places, and ship wrecks are often used as feeding areas	Potential transient species, could feed on macro-invertebrates; could use coral reefs during breeding season for resting only; no suitable nesting habitat available in project area
Seabirds			
Brown Pelican (*Pelecanus occidentalis*)	LSC	Salt bays, beaches, ocean; mostly over shallow waters along immediate coast, especially on sheltered bays; sometimes seen well out to sea. Nests on islands, which may be either bare and rocky or covered with mangroves or other trees	Potential foraging habitat available; project area does not contain nesting habitat
Magnificent Frigatebird (*Fregata magnificens*)	LE	Oceanic coasts, islands; occurs over warm waters, usually along coast but also far offshore at times; soars inland in coastal areas; nests on islands, usually small islands with dense growth of mangroves or other trees or shrubs	Potential foraging habitat available; project area does not contain nesting habitat
Laughing Gull (*Leucophaeus atricilla*)	LCT	Salt marshes, coastal bays, piers, beaches, ocean; generally found only in coastal regions, especially common around beaches and salt marshes, but also ranging several miles inland to rivers, fields, dumps; nests on beaches and dredge spoil islands among grass and bushes	Potential foraging habitat available; project area does not contain nesting habitat
Gull-billed Tern (*Gelochelidon nilotica*)	LP	Salt marshes, fields, coastal bays; restricted to seacoast in North America, but does most foraging over marshes, pastures, farmland, and other open country just inland from coast; nests mostly on beaches, islands	Potential foraging habitat available; project area does not contain nesting habitat
Coastal Least Tern (*Sterna antillarum antillarum*)	LSC (LE)	Sea beaches, bays, large rivers, salt flats; along coast generally where sand beaches close to extensive shallow waters for feeding; inland, found along rivers with broad exposed sandbars, lakes with salt flats nearby	Potential foraging habitat available; project area does not contain nesting habitat

Sources: Audubon n.d.a-e; FishBase n.d., FMNH 2017a-c; IUCN 2008a-d; NOAA 2014; NMFS n.d.a-b, 2006; USFWS 2015a-c, 2017, 2018; UWI 2015, 2017a; Zoological Society of London n.d.

Notes: * This species is a species of concern under NOAA NMFS.

Only those special-status species with potential habitat present in the project area were carried forward for analysis.

US Fish and Wildlife (USFWS) Service Endangered Species Act (16 USC § 1531 et seq.) or the Virgin Islands Endangered and Indigenous Species Act (Virgin Islands Code Annotated Title 12 § 101) (status under the existing territorial legislation is shown in parenthesis where different from the proposed revised status). Status Codes: FE = federally endangered; FT = federally threatened; FSC = federal species of concern; LE = locally endangered; LSC = local special concern; LP = locally peripheral; LCT = locally controlled

Coral. The lobed star coral (*Orbicella annularis*) species complex, which is comprised of three federally threatened species— lobed star coral (*Orbicella annularis*), boulder star coral (*O. franksi*), and mountainous star coral (*O. faveolata*) —have been identified within Christiansted Harbor and are attached to the existing bulkhead. Twenty-six of the 498 corals on the bulkhead greater than 5 cm were in the *Orbicella annularis* species complex, or approximately 5.2% of the total (Dial Cordy 2019a). Additionally, one isolated colony of the *Orbicella annularis* species complex was found on a cement structure within the open water marine bottomlands of the project area. Federally threatened species elkhorn coral (*Acropora palmata*) and staghorn coral (*A. cervicornis*) were not observed during the 2018 or 2019 surveys. Several localized hardbottom areas exist within the project area, but it is unknown if these hardbottoms are natural outcroppings or large slabs of debris rock from previous construction activities. These hardbottoms are currently covered by thick sediment and/or macroalgae over rubble and cobble, and therefore, do not provide the essential feature for elkhorn and staghorn coral (Dial Cordy 2019b). Additionally, there was a lack of any elkhorn and staghorn coral colonies, either living or skeletal, throughout the area surveyed. It is therefore unlikely that these patches of ephemeral hardbottom meet the definition of "critical habitat" for elkhorn and staghorn coral (Dial Cordy 2019b). In general, the marine bottomlands within the project area would likely not be successful for many federally listed coral species due to its shallowness, exposure to wave impacts in storm, rubble pavement bottom with thick macroalgae, turf algae cover (NPS 2019a).

Fish. The Nassau grouper is a long-lived reef fish that is federally threatened throughout its range. The project area contains shallow habitat with seagrass beds, which provides potential habitat for juvenile Nassau groupers. Juveniles are typically found in nearshore shallow waters containing seagrass beds and feed on invertebrates and smaller fish (NOAA 2014). Adults generally shift to deeper habitats associated with both natural and artificial hard structures, such as reefs, rocks, and ledges (NOAA n.d.); adult groupers could occur occasionally within the project area but would be expected in limited numbers.

The striped croaker is a species of concern. This is a coastal demersal species and is common in inshore areas over muddy and sandy bottoms; juveniles can also be found in rocky areas. The striped croaker is a small fish whose diet consists mainly of shrimp (FishBase n.d.).

Marine Mammals. The project area contains potential habitat for Antillean manatees, which have been identified within Christiansted Harbor and are likely transient species in the project area. The Antillean manatee is a federally endangered species. Manatees prefer large, slow-moving rivers, river mouths, and shallow coastal areas such as coves and bays. The animals may travel great distances as they migrate between winter and summer grounds. They typically consume non-native water hyacinths and hydrilla, along with native aquatic plants such as *Vallisneria* or eelgrass (USFWS 2018).

Sea Turtles. Federally threatened loggerhead sea turtles and federally endangered leatherback sea turtles are not expected in the project area. Although no sea turtle species were observed during the 2018 field surveys, federally threatened green sea turtles and federally endangered hawksbill sea turtles do use Christiansted Harbor and Long Reef. These species are frequently found outside the harbor entrance. Juveniles are known to forage within the harbor on sea grass beds, and hatchlings are found in the harbor after nesting during summer and fall months. The benthic surveys completed during the field visit indicated that a small turtle grass bed is present in the project area, as well as exotic paddle grass, which could both provide foraging habitat for sea turtles. Although sea turtles could occur as transient species in the project area, it is more likely that sea turtles do not forage in the vicinity of the project area due to the lack of preferred seagrasses, the lack of large seagrass beds, and the lack of coral reefs in Christiansted Harbor. Sea turtles are likely only transient species in the project area. The project area does not support nesting and breeding habitat for sea turtles.

Seabirds. The project area contains shoreline with an artificial structure, the wharf bulkhead, as the barrier between the land and the ocean; therefore, a natural shoreline is not available for seabird foraging or nesting. The open water within the project area provides foraging for some seabirds, including five territory birds of concern (brown pelican, magnificent frigatebird, laughing gull, gull-billed tern, and coastal least tern).

ARCHEOLOGICAL RESOURCES

The town of Christiansted was established in the second quarter of the 18th century by the Danish West India and Guinea Company on the site of the earlier French settlement of Basin. As the main port of St. Croix, Christiansted developed rapidly to contain an assemblage of 18th and 19th century Danish colonial administrative buildings and military fortifications. In the second half of the 18th century, Christiansted became extremely prosperous on the sugar economy of the Islands. Slave laborers from Africa were transported to the Caribbean and sold at auction to work the plantations; Christiansted became a hub in the Transatlantic Slave Trade. In the first decades of the 19th century, the prosperity of the sugar industry started to decline, and the slaves were emancipated in 1848. Thus, Christiansted NHS, which was established in 1952 as the Virgin Islands National Historic Site and re-designated as Christiansted NHS in 1960, is layered with the history of numerous stories (NPS 2015b, Gjessing 1976). The existing bulkhead was installed to stabilize the historic waterfront and protect the park's historic structures; however, at approximately 35 years old, the bulkhead itself is not a historic structure.

The project would include ground disturbance both on land and in the water. To determine the presence of archeological resources in these areas, the NPS conducted a Phase 1A archeological survey in October 2018 (Panamerican 2018). The main purpose of the Phase IA study was to identify those locations within the study area that have the potential to contain old, buried, stable land surfaces, and/or locations with historic and/or prehistoric archeological potential. The study was a non-invasive investigation.

Terrestrial Archeology. The study area for terrestrial archeology consisted of two locations, which coincide with the project area as described in the "Purpose of and Need for Action" chapter—a 1.55-acre area to the west of Fort Christiansvaern adjacent to the wharf and a 0.25-acre area on the east side of Fort Christiansvaern also adjacent to the wharf and the historic Fish Market area. The study area was identified as having a medium to high potential for buried resources. The early original ground surfaces for the historic periods should still be extant. The fill in these areas may represent midden material (refuse, rubbish) or even building material. Further, these fill areas became the period land surfaces and may also contain historic features as well as midden zones.

Underwater Archeology. The study area for the open-water archeology extended 200-feet out (seaward) perpendicular to the face of existing bulkhead, as described for the project area in the "Purpose of and Need for Action" chapter. Two isolated artifacts that contribute to the historic maritime landscape of Christiansted NHS are present. A small 18th to mid-19th century cannon is resting angled up with the muzzle against the bulkhead and an 18th century wood stock anchor is located in the central portion of the open water.

VISITOR USE AND EXPERIENCE

The study area for visitor use and experience encompasses the waterfront along the wharf, walkways, and the surrounding grounds containing the historic structures of Fort Christiansvaern. Visitors enjoy walking the grounds, picnicking, participating in self-guided or ranger-guided tours of the historic buildings, and appreciating the maritime coastal scenery. In 2018, there were approximately 107,500 visitors to Christiansted NHS (NPS 2019b). Table 5 presents the monthly visitation to Christiansted NHS over the past 5 years. Visitation is highest in February and March and lowest in August and September. It should

be noted that there was no recorded visitation in September and October of 2017 due to the occurrences of and recovery efforts for Hurricanes Irma and Maria.

Table 5. Recent Monthly Visitation to Christiansted National Historic Site (Number of Visitors)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2018	8,552	8,587	11,292	8,964	9,004	8,714	9,364	7,946	7,668	8,102	9,735	9,566	**107,494**
2017	11,267	10,093	13,428	9,145	10,552	9,151	9,755	8,229	0	0	7,379	7,780	**96,779**
2016	10,778	12,115	11,443	10,252	9,136	8,620	9,498	8,576	7,882	8,141	9,524	9,481	**115,446**
2015	11,440	11,503	12,479	10,187	9,370	8,588	10,396	8,108	8,350	8,363	8,838	9,195	**116,817**
2014	9,815	10,154	10,539	8,928	8,532	8,753	9,604	8,180	7,776	8,052	8,908	9,918	**109,159**
Average	**10,370**	**10,490**	**11,836**	**9,495**	**9,319**	**8,765**	**9,723**	**8,208**	**6,335**	**6,532**	**8,877**	**9,188**	**109,139**

Source: NPS 2019b

The park consists of 7 acres centered on the Christiansted waterfront/wharf area. The grounds contain six historic structures: Fort Christiansvaern (1738), the Danish West India & Guinea Company Warehouse (1749), the Steeple Building (1753), Danish Custom House (1844), the Scale House (1856), and the Bandstand (1917). Visitors use these resources to understand the diversity of the human experience at Christiansted during Danish sovereignty – colonial administration, the military and naval establishment, international trade (including the slave trade), religious diversity, architecture, trades, and crime and punishment (NPS 2018).

The primary purpose of the wharf bulkhead is to stabilize the historic waterfront and protect the park's historic structures. The existing wharf bulkhead was installed 35 years ago, with an anticipated life cycle of 25 years. The wharf bulkhead in its current condition does not meet federal consistency regulations and is not compliant with codes of the US Coast Guard, the USACE, or the Virgin Islands Port Authority. In response to the poor condition of the bulkhead, the NPS has closed the wharf to all marine traffic, including NPS, commercial, and marine recreation vessels, as well as terrestrial vehicle traffic. The walkway remains open for pedestrian traffic, as it is in sound condition.

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

GENERAL METHODOLOGY

This chapter describes the potential environmental impacts associated with the no-action alternative and the proposed action. The intent is to provide an analytical basis for comparing the alternatives and the impacts that would result from implementing these alternatives. First, the methodology for conducting the analysis is explained, then the results of the evaluation of the environmental consequences on marine resources, special-status species, archeological resources, and visitor use and experience are presented. Applicable BMPs and mitigation measures are presented in appendix A.

PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS

Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions, regardless of what agency (federal or nonfederal) or person undertakes such other actions" (40 CFR 1508.7). Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

To determine potential cumulative impacts, past, present, and foreseeable future actions and land uses were identified in or near the project area. Cumulative impacts are considered for the no-action alternative and the proposed action, by combining the impacts of the alternative being considered with other past, present, and reasonably foreseeable future actions and are presented at the end of each impact topic discussion. Table 6 shows the projects considered in the cumulative impact analysis for each resource.

Table 6. Cumulative Project List

Project	Project Description	Status
Scale House Repair and Rehabilitation	The historic Scale House building sits northwest of the bulkhead on King Street/Hospital Street and is the closest building to the walkway and bulkhead and work areas. Exterior work on the Scale House, including roof and siding replacement, is complete.	Past
Stucco Restoration Work	The historic Danish Custom House stucco restoration work is proposed for fiscal year 2020 or 2021 and would include funding for restoring the entire exterior of the building.	Future
Road Maintenance Projects	Roadway work to re-strip the roadways adjacent to the park, including King Street, Hospital Street, and Company Street was completed in 2019 but may need to be redone in the future.	Past and Future
Rehabilitation of Public Restrooms	This project included the rehabilitation of the public restrooms along Hospital Street across from the wharf work area from previous storm damage. This work is complete.	Past
Hurricane Repair Work	Repair work due to hurricane damage is proposed for all six of the park's historic buildings. Work would also include landscape repairs. The date of this project is during 2018 and 2019.	Ongoing
Quarterly Fire Ant Treatment	Christiansted NHS conducts quarterly fire ant treatment on the grounds of the park, as necessary. This project could occur during the proposed bulkhead replacement project, but it is expected that the ant contractor would work around the bulkhead construction areas and would only need general site access to the park.	Ongoing

Note: There has not been any structural work on the bulkhead since it was refurbished in 1985.

MARINE RESOURCES

The analysis for marine resources focuses on the potential impacts of the project to marine resources including coral, benthic habitat, and EFH. In this section, the NPS considers the potential changes to the habitat, species composition, and stress of the ecological community surrounding the wharf bulkhead and the potential to damage, destroy, or alter marine resources. The geographic area of analysis for marine resources is the approximately 140,000 square foot barge work area (3.2 acres) (figure 2). Marine resources within the project area were evaluated through database searches, a seagrass and coral survey, marine bottomland resource evaluation, and a technical visual snorkel survey.

No-Action Alternative

Under the no-action alternative, the NPS would not replace the existing wharf bulkhead. Although general maintenance, such as wharf repair and concrete walkway repair, would continue within the project area, structural work would not occur under the no-action alternative. Some segments of the bulkhead are beyond repair and some segments are in critical condition due to complete section losses of the existing steel sheet piles. Segments of the bulkhead would become damaged beyond repair under the no-action alternative and would eventually fail. The deteriorated sheet piles would eventually break up and could become a wave wash debris issue, potentially damaging the coral that has colonized the bulkhead and resulting in an indirect adverse impact.

The no-action alternative would not have direct adverse impacts on EFH because no construction activities would occur. Under the no-action alternative, no activities would occur that would disturb sediments or the water column that constitutes EFH, impact the foraging species, or reduce the quality or quantity of the marine bottom substrates for any of the life stages of the species listed in table 3. However, deteriorating sheet piles could eventually break up, become debris, and indirectly impact coral. Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, there would be negligible adverse effects on habitats designated as EFH under the no-action alternative.

Cumulative Impacts

The other past, present, and reasonably foreseeable future actions that could have an impact on resources affected by the Christiansted NHS wharf bulkhead replacement project (presented in table 6) could result in indirect temporary impacts on marine resources or EFH in the project area. The no-action alternative could result in indirect adverse impacts on corals from deterioration of the steel sheet piles. Although there would be no meaningful additive or interactive impact from these projects, the no-action alternative would constitute a negligible adverse increment to the indirect adverse cumulative impacts on coral, benthic habitat, and EFH.

Conclusion

Although the no-action would not directly alter coral, benthic habitat, or EFH, in the long-term, the no-action alternative would result in indirect adverse impacts to corals as portions of the sheet pile wall deteriorate, become debris, and damage corals through wave action. When combined with the effects of past, present, and foreseeable projects, the overall cumulative effects to marine resources (coral, benthic habitat, and EFH) would be adverse, as corals and therefore a portion of EFH, could be damaged and lost.

Proposed Action/Preferred Alternative

The proposed action has the potential to affect marine resources, including coral, benthic habitat, and EFH, through physical effects, marine vessel strikes, noise, loss of habitat, and turbidity. Impacts are evaluated largely on the likelihood that the species would be physically present during construction, and therefore, potentially impacted due to noise or marine vessel strikes from construction actions. Impacts could also occur from disruption of the food web due to impacted benthic communities, loss of foraging habitat, altered habitat conditions, change in habitat quantity, and/or altered access to foraging areas. While the project would likely result in temporary, localized increases in turbidity in the vicinity of the project area, mitigation measures would be incorporated to minimize water quality impacts and associated impacts to marine and fish resources, to the extent practicable.

Coral Relocation

The proposed action would remove and relocate coral colonies that are 5 cm or larger existing on the bulkhead, as well as those located on the marine bottomlands within 15 feet of the bulkhead. Prior to construction, live corals that do not appear diseased at the time of the work would be salvaged to the extent practicable and relocated to a designated coral relocation site. To reduce potential impacts on the corals, timing restrictions would limit relocation efforts during peak spawning and coral bleaching periods (July 1 through October 31), as established through consultation with NOAA NMFS and the VIDPNR.

Corals that are not removed could be indirectly impacted by sedimentation stirred up during construction activities. Corals are sensitive to changes in water quality, including increases in turbidity which can cause sedimentation and reduced light infiltration. Sedimentation impacts from turbidity plumes may bury, abrade, or shade corals, all of which can result in decreased recruitment and survivorship of corals (USCRTF 2016). These impacts would be temporary, lasting only during the construction period (approximately 12 months), and would be reduced by the use of turbidity curtains. A dive team would be present during all in-water construction with a marine observer in the water and another observer on land, monitoring conditions for the safety of the diver. Physical injury to corals would be avoided as the marine observer would ensure that corals are avoided prior to and during barge spud placement and protected from tugboat propeller wash.

