U.S. INTEGRATED OCEAN OBSERVING SYSTEM (IOOS®) PROGRAM OFFICE

HIGHTOWER PARK, SATELLITE BEACH, FLORIDA ENVIRONMENTAL ASSESSMENT

FINAL

September 2022

NOAA National Ocean Service

1315 East West Highway, 2nd floor

Silver Spring, Maryland 20910

THIS PAGE INTENTIONALLY LEFT BLANK.

TABLE OF CONTENT

ES-1. EXECUTIVE SUMMARY 1

ES-1.1. Introduction ES-1

ES-1.2. Proposed Action Alternative (Preferred Alternative) ES-2

ES-1.3. No Action Alternative ES-2

ES-1.4. Document Structure ES-3

ES-1.5. Background ES-3

ES-1.6. Benefits ES-4

1. INTRODUCTION 1

1.1. Background 1

1.2. Purpose and Need for Action 1

2. PROPOSED ACTION 3

2.1. HFR Technology 3

2.2. Installation and Special Cases 3

2.3. Aesthetics 3

2.4. Hightower Park Project Description 3

2.5. Maintenance 5

2.6. Public Involvement 6

2.7. Consultation and Coordination 7

3. ALTERNATIVES, INCLUDING THE PROPOSED ACTION 8

3.1. Proposed Action Alternative (Preferred Alternative) 8

3.2. No Action Alternative 8

3.3. Alternatives Considered but Eliminated 9

3.3.1. Canova Beach Park 9

3.3.2. Patrick Air Force Base 9

3.3.3. Pelican Beach Park 10

3.4. Mitigation Common to All Alternatives 10

3.4.1. Proposed Action Alternative (Preferred Alternative) Mitigation Measures 10

3.5. Comparison of Alternatives 11

3.6. Environmental Consequences for the Preferred Action and No Action Alternative 11

3.6.1. Affected Environment and Environmental Consequences 12

3.6.2. ESA Listed Species Overview.. 16

3.7. Compliance with Other Applicable Laws 21

3.7.1. Coastal Management Zone Act.. 21

3.7.2. Endangered Species Act.. 21

3.7.3. National Historic Preservation Act 22

3.8. Cumulative Effects.. 22

3.8.1. Beach Access.. 22

3.8.2. Sea Turtle Data 25

LIST OF PREPARERS 30

Preparers.. 30

Federal, State, and Local Agencies 31

REFERENCES.. 32

APPENDICES 35

Appendix A: NOAA Environmental Compliance Questionnaire 35

Appendix B: WERA Phased Array and CODAR Systems.. 60

Appendix C: A Brief Summary Of The Peer Review Literature Regarding The Impact Of Electromagnetic (And Sound) Waves On Sea Mammals. 62

Appendix D: Consultation Regarding Biological Resources.. 76

Appendix E: Consultation Regarding Cultural Resources.. 78

Appendix F: The IOOS PEA Best Management Practices for Installation.. 83

List of Figures

Figure 1: Proposed locations for the transmit antenna (green), receive antenna (yellow), and cables, which will be installed inside of flexible pvc conduit (cyan). The HFR infrastructure placement will not impede public access to the beach or park facilities. 24

Figure 2: Sea turtle nesting by year at HFR sites in North Carolina, South Carolina, and Georgia. 27

Figure 3: Total sea turtle nestings at Florida beaches. 28

Figure 4: Total sea turtle nestings at Florida beaches, Mid-Reach and Venice. 28

List of Tables

Table 1: Tentative Timeline. 5

Table 2: Summary of Potential Impacts on Resources from the Proposed Alternatives of U.S. IOOS. 11

Table 3: Summary of the threatened species in the SECOORA region of particular concern with respect to this project. 14

Table 4: Far field estimates of the transmit antenna electric and magnetic field strength at distance. Numbers shown are for the main lobe with a gain of -2.55 dB, 13.5 MHz frequency, 30 W of transmit power and EIRP of 16.677 W. 27

LIST OF ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
CODAR	Coastal Ocean Dynamics Applications Radar
CZMA	Coastal Zone Management Act
DEP	Department of Environmental Protection
EA	Environmental Assessment
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FCC	Federal Communications Commission
FCT	Florida Communities Trust
FIT	Florida Institute of Technology
HFR	High Frequency Radar
IOOS	Integrated Ocean Observing System
LERA	Least-Expensive-Radar
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
PEA	Programmatic Environmental Assessment
SECOORA	Southeast Coastal Ocean Observing Regional Association
SHPO	State Historic Preservation Office
UGA	University of Georgia
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
VHF	Very High Frequency
WERA	Wellen Radar

ES-1. EXECUTIVE SUMMARY

ES-1.1. INTRODUCTION

NOAA's U.S. Integrated Ocean Observing System (IOOS®) Program Office is proposing to allocate federal funds to the Florida Institute of Technology (FIT) through a sub-contract with the Southeast Coastal Ocean Observing Regional Association (SECOORA). FIT will install an oceanographic high frequency radar (HFR) at Hightower Beach Park. Hightower Beach Park is a municipal park operated by the City of Satellite Beach located within the state of Florida.

The coordinates listed below are for the parking lot at Hightower Beach Park. The HFR deployment location is south and shoreward of the parking lot, approximately 100 feet away. Coordinates: Latitude: 28.194372° N; Longitude: 80.594403° W (WGS 84 datum).

This action is needed because the Hightower Beach Park HFR installation is part of a large, on-going SECOORA initiative to fill HFR coverage gaps along the southeast coastline. HFR systems measure the speed and direction of ocean surface currents in near real time. The east coast of Florida represents a large coverage gap in HFR (i.e., surface current) coverage. Four sites are slated for installation in 2022/2023 outside of sea turtle nesting season:

- FIT installation at Treasure Shores Park
- FIT installation at Hightower Beach Park
- UGA/Skidaway Institute of Oceanography installation at Kennedy Space Center
- UGA/Skidaway Institute of Oceanography installation at Cape Canaveral National Seashore

HFR is a key technology supported by U.S. IOOS and filling HFR coverage gaps will expand surface current mapping for the SECOORA region. Surface current mapping is integral to research, supporting oceanographic, fisheries, and meteorological forecasting activities. Surface current mapping is also vital for U.S Coast Guard Search and Rescue activities, monitoring and tracking hazardous materials, monitoring water quality — which includes tracking harmful algal blooms— and it supports marine navigation.

The proposed installation may have short- and long-term, negligible, adverse impacts from installation and routine maintenance activities. If trenching is required to install power supplies for new or hardened sites, there may be short-term minor to moderate adverse impacts on natural resources. There are no impacts from the operation of HFR at this site.

ES-1.2. PROPOSED ACTION ALTERNATIVE (PREFERRED ALTERNATIVE)

The preferred alternative is to undertake the proposed action: to provide funding of the installation of the Hightower Park HFR to FIT through a subcontract with SECOORA.

The Hightower Beach Park HFR will operate at the Federal Communication Commission (FCC) approved frequency of 13.5 MHz. The 12 transmit and four receive antennas are 7 feet tall with a diameter of 2 inches. All transmit and receive array antennas will be placed behind the shoreward vegetation to reduce interaction with nesting sea turtles and minimize their visual impact (i.e., make them less noticeable to park visitors). All antennas will be painted a flat green color (or other color, as appropriate) to blend in with the local vegetation and so that moonlight does not reflect off the antennas and cause a visual disturbance for newly hatched sea turtles. Cables will run from the antennas, across the vegetated dune, to the boardwalk. The cables are similar in diameter to coaxial television cables, and they will be placed inside of a flexible PVC corrugated pipe and laid atop the surface of the dune.

Installation of the HFR antennas and cables will take approximately two weeks. Installation will take place outside of turtle nesting season, which runs from April 1 – October 31. The project team would like to install the HFR system at Hightower Beach Park in November/December 2022.

ES-1.3. NO ACTION ALTERNATIVE

Under the No Action Alternative, IOOS would maintain the currently deployed assets but would not fund the installation of the Hightower Beach Park HFR. The No Action Alternative would prevent the Regional Association, SECOORA, from properly operating two other installation sites. Radar antennas have already been installed at Treasure Shores Park. The HFR installation at the Florida Communities Trust (FCT) at the Hightower Park project site includes 16 antennas, each 7 feet tall, 2 inches in diameter, as well as cabling and completes the triangulation with the Treasure Shores site. This action does not fulfill the purpose and need of the project.

Although it does not meet the purpose and need of the proposed action, the No Action Alternative serves as the baseline condition against which the benefits and effects of the proposed action are evaluated.

ES-1.4. DOCUMENT STRUCTURE

U.S. IOOS has prepared this Environmental Assessment in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This assessment discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into five parts:

- ***Introduction:*** The section includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how U.S. IOOS informed the public of the proposal and how the public responded.
- ***Comparison of Alternatives, including the Proposed Action:*** This section provides a more detailed description of the agency's proposed action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on significant issues raised by the public and other agencies. This discussion also includes possible mitigation measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.
- ***Environmental Consequences:*** This section describes the environmental effects of implementing the proposed action and other alternatives. Within each section, the affected environment is described first, followed by the effects of the No Action Alternative that provides a baseline for evaluation and comparison of the other alternatives that follow.
- ***Agencies and Persons Consulted****:* This section provides a list of preparers and agencies consulted during the development of the environmental assessment.
- ***Appendices:*** The appendices provide more detailed information to support the analyses presented in the environmental assessment.

ES-1.5. BACKGROUND

The high frequency radar (HFR) network is led by the U.S. Integrated Ocean Observing System (IOOS®). The U.S. IOOS Office is comprised of 11 regional associations, which work with academic and private sector partners to install HFR for near real-time surface current mapping and wave measurement. The regional association that covers Florida, Georgia, South Carolina, and North Carolina is the Southeast Coastal Ocean Observing Regional Association (SECOORA). HFR systems are located along most U.S. coasts with the exception of eastern Central Florida, highlighting the lack of surface current mapping in this area. As a result, the Florida Institute of Technology (FIT) has been funded through a multi-year commitment by SECOORA to install, maintain, and operate two HFR systems in eastern Central Florida.

ES-1.6. BENEFITS

The HFR current data are ingested hourly into the national surface current mapping data assembly center, hosted at Scripps Institution of Oceanography. From there the data flows to the NOAA National Data Buoy Center for National Weather Service access and to the U.S. Coast Guard for search and rescue operations and model initialization. This coastal radar data supports coastal resiliency, planning and safe participation in outdoor recreation (including boating), and the maintenance and preservation of public lands. The sea surface area mapped by the two antenna sites, Treasure Shores and Hightower Beach, extends from the coast eastward to the Gulf Stream and covers the Oculina Bank, which is a habitat of particular concern in the region.

Research and operational activities supported by HFR include:

- U.S. Coast Guard Search and Rescue
- Tracking and trajectory forecasts for environmental hazards (e.g., oil spills, pollution events, harmful algal blooms)
- Management and preservation of coastal resources (e.g., erosion, beach renourishment).
- Marine biology research (e.g., larval transport)
- Marine traffic planning (e.g., safe transit into ports)

Local community members in Satellite Beach have raised concerns about the terrestrial environmental impacts of the installation of the HFR in Hightower Beach Park to the vegetation in the dune area as well as to the listed threatened and endangered species — green sea turtle (*Chelonia mydas*), gopher tortoise (*Gopherus polyphemus*), hawksbill sea turtle (*Eretmochelys imbricata*), leatherback sea turtle (*Dermochelys coriacea*), loggerhead sea turtle (*Caretta caretta*) — and their respective designated suitable habitat. This environmental assessment analyzes the potential impacts of the installation on the Hightower Beach Park vegetation and threatened and endangered species.

1. INTRODUCTION

1.1. BACKGROUND

This Environmental Assessment (EA) was prepared by the NOAA/NOS U.S. IOOS Office in accordance with the National Environmental Policy Act (NEPA; 42 U.S.C. §§ 4321 et seq.). NEPA requires that Federal agencies carefully consider all environmental effects of their proposed actions, analyze potential environmental effects of proposed actions and their alternatives, avoid or minimize adverse effects of proposed actions, and restore and enhance environmental quality to the extent practicable during their decision making process.

This EA is being prepared using the 2020 CEQ NEPA Regulations. The effective date of the 2020 CEQ NEPA Regulations was September 14, 2020 and reviews begun after these dates are required to apply the 2020 regulations unless there is a clear and fundamental conflict with an applicable statute. 85 Fed. Reg. at 43372-73 (§§ 1506.13, 1507.3(a)). This EA began on July 7, 2021, and accordingly proceeds under the 2020 regulations.

1.2. PURPOSE AND NEED FOR ACTION

HFR systems measure the speed and direction of ocean surface currents in near real time. HFR can measure currents over a large region of the coastal ocean, from a few kilometers up to 200 kilometers, and can operate under any weather conditions. They are located near the water's edge and need not be situated atop a high point of land. HFR systems are the only sensors that can measure large areas at once with the detail required for important applications. For comparison, satellites do not have this capability near the coastline.

HFR is a key technology supported by the U.S. IOOS Office. Surface current mapping is integral to research and modeling activities as well as for supporting oceanographic, fisheries, and meteorological research. Surface current mapping is also vital for U.S Coast Guard search and rescue activities, monitoring and tracking hazardous materials, monitoring water quality (including tracking harmful algal blooms), and supporting marine navigation. The purpose of this project is part of a large, on-going SECOORA initiative to fill HFR coverage gaps. The east central coast of Florida represents a large coverage gap in HFR measurements. Filling HFR coverage gaps will expand surface current mapping for the SECOORA region.

This action is needed because two HFR sites are required to map sea surface currents. The southern HFR location will be at Treasure Shores Park in Indian River County while the northern site is targeted for Hightower Beach Park in Satellite Beach. The placement of the antenna array will provide optimal coverage offshore, maximizing data reliability and product availability to all coastal interests, including local emergency management and coastal management.

U.S. IOOS manages a national data management and distribution system for all U.S. HFRs as well as radars operated by investigators in Canada and Mexico. Presently, approximately 150 HFRs and 30 institutions are part of the network, and their data are delivered by IOOS national data servers. The development server and data display are provided by Scripps Institution of Oceanography's Coastal Observing Research and Development Center. The server's mirror is at the NOAA National Data Buoy Center while data failover redundancy is also provided at Rutgers University. Data file management and distribution follow internationally accepted standards; for example, netCDF-CF file and metadata formats and OpenGIS® Web Coverage Service Interface Standard for interoperable delivery of gridded data. Data delivery is accomplished using a THREDDS Data Server.

In June 2016, U.S. IOOS completed a Programmatic Environmental Assessment (PEA) to facilitate the collection, processing, distribution, and analysis of oceanographic data related to environmental conditions of coastal, ocean, and Great Lakes systems to broaden understanding of the natural phenomena and human influences on those phenomena affecting the ecosystems.

2. PROPOSED ACTION

2.1. HFR TECHNOLOGY

The WERA® (Appendix B) HFR is a phased array system that typically consists of four transmit antennas with 8-16 receive antenna elements. These receive elements are typically evenly spaced in an approximately 100 meter line along the shore, depending on the transmit frequency and the number of elements, with receive and transmit arrays being separated by tens of meters. The four elements of the transmit array are usually arranged in a rectangular pattern with each element being 2-6 meters in height depending on transmit frequency. Currently SECOORA has four WERA radar systems in the Miami area, four along the Georgia/South Carolina coast, one on the North Carolina coast, and two on the west coast of Florida.

2.2. INSTALLATION AND SPECIAL CASES

Cables are typically laid atop the ground. In some sites cables are run through a plastic conduit and in some cases property owners require cables to be buried. For example, during a recent installation in Florida, the county required the cables to be buried as the HFR is located on a public beach. In this case the ditch for the cable run was 1.5 feet deep and 10 inches wide. The county provided the permit and the equipment to dig the trench.

2.3. AESTHETICS

Often antennas must comply with local ordinances and aesthetic code. Installations have employed some creative approaches to meet local requirements. Examples include:

- The Lighthouse Historical Society provided approval for the installation of an HFR antenna on the Block Island Lighthouse.
- Operators disguised an antenna as a flag pole for an installation on a public beach in Florida.
- Antennas were installed within fence posts in Hawaii to disguise them on a local beach.
- Antennas are painted green or brown to blend in with local vegetation.

2.4. HIGHTOWER PARK PROJECT DESCRIPTION

The Hightower Beach Park HFR will operate at the Federal Communication Commission (FCC) approved frequency 13.5 MHz. Its 12 transmit and four receive antennas are 7 feet tall with a diameter of 2 inches. All transmit and receive array antennas will be placed behind the shoreward vegetation to reduce interaction with nesting sea turtles and minimize their visual impact (i.e., make them less noticeable to park visitors). All antennas will be painted a flat green color (or other color, as appropriate) to blend in with the local vegetation. Additionally, painting the antennas assures that moonlight does not reflect off them and potentially cause a visual disturbance for newly hatched sea turtles. Cables will run from the antennas, across the vegetated dune, to the boardwalk. The cables are similar in diameter to coaxial television cables, and they will be placed inside of a flexible PVC corrugated pipe and laid atop the surface of the dune. Placing the cables inside of the corrugated pipe will protect the cables from beach mice and other wildlife that may chew on them. Additionally, placing the cables on the surface of the dunes will minimize impacts to dune vegetation since the cables will not be buried (burial would require trenching and could damage plant root structures). Over time, sand will cover the corrugated pipe and it will not be visible.

Once the cables reach the boardwalk, they will be attached to the underside with J hooks or clamps so that they are off the ground and not visible to park visitors while also mitigating impacts to dune flora and fauna. The cables will run the length of the boardwalk to the trailer/shed. The boardwalk already has utility and electrical cables run above ground under the boardwalk. This pre-existing cableway configuration is similar to what is being proposed by FIT for running the HFR cables under the boardwalk.

FIT will install shelves along with the WERA HFR transmitter/receiver chassis, computer equipment, and other electronics (e.g., wireless router) inside of the shed, which will sit on top of a towable trailer. Please see Appendix 2 for the proposed location of the trailer/shed adjacent to the parking lot. The trailer/shed combo will be placed near the restroom facility as electricity is available at this location. By placing the shed — with HFR equipment inside — on a trailer, FIT will be able to tow the WERA equipment out of Hightower Beach Park facilities in the event of a hurricane. The trailer/shed can be moved back to FIT and placed in a secure location until after the storm when it can then be reinstalled at the park.

Installation of the HFR antennas and cables will take approximately 2 weeks. Installation will take place outside of turtle nesting season, which runs from April 1 – October 31. The project team would like to install the HFR system at Hightower Beach Park in November/December 2022.

Table 1: Tentative Timeline

Summer/Fall 2022	
Work that takes place on FIT campus prior to Hightower HFR installation.	Electrical service installation (and possible meter box installation if required): 1 day - will occur later summer/early fall since no beachfront work is required (i.e. no impact to turtle nesting).
Build trailer/shed combo on FIT campus.	Proposed start date for HFR installation within Hightower Park: 11/7/2022.
Install A/C unit in shed.	Move trailered shed to Hightower Park and connect to power: 1 day.
Install wireless router, computer, and radar system within the shed.	Cable laying: 4 days.
System Testing	Antenna assembly, installation, and connecting cables: 2–3 days.
	Connecting cables to radar inside of the shed; Powering on and testing system: 2 days. Calibration and/or troubleshooting: 1-2 weeks.

2.5. MAINTENANCE

Maintenance includes monthly downloads of back-up data from the HFR computer housed in the shed and visual inspection of antennas from the park boardwalk or by walking along the beach. General maintenance and operation related activities will not disturb the dunes, vegetation, or wildlife.

It is anticipated that individual antennas may be damaged over time by storms or potential vandalism. If this occurs, FIT personnel will make repairs to or replace an antenna. Based on other HFR operations within SECOORA, most repairs require less than 1 day (e.g., to replace an antenna). This will have minimal impact on dunes, vegetation, and wildlife.

HFR are built to withstand storms; however, if the City of Satellite Beach determines that they would like the HFR equipment removed prior to a landfalling hurricane, this request can be accommodated by FIT personnel. The trailer shed can be towed back to FIT campus and the antennas can be removed. The cables will remain in place as they can withstand seawater overwash. The trailer shed and the antennas would then be replaced after the park has reopened.

2.6. PUBLIC INVOLVEMENT

The proposed project was provided to the public and other agencies for comment during the scoping phase. U.S. IOOS distributed an all-hands email on June 10, 2021 to the city representatives of Satellite Beach, the Florida Department of Environmental Quality, and local concerned public citizens. A public web site was established specifically for this proposed action, https://ioos.noaa.gov/hightower-beach-park, for the public to contact U.S. IOOS with any comments or concerns during the scoping phase.

Additionally, the proposed HFR installation was presented at the City of Satellite Beach City Council on January 20, 2021. The City Council unanimously approved the installation of the HFR with the comment that the Florida Department of Environmental Protection Florida Communities Trust (FCT) Governing Board also approved the installation.

Based on conversations with FCT representatives, it was determined that the City of Satellite Beach, SECOORA, and FIT would need to submit a linear facilities application to the FCT for approval by the Governing board. A linear facility agreement allows the installation of the HFR antenna within a 1000 ft long contiguous area. All application materials were submitted on March 8, 2022. The governing board met on April 20, 2022. The agenda and application materials (Item 6, supplemental documents) are found here: https://floridadep.gov/lands/land-and-recreation-grants/content/florida-communities-trust-governing-board. The governing board unanimously approved the linear facilities application.

In addition, IOOS published the Draft EA in the Federal Register on July 26, 2022 (FR Doc. 2022-15897) to allow other agencies and the public the opportunity to review and comment on the Proposed Action. No public comments were received.

2.7. CONSULTATION AND COORDINATION

In addition, as part of the public involvement process, U.S. IOOS initiated informal consultations with the below agencies (correspondence in appendices D-F).

FDEP Florida Communities Trust
DEP Douglas Building, Conference Room 137
3900 Commonwealth Blvd.
Tallahassee, FL 32399

Florida State Historic Preservation Office
Florida Division of Historical Resources
R.A. Gray Building
500 South Bronough Street
Tallahassee, FL 32399-0250

Satellite Beach Town Council
565 Cassia Boulevard
Satellite Beach, FL 32937

U.S. Fish & Wildlife Service Jacksonville Office
South Atlantic-Gulf & Mississippi-Basin Regions
Florida Ecological Services
7915 Baymeadows Way, Suite 200
Jacksonville, FL 32256-7517

3. ALTERNATIVES, INCLUDING THE PROPOSED ACTION

This chapter describes and compares the alternatives considered for the project. It includes a description and map of each alternative considered. This section also presents the alternatives in comparative form, sharply defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public.

3.1. PROPOSED ACTION ALTERNATIVE (PREFERRED ALTERNATIVE)

The preferred alternative is to undertake the proposed action: to provide funding of the installation of the Hightower Beach Park HFR to the FIT through a subcontract with the SECOORA.

The Hightower Beach Park HFR will operate at approximately 13.5 MHz. Its 12 transmit and four receive antennas are 7 feet tall with a diameter of 2 inches. All transmit and receive array antennas will be placed behind the shoreward vegetation to reduce interaction with nesting sea turtles and minimize their visual impact (i.e., make them less noticeable to park visitors). All antennas will be painted a flat green color (or other color, as appropriate) to blend in with the local vegetation and so that moonlight does not reflect off the antennas and cause a visual disturbance for newly hatched sea turtles. Cables will run from the antennas, across the vegetated dune, to the boardwalk. The cables are similar in diameter to coaxial television cables, and they will be placed inside of a flexible PVC corrugated pipe and laid atop the surface of the dune. Once the cables reach the boardwalk, they will be attached to the underside of the boardwalk, raising them off the dunes.

Installation of the HFR antennas and cables will take approximately two weeks. Installation will take place outside of turtle nesting season, which runs from April 1 – October 31. The project team would like to install the HFR system at Hightower Beach Park in November/December 2022.

3.2. NO ACTION ALTERNATIVE

Under the No Action Alternative, U.S. IOOS would maintain the currently deployed assets but would not fund the installation of the Hightower Beach Park HFR. The No Action Alternative would prevent the regional association, SECOORA, from properly operating two other installation sites. Radar antennas have already been installed at Treasure Shores Park. The HFR installation at the FCT project site includes 16 antennas, each 7 feet tall, 2 inches in diameter, as well as cabling and completes the triangulation with the Treasure Shores site. This action does not fulfill the purpose and need of the project.

Although it does not meet the purpose and need of the proposed action, the No Action Alternative serves as the baseline condition against which the effects of the proposed action are evaluated.

3.3. ALTERNATIVES CONSIDERED BUT ELIMINATED

HFRs are typically installed in pairs so that there is overlapping coverage between the systems — two HFR stations minimum are required to resolve the two-dimensional current field from radial velocity data. FIT installed an HFR at the Treasure Shores Park in Indian River County. The second site must be adequately spaced and overlook at the same ocean area from two different angles. The separation distance is controlled by the operational range of each HFR system, which in turn depends mainly on its operating frequency. Separation also controls the shape and the size of the HFR domain where currents can be resolved. For the best overlapping coverage, the radar beams should exhibit crossing angles (i.e., at right angles or 90º +/- 60º). We are limited by the maximum radar range as well as the coastal geometry. As a result, NOAA cannot move north of Patrick AFB (our original location) and if we move south of Hightower Beach Park (i.e., closer to the radar at Treasure Shores) the coverage east of Canaveral will diminish, impacting the utility of the system. Additionally, the HFR installation requires approximately 1000 linear feet for the antennas to be properly spaced. Hightower Beach Park meets this requirement. The team also evaluated other alternative sites for the HFR installation. These included Canova Beach Park, Patrick Air Force Base, and Pelican Beach Park.

3.3.1. Canova Beach Park

Canova Beach Park was identified as a possible alternative location; however, it is four miles south of Hightower Beach Park. This puts the radar too close to the southern site (Treasure Shores Park) and thus further shrinks the HFR coverage footprint for retrieving current data. In addition, the functional linear footage along Canova Beach is not sufficient as far as the layout of the radar is concerned. The 13.5 MHz radar requires approximately 1000 feet of contiguous linear space, but, due to the ubiquitous sea grape, this is unattainable. The sea grape, a protected dune species, can grow as tall as the antenna and impede radar operation. On the north side of the park there is also a sequence of condos, which is problematic due to interference with the HFR from metal on the buildings as well as fencing, railings, poles, etc. Finally, Canova Beach is a very populated beach (a portion of which is partitioned for dogs) compared to Hightower Beach Park, thus raising security issues.

3.3.2. Patrick Air Force Base

Patrick Air Force Base was the first proposed location for the HFR installation; however, there were two related issues with the site. First, the Air Force would not allow the antennas to be placed on the shoreward side of the dunes due to extensive sea grape. Second, the antennas would have to be elevated approximately 15 feet off the ground in order to “see” over the dunes. As a result, the elevated antenna would be subjected to more wind interference (sway and vibration), causing too much noise, thereby reducing accuracy, in the surface current data.

3.3.3. Pelican Beach Park

Pelican Beach Park is located 1.9 miles to the south of Hightower Beach Park. This site was considered as a potential alternative to Hightower Beach Park (the principal investigator visited the park in October 2021). However, Pelican Beach Park is also an FCT site, thus a linear facilities request is needed for this site as well. The space is tight in terms of linear footage with the receive antenna extending to the southernmost portion of the park and the transmit antenna limited due to sea grape coverage. A protected dune species, the sea grape can grow as tall as the antenna and impede the radar operation. While there are guidelines for trimming sea grapes, neither FIT nor SECOORA want to impact a protected species; therefore, it was determined that this location was not ideal.

3.4. MITIGATION COMMON TO ALL ALTERNATIVES

In response to public comments on the proposal, mitigation measures were developed to ease some of the potential impacts the various alternatives may cause. The mitigation measures may be applied to any of the action alternatives.

3.4.1. Proposed Action Alternative (Preferred Alternative) Mitigation Measures

1. No HFR installation will occur during turtle nesting season (April 1 – October 31).
2. Cable laying will be conducted to minimize any impacts to the dunes and beach mice (i.e., the cable will be placed inside of a flexible corrugated pipe that can be routed around any obstructions or sensitive areas so that no trenching is required for the cable at Hightower Park).
3. There are sea grapes near the main dune crossover (the boardwalk section that crosses over to the beach allowing public access); however, the HFR installation will not occur in the sea grape area.
4. After a storm or natural disaster, when the area has been cleared as safe to enter by the local government, the university will conduct a site visit to ensure no cables have fallen from underneath the boardwalk. This measure will prevent future entanglement of wildlife within the project vicinity. However, the cables will remain in place during the storm as they can withstand seawater overwash.

Additionally, the best management practices for installation as identified in the Final 2016 U.S. IOOS PEA will be adhered to (please see appendix G for the full list of best management practices).

3.5. Comparison of Alternatives

Table 2 provides a summary of the potential impacts from the installation of the HFR system and activities associated with the Proposed Action and the No Action Alternative.

Table 2: Summary of Potential Impacts on Resources from the Proposed Alternatives of U.S. IOOS

Resources	Proposed Action Preferred Alternative	No Action Alternative
Physical Resources	Short- and long-term, negligible, adverse impacts from installation and routine maintenance activities. No trenching is required.	Environmental baseline conditions would remain unchanged.
Biological Resources	Short- and long-term, negligible, adverse impacts on terrestrial biological resources. No impacts on marine biological resources. No trenching is required.	Environmental baseline conditions would remain unchanged.
Cultural Resources	No culture resources were identified during the informal consultations with the Florida State Historic Preservation office. No trenching is required (see Appendix E).	Environmental baseline conditions would remain unchanged.

3.6. Environmental Consequences for the Preferred Action and No Action Alternative

This section summarizes the physical, biological, and cultural environments of the affected project area and the potential changes to those environments due to implementation of the alternatives. It also presents the scientific and analytical basis for comparison of alternatives presented in the chart above.

3.6.1. Affected Environment and Environmental Consequences

Aesthetics and Viewshed

The Hightower Beach Park HFR is not expected to affect the beach viewshed for aesthetic reasons. This antenna will be painted a flat green (or other color, as appropriate) to blend into the environment. The antenna will be located behind the first line of dunes, so it would only be viewable from the beach in views of the boardwalk. Additionally, there is a NASA dome antenna at a nearby beach that has not caused viewshed concerns.

Physical Resources

Geology and Soils

According to the USGS, "the Holocene sediments in Florida occur near the present coastline at elevations generally less than 5 feet (1.5 meters). The sediments include quartz sands, carbonate sands and muds, and organics" (USGS, 2021).

Previous installation of HFR stations indicates that there would be negligible impacts to terrestrial geological resources during the installation of the HFR. Installation will only require 2 weeks and no heavy equipment will be necessary. Placing the cables on the surface of the dunes will minimize impacts to geology and soils since the cables will not be buried. Over a period, sand will cover the corrugated pipe and it will not be visible. There are no impacts from the operation of the HFR. Maintenance includes monthly downloads of back-up data from the HFR computer housed in the shed and visual inspection of antennas from the park boardwalk or by walking along the beach. General maintenance and operation-related activities will not disturb the dunes, vegetation, or wildlife.

Land Use

The City is proud to state that 40% of Satellite Beach's beachfront property is in public ownership, meaning that citizens can easily access the beach through parks and dune crossovers (Satellite Beach.org). Substantial improvements have been made recently to Pelican Beach Park, Hightower Beach Park, and several dune crossovers (Satellite Beach.org). The City wanted Hightower Beach Park specifically to educate its visitors about the uniqueness of the dune and beach system, and to empower the public to make a difference. Educational signs are located throughout the park to meet this goal. Amenities at this location include: 1) boardwalk and observation pavilion, 2) restrooms, 3) outdoor shower, 4) one non-reserve pavilion, and 5) parking.

Minimal disturbance to existing land use is expected. All transmit and receive array antennas will be placed behind the shoreward vegetation to minimize their visual impact (i.e., make them less noticeable to park visitors). Cables will run from the antennas, across the vegetated dune, to the boardwalk. The cables are similar in diameter to coaxial television cables, and they will be placed inside of a flexible PVC corrugated pipe and laid atop the surface of the dune.

Once the cables reach the boardwalk, they will be attached to the underside with J hooks or clamps so that they are off the ground, are not visible to park visitors, and mitigate impacts to dune flora and fauna. The cables will run the length of the boardwalk and over to the trailer/shed. The boardwalk already has utility and electrical cables run above ground, under the boardwalk. This pre-existing cableway configuration is similar to what is being proposed by FIT for running the HFR cables under the boardwalk.

Biological Resources

Vegetation, Wildlife Resources, and Aquatic Resources

Vegetated sand dunes are found along most of the beach's length and provide the major defense against storm events. Native plant species found on the dunes include sea oats, sabal palmetto, sea grape, railroad vine, dollar weed, coral bean, Spanish bayonet, wax myrtle, yaupon holly, and several grass species. More salt-tolerant and wind-tolerant species, such as sea oats and railroad vine, are found predominantly on the ocean side of the dune, while other dune vegetation species do not generally show such zonation. These plants assist in building the dune by trapping windblown sand and in stabilizing the dune with extensive lateral root systems (Florida DEP). The HFR would be located behind the first line of vegetation (IOOS, 2016). The HFR antennas, cables, and all other associated equipment are placed on land; they do not penetrate the water surface. Therefore, there would be no impacts to marine biological resources with the use of HFR. Additionally, no effects on essential fish habitat would be expected from the installation of additional HFR stations.

The Space Coast Audubon Society is the oldest and largest environmental organization in the state (Space Coast Audubon Society, 2021). It is located in Brevard County, where Satellite Beach is located. According to the Space Coast Audubon Society, the Eastern Continental Flyway is a major bird migration corridor for many migrating shorebirds, waterfowl, raptors and passerines. Additionally, the area is home to the painted bunting along with the largest populations of Florida scrub-jays remaining in the state. There are no impacts from the operation of the HFR to migrating shorebirds. General maintenance and operation-related activities will not disturb the dunes, vegetation, or wildlife.

Cable laying will be conducted so as to minimize any impacts to the dunes and beach mice. Additionally, the cables will be placed inside of PVC conduit so that cables are not exposed; thereby, reducing the potential for chewing cable by beach mice and other wildlife. There are sea grapes in the park; however, the HFR installation will not occur within the area where sea grapes are present.

Threatened and Endangered Species

The Endangered Species Act (ESA) provides a system for the conservation of threatened and endangered plants and animals along with the habitats in which they are found (EPA, 2021). The lead federal agencies include the U.S. Fish and Wildlife Service and NOAA Fisheries Service. The ESA requires that projects proposed, authorized, funded, or carried out by federal agencies do not jeopardize the continued existence of any listed species, including their habitats. The law also prohibits the 'taking' of any listed species of endangered fish or wildlife.

Table 3: Summary of the threatened species in the SECOORA region of particular concern with respect to this project.

Name (Scientific name)	Status	Has Critical Habitat	Has Suitable Habitat
Mammals			
West Indian Manatee (*Trichechus manatus)*	Threatened	No	No
Birds			
Eastern Black Rail (*Laterallus jamaicensis ssp. jamaicensis*)	Proposed Threatened	No	No
Red Knot (*Calidris canutus rufa*)	Threatened	No	Yes
Piping Plover (*Charadrius melodus*)	Threatened	No	Yes
Wood Stork (*Mycteria Americana*)	Threatened	No	No

Reptiles			
Atlantic Salt Marsh Snake (*Nerodia clarkii taeniata)*	Threatened	No	No
Gopher Tortoise (*Gopherus polyphemus*)	Candidate	No	Yes
Green Sea Turtle (*Chelonia mydas*)	Threatened	There is a final critical habitat for this species. The location is outside the critical habitat.	Yes
Hawksbill Sea Turtle (*Eretmochelys imbricata*)	Endangered	There is a final critical habitat for this species. The location is outside the critical habitat.	Yes
Leatherback Sea Turtle (*Dermochelys coriacea*)	Endangered	There is a final critical habitat for this species. The location is outside the critical habitat.	Yes
Loggerhead Sea Turtle (*Caretta caretta*)	Threatened	There is a final critical habitat for this species. The location is outside the critical habitat.	Yes
Flowering Plants			
Carter's Mustard *(Warea carteri)*	Endangered	No	No
Lewton's Polygala (*Polygala lewtonii*)	Endangered	No	No

3.6.2. ESA Listed Species Overview

West Indian Manatee

The threatened West Indian manatee is a large, aquatic mammal. There are two subspecies of West Indian manatees: the Antillean manatee and the Florida manatee. Due to their eating habits, manatees are nicknamed “sea cows” because they eat seagrasses and other aquatic plants. This threatened species is not within the vicinity of the proposed project because the installation will occur on the terrestrial environment. (USFWS, 2021k)

Eastern Black Rail

The proposed threatened species eastern black rail is a small, secretive, marsh bird. The eastern black rail is protected under the Migratory Bird Treaty Act of 1918 and is state-listed as either endangered or threatened in seven states. Eastern black rail habitat can be tidally or non-tidally influenced and range in salinity from salt to brackish to fresh. Tidal height and volume vary greatly between the Atlantic and Gulf coasts and therefore contribute to differences in salt marsh cover plants in the bird’s habitat. In the northeastern United States, the eastern black rail can typically be found in salt and brackish marshes with dense cover but can also be found in upland areas of these marshes. Further south along the Atlantic coast, eastern black rail habitat includes impounded and unimpounded salt and brackish marshes. Along portions of the Gulf Coast, eastern black rails can be found in higher elevation wetland zones with some shrubby vegetation. Impounded and unimpounded intermediate marshes (marshes closer to high elevation areas) also provide habitat for the subspecies. Inland coastal prairies and associated wetlands may also provide habitat for the bird but are largely uninvestigated. This proposed threatened species is not within the vicinity of the proposed project because the installation will occur in the terrestrial environment on land that does not fall within the marsh habitat of the Eastern black rail. (USFWS, 2021c)

Piping Plover

The threatened piping plover is a small, stocky shorebird, with a sandy-colored plumage on its back and crown and a white underside. Breeding birds have a single black breast band, a black bar across the forehead, bright orange legs and bill, and a black tip on the bill. During the winter, the birds lose their breeding plumage; the black bands are lost, the legs fade to pale yellow, and the bill becomes mostly black. Piping plovers are migratory birds. In the spring and summer, they breed in the northern United States and Canada. There are three locations where piping plovers nest in North America: the shorelines of the Great Lakes, the shores of rivers and lakes in the Northern Great Plains, and along the Atlantic Coast. The piping plover was listed as endangered in the Great Lakes watershed and threatened elsewhere within its range on January 10, 1986. This threatened species may be within the vicinity of the proposed project due to the suitable habitat of sandy beaches, sand flats, and mudflats along coastal areas. Piping plovers do not breed in Florida but spend a large portion of their year "wintering" here; therefore, the proposed project will not impact nesting piping plovers. (USFWS, 2021i)

Red Knot

The threatened red knot is a medium-sized shorebird about 9 to 11 inches (23 to 28 cm) in length. The red knot is easily recognized during the breeding season by its distinctive rufous (red) plumage (feathers). The face, prominent stripe above the eye, breast, and upper belly are a rich rufous-red to a brick or salmon red, sometimes with a few scattered light feathers mixed in. The feathers of the lower belly and under the tail are whitish with dark flecks. This threatened species may be within the vicinity of the proposed project due to habitats used by red knots in migration and wintering areas being generally coastal marine and estuarine habitats with large areas of exposed intertidal sediments. (USFWS, 2021j)

Wood Stork

The threatened wood storks are large, long-legged wading birds, about 45 inches (114 cm) tall, with a wingspan of 60 to 65 inches (152–165 cm). The plumage is white except for black primaries and secondaries and a short black tail. The head and neck are largely unfeathered and dark gray in color. Their bill is black, thick at the base, and slightly decurved. Immature birds have dingy gray feathers on their head and a yellowish bill. This threatened species will not be within the vicinity of the proposed project due to wood storks inhabiting freshwater and estuarine wetlands, primarily nesting in cypress or mangrove swamps. They feed in freshwater marshes, narrow tidal creeks, or flooded tidal pools. Particularly attractive feeding sites are depressions in marshes or swamps where fish become concentrated during periods of falling water levels. (USFWS, 2021l)

Atlantic Salt Marsh Snake

The threatened Atlantic salt marsh snake is a slender, heavily keeled water snake about 2 feet (0.6 meters) in total length, with a pattern of stripes that are variously broken into blotches. The dorsal ground color is pale olive, patterned with a pair of dark brown stripes running down the back and enclosing a pale mid-dorsal stripe. These dark stripes usually become fragmented posteriorly into a series of elongate blotches. There is also a row of dark blotches along the lower sides of the body, which merge to form stripes in the neck region. The ventral surface is black with a median series of yellowish spots. This threatened species will not be within the vicinity of the proposed project due to the Atlantic salt marsh snakes inhabiting saltmarsh tidal flats that contain grasses such as glasswort (*Salicornia*), *spartina*, and *juncus*, as well as scattered black mangroves. Atlantic salt marsh snakes can be found in Volusia and Indian River counties. (USFWS, 2021a)

Gopher Tortoise

The candidate gopher tortoise is a long-lived reptile that occupies upland habitat throughout Florida including forests, pastures, and yards. They dig deep burrows for shelter and forage on low-growing plants. Gopher tortoises share their burrows with more than 350 other species and are therefore referred to as a keystone species. Gopher tortoises prefer well-drained, sandy soils found in habitats such as longleaf pine sandhills, xeric oak hammocks, scrub, pine flatwoods, dry prairies, and coastal dunes. They are also found in a variety of disturbed habitats including pastures and urban areas. This candidate species may be within the vicinity of the proposed project because the project location contains well-drained sandy soils for digging burrows and nesting, abundant herbaceous plants for forage, and open, sunny areas with sparse canopy for nesting and basking. (USFWS, 2021d)

Green Sea Turtle

The endangered green sea turtle grows to a maximum size of about 4 feet (1.2 meters) and a weight of 440 pounds (200 kg). It has a heart-shaped shell, small head, and single-clawed flippers. Color is variable. Hatchlings generally have a black carapace, white plastron, and white margins on the shell and limbs. The adult carapace is smooth, keelless, and light to dark brown with dark mottling; the plastron is whitish to light yellow. Adult heads are light brown with yellow markings. Identifying characteristics include four pairs of costal scutes, none of which borders the nuchal scute, and only one pair of prefrontal scales between the eyes. Hatchling green turtles eat a variety of plants and animals, but adults feed almost exclusively on seagrasses and marine algae. Green sea turtle nesting in Florida occurs primarily from June through late September. Every two to three years, a female will return to the nesting beach — often the same one she visited before — and lay an average of 3.6 clutches in a season. A clutch averages about 128 eggs. This endangered species may be within the vicinity of the proposed project due to the project location being within one of the three habitat types: high-energy oceanic beaches, convergence zones in the pelagic habitat, and benthic feeding grounds in relatively shallow, protected waters. Although nesting activity has been recorded in almost every coastal county in Florida, most green sea turtle nesting is concentrated along the southeast coast of Florida. (USFWS, 2021e)

Hawksbill Sea Turtle

The endangered hawksbill bill is a small to medium-sized marine turtle having an elongated oval shell with overlapping scutes on the carapace, a relatively small head with a distinctive hawk-like beak, and flippers with two claws. General coloration is brown with numerous splashes of yellow, orange, or reddish-brown on the carapace. The plastron is yellowish with black spots on the intergular and postanal scutes. Juveniles are black or very dark brown with light brown or yellow coloration on the edge of the shell, limbs, and raised ridges of the carapace. This endangered species may be within the vicinity of the proposed project due to hawksbills habitat including frequent rocky areas, coral reefs, shallow coastal areas, lagoons or oceanic islands, and narrow creeks and passes. They are seldom seen in water deeper than 65 feet (20 meters). Hatchlings are often found floating in masses of sea plants, and nesting may occur on almost any undisturbed deep-sand beach in the tropics. Adult females can climb over reefs and rocks to nest in beach vegetation. (USFWS, 2021f)