Coral removal and relocation from the existing bulkhead and from the marine bottomlands adjacent to the bulkhead (15 feet seaward) would not result in the destruction or adverse modification within coral reef and marine hardbottom habitat. Through consultation, NOAA NMFS concurred with the NPS determination that the proposed coral relocation activities fall within the scope of *Programmatic Biological Opinion on Threatened Caribbean Coral Research, Restoration and Relocation* (PBO), initiated on October 18, 2016; any activities that fall within the scope of the PBO would not cause jeopardy to lobed star coral species complex, elkhorn coral, and staghorn coral. As the project area lacks the essential features for critical habitat for elkhorn and staghorn corals (Dial Cordy 2019b), the proposed action would not result in adverse impacts to critical habitat for staghorn and elkhorn corals. Relocating corals would reduce the potential for injury or mortality to corals, and over time additional coral habitat may form within the immediate vicinity of the new bulkhead. The coral relocation effort could result in formation of additional coral habitat at the relocation site by restoring damaged or sparse sections of an existing reef. Overall, the proposed action would have a long-term beneficial effect on coral species.

Bulkhead Replacement

Benthic Habitat. Construction of the project has the potential to affect benthic communities due to a temporary loss of a small area of benthic habitat from installation of the new wharf bulkhead, temporary changes in suspended sediment from construction activities, and effects from construction noise.

Direct adverse impacts would result from installation of the new bulkhead, which would smother seagrasses and sessile or slow-moving invertebrates in the footprint, resulting in direct loss of these resources. These direct permanent impacts would be limited to the bulkhead segments under construction. Construction of the new bulkhead structure would extend 24 to 32 inches into Christiansted Harbor, resulting in a permanent loss of approximately 1,560 square feet (0.03 acre) of marine bottomland habitat and the mortality of sessile organisms within this area. Most of the marine bottomland impacts (approximately 0.02 acre) would be to silty, sandy sediments, small to large unconsolidated bottom, and rubble in the western and central portions of the project area. The bulkhead replacement in the eastern portion would result in a loss of approximately 530 square feet (0.01 acre) of benthic habitat, including approximately 280 square feet (<0.01 acre) of turtle grass with attached and/or drift algae that has colonized sand and rubble bottom along the existing bulkhead. This represents approximately 3% of the 9,321 square foot (0.2 acre) area of turtle grass present in the barge work area.

Based on the results of the 2018 marine bottomlands survey and the 2019 technical visual snorkel survey, it was determined that no in-water work from a barge should be completed in the eastern portion of the project area due to the shallow water and the presence of a seagrass bed containing mostly turtle grass; approximately 21,500 square feet (0.5 acre) of benthic habitat would not be subject to impacts from placement of barge spuds and from propeller wash. This seagrass bed would also be delineated using surface buoys to ensure that the area is not disturbed by construction activities in adjacent areas. Additional resource protection measures are presented in appendix A.

Although the barge and push boat would not be used in the eastern portion of the project area, a temporary work area would be required approximately 3 feet seaward beyond the footprint of the new concrete bulkhead. This temporary work area would accommodate as movement of workers in the water and placement of forms and supports for pouring the concrete for the new bulkhead. Eliminating the use of a barge and push boat would reduce overall benthic habitat impacts along the cement portion of the bulkhead. Approximately 600 square feet (0.01 acre) could be indirectly impacted in the temporary work area, including an additional 310 square feet (<0.01 acre) of turtle grass.

Although the proposed action would result in a permanent loss of approximately 0.03 acre of benthic habitat within the project area, the loss would be small compared to the marine bottomlands available in the project area (3.2 acres) and in Christiansted Harbor (390 acres). Some individual benthic species would also be lost, but the impacts on the benthic community would be temporary, as mobile species would recolonize new subsurface areas within 3 to 6 months of the completion of construction.

Benthic communities would also be impacted through the temporary resuspension of sediment from in-water construction activities, and in areas of in-water construction, the placement and removal of barge spuds, and propeller wash. Installation of the new sheet pile bulkhead and concrete gravity wall would result in temporary impacts to marine bottomlands during the construction period. The area in which the work barge and push boat would operate could extend up to 200 feet from the face of the wharf, though the vast majority of the time the barge would be positioned within 100 feet of the wharf to perform the work and would likely only extend significant distances from the wharf temporarily during repositioning or maneuvering. Further, there would be no in-water work from a barge and push boat in the eastern portion of the project area (approximately one third of the project area), reducing the area where turbidity increases from placement of barge spuds and propeller wash could occur. Construction activities would create a small sediment plume, which is expected to settle out of the water column within a few hours after construction activities cease. Studies of the effects of turbid water on fish suggest that total suspended solids (TSS) concentrations can reach thousands of milligrams per liter before an acute toxic reaction is expected (Burton 1993, as cited in NMFS 2017). The TSS levels expected for pile driving (5.0 to 120.0 mg/L above background levels) are below those shown to have adverse effects on benthic communities (390 mg/L [USEPA 1986, as cited in NMFS 2017]). However, indirect impacts would result

from increased turbidity due to the release of fine sediments into the water column and could change the quality of available substrate, interfere with feeding for suspension feeders, and reduce visibility for visual foraging predators.

To reduce these effects, turbidity curtains would be used to allow suspended sediment to settle out of the water column, minimizing the area that would be affected by increased suspended sediment. Water quality monitoring would also be performed to ensure that turbidity does not exceed levels determined to be harmful to aquatic communities. Additionally, areas of high densities of native seagrasses would be delineated, propeller wash would be minimized to the extent possible, and monitoring of barge spud pile placement by on-site scientific divers would be performed. The adverse impacts would be temporary, localized to the area of work, and limited to the duration of construction activities. Recolonization of disturbed areas from adjacent undisturbed areas would facilitate recovery of the benthic communities and would be expected to occur within 3 to 6 months after construction. Therefore, with implementation of the BMPs, the indirect impacts on benthic communities from sedimentation would be negligible.

Construction activities would also result in temporary direct impacts on benthic invertebrates (e.g., shrimp, crabs, urchins) from construction equipment noise. The impacts of anthropogenic sound, such as construction noise, on marine life can range from changes in behavior to mortality. The response of an organism to increased noise can vary depending on variables such as the source of the noise and the distance of the animal from the source. Little data are available on how invertebrates use sound in their environment and if anthropogenic noise affects invertebrate behavior. One available study on the effects of seismic exploration of shrimp showed that the shrimp exhibited no changes in behavior from seismic exploration (Hawkins and Popper 2012). Similarly, no relevant data exists on the physiological effects of high sounds levels on invertebrates (Hawkins and Popper 2012). Laboratory experiments exposing shrimp to continuous high sound levels showed delayed growth and decreased reproduction (Lagardere 1982). At present, there is a lack of data on the response of invertebrates to sound exposure, and it is not possible to specify levels of sound exposure that are safe for invertebrates (BOEM 2012). Underwater construction noise levels would be reduced by using a vibratory hammer for sheet pile installation, as opposed to an impact hammer, and requiring the use of a soft start for the vibratory hammer. Also, the use of a turbidity curtain would reduce noise impacts to organisms outside of the curtain. Underwater acoustic monitoring would be used to ensure noise levels do not exceed levels determined through agency consultation. Given the limited data on the effects of noise on invertebrates, the impacts on benthic invertebrate communities cannot be accurately projected; however, it is reasonable to expect that construction noise could result in mortality or reduced fitness of benthic invertebrates within the work area. However, the project area represents a small portion (approximately 0.8%) of the habitat available in the Christiansted Harbor. The impacts on benthic invertebrates from noise are expected to be short-term, lasting only as long as necessary to install the steel sheet piles (approximately 12 to 14 weeks; see appendix C). Following construction, benthic communities would be expected to recolonize the project area within 3 to 6 months.

Once construction is complete, the extended decking on the western side of the project area would shade a portion of the benthic habitat that currently receives direct sunlight. This could result in an impact due to the change in temperature and light penetration; however, this area provides poor conditions for marine life. Impacts from this shading would be negligible.

Essential Fish Habitat. Consideration of the proposed action for EFH requires evaluating the effects on species with designated EFH that could occur within the project area. Potential impacts to marine bottomland habitat, noise impacts, marine vessel strikes, and water quality impacts could affect species with designated EFH as a result of this project. To facilitate impact assessment, the species listed in table 3 are grouped into two habitat associations: coastal demersal and reef associated. The impacts to species in these habitat associations would be similar, but where differences exist, they are explained. The impacts discussed in the following paragraphs are summarized in appendix D.

The shallow habitat within the project area can provide EFH resources for several coastal demersal species. The managed species that are classified as coastal demersal species, or those that spend most of their life cycle on or just above the marine bottomland, that could use the habitats within the project area include juvenile and adult queen conchs and spiny lobsters, as well as a variety of sharks. Juvenile and adult queen conch typically inhabit back reef areas and sand flats and seagrass beds, respectively, that are associated with coral reefs, and spiny lobsters are associated with seagrass beds and rocky areas along the nearshore waters. These species could occasionally use the habitats in the project area. Sharks are highly migratory species that migrate through Caribbean waters to forage, feed and reproduce. The shark species discussed in this assessment could use the habitat within the project area as neonates, juveniles, and/or adults: blacktip shark, Caribbean reef shark, nurse shark, and tiger shark (neonates, juveniles, and adults); dusky shark (neonates and juveniles); lemon shark (neonates and adults); and sand tiger shark (adults). These shark species are viviparous, giving birth to live young. Although these shark species are demersal, most are associated with reef habitat. Sharks could use the habitat in the project area, but occurrence would likely be transient, and these species would not be expected to use the habitat directly adjacent to the bulkhead.

Although the project area does not contain natural reef habitat, some reef-associated fishes could use the available habitat, especially the turtle grass bed, the area in front of the concrete portion of the bulkhead, and the rocky habitat at the base of this wall in the eastern portion of the project area. Reef-associated fish species for which the project area may provide EFH include schoolmaster snapper and yellowtail snapper (juveniles); grey snapper, mutton snapper, Nassau grouper, red hind, and white grunt (juveniles and adults); and buffalo trunkfish, queen triggerfish, sand tilefish, scrawled cowfish, and squirrelfish (adults). One species, redtail parrotfish, could use the habitat in the project area for all life stages. A majority of these fish predominantly live on or within the coral reefs that surround Christiansted Harbor, but may occasionally use the project area. Additional data on all managed species evaluated, including preferred habitat, depth range, and diet, can be found in appendix B.

Eggs and larvae of most reef fish species and larvae of queen conch and spiny lobster are pelagic. They are deposited through or hatch into the open water column and depend on ocean currents for movement. Spawning information is not available for some species; however, reef-associated fish generally migrate to spawn in aggregations in open water. For example, white grunt and schoolmaster snapper spawn offshore (UWI 2017b; FMNH 2017d) and Nassau grouper and red hind spawn offshore on the outer edges of reefs (FMNH 2017c; Nemeth et al. 2007). For species that spawn in offshore areas, there is an opportunity, though small, for pelagic eggs and larvae to become disbursed in the muddy and sandy substrate within the project area. The redtail parrotfish is different in that this species migrates from reef habitat to mangroves and seagrass to spawn (UWI 2016); therefore, the seagrasses in the project area could provide habitat for eggs and larvae. Spiny lobsters migrate to deeper waters to spawn; however, females carry the eggs under their tails until the eggs hatch as pelagic larvae (SeaLifeBase n.d.). Because adult spiny lobsters could occasionally be found in seagrass beds and rocky areas along the nearshore waters, the project area may also provide habitat for spiny lobster larvae. For those eggs and larvae that settle out of the water column in the project area, bulkhead installation activities could result in direct loss of these non-motile life stages in the construction footprint adjacent to the existing bulkhead and in areas where the barge spuds are placed. Construction activities that temporarily increase turbidity and/or affect water quality within the water column would result in indirect short-term negative effects, and localized eggs and larvae in the area may be lost as a result. Direct and indirect impacts within the project area on eggs and larvae of demersal and reef-associated species would be adverse but negligible. While eggs and larvae within the project area could be impacted, the project area represents a very small fraction of similar habitat available to these species in the waters in Christiansted Harbor and around St. Croix. Further, fish that spawn in seagrass beds would likely use higher quality habitat, such as Long Reef located 0.5 mile from the project area (figure 6), as opposed to the marginal habitat available in the project area.

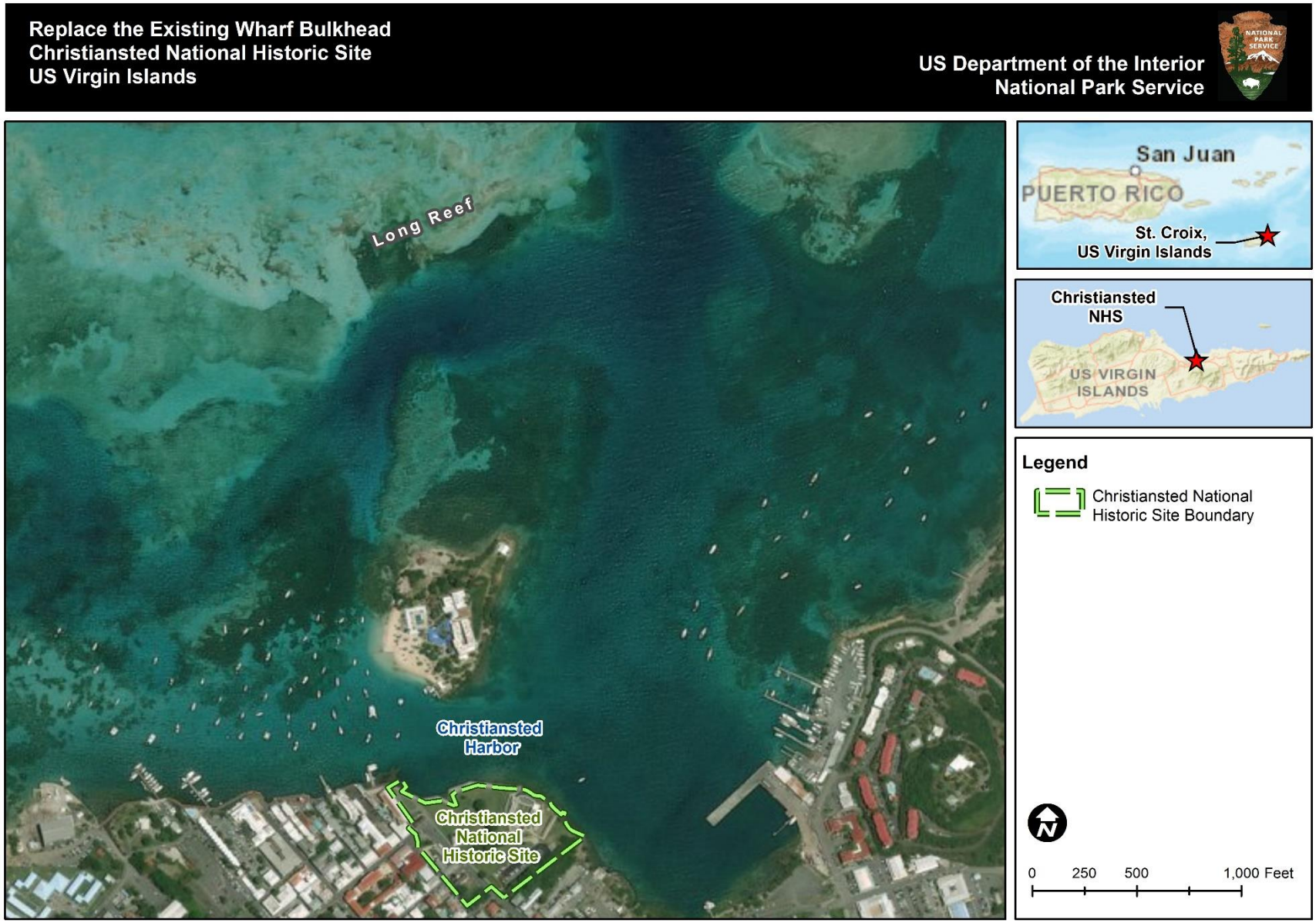

Figure 6. Location of Long Reef

Installation of the new bulkhead would reduce the marine bottomland habitat within the project area by approximately 1,560 square feet (0.03 acre), including approximately 280 square feet (<0.01 acre) of turtle grass that has colonized sand and rubble bottom in the eastern portion. The loss of seagrass would reduce refuge and foraging habitat for neonate sharks, juvenile demersal species queen conch, spiny lobster, and sharks, as well as reef-associated juvenile snappers (grey, mutton, schoolmaster, and yellow), Nassau grouper, and white grunt, as well as adult buffalo trunkfish, queen triggerfish, and scrawled cowfish, and all life stages of redtail parrotfish. Species that could use shallow-water benthic habitat along sand and rubble bottoms near coral reefs and seagrass beds for foraging include both demersal species (adult spiny lobster and queen conch) and reef-associated species (adult grey snapper, mutton snapper, Nassau grouper, sand tilefish, and white grunt and juvenile and adult red hind). The 2018 marine bottomlands survey and the 2019 technical visual snorkel survey both indicate that the eastern portion of the project area contains EFH for marine invertebrates and fishes and that the habitat is currently used as such. However, the amount of habitat that would be lost to the bulkhead replacement (approximately 530 square feet or 0.01 acre in the eastern portion of the project area) would be very small in comparison to the amount of habitat that exists within Christiansted Harbor (approximately 390 acres), and areas outside of the developed harbor would likely provide higher quality habitat, including Long Reef (figure 6) that is approximately 0.5-mile north of the project area and offers approximately 2 miles of alternative refugia and reef habitat. Within Christiansted Harbor, suitable alternate habitat exists for displaced mobile marine life to seek refuge during construction impacts. Further, the habitat along the bulkhead is manmade. The proposed action would be replacing this manmade habitat in kind, minimizing impacts to the associated natural habitats; the new habitat created by the proposed action would be recolonized fairly quickly. For these reasons, the adverse impact from this reduction of forage and refuge habitat would be negligible.

The installation of the new bulkhead, the placement and removal of barge spuds, as well as propeller wash, would disturb bottom sediments and may cause temporary increases in suspended sediment in the vicinity of the immediate work area. A small resulting sediment plume is expected to settle out of the water column within a few hours. Increases in turbidity would result in short-term effects on visibility, which in turn could adversely affect species that hunt by sight. The TSS levels expected for pile driving (5.0 to 120.0 mg/L above background levels) are below those shown to have adverse effects on fish (580 mg/L for the most sensitive species, with 1,000 mg/L more typical; Burton 1993 as cited in NMFS 2017). The anticipated increase in TSS levels expected for sheet pile driving is not expected to be detectable to larger fish species and therefore would not present a barrier to normal movements or migration. To the extent possible, turbidity would be contained during construction within turbidity curtains adjacent to the bulkhead. Further, in-water construction using a barge and push boat would be prohibited in the eastern portion of the project area along sand and rubble seagrass bottom habitat, greatly reducing the turbidity impacts in this area. Some turbidity increases would occur from the movement of workers and placement of forms and support structures in the eastern portion of the project area, but the temporary work area would be limited to approximately 3 feet seaward from the footprint of the new bulkhead. Surface buoys would be used to demarcate the area where construction and barge activities would be restricted. Therefore, a reduction in the quality or quantity of benthic species, which could be prey species for coastal demersal and reef-associated species, currently available in this area is unlikely. Disturbance of benthic sediments in the remainder of the construction footprint may temporarily decrease the occurrence of prey species. The area that is temporarily impacted is expected to recover quickly as benthic communities re-establish. Recolonization of the substrate by benthos is expected to be facilitated by the presence of adjacent undisturbed harbor sediments, and thus, should occur within several months following project activities. Due to the abundant distribution of prey species in adjacent habitats, the ability of demersal and reef-associated species to move to undisturbed areas, and the expected recolonization of the disturbed area by benthic communities, the indirect impacts to coastal demersal and reef-associated species from changes in water and sediment quality would be short-term and adverse but negligible.

All marine species that occur within the project area could be impacted through marine vessel strikes. The NPS estimates that work vessels could make 1 or 2 trips per day within the work area, for the duration of the 12-month construction period. It is also estimated that these trips would occur daily over a 7-day work week. The presence of these marine vessels temporarily increases the risk of injury or death from strikes, but coastal demersal and reef-associated species are not likely to be affected by marine vessel strikes. In-water work with a barge and push boat would be prohibited in the eastern portion (approximately a third) of the project area, where queen conch and spiny lobster would be expected to occur; this area would be marked with surface buoys to indicate the area where construction and barge activities would be restricted. In areas where in-water work would occur, a marine observer would be present during construction activities to spot placement of barge spuds to ensure that no benthic organisms, such as spiny lobster and queen conch, are impacted. Sharks and reef-associated fish species are highly mobile fish that would likely vacate the area of construction in the presence of construction noise and marine vessels. Further, turbidity curtains would prevent sharks and fish from entering the work area during construction. No impacts are expected to occur to coastal demersal or reef-associated species as a result of marine vessel strikes.

Construction activities could have an impact on demersal and reef-associated species through injury or disturbance from noise. Additionally, some fish, such as the reef-associated Nassau grouper and white grunt, use sounds for courtship or other communication, and anthropomorphic noise from construction could interfere with communication. Appendix C presents details on the installation of sheet piles and a discussion on the potential for construction noise to injure or disturb fish. The threshold for fish injury is estimated to extend 54 meters (177 feet) from the noise source (steel sheet pile), and the threshold for fish disturbance would extend approximately 80 meters (262 feet) from the source. The modeled sound pressure levels for installing steel sheet piles for this project should be considered conservative. Although fish could be exposed to noise levels at or above the projected injury and disturbance thresholds for fish throughout most of the project area, this distance is overestimated, as described in detail in appendix C. Measures, such as the use of a soft start on a vibratory hammer, would be taken to reduce the noise generated by construction equipment, giving mobile species an opportunity to vacate the construction area prior to the sound levels reaching their peak. The use of turbidity curtains could further reduce noise and keep fish from entering the construction area. Underwater acoustic monitoring would also be used to ensure noise levels do not exceed levels determined through agency consultation.

It is expected that mobile species (neonate, juvenile, and adult demersal shark species and juvenile and reef-associated fish) near the area of influence would move away from the noise source, as there is ample fish habitat available in Christiansted Harbor, including Long Reef, a coral reef located approximately 0.5 mile north of the project area. This possible modification of normal movement patterns of some individuals is expected to be short-term and negligible because underwater noise would be limited in duration, affect only a small area within the harbor, and would not pose a barrier to migration or the availability of other more suitable habitat. Thus, interference with feeding, reproduction, migration, or other activities necessary for survival is not expected. For less mobile demersal species (queen conch and spiny lobster), sound levels produced during construction activities could result in a loss of individuals. However, as the project area represents a small amount (3.2 acres) of habitat available within Christiansted Harbor (390 acres), these species are not expected to be present in significant numbers in the project area, and the impacts would be temporary, lasting only for the duration of construction, allowing the project area to be recolonized following the installation of the sheet piles. Impacts on less mobile species would be localized and are expected to be negligible.

Although the project area contains habitat that meets EFH conditions, the area is small and lower quality compared to that which is available in other areas of Christiansted Harbor and along the entire St. Croix shoreline. A majority of the species analyzed predominantly live on or within the coral reefs that surround Christiansted Harbor. EFH conditions are present in the project area for coral, marine invertebrate, and

fishes; however, these species are not expected to occur in the project area in significant numbers. In total, impacts from loss of habitat, temporary increases in turbidity, construction noise, and marine vessel strikes from the installation of the new bulkhead could occur, but the impacts would be minimized to the extent possible through project design and BMPs.

Because the adverse effects to EFH would be small, localized to the area of construction, and temporary to the timeframe of construction activities, pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulation, it is anticipated that the proposed action would have no more than a minimal impact on habitats designated as EFH. Appendix D presents the potential impacts to reef-associated and costal demersal species with designated EFH.

Nassau grouper, a reef-associated managed species that is also federally listed as threatened under Section 7 of the ESA, could potentially be affected by construction activities under the proposed action. With implementation of mitigation measures, including limitations on in-water work, water quality monitoring, the use of a marine observer, and the use of a soft start to the vibratory hammer, the proposed action would have minimal impacts to the EFH, and the proposed action *may affect but is not likely to adversely* affect Nassau grouper. Impacts to Nassau grouper are discussed in detail in the "Special-status Species" section.

Cumulative Impacts

The proposed action would result in a permanent loss of approximately 1,560 square feet or 0.03 acre of marine bottomland habitat from the installation of the new bulkhead—approximately 0.01 acre in the eastern portion of the project area and a total of 0.02 acre in the western and central portions. Temporary impacts would be associated with construction and include potential marine vessel strikes, noise, and resuspension of sediment. Temporary impacts would occur in the western and central portions where the barge and push boat would operate (up to 200 feet from the face of the wharf) and the temporary work area in the eastern portion where barge and push boat work would be restricted (3 feet seaward from the footprint of the new bulkhead). The area affected is very small compared to the remaining large nearshore areas that support coral, benthic habitat, and species with designated EFH. Mobile species would move away from the noise generated by construction vessels, vehicles, and equipment, and BMPs would be employed to ensure that noise from in-water construction does not interfere with species life cycle phases. Therefore, it is unlikely that marine resources (coral, benthic species, and all life stages of species with designated EFH) would be exposed to the noise for the amount of time required to cause direct injury from sound pressure.

The other past, present, and reasonably foreseeable future actions that could have an impact on resources affected by the Christiansted NHS wharf bulkhead replacement project (presented in table 6) could result in indirect temporary impacts on marine resources or EFH in the project area. When combined with the proposed action, if conducted concurrently, cumulative impacts to marine resources would be small and adverse. Benthic habitat within the project area would return to pre-disturbance conditions following completion of the project. The project would restore coral reef habitat in the relocation site, benefiting marine resources and hardbottom EFH, resulting in long-term beneficial impacts for marine resources. Although there would be no meaningful additive or interactive impact from these projects, the proposed action would constitute a small beneficial cumulative impact on coral reef and marine resources in Christiansted Harbor.

Conclusion

Removal and relocation of corals prior to construction would eliminate adverse effects on corals attached to and immediately adjacent to the bulkhead. Coral relocation activities would have long-term beneficial

impacts for marine resources. Coral relocation could be performed to restore a previously damaged coral reef area or augment a coral reef area with less coral cover. The final relocation area would be determined through local and federal agency consultation.

The replacement of the bulkhead would result in small adverse, short-term impacts to marine resources where project activities would displace small areas of benthic habitat and temporarily disturb bottom sediments. Although this would represent a small reduction in seagrass beds with marginal foraging and nursery area, it is likely that most fish and marine invertebrates would avoid the project area during construction. No adverse impacts to adult or juvenile fish species would be expected. Impacts to egg and larval stages of fish species would have the potential for negligible adverse impacts. Overall, impacts to EFH would be minimal, as construction related impacts would be temporary, limited to the time of construction, and localized to a relatively small area. Over time additional coral and benthic habitat may form within the immediate vicinity of the bulkhead.

Because adverse effects to EFH would be negligible, localized to the area of construction, and temporary to the timeframe of construction activities pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, it is anticipated there would be minimal impact on habitats designated as EFH. When the impacts on marine resources under this alternative are combined with the other past, present and foreseeable future projects in Christiansted NHS, the proposed action would contribute a slightly beneficial increment to the overall cumulative impacts for marine resources in the harbor.

SPECIAL-STATUS SPECIES

This analysis focuses on the potential impacts of the project to special-status species including corals, fish, manatees, sea turtles, and seabirds. In this section, the NPS considers the potential changes to the habitat, species composition, and stress of the ecological community surrounding the wharf bulkhead and the potential to damage, destroy or alter marine resources. The geographic area of analysis for special-status species is the approximately 140,000 square-foot (3.2 acre) barge work area (figure 2). This area of analysis was used to assess potential impacts for species that may result within and adjacent to the wharf bulkhead. Potential for occurrences of special-status species within the project area was evaluated through database searches, a seagrass and coral survey, a marine bottomland resource evaluation, and a technical visual snorkel survey. The three species of federally listed corals— lobed star coral, boulder star coral, and mountainous star coral—were documented within the project area during the 2018 coral survey. These species are closely related and therefore discussed together in this analysis as the lobed star coral complex. Two additional species were evaluated due to potential habitat within the project area, elkhorn coral and staghorn coral. Nassau grouper and striped croaker are two fish species that could use the habitats of the project area for certain life stages (juvenile and adult). Though no mammals or sea turtles were observed during the resource surveys, these mobile species could use the waters of the project area. Within the project area, manatees and sea turtles may forage in the seagrass beds, but no sea turtle nesting habitat or manatee breeding or pupping habitat is present. Since potential manatee and sea turtle use of the project area would be for foraging within the turtle grass areas, the discussion of the impacts on these special-status species is combined. Finally, no surveys for birds were completed; however, several locally protected species could use the waters of the project area for foraging. These birds are also discussed collectively in this analysis, as their use of the project area would be similar.

No-Action Alternative

Under the no-action alternative, the NPS would not replace the existing wharf bulkhead. Although the degraded steel sheet piles would continue to deteriorate, potentially to the point of failure, the no-action

alternative would not have direct or indirect impacts on the lobed star coral species complex, Nassau grouper, striped croaker, manatees, sea turtles, or seabirds.

Cumulative Impacts

The other past, present, and reasonably foreseeable future actions that could have an impact on resources affected by the Christiansted NHS wharf bulkhead replacement project (presented in table 6) could have indirect temporary impact on aquatic resources but would not constitute an impact on special-status species. Because no impacts are expected to federally listed threatened and endangered species under this alternative, no cumulative impacts to such species would result from the implementation of the no-action alternative.

Conclusion

There would be no new impacts on special-status species under the no-action alternative. Although the existing wharf bulkhead would continue to deteriorate and could fail, this would not have impacts on the lobed star coral species complex, Nassau grouper, striped croaker manatees, sea turtles, or seabirds. These special-status species would remain unchanged, and the no-action alternative would not contribute to cumulative impacts on special-status species.

Proposed Action/Preferred Alternative

Potential impacts to special-status species could occur in Christiansted Harbor during construction activities in the barge work area. The proposed action would result in a permanent loss of approximately 1,560 square feet (0.03 acre) of marine bottomland habitat. In the eastern portion of the project area where the rubble, sand, and seagrass habitat constitute EFH, the proposed action would result in a loss of approximately 0.01 acre. An additional 0.01 acre of EFH would be indirectly impacted in the temporary work area (approximately 3 feet seaward of the footprint of the new bulkhead in the eastern portion of the project area) from movements of workers in the water and placement of forms and support structures for pouring the concrete. However, no in-water work with a barge and push boat would occur in this area. Approximately 0.02 acre of marine bottomland habitat in the western and central portion of the project area, which contain poor habitat conditions for marine life, would also be lost from installation of the new bulkhead. While the majority of the impacts would be to silty, sandy sediments, small to large unconsolidated bottom, and rubble, approximately 280 square feet (<0.01 acre) of a seagrass bed containing turtle grass, which has colonized sand and rubble bottom along the existing bulkhead, would be permanently lost by the bulkhead replacement.

Coral Relocation

Corals. The lobed star coral species complex is present in the project area, both attached to the existing bulkhead and located in the open water marine bottomlands; all 27 colonies of the lobed star coral species complex would be removed and relocated prior to construction. Though there could be potential mortality associated with removing and relocating special-status coral species, coral relocation would avoid direct mortality to the corals within the project area and would enhance the coral reef at the relocation site. To reduce impacts, corals would be removed and relocated outside of the peak spawning and coral bleaching periods (July 1 through October 1) and all corals that do not display outwards signs of disease would be relocated. NOAA NMFS has concurred with the NPS determination that the proposed activities fall within the scope of the PBO and would not cause jeopardy to any Endangered Species Act (ESA)-listed species under NOAA's jurisdiction. Following the installation of the new wharf bulkhead, new coral habitat could be established, resulting in a small beneficial impact for corals and potentially federally listed corals.

Pursuant to section 7 of the ESA, the NPS concludes that the proposed action *may affect but is not likely adversely affect* the lobed star coral species complex. The proposed action would have *no effect* on staghorn and elkhorn corals, as they are not present in the project area. Due to the thick sediment and/or macroalgae cover over rubble and cobble, the hardbottoms present in the project area do not provide the essential feature for critical habitat for elkhorn and staghorn coral. Therefore, the proposed action would have *no effect* on elkhorn and staghorn coral critical habitat.

Bulkhead Replacement

Fish. The proposed action could affect the federally threatened Nassau grouper and the striped croaker, a species of concern, within the project area through direct injury or mortality from marine vessel strikes and noise and indirect impacts such as loss of foraging habitat, increased turbidity, and disturbance from noise.

The Nassau grouper is a reef-associated species that uses a variety of habitats through its life stages. Juveniles are generally found in turtle grass beds and could use the seagrass habitat in the project area. Adult Nassau groupers are mostly found within reefs. Long Reef is the closest reef habitat to the project area, and it is approximately 0.5 mile north of Christiansted (figure 6). Although Nassau groupers are generally associated with reef habitats, juvenile and adult groupers could use the habitat available within the project area. Eggs and larvae are pelagic, depending on ocean currents for distribution. Some eggs and larvae could occur in sandy and muddy substrates of the project area and could be impacted directly from use of in-water equipment and installation of the new bulkhead, though these impacts would be adverse but negligible. Juvenile and adult croakers could use the muddy, sandy, and rocky habitats in the project area. Little data are recorded on the egg and larval stages for striped croaker, but eggs are pelagic, and similar to Nassau grouper, could suffer negligible impacts from construction activities and bulkhead installation.

The proposed action would result in a small but permanent reduction in marine bottomlands habitat and temporary impacts on the quality of the habitat during construction due to increased turbidity. The bulkhead replacement would result in a small amount of habitat loss within the project area (approximately 1,560 square feet [0.03 acre] of marine bottomland habitat). As discussed in the "Marine Resources" section, the TSS levels expected for pile driving activities are below those shown to have adverse effects on fish and benthic communities. The resuspension of sediment that would occur during construction would be minimized to the extent possible through the use of turbidity curtains and water quality monitoring, which would ensure that turbidity levels would not exceed levels that would be harmful to aquatic communities. Nassau grouper and striped croaker would be expected to move away from the seagrass beds and nearshore areas during construction and forage or seek refuge in other surrounding areas. Following construction, the sediment would settle, and benthic communities would recolonize the disturbed marine bottomlands within several months. There would be no loss of natural hardbottom or reef habitat from this project; therefore, the installation of the bulkhead would not adversely affect nor diminish the availability of foraging habitat for adult Nassau grouper. A small amount of muddy, sandy, and rocky habitat would be lost (approximately 0.01 acre of EFH); however, given the large amount of suitable habitat available in the Christiansted Harbor (approximately 390 acres), this would result in a small, localized impact on striped croaker.

Marine vessel traffic associated with the construction and bulkhead replacement work could temporarily increase the risk of potential marine vessel strikes with Nassau grouper or striped croaker. It is estimated that work vessels could make 1 to 2 trips per day within the work area, for the duration of the 12-month construction period. It is also estimated that these trips would occur daily over a 7-day work week. In-water work with a barge and push boat would be prohibited in the eastern portion of the project area. This area would be marked with surface buoys to indicate the area where construction and barge activities

would be restricted, thus protecting any Nassau groupers or striped croakers in this location. However, these species are highly mobile fish that would likely vacate the area of construction in the presence of marine vessel and construction noise. Further, turbidity curtains would fish from entering the work area during construction. No impacts are expected to occur to Nassau grouper or striped croaker as a result of marine vessel strikes.

Nassau groupers use sound for warding off predators and courtship. Nassau grouper spawning aggregation sites are located in offshore areas at depths of 65 to 130 feet on the outer shelf (FMNH 2017c), away from nearshore construction activities in the vicinity of the bulkhead project. Data are lacking for spawning behavior, life history, and behavior of the striped croaker; however, like the Nassau grouper, fish in the *Sciaenidae* family (drums, croakers) generally use sound for attracting mates during spawning (URI 2017). Noise from in-water construction could interfere with the use of sound. Due to the distance from the spawning areas for Nassau groupers and likely for striped croakers, noise generated during construction activities would have no effect on spawning behaviors of these fish. For juvenile and adult fish using the habitats in the project area, the use a soft start of the vibratory hammer used for sheet pile driving would reduce sound levels and allow these mobile fish to vacate the area before sound levels rise further and reduce the potential exposure risk. Potential injurious levels of underwater noise for marine life would only occur very near the source, within less than 80 meters (262 feet) from the bulkhead, affecting a relatively small area within Christiansted Harbor. The fish would be able to move to adjacent suitable habitats within the harbor. For these reasons, it is unlikely that noise from sheet pile installation would result in injury to Nassau groupers or striped croakers but may cause temporary, localized behavioral effects, as the fish would avoid the work area during active construction periods.