Leatherback Sea Turtle

The endangered leatherback is the largest turtle in the world and has a primarily black rubbery skin with pinkish-white coloring on its underside. They are the only species of sea turtle that lack scales and a hard shell and are named for their tough rubbery skin. Hatchlings have white dotting along the ridges of their backs and on the margins of the flippers. A leatherback's carapace is about 1.5 inches (3.8 cm) thick and consists of leathery, oil saturated connective tissue overlaying loosely interlocking dermal bones. Their carapace has seven ridges along its length and tapers to a blunt point, which helps the leatherback move more effectively in water. Their front flippers lack claws and scales and are proportionally longer than in other sea turtles. Their back flippers are paddle-shaped. Both their rigid carapace and their large flippers make the leatherback uniquely equipped for long distance foraging migrations. Adult leatherback sea turtles are highly migratory and believed to be the most pelagic of all sea turtles. Habitat requirements for juvenile and post hatchling leatherbacks, however, are virtually unknown. This endangered species may be within the vicinity of the proposed project due to nesting females preferring high energy beaches with deep, unobstructed access, which occur most frequently along continental shorelines. Nesting occurs on sandy beaches from late February and peaks in May; however, nests have been found as late as August. Females will come onshore and dig a body pit and a nest chamber at the bottom of the pit. They typically construct their nests at night. The average clutch size is 73 yolked eggs and 25 yolkless eggs, also called "spacers". The purpose of the spacers is unclear. The incubation period is 59–75 days, with the hatchlings migrating to the ocean at night. (USFWS, 2021g)

Loggerhead Sea Turtle

The threatened loggerheads were named for their relatively large heads, which support powerful jaws and enable them to feed on hard-shelled prey, such as whelks and conch. The carapace is slightly heart-shaped and reddish-brown in adults and sub-adults, while the plastron is generally a pale yellowish color. The neck and flippers are usually dull brown to reddish brown on top and medium to pale yellow on the sides and bottom. Mean straight carapace length of adults in the southeastern U.S. is approximately 36 in. (92 cm) with a corresponding weight of about 250 lbs. (113 kg). This threatened species nests within the vicinity of the proposed project area. About 80% of loggerhead nesting occurs in six Florida counties—Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward—within those counties a 20-mile (32 kilometer) section of coastline from Melbourne Beach to Wabasso Beach. Loggerheads typically nest in Florida from April to September. Females return to their nesting beach every two or more years (average 2.7 years) to lay an average of 4.1 clutches, one about every 14 days. Each nest contains an average of 114 eggs. During nesting season, this threatened species will likely be within the vicinity of the proposed project location, as nesting occurs mainly on open beaches above the mean high tide line and shoreward of the dune vegetation. (USFWS, 2021h)

Carter's Mustard

The endangered *Warea carteri* is an annual herb, 0.2 to 1.5 meter tall with erect green stems. The plants usually have many slender, ascending branches forming an open, rounded crown. The leaves lack stipules and are arranged alternately on the stem. Lower leaves are lost by the time they plant flowers. Leaf size and shape varies with age and position on the plant. At the time of flowering, leaf petioles range from 0.8 to 3.9 mm with blades 1 to 3 cm long. Towards the tips of stems, the leaves are smaller and narrowly elliptical to almost linear, while closer to the bases of stems and branches, the leaves are larger and oblanceolate or spatulate. All leaves are rounded at the tip, their margins entire, and their bases attenuate to cuneate. The lower leaves can also be undulate, margined, or lobed. One occurrence of *W. carteri* is also known from coastal scrub in Brevard County on Florida's Atlantic coast but has not been relocated. The species occurred historically in the Miami metropolitan area, Miami-Dade County, and is extirpated from this county. This endangered species is not within the vicinity of the proposed project due to the only known populations of *Warea carteri* occurring in scrub habitats of the Lake Wales Ridge in Lake, Polk, and Highland Counties. It has historically been collected from Dade and Brevard Counties as well; however, it has been extirpated from Dade County and is possibly extirpated from Brevard County. (USFWS, 2021b)

Lewton's Polygala

The endangered *Polygala lewtonii* is a relatively short-lived (5 to 10 year) perennial herb. Each plant produces one to several annual stems, which are spreading, upward-curving or erect, and are often branched. The leaves are small, sessile, rather succulent, broader toward the tip, and are borne upright, tending to overlap along the stem, like shingles. The normally opening flowers are in erect, loosely flowered racemes about 1.5 cm or 3.3 cm long. The flowers are about 0.5 cm long and bright pink or purplish-red. Two of the five sepals are enlarged and wing-like, between which the largest of the three petals forms a keel that ends in a tuft of finger-like projections. This endangered species is not within the vicinity of the proposed project due to being found in widely scattered populations that frequently occur in transitional habitats between high pine and turkey oak barrens (USFWS, 2021).

3.7. COMPLIANCE WITH OTHER APPLICABLE LAWS

3.7.1. Coastal Management Zone Act

The Coastal Zone Management Act (CZMA) encourages coastal states, Great Lakes states, and U.S. territories and commonwealths (collectively referred to as "coastal states" or "states") to be proactive in managing natural resources for their benefit and the benefit of the Nation. The CZMA federal consistency provision (16 U.S.C. § 1456 and 15 C.F.R. part 930) provides states with an important tool to manage coastal uses and resources and to facilitate cooperation and coordination with Federal agencies. Under the CZMA, federal agency activities that have coastal effects must be consistent to the maximum extent practicable with federally approved enforceable policies of a state's NOAA-approved coastal management program. In addition, the CZMA requires non-federal applicants for federal authorizations and funding to be consistent with enforceable policies of state coastal management programs.

Determination

NOAA has determined that the proposed action impacts will not result in coastal effects; the proposed action does not have reasonably foreseeable effects on the coastal uses or resources for the state of Florida.

3.7.2. Endangered Species Act

Section 7 requires Federal agencies to use their authorities in furtherance of the purposes of the ESA by carrying out programs for the conservation of endangered and threatened species. Agencies are further required to ensure that any action authorized, funded, or carried out is not likely to jeopardize the continued existence of any threatened or endangered species or result in destruction or adverse modification of habitat for such species.

The HFR installation and associated maintenance are not occurring on the beachfront; therefore, the installation and maintenance do not pose a threat to shorebirds or the West Indian manatee. However, to further mitigate any potential impacts, all installation materials will be removed upon completion of installation; all instruments/installations must be removed when no longer in use to avoid the creation of marine debris and potential for entanglement.

Determination

The U.S. FWS Florida Ecological Service Field (FWS Log Number 21-I-1129) Office concurred with NOAA determination that this project may affect, but is not likely to adversely affect, the: red knot (*Calidris canutus rufa*); piping plover (*Charadrius melodus*); green sea turtle (*Chelonia mydas*); gopher tortoise (*Gopherus polyphemus*); hawksbill sea turtle (*Eretmochelys imbricata*); leatherback sea turtle (*Dermochelys coriacea*); loggerhead sea turtle (*Caretta*

caretta); and their respective designated suitable habitat on November 4, 2021. The finding fulfilled the requirements of the ESA.

3.7.3. National Historic Preservation Act

The National Historic Preservation Act of 1966, amended in 1992, requires that responsible agencies taking action that may potentially affect any property with historic, architectural, archeological, or cultural value that is listed on or eligible for listing on the National Register of Historic Places comply with the procedures for consultation and comment issued by the Advisory Council on Historic Preservation. The responsible agency also must identify properties affected by the action that are listed on or potentially eligible for listing on the register, usually through consultation with the state historic preservation officer.

Determination

The Florida SHPO office was contacted on June 30, 2021 and did not respond to the U.S. IOOS determination that the installation of the HFR system will have no effect on historic properties or cultural resources. U.S. IOOS will assume concurrence under 36 CFR § 800.4 Identification of historic properties. As the Florida SHPO did not object within 30 days of receipt of an adequately documented finding, the U.S. IOOS responsibilities under section 106 are fulfilled.

3.8. CUMULATIVE EFFECTS

3.8.1. Beach Access

All HFR transmit and receive array antennas will be placed behind the shoreward vegetation to reduce interaction with nesting sea turtles and minimize their visual impact (i.e., make them less noticeable to park visitors). Additionally, this will place the antenna and cables in an area of the park that is not used for recreation since visitors are not allowed in the vegetated areas of the dunes. All antennas will be painted a flat green color (or other color, as appropriate) so they blend in with the local vegetation. Painting the antennas also assures that moonlight does not reflect off them and potentially cause a visual disturbance for newly hatched sea turtles. Cables will run from the antennas, across the vegetated dune, to the existing boardwalk. The cables are similar in diameter to coaxial television cables, and they will be placed inside of a flexible PVC corrugated pipe and laid atop the surface of the dune. Placing the cables inside of the corrugated pipe will protect the cables from beach mice and other wildlife that may chew on them. Additionally, placing the cables on the surface of the dunes will minimize impacts to dune vegetation since the cables will not be buried (burial would require trenching and could damage plant root structures). Over a period of time, sand will cover the corrugated pipe and it will not be visible.

Once the cables reach the boardwalk, they will be attached to the underside with J hooks or clamps so they are off the ground, are not visible to park visitors, and mitigate impacts to dune flora and fauna. The cables will run the length of the boardwalk to the park restrooms. The boardwalk already has utility and electrical cables that run under the boardwalk. This pre-existing cableway configuration is similar to what is being proposed by FIT for running the HFR cables under the boardwalk.

FIT will install shelves along with the WERA HFR transmitter/receiver chassis, computer equipment, and other electronics (e.g., wireless router) inside of the shed, which will sit on top of a towable trailer. The trailer will be placed near the restroom facility, as electricity is available at this location. By placing the shed — with HFR equipment inside —on a trailer, FIT will be able to tow the WERA equipment out of Hightower Beach Park facilities in the event of a hurricane. The trailer/shed can be moved back to FIT and placed in a secure location until after the storm when it can then be reinstalled at the park. The trailer/shed will not impact access to park facilities.

Figure 1: Proposed locations for the transmit antenna (green), receive antenna (yellow), and cables, which will be installed inside of flexible pvc conduit (cyan). The HFR infrastructure placement will not impede public access to the beach or park facilities.

3.8.2. Sea Turtle Data

Sea turtles use multiple cues for orientation and navigation:

- Visual (light, moonlight)
- Surface waves, swells, and winds
- Auditory
- Downslope beach terrain
- Geomagnetism
- Olfactory/chemosensory

Sea turtles use geomagnetism for navigation; however, in which stages of their lives and how exactly it is used remains unknown. It is thought that different cues may act as a back-up when others are absent. Of these cues, geomagnetism is the only one relevant to the coastal radar. Studies using satellite tracking of sea turtles acknowledge the weak, ambient magnetic field that the transmitters produce, but indicate that it does not impact the turtles.

Loggerhead, green, and Kemp's ridley sea turtles use Earth's magnetic field as a navigational cue, perceiving inclination angle and field intensity (Lohmann K. and Lohmann C., 1994). Much is still unclear as to which parts of their journey, from hatchling to mature females that return to the same beaches from which they originated, that these cues are most paramount. Some studies indicate that sea turtles are the least dependent on magnetic cues at both very far and short distances with respect to their origins. In this sense, it appears as if the magnetic cues are primarily used "at intermediate spatial scales" (Benhamou et al., 2011; Endres et al., 2016). An overarching theme of existing research is that sea turtles use a combination of cues: visual cues, surface waves, swells, and winds, chemosensory cues, and geomagnetism. Hatchlings use light cues until they are sufficiently offshore, where surface waves become the main navigational driver (Hayes & Ireland 1978; Wyneken, 1990). This continues to motivate current research with respect to anthropogenic impacts of unnatural light near nesting beaches.

A recurring topic in the sea turtle navigation literature is that eliminating a single cue such as magnetism may not cause discernible change in behavior provided that there are other sources of directional information present (e.g., Able, 1993; Kennedy, 2018). Past experiments suggest that "alternative directional cues can take precedence over magnetic cues in the early phases of the migration" (Lohmann, 1991). Lohmann suggests the magnetic cues may act to either, "supplant" or act "as a 'back-up' for use when waves and/or other cues are absent." To test this hypothesis, they employed two different groups of loggerhead hatchlings, one with an unaltered magnetic field, and one subjected to an earth-strength field with a reversed horizontal component. All other potential navigational cues were removed (i.e., no light and calm water surface). They found that, when the ambient magnetic field was flipped (i.e., shifted by 180°), the distributions (i.e., direction of movement) of the two groups were significantly different. They conclude that the orientation of loggerhead hatchlings is "influenced by ambient earth-strength magnetic fields." Another study tested groups of adult sea turtles by attaching magnets to their heads in order to eliminate their ability to use the ambient magnetic field and came to a similar conclusion: the turtles were largely able to find their way home, but they took longer paths (Luschi et al., 2007). A similar study found that there were no differences in path straightness or swimming speed for green sea turtles with magnets attached to their heads and/or bodies compared to the control group (Papi et al., 2000).

Endres et al. (2016) indicate that sea turtle navigation to a nesting beach or foraging area might benefit from the use of multiple sensory cues. For sea turtles engaged in natal homing (i.e., adults return to reproduce in their area of origin), the migration from long distances might be facilitated if turtles imprint on both olfactory and magnetic cues at their natal beach (Lohmann et al., 2008b, 2013; Putman and Lohmann, 2008). In this case, a turtle might first use the magnetic information on which it imprinted to arrive in the vicinity and then use chemical cues to locate a place to nest.

HFR transmits in the same radio wave portion of the electromagnetic spectrum as ham radio. According to FCC regulations, an amateur radio operator can legally transmit at powers up to 1,500 W — 50 times that of the HFR (although they typically use much less). However, ham transmissions are generally intermittent (rather than continuous like the HFR) and the antenna placement is remote, both of which act to lessen exposure. Also, in sea turtle research, it is common practice to use low power VHF telemetry for tracking, which uses tags affixed to the sea turtle carapace. There is no evidence that these devices, which emit at a very high frequency radio signal typically in the range of 148-152 MHz, have any impact on sea turtle navigation or overall health.

Quantitative results on sea turtles' magnetic field detection — specifically their observable range of electromagnetic radiation — would prove useful to better understand anthropogenic impacts, but such data is not currently available. However, we do know that the distance from a radiating antenna will significantly lessen affects of exposure (Table 2-3). For example, using a far-field estimation approach, the main lobe field strength at a distance of 100 meters from the HFR transmit array operating at 13.5 MHz and 30 W of power, would result in an electric field strength significantly less than that associated with power transmission lines or what occurs in a typical home or workplace environment, up to two orders of magnitude less depending on the distance. More importantly, given the low transmit power, the corresponding magnetic field strength at 1 meter from the transmit array is well below that of the ambient magnetic field (on the order of 0.06 A/m versus 20-to-50 A/m respectively). For the HFR-relevant frequency range of 3-30 MHz, the maximum permissible exposure (FCC, 2007) is 136.4 V/m and 0.362 A/m respectively. Even though the estimates provided in Table 2-3 are well below these thresholds, the impact on sea turtles will be further mitigated by placing the transmit array within the dune vegetation, set back approximately 2-3 meters from sea turtles nesting (Image 1).

Table 4: Far field estimates of the transmit antenna electric and magnetic field strength at distance. Numbers shown are for the main lobe with a gain of -2.55 dB, 13.5 MHz frequency, 30 W of transmit power and EIRP of 16.677 W.

Distance (m)	Electric Field Strength (V/m)	Magnetic Field Strength (V/m)
1.0	22.368	0.05933
22.2	1.007	0.00267
100.0	0.224	0.00059

Sea turtle nesting data has been collected at some locations where HFR is installed and is currently operational such as in North Carolina, South Carolina and Georgia (Figure 2) and Florida (Figures 3 and 4). For each figure, the x-axis represents the 2009 to 2020 period for which sea turtle nesting data was available from relevant state agencies. The y-axis represents the approximate number of sea turtle nests observed at each location. Each line represents a particular site. Additionally, a best fit linear regression line is shown. The nesting trends are generally upward (positive slopes over the time period shown) at most locations despite radar installations in these regions (Figures 2, 3, and 4).

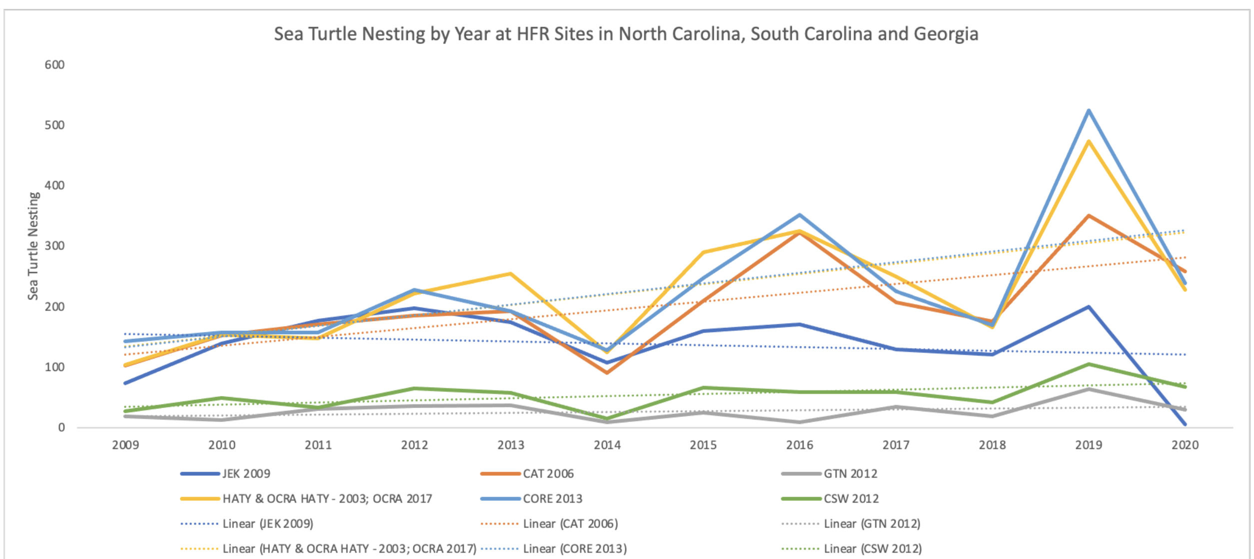


Figure 2: Sea turtle nesting by year at HFR sites in North Carolina, South Carolina, and Georgia.

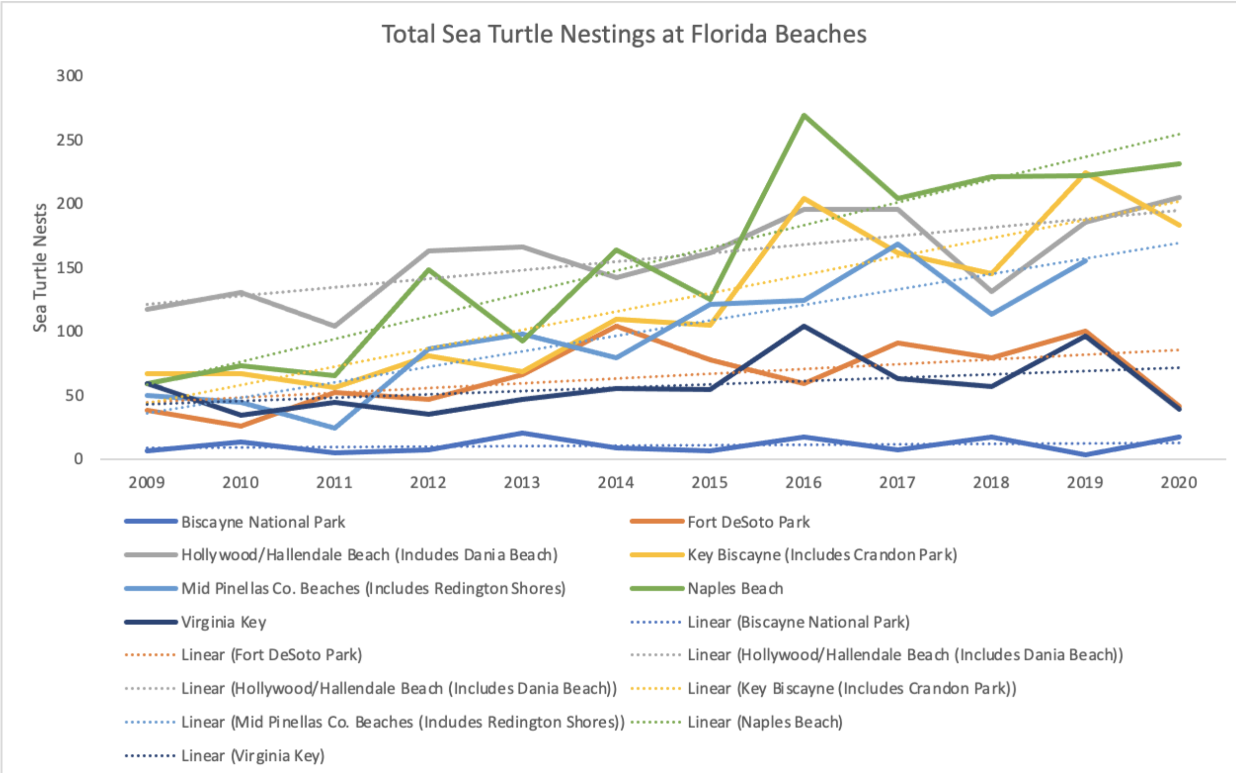


Figure 3: Total sea turtle nestings at Florida beaches.