The proposed action would create small potential adverse effects to Nassau grouper and striped croaker habitats that would be localized to the area of construction and temporary to the timeframe of construction activities. Pursuant to Section 7 of the Endangered Species Act, the proposed action *may affect, but not likely adversely affect* the Nassau grouper or the striped croaker.

Marine Mammals and Sea Turtles. Potential impacts to manatee and sea turtle species could occur in Christiansted Harbor during construction activities in the work area. Installation of the proposed bulkhead would result in the permanent loss of approximately 1,560 square feet (0.03 acre) of marine bottomland habitat. The loss of approximately 280 square feet (<0.01 acre) of a seagrass bed containing turtle grass represents a reduction in a marginal foraging area for sea turtle and manatees. However, the area is very small compared to available marine bottomland habitat available in the remainder of the Christiansted Harbor, approximately a loss 0.01 acre of the 390 acres available.

Manatees and sea turtles could be indirectly affected by underwater noise during construction activities. Measures would be taken to reduce the noise generated during construction, such as a soft start of the vibratory hammer used for sheet pile driving and nylon cushion blocks would be utilized during the impact hammering of piles. Potential injurious levels of underwater noise for marine life would only occur very near the source, within less than 80 meters (262 feet) from the bulkhead, affecting a relatively small area within Christiansted Harbor. Use of a soft start would give manatees and sea turtles an opportunity to vacate the area before sound levels rise further and reduce the potential exposure risk. This possible modification of normal movement patterns of some individuals is expected to be adverse but negligible because underwater noise would be limited in duration, affect only a small area within the harbor, and would not pose a barrier to migration or the availability of other more suitable habitat. Noise could be further reduced with the use of turbidity curtains, and marine and landside observers could be employed during the underwater construction activities to observe and stop work if sea turtles or manatees are within 50 feet of the work action area. Because of the relatively small area within Christiansted Harbor that would be affected and because the presence of manatees and sea turtles is expected to be rare in Christiansted Harbor, it is unlikely that noise from sheet pile installation would

result in injury to federally listed manatee or sea turtle species; behavioral effects would be temporary and localized, as sea turtles and manatees would avoid the area during construction.

As stated above in the discussion of impacts to special-status fish, increased marine vessel use for construction in the project area could pose a risk for injury or death due to marine vessel strikes. Sea turtles are not likely to be present in the shallow water areas, and in deeper areas, the use of the turbidity curtains would prevent manatees and sea turtles from entering the work area during construction. A marine observer could be employed during the underwater construction activities to inspect the installation of the turbidity curtain to ensure no sea turtles or other species of concern are inside the work area prior to the closure. A land-based observer would also be employed to watch for and stop work if sea turtles or manatees enter within 50 feet of the work area. If in-water work is performed in the summer, the marine observer would also inspect the turbidity curtain each morning to ensure that sea turtle hatchlings are not caught in the curtain. Although rare, sea turtles have used the beaches to the east and west of the project area for nesting. Given the low chance of manatees and sea turtles in the project area and the use of turbidity curtains and marine and landside observers, no impacts would occur to manatees and sea turtles from marine vessel strikes.

The placement and removal of barge spuds, as well as propeller wash would disturb bottom sediments and may cause temporary increases in suspended sediment in the vicinity of the immediate work area. A small resulting sediment plume is expected to settle out of the water column within a few hours. As discussed in the "Marine Resources" section, the TSS levels expected for pile driving activities are below those shown to have adverse effects on fish and benthic communities. The anticipated temporary increase in TSS levels expected for sheet pile driving is not expected to be detectable to manatees and sea turtles and therefore would not present a barrier to normal movements or migration. Submerged aquatic vegetation is present in the proposed work area, and although this area is not a known foraging area, it could be used opportunistically by manatees and green and hawksbill sea turtles. As TSS levels would also not reach levels that are toxic to the benthic communities, the increased turbidity from construction activities is unlikely to result in reductions in the quality or quantity of benthic species currently available. Impacts from the temporary changes to water quality during construction activities would not adversely impact manatees or sea turtles.

Pursuant to Section 7 of the ESA, the NPS concludes that the bulkhead replacement *may affect, but not likely adversely affect* sea turtles or manatee under US Fish and Wildlife Service (USFWS) jurisdiction. In a letter dated March 8, 2019, the USFWS concurred with the NPS determination based on the nature of the project, the habitat characteristics of the project area, and the mitigation measures that would be employed.

Seabirds. Locally protected seabirds (brown pelican, laughing gull, gull-billed tern, least tern, and magnificent frigatebird) could use the waters within the project area for foraging and could therefore be affected by construction activities. Temporary adverse impacts would be associated with construction activities and would be limited to the period of construction, localized to the area adjacent to the bulkhead, and minimized by the implementation of BMPs. As with most anthropogenic sounds, auditory masking from construction noise could limit the distance over which seabird species can communicate and detect biologically relevant sounds. Seabird responses to new sounds in their environment and their responses could differ, ranging from no response to flushing. During construction, noise and increased turbidity would cause fish to move away from construction activities, thus forage species for seabirds would be less available temporarily. However, the seabirds would also move away from construction noise to forage in other suitable areas along the shoreline of St. Croix. Shortly after construction, the water column would return to pre-construction conditions, the benthic habitats that were disturbed would also recover, fish species would populate the project area again and the birds could return to previous foraging activities. For these reasons, long-term consequences to individuals or populations of seabirds

would not be expected to result from the construction activities associated with the replacement of the bulkhead; impacts would be considered minor and adverse.

Installation of the bulkhead would not alter any habitats for the locally protected brown pelican, laughing gull, gull-billed tern, least tern, and magnificent frigatebird. Because the proposed action would not alter any habitats for these species and because they would relocate to other foraging areas in the greater vicinity of the harbor, the impacts on seabirds would be negligible.

Cumulative Impacts

The proposed action would result in a small permanent loss of marine bottomlands habitat, which could indirectly affect Nassau grouper, striped croaker, manatees, and sea turtles by reducing refuge and foraging habitat, though this habitat within the project area is marginal and small compared to that which is available throughout Christiansted Harbor. Construction noise would also affect Nassau grouper, striped croaker, manatees, sea turtles, and seabirds; however, this disturbance would be temporary and BMPs would allow these mobile species to vacate the project area prior to noise reaching levels that could cause injury. The proposed action would also result in beneficial impacts from the relocation of corals prior to construction activities. These corals have recruited onto the manmade bulkhead structure over the past 35 or more years. Under the proposed action, they will be relocated to a natural coral reef habitat to enhance that environment. Relocating the corals from the bulkhead and the construction footprint would benefit reed habitat, resulting in long-term beneficial impacts for special-status species.

When combined with this alternative, if conducted concurrently, cumulative impacts to special-status species from other past, present, and reasonably foreseeable future actions (presented in table 6) would be temporary, small, and adverse. Although there would be no meaningful additive or interactive impact from these projects, the proposed action would constitute a small beneficial cumulative impact on special-status species in Christiansted Harbor.

Conclusion

The construction activities of the proposed action could impact 11 federally listed species, 1 species of concern, and 5 territory-listed species through increased turbidity, noise impacts, and the potential for harm from the potential for marine vessel strikes in the project area; some species would also be affected through loss of marine bottomlands habitat. BMPs and mitigation measures would be taken to ensure that impacts on listed species are avoided or minimized, including removal and relocation of corals on and adjacent to the existing bulkhead. Impacts to federally and territory-listed species would be extremely localized and small when considered with the overall amount of suitable habitat present in Christiansted Harbor.

Pursuant to Section 7 of the ESA, the proposed action would have *no effect* on elkhorn coral and staghorn coral and *may affect but is not likely adversely affect* federally listed species (boulder star coral, lobed star coral, mountainous star coral, Nassau grouper, striped croaker, Antillean manatee, green sea turtle, hawksbill sea turtle, leatherback sea turtle, and loggerhead sea turtle).

The lobed star coral complex (boulder star coral, lobed star coral, and mountainous star coral) and Nassau grouper are also managed species under the Magnuson-Stevens Fishery Conservation and Management Act. Pursuant to the EFH requirements of this act and its implementing regulations, it is anticipated there would be a minimal impact on habitats designated as EFH.

The proposed action would have negligible impacts on special-status seabird species (brown pelican, gull-billed tern, laughing gull, least tern, and magnificent frigatebird).

When the impacts on marine resources under this alternative are combined with the other past, present and foreseeable future projects in Christiansted NHS, the proposed action would contribute a slightly beneficial increment to the overall cumulative impacts for special-status species in the harbor due to the restoration of coral reef habitat in the relocation site.

ARCHEOLOGICAL RESOURCES

For the purposes of NEPA, this analysis focuses on the potential impacts of the project to terrestrial and underwater archeological resources. In this section, the NPS considers the potential changes to the integrity, spatial relationship, and character-defining features of contributing elements of the historic structure and the potential to damage, destroy, or alter archeological resources. The areas of potential effects for archeological resources are three areas where potential ground disturbance could occur: an offshore area that parallels the bulkhead and that extends 200-feet offshore where the barges would be operated, and two terrestrial staging or potential construction areas comprising a 1.55-acre area on the west side of Fort Christiansvaern, and a 0.25-acre area on the east side of Fort Christiansvaern (figure 2).

No-Action Alternative

Both underwater and terrestrial archeological resources are present at Christiansted NHS. Because there would be no ground disturbance and no structural work under the no-action alternative, there would be no adverse effects to archeological resources or historic properties due to construction. Storm water run-off and drainage issues in and through the park present a threat to the stability and protection of archeological resources in the ground. Sea level rise and projected increase in storm intensity could accelerate erosion thereby exposing and weathering archeological resources. This would result in adverse impacts to archeological resources.

Cumulative Impacts

The other past, present, and reasonably foreseeable future actions that could have an impact on resources affected by the Christiansted NHS wharf bulkhead replacement project (presented in table 6) would not impact terrestrial archeological resources because they would avoid or minimize ground disturbing activities and occur in areas with previously disturbed ground. Additionally, there would be no in-water work that would affect underwater archeological resources. Therefore, there would be no meaningful additive or interactive impacts from these projects and the no-action alternative that would constitute a cumulative impact on archeological resources.

Conclusion

In the long-term, the no-action alternative would result in adverse effects to archeological resources. Although no ground disturbing activities or in-water work would take place under the no-action alternative, sea level rise would continue to contribute to increased erosion and accelerated weathering, which could damage archeological resources. Failure of the bulkhead would result in erosion of the waterfront and allow for storm surges to reach and impact archeological resources and possibly cause irreparable damage or complete loss of the resources.

Proposed Action/Preferred Alternative

The NPS proposes to replace the existing wharf bulkhead along Christiansted NHS waterfront to protect the Christiansted NHS waterfront cultural landscape from the effects of storm events. Under the proposed action, the NPS would prevent ground disturbance in the terrestrial portion of the project area through measures such as fencing, the use of protective mats to prevent rutting from heavy machinery and

establishing corridors for vehicle movement. This area has undergone large-scale land filling since 1759 (Panamerican 2018), and although it is unlikely that any historic resources would be impacted from construction activities of the proposed action, historic materials have been encountered in disturbed areas during previous projects. In the event previously unknown archeological resources are discovered, the NPS would mitigate any adverse effects through archeological data recovery or another method.

Construction areas that do not include ground disturbance (e.g., material storage and layout, equipment parking and operation) would occur in parking areas and along the area south/east of Fort Christiansvaern (Fish Market area). Because these activities would not disturb that ground, no adverse effects to archeological resources are expected. Stormwater run-off, drainage, and erosion issues in the park would be addressed, and this would reduce the threat to the stability and protection of archeological resources in the ground. This would result in a long-term beneficial effect to terrestrial archeological resources.

Construction proposed in Christiansted Harbor would occur within 200 feet out (seaward) in the barge work area. Two isolated artifacts are located within the project area—an 18th century wooden stock anchor in the middle of the barge work area and a small 18th to mid-19th century cannon resting against the existing bulkhead. Based on the current bulkhead construction design, the cannon cannot be avoided and would be adversely impacted by project activities (Panamerican 2018). Through consultation, the VISHPO has concluded that both artifacts would be moved prior to in-water construction activities and placed in a location outside the area of potential effects to be determined by the VISHPO. Relocating these artifacts would resolve the adverse effects of the project on these underwater archeological resources; however, the cannon is cemented to the bulkhead, and removing it would potentially result in exposing the iron to saltwater, leading to deterioration of and an adverse effect to the isolated artifact.

Cumulative Impacts

The other past, present, and reasonably foreseeable future actions would not impact archeological resources, as described for the no-action alternative. The proposed action would result in a slight beneficial impact on terrestrial archeological resources by replacing the bulkhead and protecting the resources from sea level rise, erosion, weathering, and severe storm events. The overall cumulative impact on archeological resources, when considered with other past, present, and foreseeable future actions, would be beneficial.

Conclusion

In the long-term, the proposed action would result in beneficial effects to terrestrial archeological resources by reducing the effects from sea level rise, erosion, and weathering and by providing further protection to Christiansted NHS and the historic buildings on the wharf grounds from severe storm events. No impacts to terrestrial archeological resources are expected since ground disturbance would be avoided; however, in the event terrestrial archeological sites are discovered, the NPS would mitigate any adverse effects through archeological data recovery or another method. The underwater archeological resources would be relocated to an area outside the area of potential effects that is determined by the VISHPO, resolving the adverse effects of the project on these objects. When the impacts on archeological resources under this alternative are combined with the other past, present and foreseeable future projects in Christiansted NHS, the proposed action would contribute a slight beneficial increment to the overall cumulative impacts for archeological resources in the project area.

VISITOR USE AND EXPERIENCE

NPS *Management Policies 2006* states that the enjoyment of park resources and values by the people of the United States is part of the fundamental purpose of all parks and that the NPS is committed to

providing appropriate high-quality opportunities for visitors to enjoy the parks. Consequently, one of the park's goals is to ensure that visitors safely enjoy and are satisfied with the availability, accessibility, diversity, and quality of park facilities, services, and appropriate recreational opportunities. Specific context for assessing impacts of the alternatives on visitor use and experience includes: the ability of visitors to experience Christiansted NHS and learn about the area's resources and the availability and quality of visitor facilities and services at Christiansted NHS (walkways, day use, interpretive areas).

The geographic area of analysis for visitor use and experience is the overall project area and includes the waterfront along the wharf, walkways, and the surrounding grounds containing the historic structures of Fort Christiansvaern. Christiansted NHS, specifically the wharf and the landscape, serve as a center for St. Croix and the US Virgin Islands, maintaining strong connections to local neighborhoods and the larger Christiansted Historic District (NPS 2015b). To identify the potential impacts of the no-action alternative and the proposed action on visitor use and experience at Christiansted NHS, the current conditions and the restoration of visitor opportunities along the wharf bulkhead were considered. The potential for changes in visitor experience was evaluated by assessing the limitations and assumed changes to visitor access and associated visitor uses related to the proposed action and determining whether these projected changes would impact visitor experience. The analysis also considered the effect of the existing conditions and the construction and operation of the proposed action on the safety of visitors and park staff.

No-Action Alternative

Under the no-action alternative, the wharf bulkhead would not be replaced, and the concrete apron would not be repaired. Existing visitor services would continue to be provided and maintained at Christiansted NHS, and visitors would continue to tour the museums at Fort Christiansvaern, the Steeple Building, and the Scale House, as well as using the grounds of Christiansted NHS for walking and picnicking. However, the wharf bulkhead would remain closed to boat operations, marine traffic, large crowds, and vehicle traffic due to safety concerns. Under the no-action alternative, the experience of Christiansted NHS visitors would remain unchanged from current conditions.

Cumulative Impacts

Future projects would repair and restore portions of the Scale House and the Danish Custom House, and the park is currently working on repairs to historic buildings caused by hurricanes. These projects would enhance visitor experience, as they maintain the historic significance of the NRHP-listed buildings at the park. Rehabilitation of public restrooms, maintenance of roads adjacent to the park, and ongoing fire ant treatment would create a more pleasant experience at the park for visitors. These projects have would result in long-term beneficial impacts on visitor use and experience. Visitor use and experience, including safety, would remain unchanged under the no-action alternative; therefore, it would have no potential to contribute to cumulative impacts when considered with the beneficial impacts of the past, present, and reasonably foreseeable future projects occurring at Christiansted NHS.

Conclusion

There would be no new impact on visitor use and experience under the no-action alternative. There would be continued adverse impacts on visitors from the closure of the wharf bulkhead and the concrete apron to marine and other recreation activities. Visitor experience for Christiansted NHS visitors within the project area would be unchanged, and the no-action alternative would not contribute to cumulative impacts on visitor use and experience.

Proposed Action/Preferred Alternative

Under the proposed action, the wharf bulkhead would be replaced, and the concrete apron would be repaired. During construction, there would be short-term adverse impacts to visitor use and experience. Construction activities, which would take approximately 12 months, would require that a portion of the parking area by Fort Christiansvaern be closed to visitors intermittently during movement of large trucks and heavy equipment and materials, and visitors would be excluded from the construction area using fencing. Figure 2 depicts the area of potential impacts. Visitors would be able to visit the historic buildings at the park during construction, and deliveries of construction materials would be scheduled to minimize disturbance to Fort Christiansvaern and the associated parking lot. A traffic plan, to include pedestrians, vehicles, and marine vessels, would be prepared to reduce the potential impacts on visitors, as well as businesses that use the existing wharf.

Following construction, the current visitor experience would be restored, as the construction barriers would be removed. The proposed action would restore all physical elements of the wharf structure. This would include all required physical structures and appurtenances that would allow the wharf structure to be utilized for its intended operational purposes. The proposed project would provide the NPS with opportunities to restore and perhaps enhance access to the waterfront from the water, as the new bulkhead would include a fendering system and new docking cleats to accommodate boat access. The proposed action would also provide opportunities to enhance access from the land due to the repaired and treated concrete apron. Once the bulkhead is replaced, the park would have the ability to expand visitor opportunities (e.g., contract and/or commercial services under commercial use authorizations and public use of the wharf once park regulations for use of the wharf are established). With restored marine access, new visitors would be likely to visit Christiansted NHS.

Overall, new wharf bulkhead would protect the historic features of Christiansted NHS, allowing for long-term use of the wharf at Christiansted NHS, as the NPS would have the ability to properly maintain it for visitor use.

Cumulative Impacts

The proposed action would result in beneficial impacts by maintaining the current visitor use and experience over the long term. The past, present and reasonably foreseeable future projects occurring at Christiansted NHS would also have long-term beneficial impacts on visitor use and experience. The projects (presented in table 6) would work towards enhancing the visitor experience by repairing and rehabilitating the historic structures, roads, and public restrooms, and the NPS continues to treat the grounds of the park for fire ants for the safety of staff and visitors. The proposed action would contribute a long-term beneficial impact on the overall cumulative effects on visitor use and experience because of improved quality of the waterfront area and maintained or enhanced visitor experiences.

Conclusion

Under the proposed action, short-term adverse impacts on visitor use and experience would occur during construction activities, due to construction noise and temporary closures of portions of the parking area adjacent to Fort Christiansvaern. The proposed action would result in a new wharf bulkhead, which would allow the NPS to continue to protect the historic resources of the park, thus maintaining a safe positive visitor experience over the long-term; the proposed action would also give the NPS the ability to enhance visitor opportunities at the park. The beneficial impacts of the proposed action would contribute a small increment to the cumulative impact, and overall, the impact on visitor use and experience at Christiansted would be beneficial.

CHAPTER 5: CONSULTATION AND COORDINATION

This chapter summarizes the process undertaken by the NPS to contact individuals, agencies, and organizations for information or that assisted in identifying important issues, analyzing impacts, or that will review and comment on the Environmental Assessment to replace the existing wharf bulkhead along Christiansted NHS waterfront. Throughout the planning process, the Christiansted NHP staff encouraged elected officials, culturally associated groups, partners in other agencies, park visitors, and private citizens to participate in this planning effort, as summarized below.

THE CIVIC ENGAGEMENT / PUBLIC INVOLVEMENT PROCESS

The NPS coordinated with resource agencies, groups, and members of the public to allow an opportunity for input. Public involvement was initiated on October 24, 2018. The NPS gathered stakeholder input on issues and gathered comments on the scope of the project through November 24, 2018. The following agencies, organizations, and stakeholders received notice of the public involvement:

Elected Officials

- Albert Bryan Jr., Governor of the US Virgin Islands
- John Lewis, St. Croix Chamber of Commerce, Vice Chair
- Ryan Nelthropp, St. Croix Chamber of Commerce, Chair
- Stacey Plaskett, US Delegate to Congress
- Tregenza A. Roach, Lieutenant Governor

Agencies

- National Marine Fisheries Service
- US Army Corps of Engineers
- US Coast Guard Office
- US Environmental Protection Agency
- US Fish and Wildlife Service
- US Virgin Islands Department of Planning and Natural Resources
- US Virgin Islands Department of Planning and Natural Resources Coastal Zone Management
- US Virgin Islands Department of Planning and Natural Resources Building Permits
- Virgin Island Port Authority
- Virgin Islands State Historic Preservation Office

Other Interested Parties

- Friends of St. Croix's National Parks
- Hotel on the Cay
- King Christian Hotel
- The Nature Conservancy
- St. Croix Environmental Association
- St. Croix Hotel and Tourism Association
- St. Croix Marine Center
- St. Croix Taxi Association
- St. Croix Yacht Club

Public involvement was advertised through a press release, and a public open house was held on November 7, 2018, from 5:00 p.m. to 7:00 p.m. at the Christiansted NHS headquarters. Based on internal and civic engagement and applicable federal law, regulations, and executive orders, the NPS determined that an EA would be the appropriate level of compliance for the project.

Agency Consultation

US Army Corps of Engineers. The NPS is consulting with the USACE with regard to permit requirements necessary to implement project in accordance with Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act.

Virgin Islands State Historic Preservation Office. The NPS initiated consultation with the VISHPO at the VIDPNR on December 13, 2018. On December 20, 2018, the SHPO responded, acknowledging the initiation of consultation and the park's identification of the undertaking. On October 24, 2018, the NPS requested review of its determination of the area of potential effect and concurrence with the findings of the archeological survey. This project results in an adverse effect to archeological resources, and the NPS anticipates the completion of a Memorandum of Agreement (MOA) to resolve these effects (i.e., relocate the 18th to mid-19th century cannon and the 18th century wooden stock anchor to an area outside the area of potential effects to be determined by the VISHPO), which would complete the Section 106 process. The draft MOA is included in appendix E.

Virgin Islands Department of Natural Resources. The NPS initiated consultation with the VIDPNR for the Coastal Zone Management Permit on February 12, 2019. The NPS will continue to consult with the VIDPNR and will obtain all appropriate federal and territorial permits for the project.

US Fish and Wildlife Service. The NPS obtained a list of federally listed endangered and threatened species that may be present in the project area from the USFWS IPaC system on January 31, 2019. The list was used as the basis for the special-status species analysis in this EA. The NPS initiated informal consultation on February 8, 2019. The NPS requested concurrence on the assessment that the proposed action *may affect but is not likely to adversely affect* the Antillean manatee, hawksbill sea turtle, leatherback sea turtle, green sea turtle, and loggerhead sea turtle. The USFWS responded on March 8, 2019 with concurrence on the assessment for these 5 species.

NOAA National Marine Fisheries Service. The NPS initiated consultation with NMFS on February 13, 2019 for activities related to research, restoration, and relocation of threatened Caribbean corals. On February 20, 2019, NMFS concurred with the NPS determination that the proposed activities fall within the scope of *Programmatic Biological Opinion on Threatened Caribbean Coral Research, Restoration and Relocation,* initiated on October 18, 2016. Those activities which fall within the scope of the PBO would not cause jeopardy to any ESA-listed species under NOAA's jurisdiction. On March 26, 2019, the NPS received confirmation from NOAA NMFS on the list of EFH species. The NPS will continue to consult with NOAA NMFS regarding the EFH assessment required Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267).

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APPENDIX A

RESOURCE PROTECTION MEASURES

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RESOURCE PROTECTION MEASURES

To minimize impacts related to the proposed action alternative, the National Park Service (NPS) would implement mitigation measures whenever feasible. Subject to the final design and approval of plans by relevant agencies, mitigation measures would include, but would not be limited to, the items listed below.

General Resource Protection

- Staging of materials will take place only in designated areas, as shown on figure 2. Areas for barge access will be established in the general areas indicated on figure 2.
- Ground protection measures will be required in all locations where equipment will operate, or materials will be placed off of paved surfaces. These measures will include plywood or other horizontal type mat that will prevent ruts from movement of heavy equipment designating limits of disturbance for contractors, fencing in all upland work areas to keep disturbances in an NPS-defined minimal impact area, establishing corridors for construction vehicle movement, staging of construction materials and equipment in minimal impact areas, and limiting construction access.
- All work areas will be fenced in order to keep related disturbances within the NPS-defined limits of construction, shown on figure 2. All workers will be instructed to avoid conducting activities beyond the fenced construction zone.
- All construction workers will be required to wear identifiable uniforms indicating they can be in the designated work area or met by project foreman for site access and control if making a delivery.
- Construction employees will be instructed on the sensitivity of the general environment, and their activity will be monitored.
- Best management practices will be followed to avoid exposure of the terrestrial and aquatic environment to risks such as fuel or chemical spills and leaks, especially during application of the apron sealant. Spill kits will be available on site in sufficient numbers and volumes to treat hydraulic spills in the event of a broken hose.
- Construction will only occur during daylight hours to reduce light pollution and to avoid night-time noise disruption.
- All protection measures will be clearly stated in the construction specifications.
- Construction equipment will be properly maintained to minimize noise from use of equipment. Contractors will use sound attenuated compressors and generators. Equipment and machinery will not exceed 85 decibels when measured at a distance of 100 linear feet.
- A traffic plan, to include pedestrians, vehicles, and marine vessels, will be prepared to reduce the potential impacts on visitors, as well as businesses that use the existing wharf.

Coral Removal and Relocation

- Prior to construction, all coral colonies that are 5 centimeters (cm) or larger that are reasonable candidates for relocation (not showing outward signs of disease) will be removed from the bulkhead structure and on the marine bottomlands within 15 feet of the bulkhead and reattached to a natural reef hardbottom recipient site. All coral relocation activities will be conducted following the guidelines established in the Virgin Islands Department of Planning and Natural

Resources (VIDPNR) *Coral Mitigation Relocation Recommendations* (VIDPNR 2018) and in consultation with NOAA NMFS.

- Coral removal and relocation will not be conducted during peak hard coral spawning or coral bleaching periods (July 1 through October 31), as established through consultation with National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA NMFS) and the VIDPNR Coastal Zone Management Coral Program. No diseased corals will be moved to the relocation site.
- All self-contained underwater breathing apparatus (SCUBA) divers will adhere to the standard operating procedures to disinfect their dive gear prior to dive operations to prevent the spread of disease among corals.
- Removal, relocation and reattachment methodologies will include a variety of hand tools; no power tools or heavy pry bars will be utilized. Rubber gloves will be worn while handling corals to minimize mucous removal and abrasion.
- Corals removed from the Christiansted bulkhead will be relocated to an appropriate recipient site. Corals will be immediately transplanted upon arrival to the recipient site to minimize the amount of time the corals are unattached to substrate.
- In order to ensure the success of the re-attachment and to minimize secondary impacts during the restoration project period, it is recommended that this work only be performed when certain environmental conditions are met, such as relatively calm sea conditions.
- Following the relocation of all corals, a baseline survey will be conducted in which the size, health, and location of all relocated corals be recorded. Subsequent monitoring will be performed on a regular monitoring schedule to determine the efficacy of the relocation effort. The performance standard to determine mitigation success for coral relocation activities should be at least 85% overall survival of all relocated species, with secure substrate attachment (USCRTF 2016); the VIDPNR requires three years of monitoring following relocation.

Marine Resource Protection

- Water quality monitoring will be conducted throughout construction activities. Water quality will be continuously monitored to ensure that turbidity does not exceed levels that will be harmful to aquatic communities, as determined through agency consultation.
- Turbidity and siltation from the installation of sheet piles will be minimized, confined to the immediate vicinity of the project work area, and contained through the use of turbidity curtains, which will be installed around the immediate work area during in-water construction operations. The turbidity curtain will be moved as work progresses along the bulkhead. The turbidity curtain will remain in place post-construction until all turbidity and siltation subsides from in-water construction.
- Erosion and sediment controls will be carefully designed, installed, and maintained to reduce sedimentation and limit turbidity and siltation into Christiansted Harbor.
- A marine observer (a certified diver) will be present during all in-water activities and will monitor barge relocation and spot before and after barge spud-down location. The marine observer will provide measures for reduction and prevention of the spread of invasive seagrasses and avoid impacts to existing benthic organisms. Surface buoys will be used to demarcate the area where construction and barge activities will be restricted to protect seagrass benthic habitat. Dive operations will require, at minimum, a top-side support worker for the diver in the water.

- In areas with significant amounts of invasive seagrasses, propeller wash should be minimized to reduce the spread of invasive seagrasses.
- The existing bulkhead will be encapsulated and enclosed by the new bulkhead to reduce debris that will have to be disposed at an upland site.
- All manmade construction debris will be collected and not allowed to enter marine waters.
- All debris removed from the bulkhead construction site will be barged off St. Croix to disposed of at an approved upland site. All trash and debris within the direct footprint of the new bulkhead would be removed from the water and disposed of properly.
- All debris or spill material will be properly disposed of at an approved off-site disposal facility.
- All equipment will be checked daily for leaks and any necessary repairs made prior to commencement of work. Fueling of construction-related equipment will occur away from the bulkhead construction site at a designated location with the ability to handle an accidental spill. Spill response kits will be available on site in sufficient numbers and volumes for the heavy equipment being used.
- A vibratory hammer will be used for all sheet pile installation; the use of any impact hammer will be prohibited. Use of a soft start of the vibratory hammer will be used as necessary to reduce overall underwater noise levels.
- Underwater acoustic monitoring will likely be employed during construction activities to ensure noise levels are below acceptable requirements that will be determined through agency consultation.

Special-Status Species Protection

- Prior to construction activities, a survey will be conducted in and adjacent to the project area to ensure that there are no nesting birds in the vicinity.
- Prior to in-water work, an exclusion zone will be established. For this project the exclusion zone includes all marine waters within 200 feet of the existing bulkhead. The exclusion zone will be marked with US Coast Guard- or Port Authority-approved markers to ensure avoidance. Because the buoys could potentially impact navigable waters, the methods of creating the required marine vessel exclusion zone will be determined through consultation with the US Coast Guard and the Port Authority.
- All personnel associated with the project will be instructed about the presence of special-status species and the need to avoid collisions with and injury.
- All on-site project personnel are responsible for observing water-related activities for the presence of special-status species. Personnel will review the entire exclusion zone for the presence of special-status species for 30 minutes prior to commencement of construction. If any special-status species are present within the exclusion zone, construction activities will not begin until the animal(s) has left the exclusion zone or no special-status species have been observed in the exclusion zone for 15 minutes.
- During all in-water construction, a marine resources monitor will be present to observe the exclusion zone. Established marine vessel speed restrictions and safe operating distances will be heeded. All in-water operations, including marine vessels, must be shut down if a special-status species comes within 50 feet of the operation. Activities will not resume until the animal has moved beyond the 50-foot radius of the project operation, or until 15 minutes elapses if the

animal has not reappeared within 50 feet of the operation. Animals will not be herded away or harassed into leaving.

- All in-water lines will be stiff, taut, and non-looping to minimize the risk of entanglement with sea turtles and manatees. If flexible lines are used, they must be enclosed in plastic or rubber sleeves/tubes that add rigidity and prevent the line from looping and tangling.
- Operation hours will be restricted to daytime hours to avoid and minimize effects to sea turtles.
- If work is conducted during sea turtle nesting season, turbidity curtains will be inspected prior to the start of work for any hatchlings that could be taking shelter in curtain folds. US Fish and Wildlife Service and/or VIDPNR Division of Fish and Wildlife will be contacted if hatchlings are found.

Cultural Resource Protection

- Submerged archeological resources will be relocated prior to construction to avoid impacts.
- An archeological monitor will be employed during the construction activities to observe and stop work if previously unknown archeological resources are discovered.
- If unknown resources are found, the contractor will immediately halt all activity within a 100-foot radius of the discovery, notify the NPS Cultural Resources Specialist and VISHPO of the discovery, and implement interim measures to protect the discovery from looting and vandalism. VISHPO will determine next actions for materials found during work.
- Staging areas will be established to confine storage of materials and equipment to specific locations on the site.
- A buffer of 10 to 12 feet will be established between any historic structure and work area, except where the bulkhead meets the Fort Christiansvaern wing wall.
- Vibration/crack monitors will be placed on historic structures, and the structures will be inspected daily prior to the onset of construction activities.
- Terrestrial acoustic monitoring will likely be employed during construction activities to ensure noise levels are below acceptable requirements that will be determined through agency consultation and historic structures are not damaged from vibrations.
- The color(s) of the new wharf installation would be selected to blend with the color effect at Christiansted National Historic Site.
- All areas where construction equipment will be used along the historic waterfront will have ground protection to ensure minimal to no ground disturbance.