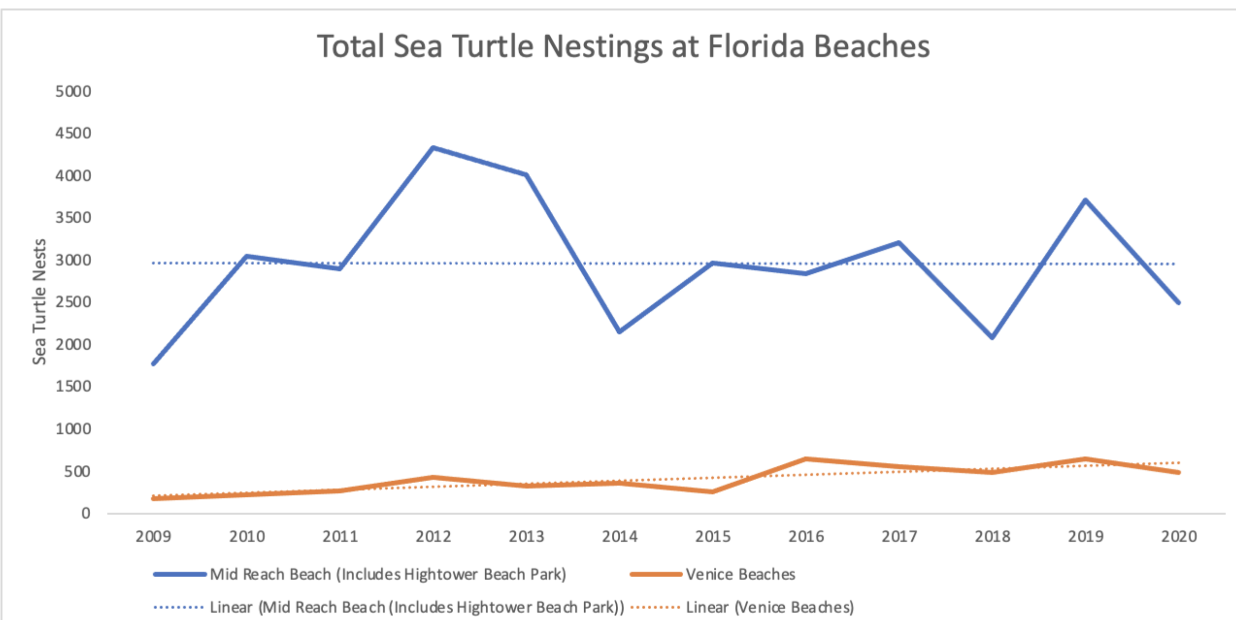


Figure 4: Total sea turtle nestings at Florida beaches, Mid-Reach and Venice.

These data suggest that there appears to be minimal effects on sea turtle nesting numbers with respect to the HFR installation in these regions. Nonetheless, in order to minimize potential impacts, HFR installation activities will not occur during turtle nesting season (April 1 – October 31).

Following the guidance of the IOOS PEA, precautions will be taken to minimize impacts to the sea turtles.

- If a sea turtle is seen within 100 yards (91 meters) of the active daily construction operation, all appropriate precautions shall be implemented to ensure its protection. These precautions shall include cessation of operation of any moving equipment closer than 50 feet (15 meters) of a sea turtle. Note that the Hightower Beach HFR installation does not require any construction or operation of heavy equipment.
- All transmit and receive array antennas will be placed behind the shoreward vegetation to reduce interaction with nesting sea turtles. Installation of the HFR antennas and cables will take approximately two weeks. Installation will take place outside of turtle nesting season, which runs from April 1 – October 31.
- All antennas will be painted a flat green color (or other color, as appropriate) to blend in with the local vegetation and so that moonlight does not reflect off the antennas and cause a visual disturbance for newly hatched sea turtles.
- Cables will run from the antennas, across the vegetated dune, to the boardwalk - away from the beach. The cables are similar in diameter to coaxial television cables, and they will be placed inside of a flexible PVC corrugated pipe and laid atop the surface of the dune. Placing the cables in PVC reduced the risk of interference with sea turtles or other beach species (e.g., beach mice, snakes, birds).

Cumulative effects are effects resulting from future state or private activities, not involving federal activities, that are reasonably certain to occur within the action area of the federal action subject to consultation.

The actions from the HFR operation and maintenance includes monthly downloads of back-up data from the HFR computer housed in the shed and visual inspection of antennas from the park boardwalk or by walking along the beach. General maintenance and operation-related activities on the public beach will have no determinable cumulative negative impact.

Given that the proposed action will be limited in time frame and restricted to a designated area and a public beach, the presence of the SECOORA subcontractor FIT and the university employees in these areas is not expected to have cumulatively significant (additive or synergistic) impacts when considered along with other uses and actions of these areas.

LIST OF PREPARERS

PREPARERS

Mequela Moreno
Environmental Compliance Coordinator
Integrated Ocean Observing System (IOOS)
National Ocean Service, NOAA
1315 East West Highway, Silver Spring, MD 20910

Jennifer Dorton
Regional Coastal Ocean Observing System Manager
Southeast Coastal Ocean Observing Regional Association (SECOORA)
P.O Box 13856
Charleston, SC 29422

Dr. Steven Lazarus
Florida Institute of Technology
150 W. University Blvd.
Melbourne, FL 32901

Kelly Carmer
Florida Institute of Technology
150 W. University Blvd.
Melbourne, FL 32901

Dr. Catherine Tobin
NOAA Sea Grant Knauss Marine Policy Fellowship Program Fellow
1315 East West Highway
Silver Spring, MD 20910

FEDERAL, STATE, AND LOCAL AGENCIES

FDEP Florida Communities Trust
DEP Douglas Building, Conference Room 137
3900 Commonwealth Blvd.
Tallahassee, FL 32399

Florida State Historic Preservation Office (SHPO)
Florida Division of Historical Resources
R.A. Gray Building
500 South Bronough Street
Tallahassee, FL 32399-0250

Satellite Beach Town Council
565 Cassia Boulevard
Satellite Beach, FL 32937

U.S. Fish & Wildlife Service Jacksonville Office
South Atlantic-Gulf & Mississippi-Basin Regions
Florida Ecological Services
7915 Baymeadows Way, Suite 200
Jacksonville, FL 32256-7517

REFERENCES

Bartol, S. M., Musick, J. A., and Lenhardt, M. L. (1999). Auditory Evoked Potentials of the Loggerhead Sea Turtle (Caretta caretta). *Copeia*, 1999(3), 836 - 840. https://doi.org/10.2307/1447625

Benhamou S., Sudre J., Bourjea J., Ciccione S., De Santis A., and Luschi P. (2011) The Role of Geomagnetic Cues in Green Turtle Open Sea Navigation. *PLoS ONE* 6(10): e26672. https://doi.org/10.1371/journal.pone.0026672

Endres C. S., Putman N. F., Ernst D. A., Kurth J. A., Lohmann C. M. F., and Lohmann K. J. (2016). Multi-Modal Homing in Sea Turtles: Modeling Dual Use of Geomagnetic and Chemical Cues in Island-Finding. *Frontiers in Behavioral Neuroscience, Volume 10*. https://doi.org/10.3389/fnbeh.2016.00019

Environmental Protection Agency (2021). Summary of the Endangered Species Act. https://www.epa.gov/laws-regulations/summary-endangered-species-act

Environmental Studies Program: Studies Development Plan, FY 2020-2022 (2019). Sea Turtle Hearing Sensitivity and Impacts of Sound. https://www.boem.gov/sites/default/files/documents/environment/environmental-studies/NT-20-02.pdf

Fisher, C. and Slater, M. (2010). Electromagnetic Field Study: Effects of electromagnets on marine species: A literature review. Oregon Innovation Council. https://tethys.pnnl.gov/sites/default/files/publications/Effects_of_Electromagnetic_Fields_on_Marine_Species.pdf

Florida Department of Environmental Protection Survey Program Database as of 5 March 2021. https://floridadep.gov/fgs/data-maps

Florida Department of Environmental Quality. 2021 Data Source: FWC/FWRI Statewide Nesting Beach

Florida Department of Health. (2021). Healthy Beaches. Florida Department of Health in Brevard County. http://brevard.floridahealth.gov/programs-and-services/environmental-health/healthy-beaches/index.html

Gill, Andrew B. and Taylor, H. (2011). The Potential Effects of EM Fields Generated by Cabling between Offshore Wind Turbines upon Elasmobranchs. *Offshore Wind Energy*. University of Liverpool, Sept. 2011.

Hayes, W.N. and Ireland, L. C. (1978). Visually guided behavior of turtles. In Mostofsky, D. I. (ed) *The behavior of fish and other aquatic organisms* (pp. 281 – 317). Academic Press, New York.

Hoffmann, E.; Astrup, J.; Larsen, F.; Munch-Petersen, S.; and Støttrup, J. (2000). *Effects of Marine Windfarms on the Distribution of Fish, Shellfish and Marine Mammals in the Horns Rev Area* (Report No. DFU-rapport 117-02). Report by Danish Institute for Fisheries Research.

Kennedy, M. (2018, April 12), "Magnetic Fields Are A Big Predictor of a Loggerhead Turtle's Genes". *The Two-Way, NPR*. https://www.npr.org/sections/thetwo-way/2018/04/12/601830318/magnetic-fields-are-a-big-predictor-of-a-loggerhead-turtles-genes

Light, P., Salmon, M., and Lohmann, K. J. (1993, September 1). Geomagnetic Orientation of Loggerhead Sea Turtles: Evidence for an Inclination Compass. *J Exp Biol, 182*(1), 1–10. https://doi.org/10.1242/jeb.182.1.1

Lohmann, K.J., Cain, S.D., Dodge, S.A., Lohmann, C.M. (2001, October 12) Regional magnetic fields as navigational markers for sea turtles. *Science, 294*(5541), 364-6. https://www.science.org/doi/10.1126/science.1064557

Lohmann, K. J. & Lohmann, C. M. F. (1994). Acquisition of magnetic directional preference in hatchling loggerhead sea turtles. *J. Exp. Biol., 190*(1), 1–8. https://doi.org/10.1242/jeb.190.1.1

Lohmann, K. J. (1991, January 1). Magnetic orientation by hatchling loggerhead sea turtles (Caretta caretta). *J Exp Biol 155*(1). 37–49. https://doi.org/10.1242/jeb.155.1.37

Lohmann, K. J., Cain, S. D., Dodge, S. A., and Lohmann, C. M. F.. (1998). Migratory Guidance Mechanisms in Marine Turtles. *Journal of Avian Biology, 29*(4), 585–596. https://doi.org/10.2307/3677179

Luschi, P., Benhamou, S., Girard, C., Ciccione, S., Roos, D., Sudre, J., Benvenuti, S. (2007). Marine Turtles Use Geomagnetic Cues during Open-Sea Homing, *Current Biology, 17*(2), 126-133. https://doi.org/10.1016/j.cub.2006.11.062

Mrosovsky, N., & Shettleworth, S. J. (1968). Wavelength Preferences and Brightness Cues in the Water Finding Behaviour of Sea Turtles. *Behaviour, 32*(4), 211–257. http://www.jstor.org/stable/4533249

NOAA (2011). IOOS HF Radar. U.S. IOOS Office. https://hfradar.ioos.us/

NOAA (2016). U.S. Integrated Ocean Observing System (IOOS®) Program Programmatic Environmental Assessment. U.S. Integrated Observing System Office. https://cdn.ioos.noaa.gov/media/2017/12/IOOS_PEA-with-Appendices_FINAL_June-2016.pdf

Papi, F., Luschi, P., Akesson, S., Capogrossi, S., Hays, G. C. (2000) Open-sea migration of magnetically disturbed sea turtles. *J Exp Biol, 203*(22): 3435–3443. https://doi.org/10.1242/jeb.203.22.3435

Salmon, M. and Lohmann, K.J. (1989). Orientation Cues Used by Hatchling Loggerhead Sea Turtles (*Caretta caretta* L.) During their Offshore Migration. *Ethology, 83,* 215-228. https://doi.org/10.1111/j.1439-0310.1989.tb00530.x

Space Coast Audubon Society. (2022). About Us. http://www.spacecoastaudubon.org/about-us/

U.S. Fish and Wildlife Service (2021a). Atlantic Salt Marsh Snake. https://myfwc.com/wildlifehabitats/profiles/reptiles/snakes/atlantic-salt-marsh-snake/

U.S. Fish and Wildlife Service (2021b). https://ipac.ecosphere.fws.gov/

U.S. Fish and Wildlife Service (2021c). https://www.fws.gov/southeast/wildlife/birds/eastern-black-rail/#laterallus jamaicensisjamaicensis-section

U.S. Fish and Wildlife Service (2021d). https://ipac.ecosphere.fws.gov/

U.S. Fish and Wildlife Service (2021e). https://ipac.ecosphere.fws.gov/

U.S. Fish and Wildlife Service (2021f). https://ipac.ecosphere.fws.gov/

U.S. Fish and Wildlife Service (2021g). https://ipac.ecosphere.fws.gov/

U.S. Fish and Wildlife Service (2021h). https://ipac.ecosphere.fws.gov/

U.S. Fish and Wildlife Service (2021i). https://ipac.ecosphere.fws.gov/

U.S. Fish and Wildlife Service (2021j). https://ipac.ecosphere.fws.gov/

U.S. Fish and Wildlife Service (2021k). https://ipac.ecosphere.fws.gov/

U.S. Fish and Wildlife Service (2021l). https://ipac.ecosphere.fws.gov/

U.S. Geological Survey (2021). https://mrdata.usgs.gov/

Wyneken, J., Salmon, M., Lohmann, K. J. (1990). Orientation by Hatchling Loggerhead Sea-Turtles *Caretta caretta* L. in a Wave Tank. *Journal of Experimental Marine Biology and Ecology*, *139*(1-2), 43–50. https://doi.org/10.1016/0022-0981(90)90037-D

Sections 3.4.2-3.6 of The Biology of Sea Turtles, Volume III, Volume 3 edited by Jeanette Wyneken, Kenneth J. Lohmann, John A. Musick

APPENDICES

APPENDIX A: NOAA ENVIRONMENTAL COMPLIANCE QUESTIONNAIRE

Environmental Compliance Questionnaire Submitted by: Southeast Coastal Ocean Observing Regional Association (SECOORA) and the Florida Institute of Technology (FIT)

Submission Date: May 19, 2021

Contacts: Jennifer Dorton, SECOORA and Steven Lazarus, FIT

Proposed Activity Information:

1. Describe the proposed activity, including:
   - Explain the purpose, objectives, and goals; and
   - Explain if the proposed activity will occur in different locations and/or multiple phases.

The Florida Institute of Technology (often referred to as Florida Tech or FIT) is a private, not-for-profit research intensive university located in Melbourne, FL. Florida Institute of Technology, herein referred to as FIT, through its sub-contract with SECOORA, is in the process of siting a WERA High Frequency Radar (HFR) on the east coast of Florida at Hightower Beach Park. Hightower Beach Park is operated by the City of Satellite Beach, FL.

FIT completed the Environmental Compliance process for another installation at Treasure Shores Park (Nov 2020). The two FIT priority radars are planned for deployment south of the UGA/Skidaway Institute of Oceanography sites at Kennedy Space Center (EC process ongoing in cooperation with NASA) and Cape Canaveral National Seashore (EC completed Aug 2020). These four HFRs will broaden HFR coverage along the Florida east coast, where surface current data is nonexistent.

HFR are scientific equipment that provide surface current data which is used for scientific research such as Gulf Stream monitoring, larval fish tracking, and harmful algal bloom tracking and forecasting. Additionally, NOAA, the U.S. Coast Guard, and other federal agencies use the data for search and rescue activities, hazardous spill monitoring, and monitoring maritime conditions (e.g., coastal erosion, waves, rip current potential). The east coast of Florida represents a major coverage gap within the SECOORA region. By filling this gap, SECOORA's research partner at FIT, Dr. Steven Lazarus, will be able to monitor and track the Gulf Stream and provide near real time data to the U.S. Coast Guard, NOAA, state and local emergency managers, as well as researchers that study oceanography and meteorology. Surface current data provided by FIT will also be used to validate ocean circulation models and satellite derived ocean products.

The data provided by the Hightower Beach Park HFR will be shared with SECOORA and the HFR National Network at Scripps Institute of Oceanography (Scripps) and Rutgers through the US IOOS-sponsored HFR Surface Current Mapping Initiative. This data is open access and freely available to the public through SECOORA and the national data centers. The data is also served through NOAA's National Data Buoy Center (NDBC) where it is open access and freely available. NDBC makes the data available to local National Weather Service Offices for use in marine weather conditions reports and forecasts.

Hightower Beach Park is operated by the city of Satellite Beach, FL. A view of some of the park features and aerial views of the park are provided in Appendix 1. Appendix 1, Image B provides an aerial view of the entire park. HFR installation will not occur in the northern portion of the park (i.e., north of the bathroom facilities) as this is the undisturbed portion of the park. The southern portion of the park has been disturbed by the installation and maintenance and operation of the park facilities such as picnic shelters, restrooms, and a boardwalk. All HFR activities are planned for the southern, disturbed section of the park (see Appendix 1, Images C, D, and E).

FIT employees have worked with the Satellite Beach personnel to identify the location for the HFR antennas and the Park facilities that will support this deployment. Proposed activities include the installation, operation, and maintenance for the Hightower Beach WERA.

The Hightower Park HFR will operate at 13.5 MHz. The 12 transmit and 4 receive antennas are 7 ft tall with a diameter of 2 inches. All transmit and receive array antenna will be placed behind the shoreward vegetation to reduce interaction with nesting sea turtles and minimize visual impact of the HFR antenna (i.e., make them less noticeable to park visitors). All antennas will be painted a flat green color so that moonlight does not reflect off of the antenna and cause a visual disturbance for newly hatched sea turtles. The proposed site design is found in Appendix 2. Examples of painted and non-painted HFR antenna from SECOORA partner sites are provided in Appendix 3.

Cables will run from the antennas, across the vegetated dune, to the boardwalk (see Appendix 2). The cables are similar in diameter to telephone cables and they will be placed inside of flexible PVC corrugated pipe and laid on the surface of the dunes (Appendix 4, Image B). Placing the cables inside of the corrugated pipe will protect the cables from beach mice and other wildlife that may chew on them. Additionally, placing the cables on the surface of the dunes will minimize impacts to dune vegetations since the cables will not be buried (Note: burial would require trenching and could damage plant root structure). Over a period of time, sand will cover the corrugated pipe and it will not be visible. Once the cables reach the boardwalk, they will be attached to the underside (with a J hooks or clamps) so they are off the ground and not visible to park visitors and mitigating impacts to dune flora and fauna. The cables will run the length of the boardwalk and over to the trailer/shed. The boardwalk has electricity and electrical cables run above ground, under the boardwalk (Appendix 4, Image A). This configuration is similar to what is being proposed by FIT for running cables under the boardwalk.

FIT will install shelves and WERA radar, computer equipment, and other electronics (e.g., wireless router) inside of shed which will sit on top of a towable trailer. See Appendix 2 for the proposed location of the trailer/shed adjacent to the parking lot. The trailer/shed combo will be placed near the restroom facility as electricity is available at this location. Photos of a similar trailer/shed combo used by the University of South Carolina and Skidaway Institute of Oceanography for their HFR installations are available in Appendix 5. By placing the shed (with HFR equipment inside) on a trailer, FIT will be able to tow the WERA equipment out of Hightower Park facilities in the event of a hurricane. The trailer/shed can be moved back to FIT and placed in a secure location until after the storm when it can then be reinstalled at the park.

FIT will acquire the following permits for this site: 1) license agreement with the city of Satellite Beach; 2) any permits required by FL Department of Natural Resources; and 3) the electrician hired to connect electricity to the trailer/shed will acquire necessary permits for electrical service installation.

Installation of the HFR antennas and cables will take approximately 2 weeks. Installation will take place outside of turtle nesting season which runs from April 1 – October 31. The project team would like to install the HFR system at Hightower Beach Park in November/December 2021.

2. Is the proposed activity a continuation or part of an ongoing activity? If yes, then:
    - describe any changes to the proposed activity since it was initiated, including progress toward achieving its objectives/goals; and
    - provide any additional information, previous environmental review documents, and/or reports from previous years.

SECOORA is a certified NOAA Integrated Ocean Observing System (IOOS) Regional Association. Through IOOS funding, SECOORA coordinates HFR activities in the four-state region of NC, SC, GA, and FL. The Hightower Beach Park HFR installation is part of a large, on-going SECOORA initiative to fill HFR coverage gaps. HFR systems measure the speed and direction of ocean surface currents in near real time. The east coast of Florida represents a large coverage gap in HFR (i.e., surface current) coverage. Four sites are slated for installation:

- FIT installation at Treasure Shores Park (EC completed Nov 2020).
- FIT installation at Hightower Beach Park (EC in progress).
- UGA/Skidaway Institute of Oceanography installation at Kennedy Space Center (EC process ongoing in cooperation with NASA – COVID is delaying action as the base is closed to non-essential staff).
- UGA/Skidaway Institute of Oceanography installation at Cape Canaveral National Seashore (EC completed Aug 2020).

Filling HFR coverage gaps will expand surface current mapping for the SECOORA region. HFR is a key technology supported by IOOS. Surface current mapping is integral to research, supporting oceanographic, fisheries, and meteorological research and modeling activities.

Surface current mapping is also vital for U.S Coast Guard search and rescue activities, monitoring and tracking hazardous materials, monitoring water quality which includes tracking harmful algal blooms, and it supports marine navigation (see https://ioos.noaa.gov/project/hf-radar/).

Proposed Activity Location

3. Describe the proposed activity location, including, if available and appropriate, geographic coordinates (latitude, longitude in DD MM.MMM), river mile markers, etc. for all distinct phases of the proposed activity.

The coordinates listed below are for the parking lot at Hightower Beach Park. The HFR deployment location is south and shoreward of the parking lot, approximately 100 ft away. See Appendix 2.

Coordinates: 28.194372
- 80.594403

There are no Federal, State, Tribal, or local protected areas within the proposed HFR footprint; however, the proposed location is within the boundaries of Hightower Park, owned and operated by the City of Satellite Beach, FL.

Proposed activities include the installation and maintenance for the Hightower Beach WERA. This station will operate at 13.5 MHz. A proposed site layout is provided in Appendix 2.

FIT will install shelves and WERA radar, computer equipment, and other electronics (e.g., wireless router) inside of a shed which will be placed on top of a towable trailer and parked within Hightower Park (near the bathhouse). A separate electrical box should not be required as an electrician can connect power to the shed from the existing power source near the park bathhouse. If needed, a separate meter box can be installed to power the system.

The 12 transmit and 4 receive antennas are 7 ft tall with a diameter of 2 inches. All transmit and receive array antennas will be placed behind the shoreward vegetation to reduce interaction with nesting sea turtles and minimize visual impact of the HFR antenna (i.e., make them less noticeable to park visitors). All antennas will be painted a flat green color so that moonlight does not reflect off of the antenna and cause a visual disturbance for newly hatched sea turtles.

Cables will run from the antennas, across the vegetated dune, to the boardwalk (see image in Appendix 2). The cables are similar in diameter to telephone cables and they will be placed inside of flexible PVC corrugated pipe (example in Appendix 4, Image B) and laid on the surface of the dunes. Placing the cables inside of the corrugated pipe will protect the cables from beach mice and other wildlife that may chew them. Additionally, placing the cables on the surface of the dunes will minimize impacts to dune vegetations since the cables will not be buried (Note: burial would require trenching which could damage plant root structure; therefore, no trenching is proposed for this installation effort). Over a period of time, sand will cover the corrugated pipe and it will not be visible. Once the cables reach the boardwalk, they will be attached to the underside of the boardwalk and will then run to the shed. By attaching the cables to the underside of the boardwalk, they will not be visible to park visitors and this will elevate the cables above the ground; thereby reducing impacts to dune flora and fauna. The length of the boardwalk has electricity and electrical cables run above ground, under the boardwalk (Appendix A, Image A). This configuration is similar to what is being proposed by FIT for running cables under the boardwalk.

No HFR installation or maintenance activities occur in water; therefore, there will be no impacts to water quality, submerged vegetation, nearshore reefs, or other aquatic habitats.

4. Provide maps and graphics of the proposed location, if available (at a scale that clearly shows site location(s) relative to the surrounding area and nearby features).

See Appendices 1 and 2.

5. Is the location of the proposed activity in a previously undisturbed area? If yes, then explain if the proposed activity would degrade or disturb the previously undisturbed area.

Hightower Beach Park is a municipal park operated by the City of Satellite Beach, FL. The southern portion of the park area has been disturbed in order to construct, maintain, an operate park amenities. These amenities include a parking lot behind the dunes, picnic shelters, a boardwalk, and dune crossovers that traverse the dune vegetation, an observation pavilion along the beach, and restrooms and shower facilities (https://www.visitspacecoast.com/satellite%20beach/things-to-do/hightower-beach-park).

6. Are there pre-existing or ongoing uses at the location of the proposed activity? If yes, then describe and explain the pre-existing or ongoing uses at the location of the proposed activity or, if not known, describe how pre-existing/ongoing uses will be determined.

Hightower Beach Park is a municipal park operated by the City of Satellite Beach. As such, the park has a high number of visitors annually. The city maintains the boardwalk and dune crossovers so that beachgoers can easily access the beach. Park amenities include a parking lot behind the dunes, picnic shelters, a boardwalk and dune crossovers that traverse the dune vegetation, an observation pavilion along the beach, and restrooms and shower facilities (https://www.visitspacecoast.com/satellite-beach/things-to-do/hightower-beach-park).

7. Describe the characteristics of the location of the proposed activity by:
    - indicating whether it includes unique geographic areas of notable recreational, ecological, scientific, cultural, historical, scenic, economic, or aesthetic importance;

There are no cultural or historical areas of significance within the park. As noted above, this is a municipal park and is open to the public for recreation. No HFR installation or maintenance activities occur in water; therefore, there will be no impacts to water quality, submerged vegetation, nearshore reefs, or other aquatic habitats.

- describing any anticipated changes over time to the natural landscape and/or viewshed that would result from the proposed activity;

The only viewshed disturbances are the 12 transmit and 4 receive antennas (7 ft tall with a diameter of 2 inches) that will be installed along the disturbed southern portion of the park. The antennas will be painted a flat green color so that they blend in the with the dune vegetation. Painting the antenna will also mitigate light reflection at night. An example of painted antennas is in Appendix 3.

- listing any ecologically significant or critical areas in the location of the proposed activity, including areas that are normally inundated by water or areas within the 100-year flood plain;

Hightower Beach is a beachfront park. As such, there is the potential for inundation with sea water during a tropical storm or hurricane.

- essential fish habitat and habitat areas of particular concern designated under the Magnusnon-Stevens Fishery Conservation and Management Act;

N/A – this is a land-based installation.

- listing any critical habitat areas for Endangered Species Act-listed species;

Hightower Beach Park is a sea turtle nesting area. No HFR installation will occur during turtle nesting season (April 1 – October 31). Florida beach mice may be present within the park. Cable laying will be conducted to minimize any impacts to the dunes and beach mice (i.e., the cable will be placed inside of corrugated pipe so that no trenching is required to bury the cable). There are sea grapes near the main dune crossover (the boardwalk section that crosses over to the beach allowing public access; however, the HFR installation will not occur in the sea grape area.

The HFR installation and associated maintenance are not occurring on the beachfront (i.e., eastward of the dunes); therefore, the installation and maintenance do not pose a threat to shorebirds.

All proposed HFR installation activities are terrestrial based. FIT will follow all best management practices as related to HFR installation and operation as outlined in Appendix G of the IOOS PEA (https://ioos.noaa.gov/about/governance-and-management/environmental-compliance/). Specifically, installation will occur during daylight hours; all installation materials will be removed upon completion of installation; all instruments/installations must be removed when no longer in use to avoid the creation of marine debris and potential for entanglement; no impact hammers will be used; there are no ice seals or pinniped rookeries or haul-out locations at the Hightower Beach HFR site; and no submarine cables will be used. FIT will follow NMFS guidelines, were applicable for terrestrial work, as provided in Enclosure 1 to Appendix G. Installation activities will not occur during sea turtle nesting season. Additionally, all transmit and receive antennas will be painted in a flat green color so they do not reflect moon light.

- listing any marine protected areas or national marine sanctuaries in the location of the proposed activity;

N/A

- listing any part of refuge lands, wild or scenic rivers, wetlands, or prime/unique farmland in the location of the proposed activity;

N/A

- listing any properties listed or eligible for listing on the National Register of Historic Places, National Historic Landmarks, or National Monuments; and

N/A

- listing any religious or cultural sites of any Federally recognized Indian Tribes or Native Hawaiian organizations in the proposed activity area.

N/A

Proposed Activity Timeframe

8. Specify the proposed start date and duration of the proposed activity for all distinct phases of the project.

Work that takes place on FIT campus prior to Hightower HFR installation (Summer 2021):

- Build trailer/shed combo on FIT campus
- Install computer and radar system within the shed
- Install wireless router
- Install A/C unit in shed
- System testing

Proposed start date for work taking place within Hightower Park: November 15, 2021.

HFR installation will take approximately 2 weeks total. A breakdown of the activities are as follows:

- Electrical service installation (and possible meter box installation if required) – 1 day (will occur prior to beach front work)
- Cable laying – 4 days
- Antenna assembly, installation, and connecting cables - 2-3 days
- Moving trailered shed to Hightower Park and connecting to power – 1 day
- Connecting cables to radar inside of the shed; Powering on and testing system (and any required calibration and/or troubleshooting) – 2-3 days

9. Provide proposed activity schedules for all distinct phases of the proposed activity, including:
    - implementation dates of major elements of the proposed activity;
    - frequency of activities within the proposed activity schedule (e.g. once per week, 10 days per month, daily); and
    - deployment and recovery schedules of equipment or structures that would be temporarily or permanently placed in the environment.

Work that takes place on FIT campus prior to Hightower HFR installation (Summer 2021):

- Build trailer/shed combo on FIT campus
- Install computer and radar system within the shed
- Install wireless router
- Install A/C unit in shed
- System testing

Proposed start date for work taking place within Hightower Park: November 15, 2021.

HFR installation will take approximately 2 weeks total. A breakdown of the activities are as follows:

- Electrical service installation (and possible meter box installation if required) – 1 day (will occur prior to beach front work)
- Cable laying – 4 days
- Antenna assembly, installation, and connecting cables - 2-3 days
- Moving trailered shed to Hightower Park and connecting to power – 1 day
- Connecting cables to radar inside of the shed; Powering on and testing system (and any required calibration and/or troubleshooting) – 2-3 days

Maintenance includes monthly downloads of data from the HFR computer (housed in the shed) and visual inspection of antenna from the park boardwalk or by walking along the beach. General maintenance and operation-related activities will not disturb the dunes, vegetation, or wildlife.

It is anticipated that individual antenna may be damaged over time – from storms or potentially vandalism. If this occurs, FIT personnel will make repairs to or replace an antenna. Based on other HFR operations within SECOORA, most repairs require less than 1 day (e.g., replace an antenna). This will have minimal impact to dunes, vegetation, and wildlife.

HFR are built to withstand storms; however, if the City of Satellite Beach determines that they would like the HFR equipment removed prior to a landfalling hurricane, this request can be accommodated by FIT personnel. The trailered shed can be towed back to FIT campus and the antenna can be removed. The cables will remain in place as they can withstand sea water overwash. The trailered shed and the antennas would then be replaced after the park has reopened to visitors.

Deployment of the HFR is proposed for Nov. 15 and will occur over a two-week period. The HFR will be decommissioned if NOAA IOOS funding no longer supports its use. At this time, SECOORA will continue providing funding through the new IOOS 5-year cooperative agreement that covers the period 2021-2026. At minimum, the HFR will remain in place through June 30, 2026.

Project Partners, Permits, and Consultations

10. Is this proposed activity funded in any way by another Federal or state agency? If yes, then:
    - identify the Federal or state agency; and
    - include information on whether an environmental assessment or environmental impact statement was completed or is in the process of being completed for the proposed activity.

The US IOOS completed a Programmatic Environmental Assessment in 2016. HFR installation and operation are included in the IOOS Final PEA. Additionally, a FONSI was issued for this PEA. Both documents are available here: https://ioos.noaa.gov/about/governance-and-management/environmental-compliance/

Relevant IOOS PEA sections and number(s): A description of HFR is found on page 1-7 and in Appendix E, specifically page E-1, and WERA HFR is described on page E-4. A description of the preferred alternative for FY16- 20 is found on page 2-14; however, the PEA did not capture all of proposed HFR locations that are listed in the SECOORA HFR Gap Analysis. The impacts for installation and operations of the HFR to physical resources for the proposed action is found in the IOOS PEA as follows: Geological resources, page 4-3; Water Quality 4-5. A description of the impacts to biological resources for the proposed action is found in the IOOS PEA as follows: Terrestrial Biological Resources 4-6; Marine Biological Resources, 4-9. A description of the impacts to cultural resources for the proposed action is found in the IOOS PEA on page 4-11.

11. List all other interested or affected Federal, state, and local agencies, Native American tribes or Native Hawaiian organizations, non-governmental organizations, and private individuals which may potentially be interested and/or affected by the action.

A private citizen has expressed concerns over the HFR installation at Hightower Park. Some of the expressed concerns include negative impacts to dune vegetation, endangered mice, threatened and endangered shore birds, endangered and threatened sea turtles, as well as protections for the near-shore reef.

12. Are minority or low-income communities located in the area of the proposed activity? If yes, then describe how the minority or low-income communities may be impacted by the proposed activity.

N/A

13. Are Federal, state, or local permits, authorizations, waivers, determinations, or consultations required for the proposed activity to comply with all applicable environmental laws and regulations? If yes, then:
    - list and provide the status of all required Federal, state, or local permits, authorizations, waivers, determinations, conditions, and consultations, as applicable; and
    - provide copies of all required Federal, state, or local permits, authorizations, waivers, or determinations that you have secured.

U.S. Fish and Wildlife Service and the FL SHPO will provide consultation during the NEPA process.

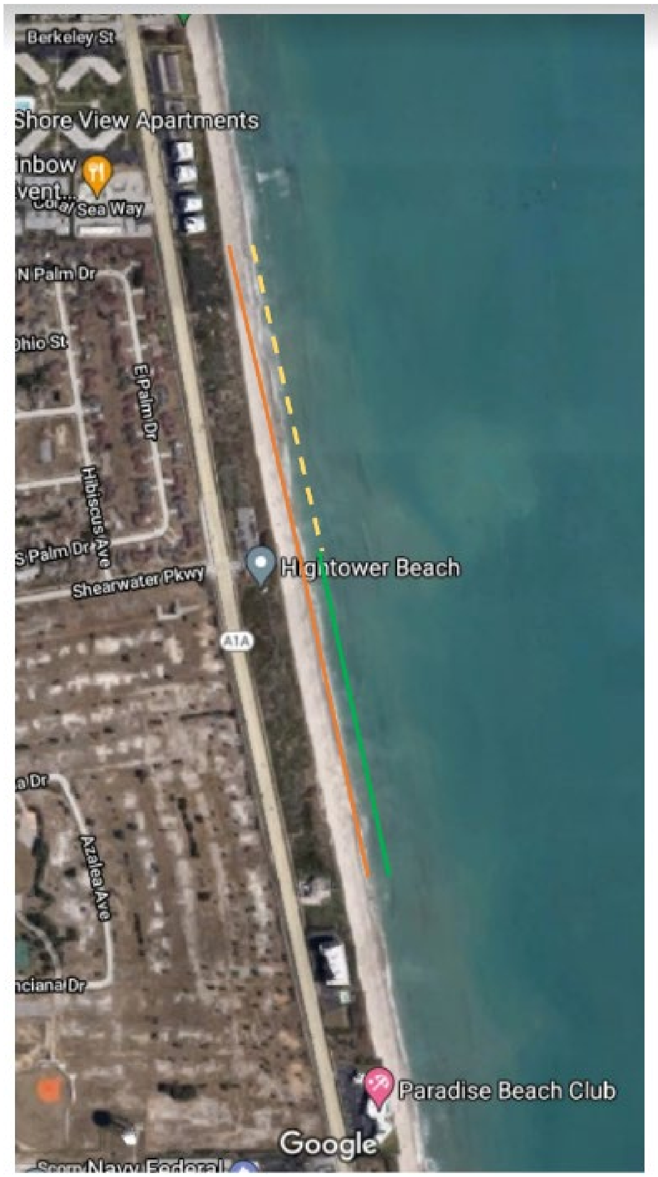
FIT has presented this project to the Satellite Beach City Council (1/20/21). The Satellite Beach City Council approved the HFR installation (see page 3 of the attached minutes from the meeting – Appendix 6). The final site layout will be reviewed by the City Council for final approval prior to installation.

The City Council staff will work with the Florida Department of Environmental Protection (FL DEP) so that staff with the Florida Community Trust (https://floridadep.gov/lands/land-and-recreation-grants/content/fct-florida-communities-trust-home) are able to review the site plan and provide input on the design.

Appendix 1, Image A: Overview of Hightower Beach Park

Hightower Beach Park entrance off of FL Highway A1A. The park is owned and operated by the City of Satellite Beach, FL.

Appendix 1, Image B: Overview of Hightower Beach Park



Aerial view of Hightower Beach

Park. The orange line represents the entire length of the park.

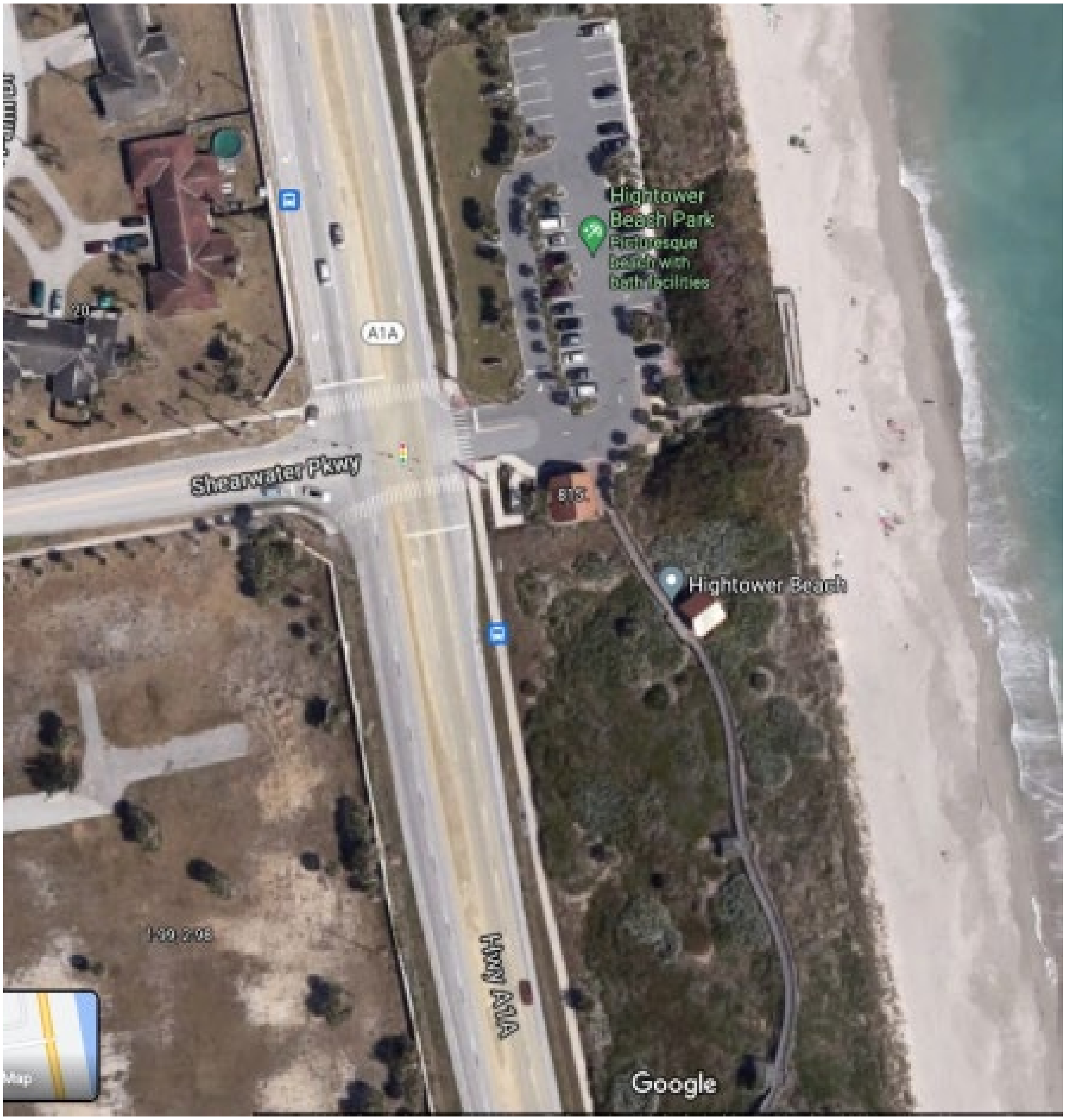
The yellow dashed line is the northern portion of the park that is undisturbed. HFR installation will not occur in the northern portion of the park (i.e., north of the bathroom facilities).

The green line represents the southern portion of the park which has been disturbed by the installation and maintenance of park facilities such as picnic shelters, restrooms, and a boardwalk. All HFR activities are planned for the southern, disturbed section of the park.

Appendix 1, Image C: Overview of Hightower Beach Park

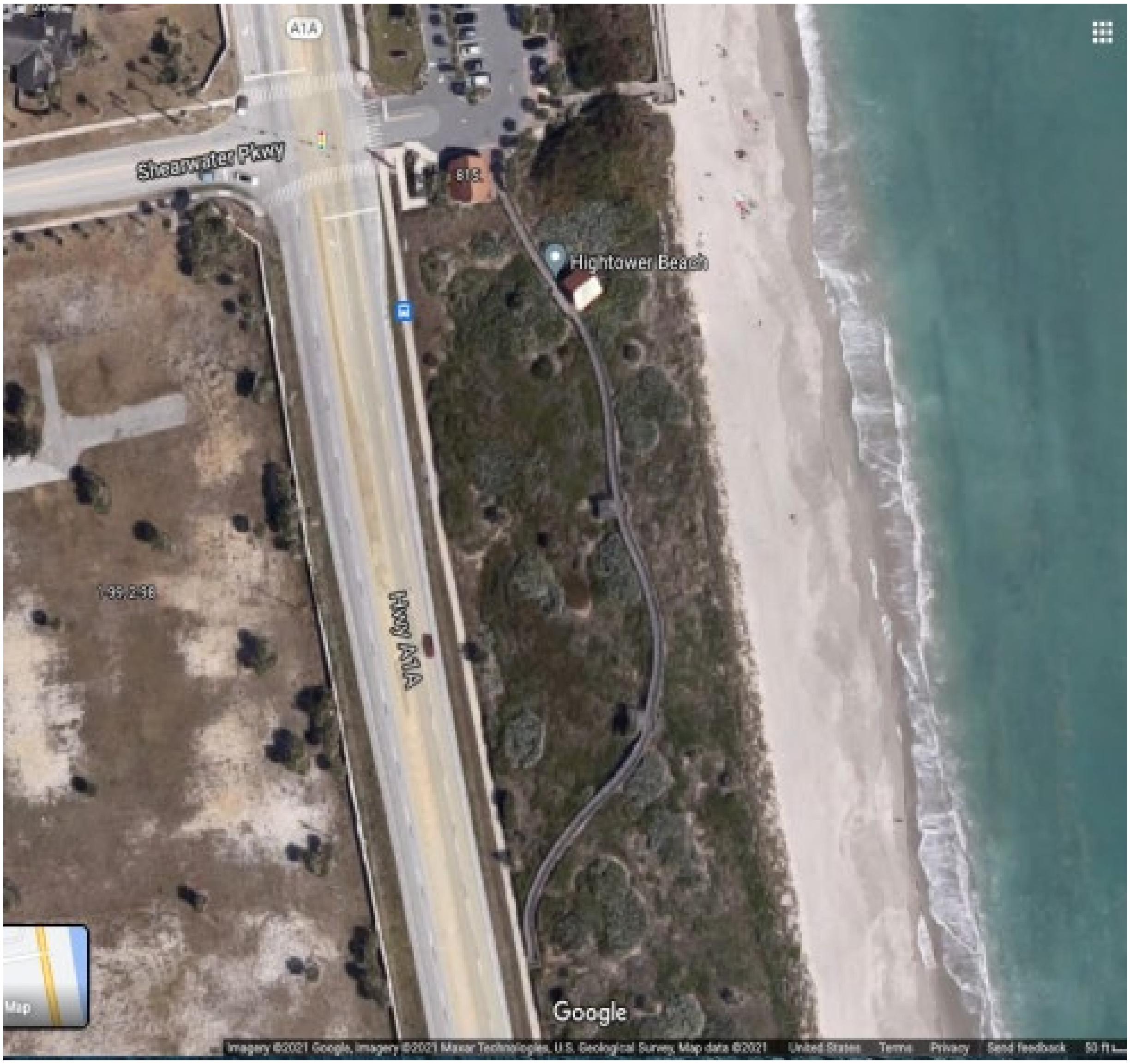
Image A: Hightower Beach Park restroom facilities located on the south side of the parking lot.
Image B: North entrance to the dune boardwalk located shoreward of the restroom facilities.