References

US Virgin Islands Department of Planning and Natural Resources (DPNR)

2018 Coral Mitigation Relocation Recommendations. December.

APPENDIX B

LIFE HISTORY INFORMATION FOR ESSENTIAL FISH HABITAT SPECIES

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Life History Information for Species Screened for Designated Essential Fish Habitat

Species	Habitat Type	Depth	Seasonal	Diet	Gametes/Eggs	Larvae/Neonates	Juveniles	Juvenile/Adult
Corals								
Blushing Star Coral (*Stephanocoenia intersepta*)	Reef-Associated	0-100 m (0-328 ft)	N	Zooplankton	Reproduces sexually (broadcast)	N/A	Most reef communities	Most reef communities
Boulder Brain Coral (*Colpophyllia natans*)	Reef-Associated	0-55 m (0-180.4 ft)	N	Zooplankton	Reproduces sexually (broadcast)	N/A	Back reef and fore reef environments	Back reef and fore reef environments
Club Finger Coral (*Porites porites*)	Reef-Associated	0-50 (0-164 ft) Usually 1-15 m (3.3-49.2 ft)	N	Zooplankton	Reproduces sexually (brooding); possibly asexual reproduction (fragmentation)	N/A	Most reef environments; back reef shallow platforms with *Thalassia* turtle grass beds and attached to mangrove prop roots	Most reef environments; back reef shallow platforms with *Thalassia* turtle grass beds and attached to mangrove prop roots
Elliptical Star Coral* (*Dichocoenia stokesi*)	Reef-Associated	0-72 m (0-236.2 ft)	N	Zooplankton	Reproduces sexually (broadcast)	N/A	Back and fore reef environments, rocky reefs, lagoon habitats, spur and groove formations, channels; sometimes at the base of the reef	Back and fore reef environments, rocky reefs, lagoon habitats, spur and groove formations, channels; sometimes at the base of the reef
Elkhorn Coral (*Acropora palmata*)	Reef-Associated	1-15 m (3.3-49.2 ft)	N	Zooplankton	Reproduces sexually (broadcast)	N/A	Typically grows in clear, shallow water on coral reefs in high-energy zones with a lot of wave action; requires hard, consolidated substrate	Typically grows in clear, shallow water on coral reefs in high-energy zones with a lot of wave action; requires hard, consolidated substrate
Flower Coral (*Eusmilia fastigiata*)	Reef-Associated	0-60 m (0-196.8 ft) Usually 10-25 m (32.8-82 ft)	N	Zooplankton	Reproduces sexually (broadcast)	N/A	Shallow, intermediate, and deep fore reef environments; occasionally occurs in patch reefs in lagoon environments	Shallow, intermediate, and deep fore reef environments; occasionally occurs in patch reefs in lagoon environments
Golf Ball Coral (*Favia fragum*)	Reef-Associated	0-30 m (0-98.4 ft) Usually 0.5-5 m (1.6-16.4 ft)	N	Zooplankton	Reproduces sexually (brooding)	N/A	Most fore reef and back reef environments and in seagrass beds provided there is suitable substrate for them to settle on	Most fore reef and back reef environments and in seagrass beds provided there is suitable substrate for them to settle on
Knobby Brain Coral (*Diploria clivosa*)	Reef-Associated	0-41 m (0-134.5 ft) Usually 0.5-3 m (1.6-9.8 ft)	N	Zooplankton	Reproduces sexually (broadcast)	N/A	Most abundant in back-reef and exposed fore-reef environments	Most abundant in back-reef and exposed fore-reef environments
Lesser Starlet Coral (*Siderastrea radians*)	Reef-Associated	0-40 m (0-131.2 ft)	N	Zooplankton	Reproduces sexually (brooding)	N/A	Shallow reef environments, hard-bottom communities, tidal flats, seagrass beds and rubble fields	Shallow reef environments, hard-bottom communities, tidal flats, seagrass beds and rubble fields
Lettuce Coral (*Agaricia agaricites*)	Reef-Associated	0-2000 m (0-6,561.6 ft)	N	Zooplankton	Reproduces sexually (brooding); possibly asexual reproduction (fragmentation)	N/A	Very shallow water	Very shallow water
Lobed, Boulder Star, Mountainous Star Coral* (*Orbicella annularis* species complex)	Reef-Associated	0 .5-82 m (1.6-269 ft) Usually 1-10 m (3.3-32.8 ft)	N	Zooplankton	Reproduces sexually (broadcast)	N/A	Marine waters ranging; more abundant in reef environments; also found in lagoons and upper reef slopes	Marine waters ranging; more abundant in reef environments; also found in lagoons and upper reef slopes
Massive Starlet Coral (*Siderastrea siderea*)	Reef-Associated	0-70 m (0-229.6 ft) Usually 5-15 m (16.4-49.2 ft)	N	Zooplankton	Reproduces sexually (broadcast)	N/A	All types of reef environments from the shallow subtidal; does well in areas with high sedimentation and high turbidity	All types of reef environments from the shallow subtidal; does well in areas with high sedimentation and high turbidity
Maze Coral (*Meandrina meandrites*)	Reef-Associated	0-75 m (0-246 ft) Usually 8-30 m (26.2-98.4 ft)	N	Zooplankton	Reproduces sexually (brooding); possibly asexual reproduction (fragmentation)	N/A	Primarily on the fore reef but is also found in back reef environments; tolerates high turbidity and high sediment influx	Primarily on the fore reef but is also found in back reef environments; tolerates high turbidity and high sediment influx
Mustard Hill Coral (*Porites astreoides*)	Reef-Associated	0 -70 m (0-229.6 ft) Usually 1-15 m (3.3-49.2 ft)	N	Zooplankton	Reproduces sexually (brooding)	N/A	All reef and near-reef environments; also present in subtidal rocky environments and seagrass beds; common on disturbed reef surfaces; also common in areas of high sedimentation and high turbidity	All reef and near-reef environments; also present in subtidal rocky environments and seagrass beds; common on disturbed reef surfaces; also common in areas of high sedimentation and high turbidity
Rose Coral (*Manicina areolata*)	Reef-Associated	0-65 m (0-213.2 ft) Usually 1-10 m (3.3-32.8 ft)	N	Zooplankton	Reproduces sexually (brooding)	N/A	Back or fore reef environments, only in soft bottom habitats or cobble, rubble, mixed-sand communities; common in subtidal seagrass beds; tolerant of temperature and salinity changes; found in areas of high sedimentation	Back or fore reef environments, only in soft bottom habitats or cobble, rubble, mixed-sand communities; common in subtidal seagrass beds; tolerant of temperature and salinity changes; found in areas of high sedimentation

Species	Habitat Type	Depth	Seasonal	Diet	Gametes/Eggs	Larvae/Neonates	Juveniles	Juvenile/Adult
Staghorn Coral* (*Acropora cervicornis*)	Reef-Associated	15-60 m (49.2-196.8 ft) Usually 5-20 m (16.4-65.6 ft)	N	Zooplankton	Reproduces sexually (broadcast)	N/A	Naturally occurs on spur and groove, bank reef, patch reef, and transitional reef habitats, limestone ridges, terraces, and hardbottom habitats; requires hard, consolidated substrate	Naturally occurs on spur and groove, bank reef, patch reef, and transitional reef habitats, limestone ridges, terraces, and hardbottom habitats; requires hard, consolidated substrate
Symmetrical Brain Coral (*Diploria strigosa*)	Reef-Associated	0-47 m (0-154.2 ft) Usually above 10 m (32.8 ft)	N	Zooplankton	Reproduces sexually (brooding)	N/A	Exposed locations; protected back reef environments; bays with high sediment loads	Exposed locations; protected back reef environments; bays with high sediment loads
Whitestar Sheet Coral (*Agaricia lamarcki*)	Reef-Associated	0-80 m (0-262.4 ft) Usually 15-25 m (49.2-82 ft)	N	Zooplankton	Reproduces sexually (brooding) ; possibly asexual reproduction (fragmentation)	N/A	Fore reef, slope, deep channels and deep lagoon environments	Fore reef, slope, deep channels and deep lagoon environments
Marine Invertebrates								
Queen Conch (*Lobatus gigas*)	Coastal Demersal	2-73 m (6.6-239.5 ft) Usually up to 30 m (98.4 ft)	Yes, associated with summer spawning	Diatoms, seagrass detritus, and various algae and epiphytes	Egg masses generally are produced in clean coral sand with low organic content	Pelagic, location determined by currents; preferred habitat for larval settlement is shallow back reefs areas and sand bars near a seagrass meadow	Primarily in back reef areas of medium seagrass density with a depth of 2-4 m, strong tidal currents, and frequent tidal water exchanges	Prefer sandy algal flats but can also be found on gravel, coral rubble, smooth hard coral or beach rock bottoms
Spiny Lobster (*Panulirus argus*)	Coastal Demersal	0-90 m (0-295.2 ft)	yes	Mainly gastropods, bivalves, and chitons; also, carrion, crustaceans, worms, and sea urchins	Same habitat as adult females, as she carries the eggs beneath her tail	Pelagic for several months, postlarvae settle in sponges, under sea urchins, algal mats, rock crevices, etc.	Grass flats and mangrove roots	Coral reefs and rocky substrate from the shoreline (just below the surface) to the edge of the shelf; move both alongshore and directly offshore, potentially seasonally
Reef Fish								
Buffalo Trunkfish (*Lactophrys trigonus*)	Reef-Associated	2-50 m (6.6-164 ft)	--	Small benthic invertebrates such as mollusks, crustaceans, worms and sessile tunicates, as well as some sea grasses	Pelagic	Pelagic	--	Seagrass beds, coral rubble areas, and offshore reefs down to about 50 m (164 ft)
Butterfly Fish (*Chaetodon striatus*)	Reef-Associated	3-55 m (9.8-180.4 ft) Usually 5-20 m (16.4-65.6 ft)	--	Polychaete worms, coral polyps, crustaceans and mollusk eggs	Pelagic	Pelagic	--	Shallow waters around coral reefs
Coney (*Epinephelus fulvus*)	Reef-Associated	1-150 m (3.3-492.1 ft)	No	Mainly small fishes and crustaceans	--	--	Filamentous algal growth on Shallow artificial cement module reefs	Prefer coral reefs and clear water; usually hide in caves or under ledges during the day
Grey Snapper (*Lutjanus griseus*)	Reef-Associated	5-180 m (16.4-590.6 ft) Usually up to 50 m (164 ft)	--	Small fishes, shrimps, crabs, gastropods, cephalopods and some planktonic items	Pelagic (buoyant)	Pelagic (planktonic)	Inshore in areas such as seagrass beds and soft and sand-bottom areas; may be found in a variety of habitats	Coastal and offshore waters from very shallow areas to depths of 180 m (590.6 ft); large aggregations frequently observed amongst coral reefs, rocky areas, estuaries, and mangrove habitats
Mutton Snapper (*Lutjanus analis*)	Reef-Associated	25-95 m (82-311.7 ft) Usually 40-70 m (131.2-229.6 ft)	--	Fishes, shrimps, crabs, cephalopods, and gastropods	Pelagic	Pelagic (planktonic)	Over sandy, vegetated (usually *Thalassia*) bottoms	Continental shelf areas and clear waters around islands; usually among rocks and coral
Nassau Grouper (*Epinephelus striatus*)	Reef-Associated	1-90 m (3.3-295.3 ft)	Yes, migrates to spawn	Mainly fishes and crabs; lesser amounts of other crustaceans and mollusks	Pelagic	Pelagic (planktonic)	Mangrove creeks, seagrass beds, and shallow reefs	Occurs from the shoreline to at least 90 m (295.3 ft) depth; usually close to caves
Queen Triggerfish (*Balistes vetula*)	Reef-Associated	2-275 m (6.6-902.2 ft) Usually 3-30 m (9.8-98.4 ft)	--	Benthic invertebrates	Demersal nests	Pelagic (planktonic)	--	Rocky bottoms and often associated with reefs; over sandy and grassy habitats
Red Hind (*Epinephelus guttatus*)	Reef-Associated	Greater than 100 m (328 ft)	--	Mainly crabs and other crustaceans (alpheid shrimps and scyllarid lobsters), fishes (labrids and haemulids), and octopus	Pelagic (buoyant)	Pelagic	Shallow rocky, rubble, and sandy areas	Rocky and coral reefs areas in relatively shallow waters
Redtail Parrotfish (*Sparisoma chrysopterum*)	Reef-Associated	1-15 m (3.3-49.2 ft)	--	Benthic algae and seagrasses	Pelagic; adults spawn in seagrasses	Mangroves and seagrass beds act as nursery sites	Exclusively found in bays with mangroves and/or seagrass beds and are rarely found in coral reefs	Coral reef and seagrass habitats

Species	Habitat Type	Depth	Seasonal	Diet	Gametes/Eggs	Larvae/Neonates	Juveniles	Juvenile/Adult
Sand Tilefish (*Malacanthus plumieri*)	Reef-Associated	10-153 m (32.8-502 ft) Usually 10-50 m (32.8-164 ft)	--	Stomatopods, fishes, polychaete worms, chitons, sea urchins, sea stars, amphipods and shrimps	Pelagic	--	--	Shallow water found on sand and rubble bottoms; builds mounds of rubble and shell fragments near reefs and grass beds
Schoolmaster Snapper (*Lutjanus apodus*)	Reef-Associated	2-63 m (6.6-206.7 ft)	--	Fishes, shrimps, crabs, worms, gastropods and cephalopods	Pelagic	Pelagic (planktonic)	Over sand bottoms with or without seagrass (*Thalassia*), and over muddy bottoms of lagoons or mangrove areas, sometimes brackish waters	Shallow, clear, warm, coastal waters over coral reefs. Often near the shelter of elkhorn corals and gorgonians
Scrawled cowfish (*Acanthostracion quadricornis*)	Reef-Associated	1-80 m (3.3-262.5 ft) Usually 10-30 m (32.8-98.4 ft)	--	Sessile invertebrates such as tunicates, gorgonians and anemones, as well as on slow-moving crustaceans, sponges	Pelagic (buoyant)	Pelagic	--	Shallow water, mainly in seagrass beds
Silk Snapper (*Lutjanus vivanus*)	Reef-Associated	90-242 m (295.3-794 ft) Usually 90-140 m (295.3-495.3 ft)	--	Fishes, shrimps, crabs, gastropods, cephalopods, tunicates and some pelagic items including urochordates	Pelagic	Pelagic	--	Common near the edge of the continental and island shelves; also found in deeper waters; usually ascending to shallower water at night
Squirrelfish (*Holocentrus adscensionis*)	Reef-Associated	0-180 m (0-590.6 ft) Usually 8-30 m (26.2-98.4 ft)	--	Mainly crabs and other small crustaceans	Pelagic	Pelagic	Pelagic	Occurring in deeper offshore waters and over shallow coral reefs; swims over sandy bottoms and seagrass bed at night, searching for prey items
Striped Croaker (*Corvula sanctaeluciae*)	Reef-Associated	0-35 m (0-114.8 ft)	--	Shrimps	Pelagic (buoyant)	--	Common over muddy and sandy bottoms in inshore waters; also found in rocky areas.	Common over muddy and sandy bottoms in nearshore areas; juveniles also found in rocky areas; found at depths up to 35 m (114.8 ft)
White Grunt (*Haemulon plumieri*)	Reef-Associated	3-40 m (9.8-131.2 ft)	--	Crustaceans, small mollusks, and small fishes	Pelagic	Pelagic	Seagrass beds, sand flats, rocky shorelines, and coral reefs; common in *Thalassia testudinum* beds	Patch reefs, around coral formations, or on sandy bottoms
Yellowtail Snapper (*Ocyurus chrysurus*)	Reef-Associated	0-180 m (0-590.6 ft) Usually 10-70 m (32.8-229.6 ft)	--	Plankton and benthic animals, including fishes, crustaceans, worms, gastropods and cephalopods	Pelagic	Pelagic (planktonic)	Inshore in seagrass bed nursery areas	Coastal waters, mostly around coral reefs; younger adults are found in hardbottom habitats
Highly Migratory Species								
Atlantic Sailfish (*Istiophorus platypterus*)	Pelagic-Oceanic	0-200 m (0-656.2 ft) Usually greater than 30 m (98.4 ft)	yes	Fishes, crustaceans and cephalopods	Pelagic	Pelagic	Pelagic and coastal surface waters 5-125 miles offshore	Epipelagic and coastal to oceanic, and are usually found above the thermocline at a temperature range of 21-28 °C (69.8-82.4 °F); may dive into deeper, colder water; least oceanic of the Atlantic billfish, often moving to inshore waters
Bigeye Tuna (*Thunnus obesus*)	Pelagic-Oceanic	0-1,500 m (0-4,921.3 ft) Usually 1-500 m (3.3-1,640.4 ft)	yes	Wide variety of fishes, cephalopods and crustaceans	Pelagic	Pelagic	School at the surface in monospecific groups or mixed with other tunas	Pelagic and oceanodromous; occurring in waters with temperatures 13-29 °C (55.4-84.2 °F), but the optimum is 17-22 °C (62.6-71.6 °F)
Blacktip Shark (*Carcharhinus limbatus*)	Reef-Associated	0-100 m (0-328.1 ft) Usually 0-30 m (0-98.4 ft)	yes	Pelagic and benthic fishes, also small sharks and rays, cephalopods and crustaceans	N/A - viviparous species	Shallow coastal waters	Shallow coastal waters	Shallow coastal waters and offshore surface waters of the continental shelves.
Blue Marlin (*Makaira nigricans*)	Pelagic-Oceanic	0-1,000 m (0-3,280.1 ft)	yes	Fishes; also preys on octopods and squids	Pelagic	Pelagic	Pelagic surface waters not less than 24 °C (75.2 °F)	Epipelagic and oceanic generally found in blue water with a temperature range of 22-31 °C (71.6-87.8 °F)
Caribbean Reef Shark (*Carcharhinus perezi*)	Reef-Associated	1-65 m (3.3-213.2 ft) Usually 1-35 m (3.3-114.8 ft)	yes	Bony fishes, including bigeyes	N/A - viviparous species	Nearshore waters of oceanic insular areas	Lagoons and forereef areas	Shallow coastal waters, usually around coral reefs

Appendix B

Species	Habitat Type	Depth	Seasonal	Diet	Gametes/Eggs	Larvae/Neonates	Juveniles	Juvenile/Adult
Dusky Shark (*Carcharhinus obscurus*)	Reef-Associated	0-400 m (0-1,312.3 ft) Usually 200-400 m (656.2-1,312.3 ft)	yes	Bottom and pelagic bony fish, sharks, skates, rays, cephalopods, gastropods, crustaceans, sometimes mammalian carrion and inorganic objects	N/A - viviparous species	Shallow coastal waters, inlets and estuaries and offshore areas	Shallower water than adults	Found in coastal and offshore waters but not oceanic; adults are commonly found at depths of 200-400 m
Lemon Shark (*Negaprion brevirostris*)	Reef-Associated	0-92 m (0-301.8 ft)	yes	Mainly on fish; also takes crustaceans and mollusks	N/A - viviparous species	Shallow coastal waters, inlets and estuaries	Nurseries are in shallow waters around mangrove islands	Shallow coastal areas, especially around coral reefs.
Longbill Spearfish (*Tetrapturus pfluegeri*)	Pelagic-Oceanic	0-200 m (0-656.2 ft) Usually greater than 100 m (328.1 ft)	yes	Pelagic fishes and squids	Pelagic	Pelagic	Offshore	Epipelagic, oceanic species, usually inhabiting waters above the thermocline, generally found in offshore waters
Night Shark (*Carcharhinus signatus*)	Coastal Demersal	0-600 m (0-1,968.5 ft) Usually 50-100 m (164-328.1 ft)	yes	Mainly on small bony fishes and squid	N/A - viviparous species	--	Offshore from the 100 to 2,000 isobath	Coastal and semi-oceanic species found on or along outer continental and insular shelves; feeding mainly on small bony fishes and squid
Nurse Shark (*Ginglymostoma cirratum*)	Reef-Associated	0-130 m (0-426.5 ft) Usually 1-35 m (3.3-114.8 ft)	yes	Bottom invertebrates such as spiny lobsters, shrimps, crabs, sea urchins, squids, octopi, snails and bivalves, and fishes like catfishes, mullets, puffers and stingrays	N/A - viviparous species	Shallow coastal areas in waters less than 25 m (82 ft) deep	Nurseries are in shallow turtle grass beds and shallow coral reefs	Inhabits littoral waters; shallow water species, often found lying motionless on the bottom under coral reefs or rocks
Oceanic Whitetip Shark (*Carcharhinus longimanus*)*	Pelagic-Oceanic	0-230 m (0-754.6 ft) Usually 0-152 m (0-498.7 ft)	yes	Oceanic bony fishes, also threadfins, stingrays, sea turtles, sea birds, gastropods, squid, crustaceans, mammalian carrion and garbage	N/A - viviparous species	--	--	Warm oceanic waters; water deeper than 180 m and warmer than 21 °C (69.8 °F)
Sand Tiger Shark (*Carcharias taurus*)	Reef-Associated	1-191 m (3.3-626.6 ft) Usually 15-25 m (49.2-82 ft)	yes	Bony fishes, small sharks, rays, squids, crabs, and lobsters	N/A - ovoviviparous species	--	--	Common littoral shark found inshore from the surf zone and in shallow bays to at least 191 m on the outer continental shelves; often on or near the bottom but also occurs in midwater or at the surface
Southern Ray (*Hypanus americanus*)	Reef-Associated	0-53 m (0-173.9 ft) Usually up to 4 m (13.1 ft)	Yes	Bivalves, worms, shrimps, crabs, and small fishes	N/A - ovoviviparous species	--	--	Found on sandy bottoms, seagrass beds, lagoons and the reef face; buries in the sand during the day and forages at night, usually in seagrass beds
Swordfish (*Xiphias gladius*)	Pelagic-Oceanic	0-2,878 m (0-9,442.2 ft) Usually 0-550 m (0-1,804.5 ft)	yes	Fishes (Atlantic mackerel, barracudinas, silver hake, redfish, herring and lanternfishes)	Pelagic	Pelagic	Pelagic waters warmer than 18 °C (64.4 °F)	Epipelagic to meso-pelagic, and are usually found in waters warmer than 13 °C (55.4 °F)
Tiger Shark (*Galeocerdo cuvier*)	Coastal Demersal	0-800 m (0-2,624.7 ft) Usually 0-140 m (0-459.3 ft)	yes	Other sharks, rays, bony fishes, marine mammals, tortoises, seabirds, sea snakes, squids, gastropods, crustaceans, detritus	N/A - viviparous species	Shallow coastal areas	Shallow coastal areas	Warm waters in both deep oceanic and shallow coastal regions
White Marlin (*Kajikia albida*)	Pelagic-Oceanic	0-150 m (0-492.1 ft)	yes	Fishes and squids	Pelagic	Pelagic	Pelagic waters warmer than 22 °C (71.6 °F)	Oceanic, epipelagic species; usually occur above the thermocline in deep, blue waters
Yellowfin Tuna (*Thunnus albacares*)	Pelagic-Oceanic	1-250 m (3.3-820.2 ft) Usually 1-100 m (3.3-328.1 ft)	yes	Fishes, crustaceans and squids	Pelagic	Pelagic	Pelagic; found in schools at the surface, mixing with skipjack and bigeye tuna	Epipelagic, oceanic species, found in water temperatures 18-31 °C (64.4-87.8 °F)

* Indicates federally listed species
-- = data not available

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APPENDIX C

POTENTIAL IMPACTS FROM NOISE ASSOCIATED WITH STEEL SHEET PILE INSTALLATION

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Potential Impacts from Noise Associated with Steel Sheet Pile Installation

Potential Impacts from Noise. Approximately 202 steel sheet piles, or 101 pairs of steel sheet piles, would be driven for this project. Assuming no major subsurface obstructions are encountered when driving the piles, each new sheet pile would be installed using a vibratory hammer mounted to a crane. If no subsurface obstructions are encountered, it is estimated that each pile would require approximately 10 to 15 minutes of vibratory installation to seat each pile at the design depth. If repositioning of the work barge and/or driving templates is not required, there would be a break of approximately 10 to 15 minutes between driving of each pile. It is estimated that this process would allow approximately 5 to 10 steel sheet piles to be installed per day. Based on these assumptions and not accounting for any unexpected subsurface conditions or other factors, it is estimated that the pile installation process for this project would take approximately 12 to 14 work weeks, which includes setup and relocation of driving templates, predrilling/preforming, sheet pile installation, and barge/equipment repositioning.

If a subsurface obstruction is encountered which the vibratory hammer cannot drive the pile, subsurface predrilling/preforming methods would be used to fracture and/or perforate the hard rock layers in order to allow for sheet pile installation. It is anticipated that some amount of predrilling may be required for approximately 100 of the 500 linear feet of the sheet piles due to anticipated subsurface conditions, such as cemented bedrock. The predrilling process would consist of a crane mounted drilling rig with auger bit that penetrates the mudline at the intended sheet pile footprint and is advanced through the subsurface layers to a sufficient depth until the obstruction is perforated or fractured sufficiently to install the steel sheet piles. Such methods do not generally produce significant noise, aside from the above-water equipment used to advance the auger bit.

The concrete placement methods for the 200 feet at the eastern portion of the project area are not expected to produce noise levels approaching the levels produced by the pile installation methods.

When a pile driving (impact) hammer strikes a pile, a pulse is created that propagates through the pile and radiates sound into the water, the ground substrate, and the air. Sound pressure pulse as a function of time is referred to as the waveform. In terms of acoustics, these sounds are described by the peak pressure, the root-mean-square pressure (RMS), and the sound exposure level (SEL). However, for this project, the use of impact hammers would be prohibited during construction and only the use of vibratory hammers would be used during installation of the sheet pile for this project. It is assumed that any underwater noise levels produced by vibratory pile driving will be below the noise levels produced by the impact hammer. Because any noise generated during vibratory pile driving will be less than would be produced during proofing of the piles using an impact hammer, the analysis considering the effects of noise during pile installation is conservative.

Transmission Loss Calculations and NMFS Disturbance and Injury Thresholds

Type of Equipment	Peak sound level at 10 m (dB/1 µPa)	In-water sound level (RMS) at 10 m (dB/1 µPa)	Sound exposure level (SEL) at 10 m (dB/1 µPa ^{2}·s)	Distance to 150 dB sSEL fish injury threshold*	Distance to 150 dB RMS fish disturbance threshold*
Vibratory Hammer; 50-inch wide steel sheet pile	175	160	160	54 meters (177 feet)	80 meters (262 feet)

*Values for distances to fish injury and disturbance thresholds are based on use of impact hammer with nylon cushion blocks (Peak Sound at 10 m = 198 dB, RMS = 185 dB, SEL = 172 dB) (CA DOT 2009) and are therefore conservative for this project, which would use only vibratory hammer methods that produce less sound; sSEL = single-strike SEL; cSEL = cumulative SEL.

Based on information on underwater noise levels associated with vibratory hammer driving of a 50-inch-wide steel sheet pile, peak sound pressures of 175 decibels (dB), RMS sound pressure levels of 160 dB, and SELs of 160 dB at 10 meters (33 feet) from the pile were used to estimate transmission loss (Hastings 2010 and NOAA Fisheries Service). The peak sound level for underwater noise thresholds used by NMFS that may result in injury to fish is 206 dB. The estimated peak sound levels expected to be produced by any process for this project are below this threshold.

The fish injury and disturbance thresholds presented in the table and discussed below should be considered conservative, as they are based on the use of an impact hammer with nylon cushion blocks, as opposed to the vibratory hammer that would be used for the proposed action, which would produce lower sound levels. The single-strike SEL (sSEL) fish injury threshold of 150 dB (surrogate for a cumulative SEL fish injury threshold of 187 dB) is estimated to be (54 meters) 177 feet from the pile. Although fish could be exposed to noise levels at or above the projected 150 dB sSEL injury threshold for fish throughout most of the project area, this distance is overestimated and represents only a small portion of Christiansted Harbor. The use of a soft start of the vibratory hammer would give fish an opportunity to vacate the area before sound levels rise further and reduce the potential exposure risk.

The projected 150 dB disturbance threshold for fish would extend approximately 80 meters (262 feet) from the steel sheet piles. It is expected that fish that near the 150-dB area of influence would move away from the noise source, as there is ample fish habitat available in Christiansted Harbor. This possible modification of normal movement patterns of some individuals is expected to be insignificant because underwater noise would be limited in duration, affect only a small area within the harbor, and would not pose a barrier to migration or the availability of other more suitable habitat. Thus, interference with feeding, reproduction, migration, or other activities necessary for survival is not expected.

Because of the relatively small area within Christiansted Harbor that would be affected, and that larger fish species would likely vacate the area during construction, it is unlikely that pile installation would result in injury and or significant behavioral effects to EFH fish species.

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APPENDIX D

SUMMARY OF POTENTIAL IMPACTS FOR SPECIES WITH DESIGNATED ESSENTIAL FISH HABITAT

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Summary of Potential Impacts for Species with Designated EFH

Species	Life Stage	Potential Impacts	Effects Determination*
Corals			
Blushing Star Coral (*Stephanocoenia intersepta*)	G, J, A	corals 5 cm or larger that do not show outward signs of disease would be relocated prior to construction activities; relocation would be completed outside of peak hard coral spawning and bleaching periods (July 1 to October 31), as established through consultation with NOAA NMFS and VIDPNR	Minimal effects
Boulder Brain Coral (*Colpophyllia natans*)	G, J, A	corals 5 cm or larger that do not show outward signs of disease would be relocated prior to construction activities; relocation would be completed outside of peak hard coral spawning and bleaching periods (July 1 – October 31), as established through consultation with NOAA NMFS and VIDPNR	Minimal effects
Club Finger Coral (*Porites porites*)	G, J, A	corals 5 cm or larger that do not show outward signs of disease would be relocated prior to construction activities; relocation would be completed outside of peak hard coral spawning and bleaching periods (July 1 – October 31), as established through consultation with NOAA NMFS and VIDPNR	Minimal effects
Elkhorn Coral** (*Acropora palmata*)	G, J, A	corals 5 cm or larger that do not show outward signs of disease would be relocated prior to construction activities; relocation would be completed outside of peak hard coral spawning and bleaching periods (July 1 – October 31), as established through consultation with NOAA NMFS and VIDPNR	No adverse effect (MSA) No adverse effect (ESA)
Elliptical Star Coral (*Dichocoenia stokesi*)	G, J, A	corals 5 cm or larger that do not show outward signs of disease would be relocated prior to construction activities; relocation would be completed outside of peak hard coral spawning and bleaching periods (July 1 – October 31), as established through consultation with NOAA NMFS and VIDPNR	Minimal effects
Flower Coral (*Eusmilia fastigiata*)	G, J, A	corals 5 cm or larger that do not show outward signs of disease would be relocated prior to construction activities; relocation would be completed outside of peak hard coral spawning and bleaching periods (July 1 – October 31), as established through consultation with NOAA NMFS and VIDPNR	Minimal effects
Golf Ball Coral (*Favia fragum*)	G, J, A	corals 5 cm or larger that do not show outward signs of disease would be relocated prior to construction activities; relocation would be completed outside of peak hard coral spawning and bleaching periods (July 1 – October 31), as established through consultation with NOAA NMFS and VIDPNR	Minimal effects
Knobby Brain Coral (*Diploria clivosa*)	G, J, A	corals 5 cm or larger that do not show outward signs of disease would be relocated prior to construction activities; relocation would be completed outside of peak hard coral spawning and bleaching periods (July 1 – October 31), as established through consultation with NOAA NMFS and VIDPNR	Minimal effects

Species	Life Stage	Potential Impacts	Effects Determination*
Lesser Starlet Coral (*Siderastrea radians*)	G, J, A	corals 5 cm or larger that do not show outward signs of disease would be relocated prior to construction activities; relocation would be completed outside of peak hard coral spawning and bleaching periods (July 1 – October 31), as established through consultation with NOAA NMFS and VIDPNR	Minimal effects
Lettuce Coral (*Agaricia agaricites*)	G, J, A	corals 5 cm or larger that do not show outward signs of disease would be relocated prior to construction activities; relocation would be completed outside of peak hard coral spawning and bleaching periods (July 1 – October 31), as established through consultation with NOAA NMFS and VIDPNR	Minimal effects
Lobed, Boulder Star, Mountainous Star Coral** (*Orbicella annularis* species complex)	G, J, A	corals 5 cm or larger that do not show outward signs of disease would be relocated prior to construction activities; relocation would be completed outside of peak hard coral spawning and bleaching periods (July 1 – October 31), as established through consultation with NOAA NMFS and VIDPNR	Minimal effects (MSA) May affect, not likely to adversely affect (ESA)
Massive Starlet Coral (*Siderastrea siderea*)	G, J, A	corals 5 cm or larger that do not show outward signs of disease would be relocated prior to construction activities; relocation would be completed outside of peak hard coral spawning and bleaching periods (July 1 – October 31), as established through consultation with NOAA NMFS and VIDPNR	Minimal effects
Maze Coral (*Meandrina meandrites*)	G, J, A	corals 5 cm or larger that do not show outward signs of disease would be relocated prior to construction activities; relocation would be completed outside of peak hard coral spawning and bleaching periods (July 1 – October 31), as established through consultation with NOAA NMFS and VIDPNR	Minimal effects
Mustard Hill Coral (*Porites astreoides*)	G, J, A	corals 5 cm or larger that do not show outward signs of disease would be relocated prior to construction activities; relocation would be completed outside of peak hard coral spawning and bleaching periods (July 1 – October 31), as established through consultation with NOAA NMFS and VIDPNR	Minimal effects
Rose Coral (*Manicina areolata*)	G, J, A	corals 5 cm or larger that do not show outward signs of disease would be relocated prior to construction activities; relocation would be completed outside of peak hard coral spawning and bleaching periods (July 1 – October 31), as established through consultation with NOAA NMFS and VIDPNR	Minimal effects
Staghorn Coral** (*Acropora cervicornis*)	G, J, A	corals 5 cm or larger that do not show outward signs of disease would be relocated prior to construction activities; relocation would be completed outside of peak hard coral spawning and bleaching periods (July 1 – October 31), as established through consultation with NOAA NMFS and VIDPNR	No adverse effect (MSA) No adverse effect (ESA)
Symmetrical Brain Coral (*Diploria strigosa*)	G, J, A	corals 5 cm or larger that do not show outward signs of disease would be relocated prior to construction activities; relocation would be completed outside of peak hard coral spawning and bleaching periods (July 1 – October 31), as established through consultation with NOAA NMFS and VIDPNR	Minimal effects

Species	Life Stage	Potential Impacts	Effects Determination*
Whitestar Sheet Coral (*Agaricia lamarcki*)	G, J, A	corals 5 cm or larger that do not show outward signs of disease would be relocated prior to construction activities; relocation would be completed outside of peak hard coral spawning and bleaching periods (July 1 – October 31), as established through consultation with NOAA NMFS and VIDPNR	Minimal effects
Marine Invertebrates			
Queen Conch (*Lobatus gigas*)	J, A	unlikely/occasional inhabitant of seagrass area (juvenile) and sandy and rocky areas (adult); indirect impacts from loss of small area of habitat and forage area; potential direct impact (injury or disturbance) from construction noise due to inability to move from noise source quickly; direct impacts from marine vessel strikes are unlikely, as in-water work with a barge and push boat would be prohibited in turtle grass area and a marine observer would be present during all in-water construction	Minimal effects
Spiny Lobster (*Panulirus argus*)	L, J, A	potential mortality (larvae) from bulkhead installation and increased turbidity; direct impacts from loss of small area of refuge habitat (larvae); indirect impacts from loss of small area of seagrass habitat (juveniles) and rocky bottom habitat (adults) and a temporary decrease in prey species; direct impacts from noise and marine vessel strikes are unlikely, as individuals would vacate the construction area, in-water work with a barge and push boat would be prohibited in turtle grass area, a marine observer would be present, and a turbidity curtain used during in-water construction	Minimal effects
Reef Fish			
Buffalo Trunkfish (*Lactophrys trigonus*)	A	indirect impacts from loss of small area of seagrass habitat used for forage and refuge habitat; negligible indirect impact from temporary decrease in benthic prey and visibility due to sediment disturbance; no impact from marine vessel strikes due to mobility, use of turbidity curtains, and marine observer during in-water construction; negligible impact from disturbance due to construction noise	Minimal effects
Grey Snapper (*Lutjanus griseus*)	J, A	indirect impacts from loss of small area of seagrass and sandy (juvenile) and rocky bottom (adult) habitats used for forage and refuge habitat; negligible indirect impact from temporary decrease in benthic prey and visibility due to sediment disturbance; no impact from marine vessel strikes due to mobility, use of turbidity curtains, and marine observer during in-water construction; negligible impact from disturbance due to construction noise	Minimal effects
Mutton Snapper (*Lutjanus analis*)	J, A	indirect impacts from loss of small area of seagrass and sandy (juvenile) and rocky bottom (adult) habitat used for forage and refuge habitat; negligible indirect impact from temporary decrease in benthic prey and visibility due to sediment disturbance; no impact from marine vessel strikes due to mobility, use of turbidity curtains and marine observer during in-water construction; negligible impact from disturbance due to construction noise	Minimal effects

Species	Life Stage	Potential Impacts	Effects Determination*
Nassau Grouper** (*Epinephelus striatus*)	J, A	indirect impacts from loss of small area of seagrass (juvenile) and rocky bottom (adult) habitat used for forage and refuge habitat; negligible indirect impact from temporary decrease in benthic prey and visibility due to sediment disturbance; no impact from marine vessel strikes due to mobility, use of turbidity curtains, and marine observer during in-water construction; negligible impact from disturbance due to construction noise	Minimal effects (MSA) May affect, not likely to adversely affect (ESA)
Queen Triggerfish (*Balistes vetula*)	A	indirect impacts from loss of small area of seagrass, rocky, and sandy habitats used for forage and refuge habitat; negligible indirect impact from temporary decrease in benthic prey and visibility due to sediment disturbance; no impact from marine vessel strikes due to mobility, use of turbidity curtains and marine observer during in-water construction; negligible impact from disturbance due to construction noise	Minimal effects
Red Hind (*Epinephelus guttatus*)	J, A	indirect impacts from loss of small area of sand and rubble bottom (juvenile) and rocky (juvenile/adult) habitat used for forage habitat; negligible indirect impact from temporary decrease in benthic prey and visibility due to sediment disturbance; no impact from marine vessel strikes due to mobility, use of turbidity curtains, and marine observer during in-water construction; negligible impact from disturbance due to construction noise	Minimal effects
Redtail Parrotfish (*Sparisoma chrysopterum*)	E, L, J, A	potential mortality from bulkhead installation and increased turbidity (eggs/larvae); direct impacts from loss of small area of seagrass refuge habitat (eggs/larvae); indirect impacts from loss of small area of seagrass habitat (adult/juvenile) used for forage and refuge habitat; negligible indirect impact from temporary decrease in benthic forage and visibility due to sediment disturbance; no impact from marine vessel strikes due to mobility, use of turbidity curtains, and marine observer during in-water construction; negligible impact from disturbance due to construction noise	Minimal effects
Sand Tilefish (*Malacanthus plumieri*)	A	indirect impacts from loss of small area of sand/rubble bottom and seagrass habitat used for forage habitat; negligible indirect impact from temporary decrease in benthic prey and visibility due to sediment disturbance; no impact from marine vessel strikes due to mobility, use of turbidity curtains, and marine observer during in-water construction; negligible impact from disturbance due to construction noise	Minimal effects
Schoolmaster Snapper (*Lutjanus apodus*)	J	indirect impacts from loss of small area of seagrass habitat used for forage and refuge habitat; negligible indirect impact from temporary decrease in benthic prey and visibility due to sediment disturbance; no impact from marine vessel strikes due to mobility, use of turbidity curtains, and marine observer during in-water construction; negligible impact from disturbance due to construction noise	Minimal effects
Scrawled cowfish (*Acanthostracion quadricornis*)	A	indirect impacts from loss of small area of seagrass habitat used for forage and refuge habitat; negligible indirect impact from temporary decrease in benthic prey and visibility due to sediment disturbance; no impact from marine vessel strikes due to mobility, use of turbidity curtains, and marine observer during in-water construction; negligible impact from disturbance due to construction noise	Minimal effects