Appendix 1, Image D: Overview of Hightower Beach Park



Aerial view of the south portion of Hightower Beach Park, including the entrance, parking lot, dune crossover, bathroom, shelters along the boardwalk, and a portion of the boardwalk.

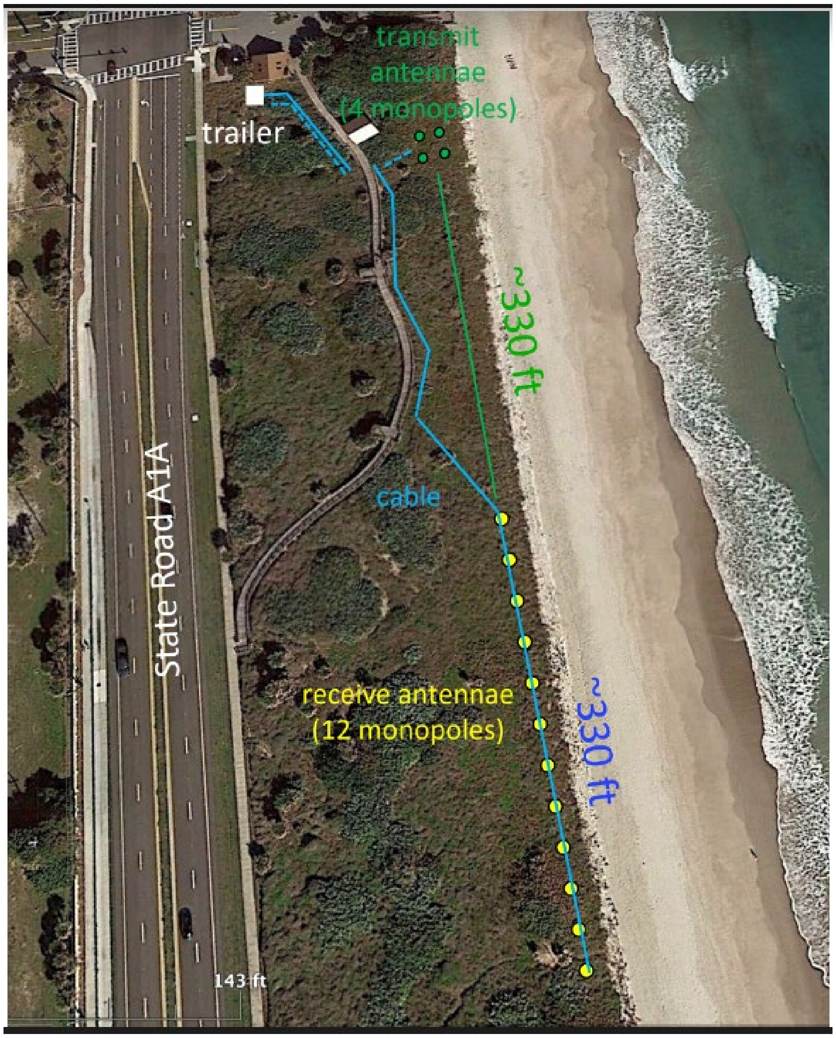
Appendix 1, Image E: Overview of Hightower Beach Park



Aerial view of Hightower Park showing the south end of the parking lot and the full extent of the boardwalk that winds through the dune vegetation.

The FIT HFR installation is proposed for the south end of the park as this area is already impacted due to installation and maintenance activities related to park amenities and the boardwalk.

Appendix 2: Proposed site layout



Cables (blue line on map) from the transmit and receive antennas will be placed inside of corrugated, flexible pipe. The cables will not be buried (they will be laid on the dune surface until they reach the boardwalk). Once reaching the boardwalk, the cables will be elevated and secured under the boardwalk (off the ground). This will reduce impacts to flora and fauna and make them less visible to park visitors.

The HFR antennas will be placed within the dune vegetation, allowing them to blend into the scenery. This will reduce visibility of the monopoles.

The trailer/shed will be placed near the restroom in a limited vegetated (disturbed) location.

Appendix 3: HFR antenna examples

Twelve transmit antenna for the St. Catherine's Island (CAT) HFR installation are pictured. These antennas are not painted. CAT is operated by the Skidaway Institute of Oceanography and was installed in 2006.

Appendix 3: HFR antenna examples

Receive antennas for HFR installation at Myrtle Beach State Park in South Carolina. The University of South Carolina painted these antenna brown so they are less noticeable to park visitors.

Appendix 4, Image A: View of the boardwalk at Hightower Beach Park & electrical service

Electricity along boardwalk (embedded within PVC). The cables for the HFR will be attached to the underside of the boardwalk, similar to the electricity cables, so that they are not visible to the public.

Appendix 4, Image B: Corrugated PVC pipe

University of Miami students and technicians placing WERA HFR cables inside of 4” corrugated pipe. The conduit with the HFR cables inside was placed within the vegetation at the HFR site at Crandon Park, Miami, FL.

Appendix 5: Shed/trailer combos used by HFR operators in NC and GA

Trailer/shed combos can be a flat color (e.g., white) or painted to blend in with the environment. Image A) Trailer/shed used by Skidaway Institute of Oceanography on St. Catherine's Island, GA; and B) Trailer/shed used by the University of South Carolina at Caswell Beach, NC. Components required to operate the HFR (e.g., the radar, computer, wireless router, and A/C) are housed inside of the shed.

Appendix 6: Council meeting minutes

CITY COUNCIL REGULAR MEETING MINUTES

JANUARY 20, 2021

Pursuant to Public Notice, Mayor Steven Osmer convened a regular meeting of the City Council on Wednesday, January 20, 2021, at 7:00 p.m., in the Council Chamber. Those present were Mayor Steven Osmer, Vice Mayor Dominick Montanaro, Councilmember Mindy Gibson, Councilmember Jodi Rozycki, Councilmember David Vigliotti, City Manager Courtney Barker, City Attorney James Beadle and City Clerk Gwen Peirce.

Vice Mayor Montanaro led the Pledge of Allegiance and a moment of silence.

(TIME: 7:01 P.M.) PRESENTATION OF CERTIFICATE OF RECOGNITION TO KAREN COLEMAN FOR HER SERVICE TO THE COMMUNITY

Mayor Osmer introduced Robert Settembrino, Project Superintendent, who wrote the letter commending Ms. Coleman's volunteer service. Mayor Osmer presented the certificate to Ms. Coleman.

(TIME: 7:05 P.M.) SWEARING IN OF FIREFIGHTER BRADLEY PETTINGILL

Fire Chief Dave Abernathy provided background on Firefighter Pettingill and introduced his father and sister who administered the oath and "pinned" him.

(TIME: 7:09 P.M.) CITIZEN COMMENTS

Sandra Sullivan, non-resident, spoke regarding the Hightower Preserve and former Patrick Air Force Base South Housing.

(TIME: 7:14 P.M.) CITY COUNCIL COMMENTS

Councilmember Vigliotti commended Mrs. Coleman and spoke regarding upcoming trash clean-up events and a tree planting event at City Hall.

Vice Mayor Montanaro spoke regarding his attendance at a virtual meeting of the Florida League of Cities Advocacy Committee and encouraged councilmembers and residents to contact legislators regarding proposed House and Senate Bills that would impact the City.

Councilmember Gibson thanked City Council, City Manager and staff for the flowers commemorating the death of her sister. She spoke regarding the funeral of Jake Williams, former Mayor of Cocoa. She spoke regarding her attendance to a retreat of the East Central Florida Regional Planning Council. She spoke regarding Senate Bill 62, which would eliminate regional planning councils.

Councilmember Rozycki provided updates on the Youth Council, including the youth photo contest and the installation of the new water fountain at Satellite High School. She spoke regarding the swearing in of President Joe Biden and the great feeling of community in Satellite Beach.

Mayor Osmer spoke regarding his attendance at recent meetings of Planning Advisory Board and Library Board.

Vice Mayor Montanaro spoke regarding Senate and House bills pertaining to short-term rentals and not allowing cities to hire lobbyists. He announced the tree planting event at City Hall.

(TIME: 7:26 P.M.) CITY ATTORNEY REPORT

City Attorney Beadle provided an update on the Sunshine Law case.

(TIME: 7:27 P.M.) CITY MANAGER REPORT

City Manager Barker spoke regarding an upcoming Melbourne Municipal Band concert at DRS and the Villon Surf Contest. She spoke regarding a thank you letter that she received for the efficient response from the Fire Department. She provided an update on the Fire Department providing COVID-19 vaccines to residents 65 and older. She provided an update on current public works projects throughout the City. She spoke regarding the new sound system in the Council Chambers. She spoke regarding the tree planting in honor of Gail Meredith, who was an environmentalist and City resident.

(TIME: 7:33 P.M.) CONSENT AGENDA

A. ADOPTION OF MINUTES: DECEMBER 16, 2020 REGULAR MEETING B. DISCUSS/TAKE ACTION ON AGREEMENT TO ALLOW THE INSTALLATION OF A HIGH FREQUENCY RADAR NETWORK SYSTEM AT HIGHTOWER BEACH BY THE FLORIDA INSTITUTE OF TECHNOLOGY AS PART OF A NOAA RESEARCH PROJECT

C. APPROVE HIRING A FULL-TIME GROUNDS MAINTENANCE SPECIALIST

AND A PART-TIME STAFF ASSISTANT TO THE PUBLIC WORKS DEPARTMENT

Mayor Osmer stated that Item 9B will be pulled off the Consent Agenda.

Vice Mayor Montanaro commended the Public Works Department on their hard work, especially during the COVID pandemic.

Mayor Osmer asked for citizen comments; there were no comments.

ACTION: Vice Mayor Montanaro MOVED, SECOND by Councilmember Gibson, to approve the Consent Agenda, Items A and C, as presented. VOTE: ALL YES. MOTION CARRIED.

(TIME: 7:37 P.M.) ITEM B: DISCUSS/TAKE ACTION ON AGREEMENT TO ALLOW THE INSTALLATION OF A HIGH FREQUENCY RADAR NETWORK SYSTEM AT HIGHTOWER BEACH BY THE FLORIDA INSTITUTE OF TECHNOLOGY AS PART OF A NOAA RESEARCH PROJECT

City Manager Barker introduced Dr. Steven Lazarus from Florida Institute of Technology, who presented a PowerPoint Presentation regarding this item.

The following non-resident spoke regarding this item: Sandra Sullivan.

ACTION: Vice Mayor Montanaro MOVED, SECOND by Councilmember Gibson, to approve the Agreement to allow the installation of a High Frequency Radar Network System at Hightower Beach Park by the Florida Institute of Technology as part of a NOAA Research Project; with the additional approval for staff to determine the placement and approval of any minor changes to the agreement from the City Attorney. VOTE: ALL YES. MOTION CARRIED.

(TIME: 8:05 P.M.) DISCUSS/TAKE ACTION ON RESOLUTION NO. 1035, A RESOLUTION OF THE CITY OF SATELLITE BEACH, BREVARD COUNTY, FLORIDA

AUTHORIZING A LOAN IN A PRINCIPAL AMOUNT NOT TO EXCEED $2,975,000 TO FINANCE STORMWATER SYSTEM IMPROVEMENTS AND TO PAY COSTS OF SUCH LOAN; APPROVING THE FORM OF A REVENUE NOTE, A LOAN AGREEMENT AND AN ESCROW AGREEMENT; DELEGATING TO CERTAIN

OFFICIALS OF THE CITY TO TAKE CERTAIN ACTIONS AND TO EXECUTE ANY DOCUMENTS AND TAKE ANY ACTIONS REQUIRED IN CONNECTION WITH THE ISSUANCE OF SAID LOAN AND APPOINTING TRUIST BANK TO ACT AS ESCROW AGENT UNDER SUCH ESCROW AGREEMENT; PROVIDING OTHER DETAILS WITH RESPECT THERETO; AND PROVIDING AN EFFECTIVE DATE

Brittany Jumper, Support Services Director, presented background information on this item.

Mayor Osmer asked for citizen comments; there were no comments.

ACTION: Councilmember Gibson MOVED, SECOND by Councilmember Vigliotti, to

Adopt Resolution No. 1035. VOTE: ALL YES. MOTION CARRIED.

(TIME: 8:12 P.M.) PUBLIC HEARING: DISCUSS/TAKE ACTION ON ORDINANCE NO. 1194, FIRST READING OF COMPREHENSIVE PLAN AMENDMENT TRANSMITTAL INCORPORATING CLIMATE CHANGE ADAPTATION AND

RESILIENCY POLICIES AND TRANSMITTAL TO THE STATE DEPARTMENT OF ECONOMIC OPPORTUNITY FOR REVIEW

City Manager Barker presented the background information on the item.

The following non-resident spoke regarding this item: Sandra Sullivan.

ACTION: Vice Mayor Montanaro MOVED, SECOND by Councilmember Vigliotti, to approve Ordinance No. 1194 on first reading and for transmittal to the Department of Economic Opportunity for review and comments. VOTE: ALL YES. MOTION CARRIED.

(TIME: 8:27 P.M.) PUBLIC HEARING: DISCUSS/TAKE ACTION ON ORDINANCE NO. 1196, AN ORDINANCE OF THE CITY OF SATELLITE BEACH, BREVARD COUNTY, FLORIDA, AMENDING THE CITY OF SATELLITE BEACH 1998 COMPREHENSIVE PLAN, AS AMENDED, BY REVISING THE FUTURE LAND USE MAP FOR PROPERTY LOCATED AT 1100 SOUTH PATRICK DRIVE FROM C, COMMERCIAL AND SERVICES TO RL-1, RESIDENTIAL LOW DENSITY (1 DU/ACRE) PROVIDING FOR INCLUSION OF ORDINANCE AND REVISED FUTURE LAND USE MAP IN THE COMPREHENSIVE PLAN; PROVIDING FOR AN EFFECTIVE

DATE (SECOND READING)

Mayor Osmer asked for citizen comments; there were no comments.

ACTION: Vice Mayor Montanaro MOVED, SECOND by Councilmember Gibson, to approve Ordinance No. 1196 on second reading. VOTE: ALL YES. MOTION CARRIED.

(TIME: 8:29 P.M.) PUBLIC HEARING: DISCUSS/TAKE ACTION ON ORDINANCE NO. 1197, AN ORDINANCE OF THE CITY OF SATELLITE BEACH, BREVARD COUNTY, FLORIDA AMENDING THE CITY'S OFFICIAL ZONING MAP BY REZONING REAL PROPERTY LOCATED AT 1100 SOUTH PATRICK DRIVE FROM C, COMMERCIAL, TO R-1, SINGLE FAMILY RESIDENTIAL AMENDING THE ZONING MAP ACCORDINGLY, AND PROVIDING AN EFFECTIVE DATE (SECOND READING)

Mayor Osmer asked for citizen comments; there were no comments.

ACTION: Councilmember Gibson MOVED, SECOND by Vice Mayor Montanaro, to approve Ordinance No. 1197 on second reading. VOTE: ALL YES. MOTION CARRIED. **(TIME: 8:30 P.M.) AGENDA ITEMS FOR NEXT REGULAR COUNCIL MEETING**

None.

Mayor Osmer adjourned the meeting at 8:37 p.m.

/s/

Gwen Peirce, CMC

City Clerk

APPENDIX B: WERA PHASED ARRAY AND CODAR SYSTEMS

Description of High Frequency Radar Types, Placement, and Installation

High frequency radar (HFR) systems measure the speed and direction of ocean surface currents in near real time. Currents in the ocean are equivalent to winds in the atmosphere because they move things from one location to another. Currents carry nutrients as well as pollutants, so it is important to know the currents for ecological and economic reasons. Because currents carry any floating object, U.S. Coast Guard Search and Rescue operators use HFR data to make critical decisions when rescuing disabled vessels and people stranded in the water.

HFR can measure currents over a large region of the coastal ocean, from a few kilometers offshore up to 200 kilometers, and can operate under any weather conditions. They are located near the water's edge, and need not be situated atop a high point of land. Traditionally, crews placed current measuring devices directly into the water to retrieve current speeds. While these direct measurement systems are still widely used as a standard reference, HFR are the only sensors that can measure large areas at once with the detail required for the important applications described here; not even satellites have this capability (NOAA 2011). HFR systems support a range of applications, including search and rescue, spill response, harmful algal bloom monitoring, pollution tracking, larval transport, and coastal water quality assessments. Data can also provide value in ecosystem assessment and fisheries management. U.S. IOOS® partners currently operate approximately 165 HFRs in 10 U.S. IOOS regions. All but one of the HFR sites in U.S. and Caribbean coastal zones are operated by U.S. IOOS Regional Associations. There are two types of radars used by the U.S. IOOS Regional Associations; – direction finding and the WERA® and LERA and the Phased Array and the CODAR SeaSonde.

WERA and LERA Phased Array Systems

WERA and LERA phased array systems differ from the CODAR SeaSonde systems in the number of antennas employed: there are typically four transmit antenna elements but between 8 - 16 receive antenna elements. These receive elements are typically arranged in a line along the shore with receive and transmit arrays being separated by tens of meters. The four elements of the transmit array are usually arranged in a rectangular pattern with each element being 2 - 6 meters in height depending on transmit frequency. The length of the receive antenna arrays depend on the transmit frequency and the number of elements but are on the order of 100 meters in length. Currently there are four radar systems in the Miami area, four along the Georgia/South Carolina coast, two on the west coast of Florida, and four arrays on the island of O'ahu in Hawaii.

Installation and Special Cases

Cables are typically laid on the ground. At some sites cables are run through a plastic conduit and in some cases property owners require cables be buried. For example, during a recent installation in Florida, the county required the cables to be buried as the HFR is located on a public beach. In this case the ditch for the cable run was 1.5 feet deep and 10 inches wide. The county provided the equipment to dig the trench.

Aesthetics

Often antennas must comply with local ordinances and aesthetic code. Installations have employed some creative approaches to meet local requirements.

Examples include:

- The Lighthouse Historical Society provided approval for the installation of an HFR antenna on the Block Island Lighthouse.
- Operators disguised an antenna as a flag pole for an installation on a public beach in Florida.
- Antennas were installed within fence posts in Hawaii to disguise them on a local beach.

CODAR SeaSonde

Newer CODAR SeaSondes use a single-pole combined transmit and receive antenna while some older models and the lower frequency models (5 MHz) use separate transmit and receive antennas. Of the ~130 radars in operation within U.S. IOOS® Regional Associations, more than 90% are of this design. Each CODAR radar site will have, therefore, one or, at most, two antenna poles. Total height, including supporting base, ranges from 6 to 8 meters for the combined or the separate antenna systems depending on transmit frequency.

Installation

Antennas can be secured by a base such as shown in Figure C-2, or tethered to the ground using wire or polyester rope. Data transmission from the antennas to a base station is made via one transmit cable and 3 receive cables. The typical cable run is between 30-100m. Cables are typically laid on the ground. In some locations, cables are run through a plastic conduit and, in some cases, property owners require cables be buried. For underground cable runs, installers dig a ditch using a ditch witch, at a depth of about 6 inches.

Computer Requirements

The computer is located in an existing nearby building where possible, or in a specialized CODAR enclosure. The SeaSonde Enclosure 36 is a small, rugged closed-loop temperature-controlled enclosure for containing the SeaSonde remote unit electronics. The small enclosure is just large enough to fit the SeaSonde transmit and receive chassis, the mini-style computer with small monitor (or laptop style computer), a UPS device and other small pieces of electronics. This enclosure is appropriate for both indoor and outdoor use.

APPENDIX C: A BRIEF SUMMARY OF THE PEER REVIEW LITERATURE REGARDING THE IMPACT OF ELECTROMAGNETIC (AND SOUND) WAVES ON SEA MAMMALS.

Written by: Kelly Carmer, Florida Institute of Technology

1) Hoffmann, E.; Astrup, J.; Larsen, F.; Munch-Petersen, S.; Støttrup, J. (2000). *Effects of Marine Windfarms on the Distribution of Fish, Shellfish and Marine Mammals in the Horns Rev Area* (Report No. DFU-rapport 117-02). Report by Danish Institute for Fisheries Research.

Summary: This article discusses the impact of building an offshore wind farm on primarily fish, sharks, and porpoises. Sharks use Earth's magnetic field for navigation (similar to sea turtles) while porpoises use echolocation to communicate. The article indicates that magnetic field effects are very localized to the structures (i.e., on the order of 1-m away). The article also discusses the magnetic fields generated from cables associated with the offshore windfarms.

There is a brief discussion of the frequencies that porpoises hear at and the impact of the noise from the rotor blades; however, this is not relevant to the HFR since these are sound waves (the radar will not be making any noise at these frequencies).

Relevant Quotes:

- "Magnetic fields from cables, windmills, and the offshore transformer station may be expected to reach geomagnetic field-strength levels only in the immediate vicinity of these structures, at distances no more than 1 m. *Cartilaginous fishes* (sharks and rays) are, by way of their electroreceptive sense organs, able to detect magnetic fields, and they may use the geomagnetic field for navigation. For *bony fishes*, a true magnetic sense has been proposed, but the evidence is much less compelling. Thus, the weak magnetic fields from the marine windmill park at Horn Rev are not expected to pose any serious problem for the local fish species. Furthermore, it does not appear likely that the magnetic fields generated by the power transmission cables will have any detectable effects on the harbour porpoises and seals in the area."

These are noise related…

- "The windmills are expected to generate noise above ambient levels only in frequencies below 1-2 kHz. Below 500 Hz, noise from the windmills could be considerably above ambient levels. This could potentially affect the communication of porpoises in the area, if they indeed use these frequencies."
- "However, fish respond only weakly, and the influence of the windmills, especially compared to the level of marine anthropogenic noise in general, is most likely minor. Above 2 kHz, no noise is expected from the windmills, and this frequency range may therefore be considered of no concern."

2) Gill, Andrew B., and Helen Taylor. *"The Potential Effects of EM Fields Generated by Cabling between Offshore Wind Turbines upon Elasmobranchs."* Offshore Wind Energy. University of Liverpool, Sept. 2011. Web. 17 May 2011.

http://www.offshorewindenergy.org/reports/report_004.pdf

Summary: This reference is very similar case to the one summarized above.

Relevant Quotes:

- "There is a dearth of objective and definitive published information relating to the question of whether electric fields produced by underwater cables have any effect on electrosensitive species."
- "Cables transmitting power to the mainland and between turbines have the potential to disturb marine animals that are sensitive to electric and magnetic fields. Electromagnetic fields produced by cables may affect fish, in particular the elasmobranchs and mammals that use the Earth's magnetic field to navigate or for species that may have their social behaviour and communications affected. For example, a magnetic field equal to that of the Earth's, can be detected from the Baltic HYDC cable at distance of 6 meters away[16]. This field can affect ship compasses and has the potential to affect the navigation and orientation of any animal relying on the Earth's magnetic field in the area."
- "The latter of these scenarios may particularly cause a problem if the cable runs through an important breeding ground."

3) P. Light, M. Salmon, K. J. Lohmann; *GEOMAGNETIC ORIENTATION OF LOGGERHEAD SEA TURTLES: EVIDENCE FOR AN INCLINATION COMPASS*. J Exp Biol 1 September 1993; 182 (1): 1–10. DOI: https://doi.org/10.1242/jeb.182.1.1

Summary: This article talks about how sea turtles use magnetic fields in conjunction with other cues for orientation and navigation.

Relevant Quotes:

- "Our results and previous experiments (Lohmann, 1991) have demonstrated that in the laboratory, hatchling loggerheads can derive directional information from the earth's magnetic field. Under natural conditions, this ability may be augmented or supplanted during migration by other sensory cues. The use of multiple cues has been repeatedly demonstrated (e.g., birds possess magnetic, sun and star compasses; Able, 1991)."
- "Thus, the earth's magnetic field is probably only one of several cues used by hatchlings in the course of their offshore migration."
- "Further research investigating the sensitivity of the compass, ontogenetic changes in orientation, the mechanism of magnetic field detection and the transfer of directional information between sensory systems is needed to address these issues."

4) Lohmann KJ, Cain SD, Dodge SA, Lohmann CM. *Regional magnetic fields as navigational markers for sea turtles*. Science. 2001 Oct 12;294(5541):364-6. DOI: 10.1126/science.1064557. PMID: 11598298.

Summary: This article details how sea turtles use magnetic fields to orient themselves in water.

Relevant Quotes:

- "Thus, the results show that loggerhead turtles can distinguish among magnetic fields that exist in widely separated oceanic regions."

5) Lohmann, K. J. & Lohmann, C. M. F. 1994. *Acquisition of magnetic directional preference in hatchling loggerhead sea turtles.* J. exp. Biol., 190, 1–8.

Summary: This article explored visual (light) cues and magnetic field orientation with loggerhead sea turtle movement. Hatchlings use light and downward slope to indicate direction, reference the magnetic field, and use this magnetic field when away from the land.

Relevant Quotes

- "On land, hatchlings find the ocean using light cues associated with the seaward horizon."
- "These results demonstrate that light cues can set the preferred direction of magnetic orientation by loggerhead hatchlings. We therefore hypothesize that hatchlings initially establish a seaward course using visual cues available on or near land, then maintain the course using magnetic cues as they migrate into the open sea."
- "Because the ocean reflects more light than does the land, and because most nesting beaches are backed by dunes or vegetation, the seaward horizon is both brighter and lower in elevation than the landward horizon. By moving towards the lower and brighter horizon, hatchlings reliably find the sea (Limpus, 1971; Salmon et al. 1992). Thus, one possible interpretation of our data is that hatchlings (i) determine the direction of the open ocean while on or near shore using light or horizon cues; (ii) establish an appropriate magnetic directional preference on this basis, and (iii) subsequently use this acquired directional preference to maintain orientation as they migrate into the open sea."
- "The only hatchlings that were not significantly oriented as a group were those tested without prior exposure to light cues (Fig. 2D). This result is consistent with the hypothesis that hatchlings emerge from their nests without a preferred magnetic direction and must subsequently acquire one."
- "Loggerhead hatchlings emerging on the east coast of Florida, for example, must swim eastward to reach open water, whereas hatchlings that emerge on the west coast of Florida must swim west. To establish appropriate offshore headings from any location, hatchlings might need only to determine the direction of the open ocean visually and subsequently maintain an appropriate seaward bearing using their magnetic compasses."

- "The magnetic compass might also function continuously as a 'backup' system throughout the migration for use when waves and/or other cues are not available (Lohmann, 1991)."
- ". . . the results demonstrate that environmental features that hatchlings encounter soon after emerging from their nests can influence the preferred direction of magnetic orientation. Thus, the experience of a hatchling early in its migration may influence its subsequent orientation behavior."

6) Lohmann, K. J., & Catherine M. F. Lohmann. (1998). *Migratory Guidance Mechanisms in Marine Turtles*. Journal of Avian Biology, 29(4), 585–596. DOI: https://doi.org/10.2307/3677179

Summary: This article discusses issues associated with a sea turtle's ability to observe the intensity of magnetic fields (in the open ocean).

Relevant Quotes:

- "These results demonstrate that hatchlings can distinguish between field intensities that occur in different locations along their migratory route."

7) Bartol, S. M., Musick, J. A., & Lenhardt, M. L. (1999). Auditory Evoked Potentials of the Loggerhead Sea Turtle (Caretta caretta). Copeia, 1999(3), 836. DOI: https://doi.org/10.2307/1447625

Summary: The purpose of this study was to measure the hearing range of loggerhead sea turtles.

Relevant Quotes:

- "…indicated the range of effective hearing to be from at least 250 Hz to 750 Hz."

8) Environmental Studies Program: Studies Development Plan – FY 2020-2022. Sea Turtle Hearing Sensitivity and Impacts of Sound. DOI:

https://www.boem.gov/sites/default/files/documents/environment/environmental-studies/NT-20-02.pdf

Summary: This article concerns low frequency sound waves.

Relevant Quotes:

- "Although all sea turtle species studied exhibit the ability to detect low frequency sound, the potential effects of exposure to loud sounds on sea turtle biology remain largely unknown (Nelms et al. 2016)."

- “Previous studies on hearing in several species of sea turtles have demonstrated that they detect low-frequency (<1000 Hz) acoustic and/or vibratory stimuli in air and underwater (Lavender et al. 2014, Piniak et al. 2016). This range of maximum sensitivity overlaps with several low-frequency anthropogenic sound sources such as: seismic air guns, offshore drilling, pile driving, and vessel traffic (Hildebrand 2009). Variation in threshold levels and frequencies of maximum sensitivity (i.e., the audiogram) between species and age classes exist. In addition, behavioral responses to anthropogenic sounds may vary throughout a turtle’s lifetime. Breeding adult females may experience a lower stress response, as female loggerhead, hawksbill, and green turtles appear to have a physiological mechanism to reduce hormonal response to stress in order to maintain reproductive capacity at least during their breeding season, a mechanism apparently not shared with males (Jessop et al. 2004).”

9) Kennedy, M. (2018), “Magnetic Fields Are A Big Predictor Of A Loggerhead Turtle’s Genes”. *The Two-Way, NPR*. https://www.npr.org/sections/thetwo-way/2018/04/12/601830318/magnetic-fields-are-a-big-predictor-of-a-loggerhead-turtles-genes

Summary: Discusses issues similar to other articles w.r.t. multiple cues and sea turtle navigation / orientation.

Relevant Quotes:

- “An important caveat, however, is that many animals use multiple, redundant cues for orientation and navigation. Thus, eliminating a single cue such as magnetism may cause no obvious change in behavior if alternative sources of directional information are present (Able, 1993).”

10) Papi F, Luschi P, Akesson S, Capogrossi S, Hays GC. Open-sea migration of magnetically disturbed sea turtles. J Exp Biol. 2000 Nov;203(Pt 22):3435-43. DOI: 10.1242/jeb.203.22.3435. PMID: 11044382.

Summary: Another article concerned with navigation – in the open ocean.

Relevant Quotes:

- “…no differences between magnetically disrupted and untreated turtles were found as regards navigational performance and course straightness. These findings show that magnetic cues are not essential to turtles making the return trip to the Brazilian coast. The navigational mechanisms used by these turtles remain enigmatic.”

11) Salmon, M. and Lohmann, K.J. (1989), Orientation Cues Used by Hatchling Loggerhead Sea Turtles (Caretta caretta L.) During their Offshore Migration. *Ethology*, 83: 215-228. DOI: https://doi.org/10.1111/j.1439-0310.1989.tb00530.x

Summary: This experiment was conducted by bringing hatchlings from a beach hatchery to an Eastern Florida beach. It looks at sea turtles' reliance on waves, winds, and swells as navigational cues both near-land and not.

Relevant Quotes:

- "Although visual cues apparently guide hatchlings to the sea, nothing is known about the orientation cues utilized by the turtles once they enter the water. Anecdotal evidence has suggested that differences in light intensity used by hatchlings to find the ocean might continue to guide them in the sea (HENDRICKSON 1958). However, FRICK (1976) noted that brightness differences between land and sea disappear within a few kilometers from land. Indeed, IRELAND et al. (1978) reported that green turtle hatchlings often failed to swim toward the brightest portion of the horizon during tracking experiments at night. Thus light cues alone appear insufficient to guide hatchlings once they swim only a short distance away from shore."
- "Our results suggest that hatchlings are guided primarily by surface waves which enables turtles to remain oriented in a seaward direction even when land is no longer visible."
- "All experiments were conducted during July-Sep., 1988, at Ft. Pierce, Florida."
- "The results suggest that stimuli functioning as guideposts for swimming hatchlings differ from those that guide hatchlings from the nest to the ocean."
- "One interpretation of these data is that the compass (or compasses) used by hatchlings to maintain offshore orientation is "calibrated" by directions turtles move while on land or shortly after entering the sea (MROSOVSKY 1983)."
- "Thus for loggerheads neither the experience of a crawl from the nest nor entry into the surf is essential for normal orientation when land is near. The experiments we report here suggest that even far away from land, hatchlings taken directly from nests can establish appropriate offshore courses if surface waves are present."
- "Experiments with young (3—7 moth odl) Kemp's Ridley turtles (*Lepidochelys kempi*) yielded results consistent with those we report."
- "Thus our data do not provide insight into whether near-shore orientation depends on surface waves, visual cues from land or other sources of stimuli we have not considered."
- "These results are consistent with the hypothesis that hatchlings do not utilize cues associated with land for very long after they enter the water (HAYES & IRELAND 1978), either because land cannot be detected or because other stimuli become primary in orientation."

12) Mrosovsky, N., & Shettleworth, S. J. (1968). Wavelength Preferences and Brightness Cues in the Water Finding Behaviour of Sea Turtles. *Behaviour*, 32(4), 211–257. DOI: http://www.jstor.org/stable/4533249

Summary: This article tested different types of light along with different kinds of blindfolding techniques on baby sea turtles to explore how they find there way to the water upon hatching.

Relevant Quotes:

- "There are two main lines of evidence showing that this depends on vision… Circumstantial evidence that visual cues are ones involved comes from the fact that newly… show a strong positive reaction to light (HENDRICKSON, I958; MCFARLANCE, 1963)."

13) Wyneken. (1990). Orientation by Hatchling Loggerhead Sea-Turtles Caretta-Caretta L in a Wave Tank. *Journal of Experimental Marine Biology and Ecology*, *139*(1-2), 43–50. DOI: https://doi.org/10.1016/0022-0981(90)90037-D

Summary: This experiment tested the reliance of turtles on light cues and surface waves.

Relevant Quotes:

- "Recent field studies show that hatchlings orient toward surface waves. Our experiments,- conducted in a wave tank, demonstrate that loggerhead sea turtle hatchlings maintain headings toward oncoming waves. The response does not depend upon visual cues as it persists in the absence of visible light."
- "Light cues from the seaward horizon are thought to guide hatchlings from the nest to the ocean (reviewed by Hayes & Ireland, 1978; Mrosovsky & Kingsmill, 1985). However, little is known about the orientation mechanisms used by hatchling turtles once they enter the sea. Turtles continue to swim toward the open sea, even when distant lights make the shoreward horizon brighter (Hayes dz Ireland, 1978; Salmon & Lohmann, 1989). Thus differences in horizon brightness, thought to be critical for guiding hatchlings from the nest to the sea, appear unlikely to guide swimming turtles offshore (Frick, 1976)."
- "Witham (1980) proposed that hatchlings might establish and maintain seaward bearings using wave cues. Recent field experiments indicate that loggerhead hatchlings consistently swim toward approaching waves and swells (Salmon & Lohmann, 1989). These field experiments provided correlations between turtle headings and surface wave direction under field conditions."
- "These experiments demonstrate that loggerhead hatchlings, when they first enter the water, are strongly predisposed to orient toward surface waves. This response does not depend upon observing the waves visually. Even when turtles are tested under IR illumination (which no vertebrate can detect with photoreceptors), they continue to swim toward approaching waves."
- "In experiments conducted on the ocean (Salmon & Lohmann, 1989) hatchlings oriented toward approaching waves or swells. When both waves and swells were present and approached from somewhat different directions, hatchlings selected courses which averaged between the two sources of surface stimuli."

- "Several species of invertebrates are known to utilize wave surge cues for underwater orientation."
- "This study provides conclusive evidence that a marine vertebrate can use surface waves as an orientation cue."
- "Oceanic swells are produced by prevailing wind belts (Bascom, 1980). These, in turn, are specific to particular latitudes. Thus orientation with respect to surface waves can be a potentially important cue for any open sea migrant. Loggerhead hatchlings migrating from the east coast of Florida encounter waves and swells generated by prevailing winds from the east or southeast (Anonymous, 1988). By swimming toward them hatchlings should eventually reach the Gulf Stream, their presumed goal (Carr, 1986a,b). Further studies are needed to determine how long hatchlings continue to respond to surface waves produced by prevailing winds, and if they use these stimuli to gain latitudinal, as well as directional information."

14) Hayes, W.N. & L.C. Ireland, 1978. Visually guided behavior of turtles. In*, The behavior of fish and other aquatic organisms*, edited by D.I. Mostofsky, Academic Press, New York, pp. 281-317.

Summary: This section of the book serves as a great overview and tethering of many of the articles in this document and other resources on sea turtle's navigational mechanisms.

Relevant Quotes:

- "There is considerable circumstantial evidence which indicates that successful water-finding by sea turtles involves visual information. Green turtle and loggerhead (*Caretta caretta*) hatchlings traveling toward the water show a strong, positive reaction to light (Hooker, 1908, 1909; Parker, 1922; Hendrickson, 1958)…also, artificial lighting on roads near nesting beaches has been reported to disorient loggerhead hatchlings (McFarlane, 1963). Equally important, neither green turtle nor loggerhead hatchlings seem able to find the water if both eyes are blindfolded (Daniel and Smith, 1947; Carr and Orgen, 1960)."
- "Experiments with unilaterally blindfolded hatchling greens and loggerheads (Daniel and Smith, 1947; Mrosovsky and Shettleworth, 1968) lend considerable support to this phototropotactic interpretation of water-finding behavior. Hatchlings with monocular blindfolds have a strong tendency to turn in circles, almost always moving in the direction of the open eye. Adult female green turtles with one eye covered also circle toward the open eye (Ehrenfeld and Carr, 1967). This is precisely the behavior one would expect from an animal attempting to equalize the intensities of the visual inputs to the two eyes. Yet, as Mrosovsky (1972) pointed out, a tropotactic reaction to light will not account for all aspects of hatchling orientation. Occasionally, a unilaterally blindfolded turtle circles toward its covered eye. If orientation depends strictly upon a tropotactic reaction to light intensity, this should never occur."
- "The sensory basis of their straight-line ravel has not been determined, but Ireland *et al.* (1976) noted that the turtles did not appear to simply orient toward the brightest portion

of the sky or horizon, suggesting that the mechanisms involved in this straight-line travel are different from those involved in sea finding."

- "Gould reported that the turtles failed to orient in a homeward direction when the skies were either partly cloudy or overcast but continued to do so under clear skies, a result which appears to confirm his hypothesis that the turtles were choosing their travel paths with reference to some celestial cue or cues." –Note the author criticizes this study and offers another study that conflicts with this finding.

15) K. J. Lohmann; Magnetic orientation by hatchling loggerhead sea turtles (Caretta caretta). *J Exp Biol* 1 January 1991; 155 (1): 37–49. DOI: https://doi.org/10.1242/jeb.155.1.37

Summary: This experiment involved placing hatchlings into a satellite dish, with a Rubens cube coil around it to control the direction and intensity of a magnetic field. "Hatchlings were tethered to a lever-arm mounted on a rheostat, "used to control the electrical current, in the center of the dish. After initially placing the turtles, the only light in the room was placed above "the east side of the orientation arena" to simulate the natural condition and because they "may play a role in calibrating the magnetic compass". After a period of time, the light was turned off and a control group and a group of hatchlings exposed to a magnetic field opposite to Earth's via the Rubens coil. The results show that the turtles in the altered magnetic field had a different preferred direction, but also had more variability in their preferred direction. The authors speculate that a magnetic compass may act to supplant or as a 'back-up' system to other cues. A comment is made to suggest that turtles may remember more localized variations in magnetic field at places like nesting sites.

Relevant Quotes:

- "…indicating that loggerhead sea turtle hatchlings can detect the magnetic field of the earth and use it as a cue in orientation."
- "Results indicate that hatchlings possess a magnetic compass sense capable of functioning in the offshore migration."
- "At the completion of all experiments, the mean angles of turtles swimming in the geomagnetic and reversed fields were analyzed to determine whether: (1) each group was significantly oriented in a preferred direction, and (2) the distributions of mean angles under the two field conditions differed significantly."
- "No difference was observed between the orientation of turtles kept in coolers and those allowed to swim in holding tanks before testing. Similarly, the length of captivity before testing (0, 1 or 2 days), the length of the dark period (90-180 min) and the period of exposure to dim eastern light (60-245 min) had no apparent effect on turtle orientation (Tables 1 and 2). The data thus provided no justification for separating hatchlings other than on the basis of magnetic field conditions during testing."
- "…indicating that the magnetic field conditions influenced the orientation of the turtles."
- "When tested in complete darkness under geomagnetic or reversed-field conditions, tethered loggerhead hatchlings demonstrated statistically nonrandom directional

preferences. The mean angle of turtles tested in the magnetic field of the earth was 42° (Fig. 2A), whereas the mean angle for the reversed field group was 196° (Fig. 2B). Thus, when the ambient magnetic field was shifted by 180°, the group mean angle showed a corresponding shift of 154°. The distributions in the two fields were significantly different, indicating that the orientation of loggerhead hatchlings is influenced by ambient earth-strength magnetic fields."

- "Previous attempts to demonstrate magnetic field detection by sea turtles have relied upon conditioning experiments. These have been unsuccessful (Lemkau, 1976) or have yielded ambiguous results (Perry et al. 1985). In these earlier studies, however, turtles were required to respond to a briefly imposed magnetic field by pressing paddles or keys within seconds after a stimulus was presented; in addition, all turtles tested were at least 1 year old. In contrast, the present experiments examined the unconditioned responses of hatchling loggerheads during the first few days after emergence, when turtles are strongly motivated to orient and swim. Moreover, hatchlings were tested in an earth-strength field that remained essentially constant for 1.5 h or more after the light was turned off. These conditions more closely approximate those under which migrating turtles may utilize magnetic cues naturally."
- "Upon emerging from eggs, turtles may already possess a preference for orienting towards magnetic northeast when other cues are absent. Alternatively, hatchlings could calibrate a magnetic compass on a directional reference available to them from inside the nest. They might, for example, determine the direction of the ocean from the sounds of breaking waves, the vibrations waves generate or other, as yet unidentified, cues. Calibration might thus have been completed before hatchlings were taken to the laboratory."
- "Recent field experiments suggest that alternative directional cues take precedence over magnetic cues in the early phases of the migration. Loggerhead hatchlings released between 0.7 and 13 nautical miles from shore, for example, consistently swam towards approaching waves (Salmon and Lohmann, 1989). On days when unusual wind conditions generated waves that moved away from shore, hatchlings reversed their normal seaward orientation and swam towards the beach. If turtles were relying entirely upon magnetic orientation, they presumably would not have reversed swimming direction in response to a reversal in the direction of wave approach. However, the magnetic compass could conceivably supplant orientation to waves at a subsequent point in the migration, or it might continuously function as a 'back-up' system for use when waves and/or other cues are absent."
- "Turtles might also have the ability to detect and remember parameters of localized magnetic anomalies unique to specific sites such as feeding, mating, or nesting grounds."

16) Paolo Luschi, Simon Benhamou, Charlotte Girard, Stephane Ciccione, David Roos, Joël Sudre, Silvano Benvenuti, Marine Turtles Use Geomagnetic Cues during Open-Sea Homing,

Current Biology, Volume 17, Issue 2, 2007, Pages 126-133, ISSN 0960-9822, https://doi.org/10.1016/j.cub.2006.11.062.

Summary: This study released three sets of turtles from open-sea sites away from their 'homes'. One set was a control, and the others had magnets attached to their head either on the trip to the release site, or just before embarking on their homing trip. The results found that the turtles with the magnets generally took longer trips home, but all but one turtle found its way back eventually. The authors conclude that other navigational cues must be at work, and the role of geomagnetic information can not be precisely described, however, plays a role, nonetheless.