Species	Life Stage	Potential Impacts	Effects Determination*
Squirrelfish (*Holocentrus adscensionis*)	A	indirect impacts from loss of small area of sandy and seagrass habitat used for forage habitat; negligible indirect impact from temporary decrease in benthic prey and visibility due to sediment disturbance; no impact from marine vessel strikes due to mobility, use of turbidity curtains, and marine observer during in-water construction; negligible impact from disturbance due to construction noise	Minimal effects
Striped Croaker** (*Corvula sanctaeluciae*)	J, A	indirect impacts from loss of small area of rocky (juvenile) and muddy and sandy bottom (juvenile and adult) habitat used for forage habitat; negligible indirect impact from temporary decrease in benthic prey and visibility due to sediment disturbance; no impact from marine vessel strikes due to mobility, use of turbidity curtains, and marine observer during in-water construction; negligible impact from disturbance due to construction noise	Minimal effects (MSA) May affect, not likely to adversely affect (ESA)
White Grunt (*Haemulon plumieri*)	J, A	indirect impacts from loss of small area of seagrass/sandy/rocky (juvenile) and sandy bottom (adult) habitat used for forage and refuge habitat; negligible indirect impact from temporary decrease in benthic prey and visibility due to sediment disturbance; no impact from marine vessel strikes due to mobility, use of turbidity curtains, and marine observer during in-water construction; negligible impact from disturbance due to construction noise	Minimal effects
Yellowtail Snapper (*Ocyurus chrysurus*)	J	indirect impacts from loss of small area of seagrass habitat used for forage and refuge habitat; negligible indirect impact from temporary decrease in benthic prey and visibility due to sediment disturbance; no impact from marine vessel strikes due to mobility, use of turbidity curtains, and marine observer during in-water construction; negligible impact from disturbance due to construction noise	Minimal effects
Highly Migratory Species			
Blacktip Shark (*Carcharhinus limbatus*)	N, J, A	unlikely inhabitant of/potential transient in project area; indirect impacts from loss of small area of forage and refuge habitat; negligible indirect impact from temporary decrease in prey species and visibility due to sediment disturbance; no impact from marine vessel strikes due to mobility, use of turbidity curtains, and marine observer during in-water construction; negligible impact from disturbance due to construction noise	Minimal effects
Caribbean Reef Shark (*Carcharhinus perezi*)	N, J, A	unlikely inhabitant of/potential transient in project area; indirect impacts from loss of small area of forage and refuge habitat; negligible indirect impact from temporary decrease in prey species and visibility due to sediment disturbance; no impact from marine vessel strikes due to mobility, use of turbidity curtains, and marine observer during in-water construction; negligible impact from disturbance due to construction noise	Minimal effects

Species	Life Stage	Potential Impacts	Effects Determination*
Dusky shark (*Carcharhinus obscurus*)	N, J	unlikely inhabitant of/potential transient in project area; indirect impacts from loss of small area of forage and refuge habitat; negligible indirect impact from temporary decrease in prey species and visibility due to sediment disturbance; no impact from marine vessel strikes due to mobility, use of turbidity curtains, and marine observer during in-water construction; negligible impact from disturbance due to construction noise	Minimal effects
Lemon Shark (*Negaprion brevirostris*)	N, A	unlikely inhabitant of/potential transient in project area; indirect impacts from loss of small area of forage and refuge habitat; negligible indirect impact from temporary decrease in prey species and visibility due to sediment disturbance; no impact from marine vessel strikes due to mobility, use of turbidity curtains, and marine observer during in-water construction; negligible impact from disturbance due to construction noise	Minimal effects
Nurse Shark (*Ginglymostoma cirratum*)	N, J, A	unlikely inhabitant of/potential transient in project area; indirect impacts from loss of small area of forage and refuge habitat; negligible indirect impact from temporary decrease in prey species and visibility due to sediment disturbance; no impact from marine vessel strikes due to mobility, use of turbidity curtains, and marine observer during in-water construction; negligible impact from disturbance due to construction noise	Minimal effects
Sand tiger shark (*Carcharias taurus*)	A	unlikely inhabitant of/potential transient in project area; indirect impacts from loss of small area of forage habitat; negligible indirect impact from temporary decrease in prey species and visibility due to sediment disturbance; no impact from marine vessel strikes due to mobility, use of turbidity curtains, and marine observer during in-water construction; negligible impact from disturbance due to construction noise	Minimal effects
Southern Ray (*Hypanus americanus*)	A	unlikely inhabitant of/potential transient in project area; indirect impacts from loss of small area of forage habitat; negligible indirect impact from temporary decrease in prey species and visibility due to sediment disturbance; no impact from marine vessel strikes due to mobility, use of turbidity curtains, and marine observer during in-water construction; negligible impact from disturbance due to construction noise	Minimal effects
Tiger Shark (*Galeocerdo cuvier*)	N, J, A	unlikely inhabitant of/potential transient in project area; indirect impacts from loss of small area of forage and refuge habitat; negligible indirect impact from temporary decrease in prey species and visibility due to sediment disturbance; no impact from marine vessel strikes due to mobility, use of turbidity curtains, and marine observer during in-water construction; negligible impact from disturbance due to construction noise	Minimal effects

Notes: G = Gametes, E = eggs, L = larvae, N= neonates, J = juveniles, A = adults

* This column presents the effects determination under the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations; for federally listed species (indicated by ** next to the species name), this column presents both Magnuson-Stevens Fishery Conservation and Management Act determination and the Endangered Species Act determination, noted with (MSA) and (ESA), respectively.

** Indicates a federally listed species

APPENDIX E

DRAFT MEMORANDUM OF AGREEMENT

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DRAFT MEMORANDUM OF AGREEMENT
Between
THE NATIONAL PARK SERVICE
And
THE VIRGIN ISLANDS STATE HISTORIC PRESERVATION OFFICE
Regarding
MITIGATION OF ADVERSE EFFECTS FOR ACTIVITIES ASSOCIATED WITH THE REPLACEMENT OF THE WHARF BULKHEAD ALONG THE CHRISTIANSTED NATIONAL HISTORIC SITE WATERFRONT

May 2019

WHEREAS, the Christiansted National Historic Site (NHS) is a unit of the National Park Service (NPS) within the NPS Southeast Region and charged to meet the directives of the NPS Organic Act of 1916 (P.L. 64-235, 39 Stat. 535) to "conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations," as it applies to the park units; and

WHEREAS, the NPS is proposing to replace the existing wharf bulkhead along the Christiansted NHS waterfront (project). Christiansted NHS is located in the historic town of Christiansted on the island of St. Croix, US Virgin Islands (see attachment A); and

WHEREAS, the NPS, in compliance with the National Environmental Policy Act of 1969, as amended (NEPA) (Public Law 91–190), its implementing regulations (40 CFR 1500-1508), and the Department of the Interior's NEPA regulations (43 CFR Part 46), has prepared an environmental assessment. The assessment of potential impacts determined that the project could affect two isolated artifacts are located within the project area; and

WHEREAS, the NPS recognizes that in 1998, the US Virgin Islands enacted Law Number 6234, known as the Antiquities and Cultural Properties Act (codified in Title 29, Chapter 17 of the US Virgin Islands Code [29 V.I.C.]). This law sets forth the policies and responsibilities of the Territory to protect and manage its terrestrial and marine historical, cultural, and archeological resources for the benefit of its citizens; and

WHEREAS, by this law, the NPS recognizes that the Government of the Virgin Islands lays an exclusive claim of ownership over all historical, cultural, and archeological materials located on lands owned by the Territory, whether on land or submerged within three miles of the coastline; and

WHEREAS, the NPS has determined that this Project constitutes an undertaking subject to review under Section 106 of the National Historic Preservation Act (NHPA), as amended, 54 USC 306108 (formerly 16 USC § 470f), *Protection of Historic Properties*, its implementing regulations, 36 CFR Part 800, herein referred to as Section 106, and 29 V.I.C. Chapter 17, § 952; and

WHEREAS, the NPS has determined that implementation of this Project may affect properties listed in or eligible for listing in the National Register of Historic Places (NRHP) or the Virgin Islands Registry of Historic Places, and the NPS has consulted with the US Virgin Island State Historic Preservation Office (VISHPO) pursuant to 36 CFR Part 800.14(b)(1)(ii); and

WHEREAS, the NPS has notified the Advisory Council on Historic Preservation (ACHP) of the potential adverse effect pursuant to 36 CFR Part 800.6(a)(1) and 36 CFR Part 800.14(b)(3) on (add date) and has invited the ACHP to participate in consultation and the ACHP has declined to participate; and

WHEREAS, the NPS has solicited and considered the views of the public using its NEPA public involvement procedures pursuant to 40 CFR Part 1500.2(d) and 40 CFR Part 1506.6, and National Preservation Act notification 36 CFR 800.2 (d) (2); the NPS has notified the public through news releases (April xx, 2019), a public scoping meeting (insert dates), and public review period (April xx - May xx, 2019); and

NOW, THEREFORE, the NPS and the VISHPO agree that should the NPS proceed with the Undertaking, the NPS will ensure that the following stipulations are implemented to satisfy the NPS's Section 106 responsibilities for all individual actions related to the Undertaking:

STIPULATIONS

I. UNDERWATER ARCHEOLOGICAL RESOURCES

A. The NPS will have the two artifacts (e.g., 18th century wooden stock anchor and 18th to mid-19th century cannon) currently located within the work limits of the project area relocated to a place of VISHPO designation. The VISHPO will be on sight during any relocation activities.

B. During removal, the artifact(s) will be lifted straight up and moved using air bags or a crane winch, rather than dragging it, to the relocation site, to avoid causing damage to it or other marine resources.

C. Relocation will be performed by commercial divers and relocated to a site designated by VISHPO. The relocation site will be inspected prior to work to ensure installation of cannon and anchor will not impact any marine or cultural submerged resources in the area.

D. The contractor or other entity responsible for the relocation of the artifacts will be required to abstain from revealing either the original location, or the place of relocation, of the object(s). The contractor will not take pictures and will not share or post any information regarding the relocation on social media or will not take any action that would create a risk of loss of archeological resources, as per 29 V.I.C. Chapter 17 § 961. Confidentiality of site location.

E. The VISHPO will take full responsibility for the selected relocation site for the artifacts and full responsibility of the artifacts following relocation.

F. Any press releases by NPS and VISHPO will emphasize the Antiquities and Cultural Properties Act (V.I.C. 29) and state that violators of the law (someone who appropriates, excavates, injures or destroys or cause to be appropriated, excavated, injured or destroyed any historical, cultural or archeological site, object, specimen, artifact, ruin, or feature situated in lands owned by the Government without a valid permit) may result in criminal and civil penalties.

II. TERRESTRIAL HISTORIC PROPERTIES

G. Terrestrial acoustic monitoring would be employed during construction activities to ensure noise levels are below acceptable requirements that would be determined through agency consultation and historic structures are not damaged from vibrations.

H. A buffer of 10 to 12 feet will be established between any historic structure and work area, except where the bulkhead meets the Fort Christiansvaern wing wall.

I. An archeological monitor would be employed during the construction activities to observe and stop work if previously unknown archeological resources are discovered. NPS shall ensure that all application documents include the following provisions:

1. If previously unidentified historic properties or unanticipated effects to historic properties are discovered during replacement activities, the contractor shall immediately halt all activity within a one hundred (100) foot radius of the discovery, notify the NPS and VISHPO of the discovery and implement interim measures to protect the discovery from looting and vandalism. VISHPO will determine next actions for materials found during work.

2. Immediately upon receipt of the notification required in Stipulation II.B.1 of this MOA, the NPS shall:

    a) inspect the application site to determine the extent of the discovery and ensure that activities have halted;

    b) clearly mark the area of the discovery;

    c) implement additional measures, as appropriate, to protect the discovery from looting and vandalism; and

    d) have a professional archeologist inspect the application site to determine the extent of the discovery and provide recommendations regarding its NRHP eligibility and treatment; and

    e) notify the VISHPO of the discovery describing the measures that have been implemented to comply with Stipulations II.B.1 and B.2 (a-d) of this MOA.

3. Within forty-eight (48) hours of receipt of the notification described in Stipulation II.B.2 (e) of this MOA, the NPS shall provide the VISHPO with its assessment of the NRHP eligibility of the discovery and the measures it proposes to take to resolve adverse effects. In making its official evaluation, the NPS, in consultation with the VISHPO may assume the discovery to be NRHP eligible for the purposes of Section 106 pursuant to 36 CFR Part 800.13(c). The VISHPO shall respond within forty-eight (48) hours of receipt.

4. The application activities may proceed in the area of the discovery when the NPS has determined that implementation of the actions undertaken to address the discovery pursuant to Stipulation II.B are complete.

III. HUMAN REMAINS –

A. In the unlikely event that human remains are uncovered during the undertaking, the NPS shall treat all human remains in a manner consistent with the ACHP's "Policy Statement Regarding Treatment of Burial Sites, Human Remains and Funerary Objects" (February 23, 2007) or ACHP policy in effect at the time remains and funerary artifacts are handled.

IV. MONITORING AND REPORTING

Each year following the execution of this MOA until it expires or is terminated, the NPS shall provide the VISHPO a summary report detailing work undertaken pursuant to the Project and provide photographs of

work completed. The report shall include any scheduling changes proposed, any problems encountered, and disputes and objections received in the NPS's efforts to carry out the terms of the MOA.

V. DISPUTE RESOLUTION

A. Should any consulting party object in writing to the NPS regarding any action carried out or proposed with respect to this MOA or the implementation of its terms, the NPS shall consult with the objecting party in an effort to resolve the objection. If, after initiating such consultation, the NPS determines that the objection cannot be resolved, the NPS shall:

1. Forward all documentation relevant to the dispute, including the NPS's proposed resolution, to the ACHP. The ACHP shall provide the NPS with its advice on the resolution of the objection within thirty (30) days of receiving adequate documentation. Prior to reaching a final decision on the dispute, the NPS shall prepare a written response that takes into account any timely advice or comments regarding the dispute from the ACHP, consulting parties to this MOA, and provide them with a copy of this written response. The NPS will then proceed according to its final decision.

2. If the ACHP does not provide its advice regarding the dispute within the thirty (30) day time period, the NPS may make a final decision on the dispute and proceed accordingly. Prior to reaching such a final decision, the NPS shall prepare a written response that takes into account any timely comments regarding the dispute from the consulting parties to this MOA and provide them and the ACHP with a copy of such written response.

B. The NPS's responsibility to carry out all actions under this MOA that are not the subject of the objection remains unchanged.

VI. RESOLUTION OF OBJECTIONS BY THE PUBLIC

At any time during implementation of the measures stipulated in this MOA, should an objection pertaining to this MOA or the effect of the Project on historic properties be raised by a member of the public, the NPS shall notify the other consulting parties, and attempt to resolve the objection. If the NPS determines that the objection cannot be resolved, the NPS shall comply with Stipulations V.A and V.B of this MOA.

VII. AMENDMENT

Should any party to this MOA request an amendment, the requesting party shall notify all other parties in writing. The written notification shall include a statement of purpose of the required modification and the proposed working to amend the MOA. All parties shall review the proposed amendment and, if necessary, shall consult among themselves to discuss the amendment. If after consultation it is agreed that the amendment is necessary or desirable, all parties to this original MOA shall sign the amended MOA. If necessary, dispute resolution shall follow Stipulation V.

VIII. TERMINATION

If any signatory determines that the terms of this MOA will not or cannot be carried out, that party shall immediately consult with the other signatories and concurring parties to seek an amendment in accordance with Stipulation VII of this MOA. If within thirty (30) days an amendment cannot be reached, any signatory may terminate the MOA upon written notification to the other signatories and concurring parties.

Once the MOA is terminated, and prior to work continuing on the Undertaking, the NPS must either (a) execute another MOA pursuant to 36 CFR Part 800.6, or (b) request, take into account, and respond to the comments of the ACHP under 36 CFR Part 800.7. The NPS shall notify the signatories as to the course of action it will pursue.

IX. DURATION OF AGREEMENT

This MOA will expire if its terms are not carried out within five (5) years from the date of its execution. Prior to such time, the signatories may consult and agree in writing to an extension for carrying out the terms of the MOA in accordance with Stipulation VII above.

Execution of this MOA by the NPS and the VISHPO and implementation of its terms are evidence that the NPS has taken into account the effects of the Project on historic properties, and that the NPS has satisfied its Section 106 responsibilities for the Undertakings covered by this agreement.

Upon the completion of all stipulations to this MOA, the NPS shall circulate to the VISHPO a signed memorandum documenting that the NPS has fulfilled all its responsibilities under this MOA.

SIGNATORIES:

NATIONAL PARK SERVICE:

_____ Date: _____
Gregory Camacho, Acting Superintendent
Christiansted National Historic Site
National Park Service, US Department of the Interior

US VIRGIN ISLANDS STATE HISTORIC PRESERVATION OFFICER:

_____ Date: _____
Sean Krigger, Acting Director
Department of Planning and Natural Resources
Virgin Islands State Historic Preservation Office

As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering wise use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historic places, and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people. The department also promotes the goals of the Take Pride in America campaign by encouraging stewardship and citizen responsibility for the public lands and promoting citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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