Relevant Quotes:

- "For instance, the magnets' field may have physically altered magnetite particles possibly involved in magnetoreception, with an effect lasting longer than magnet application. In this view, the application of strong magnets might have had an effect similar to that of pulse magnetization treatments, altering for some days orientation responses mediated by magnetite-based magnetoreceptors [22]. To our knowledge, long-lasting after-effects of magnet application have not been described, nor can they be immediately inferred from the proposed models of animal magnetoreception [23]. However, such a possibility cannot be dismissed."
- "Most likely, the homing turtles relied on additional, nonmagnetic navigational cues that may have contributed to shaping the turtles' routes, besides allowing the magnetically disturbed turtles to home (even if less efficiently than controls)."
- "However, because the magnetically disturbed turtles did home, our findings show that the geomagnetic field provides important, although not essential, cues for sea-turtle navigation after displacement. These conclusions are in accordance with similar indications obtained through arena experiments in juvenile turtles [4] but are somewhat at variance with those deriving from a previous field experiment showing that magnet attachment did not affect the navigational performances of Ascension Island green turtles during their oceanic migration toward foraging sites along the Brazilian coast [6]. However, because nonmagnetic cues are likely to be involved in sea turtles' homing processes (as also indicated by the present experiment), it may be hypothesized that although nonmagnetic cues alone may be sufficient to allow efficient open-sea navigation directed to large goals (like the Brazilian coast), geomagnetic information has a major, albeit still not exclusive, role in pinpointing isolated targets."

17) Endres Courtney S., Putman Nathan F., Ernst David A., Kurth Jessica A., Lohmann Catherine M. F., and Lohmann Kenneth J., Multi-Modal Homing in Sea Turtles: Modeling Dual Use of Geomagnetic and Chemical Cues in Island-Finding, *Frontiers in Behavioral Neuroscience*, Volume 10, 2016, DOI: 10.3389/fnbeh.2016.00019.

Relevant Quotes:

- "One possibility is that turtles use magnetic cues to arrive in the vicinity of the island, then use chemical cues to pinpoint its location. As a first step toward investigating this hypothesis, we used oceanic, atmospheric, and geomagnetic models to assess whether magnetic and chemical cues might plausibly be used by turtles to locate Ascension Island. Results suggest that waterborne and airborne odorants alone are insufficient to guide turtles from Brazil to Ascension, but might permit localization of the island once turtles arrive in its vicinity. By contrast, magnetic cues might lead turtles into the vicinity of the island, but would not typically permit its localization because the field shifts gradually over time. Simulations reveal, however, that the sequential use of magnetic and chemical cues can potentially provide a robust navigational strategy for locating Ascension Island."
- "These findings are consistent with the hypothesis that sea turtles, and perhaps other marine animals, use a multi-modal navigational strategy for locating remote islands."
- "These parameters vary predictably across the globe (Gould, 1982; Skiles, 1985). As a result, each area of coastline is typically marked by a different isoline of inclination and a different isoline of intensity and thus has a unique magnetic signature (Lohmann et al., 2008b). Growing evidence indicates that sea turtles (Lohmann et al., 2004; Putman and Lohmann, 2008; Brothers and Lohmann, 2015), as well as salmon (Bracis and Anderson, 2012; Putman et al., 2013, 2014), return to specific areas along continental coastlines by recognizing magnetic signatures that exist at or near the target area."
- "…a turtle migrating to the island from Brazil might be able to follow an intensity isoline into the vicinity of Ascension Island, and then use waterborne chemical cues to find the island directly."
- "A turtle navigating to any nesting beach or any specific foraging area, whether on an island or a mainland, might benefit from the use of multiple sensory cues. For turtles engaged in natal homing, in which adults return to reproduce in their area of origin after first migrating long distances away, the process might be facilitated if turtles imprint on both olfactory cues and magnetic cues that exist at their natal beach (Lohmann et al., 2008b, 2013; Putman and Lohmann, 2008). By doing so, a turtle might use the magnetic information on which it imprinted to arrive in the vicinity of the target area, and then employ chemical cues to locate a suitable place to nest."

18) Benhamou S, Sudre J, Bourjea J, Ciccione S, De Santis A, Luschi P (2011) The Role of Geomagnetic Cues in Green Turtle Open Sea Navigation. *PLoS ONE* 6(10): e26672. DOI: https://doi.org/10.1371/journal.pone.0026672

Relevant Quotes:

- "While green turtles do not seem to need geomagnetic cues to navigate far from the goal, these cues become necessary when turtles get closer to home. As the very last part of the homing trip (within a few kilometers of home) likely depends on non-magnetic cues, our results suggest that magnetic cues play a key role in sea turtle navigation at an intermediate scale by bridging the gap between large and small scale navigational processes, which both appear to depend on non-magnetic cues."

19) Sections 3.4.2-3.6 of The Biology of Sea Turtles, Volume III, Volume 3 edited by Jeanette Wyneken, Kenneth J. Lohmann, John A. Musick

Summary: The sections of this book offer another great collection of multiple peer-reviewed articles discussing the magnetic field detection and utilization of sea turtles, specifically loggerhead, green, and Kemp's ridley sea turtles, of all ages, which are found in Eastern Florida.

20) Sections 4.5 Turtles and 5 Conclusions of Slater, M. (2010). Effects of Electromagnetic Fields on Marine Species: A Literature Review. Report by Oregon Innovation Council.

Relevant Quotes:

- "Several species of sea turtles undergo transoceanic migration; however, limited research has been conducted on these species and their use of magnetic "maps" (Lohmann et al. 2001, Lohmann et al. 2004). What research that has been conducted suggests several species of turtle use the earth's B-fields for migration. Lohmann and Lohmann (1996) noted that Kemps ridley's turtle (Lepidochelys kempi), green sea turtle (Chelonia mydas), and loggerheads (Caretta caretta) all utilize the Earth B-fields, although, the use of these fields is not necessary for these species. Green sea turtle's magnetic cues were found to not be essential for adult females to navigate 2,000 kilometers from Ascension Island to Brazil (Papi, et al., 2000)."
- "There is a significant lack of research into the potential impacts of EMF to sea turtles and marine mammals. Sea turtles do not appear to be as sensitive to EMF as marine mammals. Statistical evidence suggests that marine mammals are susceptible to stranding as a result of increased levels of EMF."

21) F. Papi, P. Luschi, S. Akesson, S. Capogrossi, G.C. Hays; Open-sea migration of magnetically disturbed sea turtles. J Exp Biol 15 November 2000; 203 (22): 3435–3443. DOI: https://doi.org/10.1242/jeb.203.22.3435

Summary: An experiment involving 7 with 6 magnets glued to their bodies and eight with no magnets, all tracked via satellite, was conducted to investigate the role of geomagnetic cues to sea turtle navigation. This article gives numerical values for the magnetic field strengths and results! It found no differences in the path "straightness" or swimming speed between the control and experimental groups.

Relevant Quotes:

- "These findings show that magnetic cues are not essential to turtles making the return trip to the Brazilian coast."
- "A concurrent chemosensory hypothesis assumes that turtles would be guided by the perception of substances originating from Ascension and transported westwards by the South Atlantic Equatorial Current (Koch et al., 1969; Carr, 1972), forming a plume that establishes a chemical link between the island and the easternmost part of Brazil. Turtles would use their chemical sense to swim within the plume on the way to the island and back (Luschi et al., 1998)."
- "The latter finding should not be trivialised by arguing that the animal navigational cues are redundant (Keeton, 1979; Wehner, 1998), as it would represent the first experimental evidence for the involvement of so-far unknown non-magnetic cues in long-distance navigation in the ocean."
- "The turtles of both treatment groups travelled significantly faster during the day than at night; intraindividual differences were significant in two experimental and six control turtles (Table 2). No significant differences were found between the mean speeds of controls and experimentals either during the day or at night. Similarly, no differences were found between the swimming speeds recorded in segments covered at night whether or not the moon was above the horizon, experimental and control turtles performing similarly under both conditions (Table 2)."
- "Since the Argos transmitter was glued onto the head of turtles C1 and C2, producing a magnetic field, these two individuals might be considered as having been magnetically disturbed, although the field applied was not mobile and was much smaller than that produced in the experimental turtles. The routes of turtles C1 and C2 were, however, very similar to those of the other controls (Fig. 2)."
- "A t-test showed no differences between the two groups of turtles in any of the variables taken into account, except for the mean travel speed, which turned out to be higher for the 'experimental' group than for the controls (t-test, $P<0.05$)."
- "The demonstration that turtles can cross the ocean disregarding magnetic information does not exclude the possibility that adult turtles retain the capacity of hatchlings to evaluate geomagnetic field features (Lohmann and Lohmann, 1994, 1996a).

APPENDIX D: CONSULTATION REGARDING BIOLOGICAL RESOURCES

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
US Integrated Ocean Observing System (IOOS®)
1315 East West Highway, 2nd Floor
Silver Spring, Maryland 20910

Florida Ecological Services Field Office

FWS Log No 21-I-1129

The Service concurs with your effect determination(s) for resources protected by the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.). This finding fulfills the requirements of the Act.

CHRISTOPHER PUTNAM
Digitally signed by CHRISTOPHER PUTNAM
Date: 2021.11.04 13:36:11 -04'00'

Environmental Review Supervisor Date

U.S. Fish & Wildlife Service
North Florida Ecological Services Field Office
7915 Baymeadows Way, Suite 200
Jacksonville, FL 32256-7517

July 1, 2021

Subject: U.S. Integrated Ocean Observing System (IOOS) Office, of the National Oceanic and Atmospheric Administration (NOAA), Installation of an Oceanographic High-frequency Radar (HFR) Station at (04EF1000-2021-SLI-1129).

Dear Sir/Madam:

NOAA's IOOS office is proposing to allocate federal funds to the Southeast Coastal Ocean Observing Regional Association (SECOORA) to install an oceanographic HFR station at Hightower Beach Park, which is owned by the city of Satellite Beach Florida. SECOORA will sub-contract the Florida Institute of Technology (FIT) and the University of Georgia's Skidaway Institute of Oceanography (SkIO) for the installation.

It has been determined by NOAA that this project may affect, but is not likely to adversely affect, the: Red Knot (*Calidris canutus rufa*); Piping Plover (*Charadrius melodus*); Green Sea Turtle (*Chelonia mydas*); Gopher Tortoise (*Gopherus polyphemus*); Hawksbill Sea Turtle (*Eretmochelys imbricate*); Leatherback Sea Turtle (*Dermochelys coriacea*); Loggerhead Sea Turtle (*Caretta caretta*); and their respective designated suitable habitat.

After reviewing the enclosures, NOAA requests that the U.S. Fish and Wildlife Service (USFWS) concur in writing with the above determination. If any additional information is needed, please contact the IOOS Environmental Compliance Coordinator at 301-533-9355 or email mequela.thomas@noaa.gov.

Sincerely,

Krisa M. Arzayus, Ph.D.
Deputy Director, U.S. IOOS Office
1315 East-West Hwy
Silver Spring, MD 20910
Office: 240-533-9455

Enclosures:

- Appendix 1 Proposed Receive Locations
- Appendix 2 Antennae Placement
- Appendix 3 HFR Examples
- Appendix 4 Image of the boardwalk at Hightower Beach and Electrical Service
- Shed/Trailer Combos used by HFR operator in NC and GA

1. **Locations:**

The coordinates listed below are for the parking lot at Hightower Beach Park. The HFR deployment location is south and shoreward of the parking lot, approximately 100 ft. away.

Coordinates: Latitude: 28.194372° N; Longitude: 80.594403° W (WGS 84 datum)

2. Project Description:

The Hightower Park HFR will operate at approx. 13.5 MHz. Its 12 transmit and 4 receive antennas are 7 ft. tall with a diameter of 2 inches. All transmit and receive array antennae will be placed behind the shoreward vegetation to reduce interaction with nesting sea turtles and minimize their visual impact (i.e., make them less noticeable to park visitors). All antennas will be painted a flat green color so that moonlight does not reflect off the antennae and cause a visual disturbance for newly hatched sea turtles. The proposed site design is found in Appendix 2. Examples of painted and non-painted HFR antennae from SECOORA partner sites are provided in Appendix 3.

Cables will run from the antennas, across the vegetated dune, to the boardwalk (see Appendix 2). The cables are similar in diameter to coaxial television cables, and they will be placed inside of flexible PVC corrugated pipe and laid atop the surface of the dunes (Appendix 4, Image B). Placing the cables inside of the corrugated pipe will protect the cables from beach mice and other wildlife that may chew on them. Additionally, placing the cables on the surface of the dunes will minimize impacts to dune vegetation since the cables will not be buried (Note: burial would require trenching and could damage plant root structures). Over a period, sand will cover the corrugated pipe and it will not be visible. Once the cables reach the boardwalk, they will be attached to the underside (with a J hooks or clamps), so they are off the ground, not visible to park visitors, and mitigate impacts to dune flora and fauna. The cables will run the length of the boardwalk and over to the trailer/shed. The boardwalk has electricity and electrical cables run above ground, under the boardwalk (Appendix 4, Image A). This configuration is like what is being proposed by FIT for running cables under the boardwalk.

FIT will install shelves along with the WERA® HFR transmitter/receiver chassis, computer equipment, and other electronics (e.g., wireless router) inside of shed which will sit on top of a towable trailer. See Appendix 2 for the proposed location of the trailer/shed adjacent to the parking lot. The trailer/shed combo will be placed near the restroom facility, as electricity is available at this location. Photos of a similar trailer/shed combo used by the University of South Carolina and SkIO for their HFR installations are available in Appendix 5. By placing the shed (with HFR equipment inside) on a trailer, FIT will be able to tow the WERA equipment out of Hightower Park facilities in the event of a hurricane. The trailer/shed can be moved back to FIT and placed in a secure location until after the storm when it can then be reinstalled at the park.

FIT will acquire the following permits for this site: 1) license agreement with the city of Satellite Beach; 2) any permits required by FL Department of Natural Resources; and 3) the electrician hired to connect electricity to the trailer/shed will acquire necessary permits for electrical service installation.

Installation of the HFR antennas and cables will take approximately 2 weeks. **Installation will take place outside of turtle nesting season which runs from April 1 – October 31**. The project team would like to install the HFR system at Hightower Beach Park in November/December 2021.

APPENDIX E: CONSULTATION REGARDING CULTURAL RESOURCES

DHR Compliance Review State Lands Consultation Form

Mail To: Robin Jackson
Bureau of Historic Preservation
R.A. Gray Building, MS 8
500 S. Bronough Street
Tallahassee, Florida 32399-0250
Or
Email To: Robin.Jackson@DOS.myflorida.com

From: Mequela Thomas
Address: 1315 East West Highway
Floor 2
Silver Spring, MD 20910
Email: mequela.thomas@noaa.gov
Date: 6/30/2021

Would you like your response letter emailed to you? ☑ Yes ☐ No

Management Area: N.A

Township: ______ Range: ______ Section: ______ County: Brevard

Lat: 28.194372° N; Long: 80.594403° / Address Kennedy Space Center, Florida 32899

Project Name: The High tower Park High Frequency Radar Install

Project Description:

The Hightower Park HFR will operate at approx. 13.5 MHz. Its 12 transmit and 4 receive antennas are 7 ft. tall with a diameter of 2 inches.

Cables will run from the antennas, across the vegetated dune, to the boardwalk. The cables are similar in diameter to coaxial television cables, and they will be placed inside of flexible PVC corrugated pipe and laid atop the surface of the dunes. Placing the cables inside of the corrugated pipe will protect the cables from beach mice and other wildlife that may chew on them. Additionally, placing the cables on the surface of the dunes will minimize impacts to dune vegetation since the cables will not be buried (Note: burial would require trenching and could damage plant root structures). Over a period, sand will cover the corrugated pipe and it will not be visible.

The cables will run the length of the boardwalk and over to the trailer/shed. The boardwalk has electricity and electrical cables run above ground, under the boardwalk

Attach supplemental pages with additional information if needed. **Please include the following relevant documents: map/aerial image of the project location with area(s) of proposed ground disturbance clearly labeled, site plan, architectural plans, building photographs and date of construction, Florida Master Site File Numbers for recorded resources.**

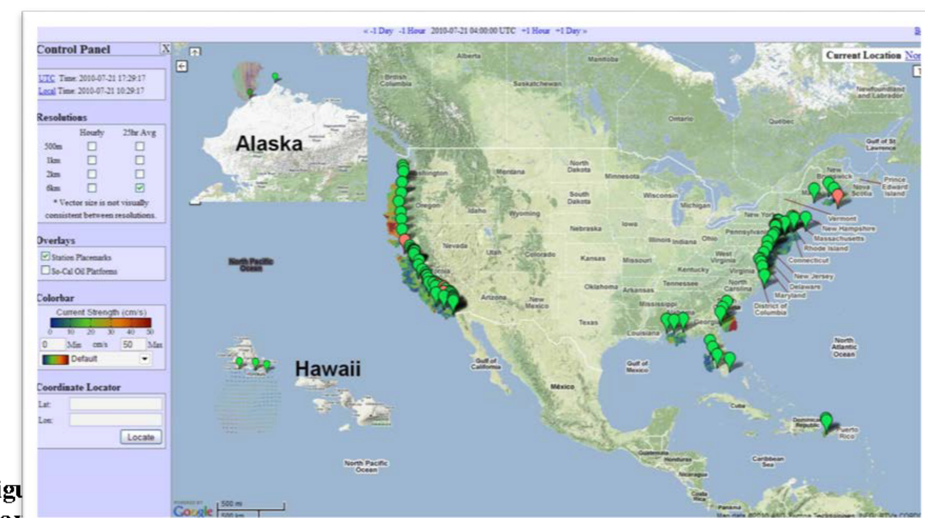
Florida Park Service Only send to:
cc: Bureau of Natural and Cultural Resources, 3900 Commonwealth Boulevard, MS 530, Tallahassee, Florida 32399-3000.
William Stanton 850-245-3110, William.Stanton@dep.state.fl.us.

Attachment 1

Description of High Frequency Radar Types, Placement, and Installation

HF Radar

HF radar systems measure the speed and direction of ocean surface currents in near real time. Currents in the ocean are equivalent to winds in the atmosphere because they move things from one location to another. Currents carry nutrients as well as pollutants, so it is important to know the currents for ecological and economic reasons. Because currents carry any floating object, USCG search and rescue operators use HF radar data to make critical decisions when rescuing disabled vessels and people stranded in the water. HF radar can measure currents over a large region of the coastal ocean, from a few kilometers offshore up to 200 km, and can operate under any weather conditions. They are located near the water's edge, and need not be situated atop a high point of land. Traditionally, crews placed current measuring devices directly into the water to retrieve current speeds. While these direct measurement systems are still widely used as a standard reference, HF radars are the only sensors that can measure large areas at once with the detail required for the important applications described here. Not even satellites have this capability (NOAA 2011f). HF radar systems support a range of applications, including search and rescue, spill response, harmful algal bloom monitoring, pollution tracking, larval transport, and coastal water quality assessments. Data can also provide value in ecosystem assessment and fisheries management. U.S. IOOS® partners currently operate approximately 130 HF radars in 10 of the 11 U.S. IOOS® Regions. All but one of the HF radar sites in U.S. and Caribbean coastal zones are operated by U.S. IOOS® Regional Associations.



Figu **te**
max

Installation

Antennas can be secured by a base such as shown in Figure C-2, or tethered to the ground using wire or polyester rope. Data transmission from the antennas to a base station is made via one transmit cable and 3 receive cables. The typical cable run is between 30-100m. Cables are typically laid on the ground. In some locations, cables are run through a plastic conduit, and in some cases property owners require cables be buried. For underground cable runs, installers dig a ditch using a ditch witch, at a depth of about 6 inches.

Computer Requirements

Figure E-3: A CODAR Computer system.

The computer is located in an existing nearby building where possible, or in a specialized CODAR enclosure.

The SeaSonde Enclosure 36 is a small, rugged closed-loop temperature-controlled enclosure for containing the SeaSonde remote unit electronics. The small enclosure is just large enough to fit the SeaSonde transmit and receive chassis, the mini-style computer with small monitor (or laptop style computer), a UPS device and other small pieces of electronics. This enclosure is appropriate for both indoor and outdoor use.

Figure E-4: SeaSonde Enclosure 36

WERA and LERA Phased Array Systems

WERA and LERA phased array systems differ from the CODAR SeaSonde systems in the number of antennas employed: there are typically four transmit antenna elements but between 8-16 receive antenna elements. These receive elements are typically arranged in a line along the shore with receive and transmit arrays being separated by tens of meters. The four elements of the transmit array are usually arranged in a rectangular pattern with each element being two to six meters in height depending on transmit frequency. The length of the receive antenna arrays depend on the transmit frequency and the number of elements but are on the order of 100 meters in length. Currently there are four radar systems in the Miami area, four along the Georgia/South Carolina coast, two on the west coast of Florida and four arrays on the island of Oahu in Hawaii.

Installation and Special Cases

Cables are typically laid on the ground. In some sites cables are run through a plastic conduit, and in some cases property owners require cables be buried. For example, during a recent installation in Florida, the county required the cables to be buried as the HF radar is located on a public beach. In this case the ditch for the cable run was 1.5 feet deep and 10 inches wide. The county provided the equipment to dig the trench.

Aesthetics

Often antennas must comply with local ordinances and aesthetic code. Installations have employed some creative approaches to meet local requirements. Examples include:

- The Lighthouse Historical Society provided approval for the installation of an HF radar antenna on the Block Island Light House.
- Operators disguised an antenna as a flag pole for an installation on a public beach in Florida.
- Antennas were installed within fence posts in Hawaii to disguise them on a local beach.

Appendix F: The IOOS PEA Best Management Practices for Installation

HFR Installation

- Installations must occur during daylight hours.
- All installation material must be removed upon completion of the installation; all instruments/installations must be removed when no longer in use to avoid the creation of marine debris and the potential for entanglement.
- Avoid use of impact/vibratory hammers.
- Avoid installations in designated critical habitat.
- Avoid disturbing benthic ESA-listed species.
- Avoid land installations (HFR) at pinniped rookeries and known haul-out/pupping beaches