

Final

**Biological Avoidance Plan for
Terrestrial MEC and MC Investigations and Interim Removal Actions**

**Atlantic Fleet Weapons Training Center – Atlantic
Vieques, Puerto Rico**

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Acronyms and Abbreviations

AFWTF	Atlantic Fleet Weapons Training Facility
AOC	Area of Concern
ATG	air-to-ground
BA	Biological Assessment
BO	Biological Opinion
CCP	Comprehensive Conservation Plan
CD	compact disk
CFR	Code of Federal Regulations
CITES	Convention on International Trade in Endangered Species
CPC	Center for Plant Conservation
DBH	diameter at breast height
DDT	dichlorodiphenyltrichloroethane
DGM	digital geophysical mapping
DOI	Department of the Interior
DPS	distinct population segment
ECA	Eastern Conservation Area
EMA	Eastern Maneuver Area
ESA	Endangered Species Act
FR	Federal Register
Geo-Marine	Geo-Marine, Inc.
IITF	International Institute of Tropical Forestry
IUCN	International Union for Conservation of Nature
INRMP	Integrated Natural Resource Management Plan
LIA	Live Impact Area
MC	munitions constituent
MEC	munitions and explosives of concern
MOU	Memorandum of Understanding
MPPEH	material potentially presenting and explosive hazard
MR	munitions response
NAF	Naval Ammunition Facility
NASD	Naval Ammunition Support Detachment
NAVFAC	Naval Facilities Engineering Command
Navy	Department of the Navy
NGFS	naval gunfire support
NMFS	National Marine Fisheries Service
NSRR	Naval Station Roosevelt Roads
NTCRA	Non-time-critical Removal Action
NWI	National Wetland Inventory
PAOC	Potential Area of Concern
PI	Photo Identified
PRDNER	Puerto Rico Department of Natural and Environmental Resources
PRE	Puerto Rico Encyclopedia
RI	remedial investigation

SAP	Sampling and Analysis Plan
SIA	Surface Impact Area
T&E	threatened and endangered
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
UXO	Unexploded Ordnance
VNTR	Vieques Naval Training Range
VNWR	Vieques National Wildlife Refuge
WAC	World Agroforestry Centre
WAD	Work Area Determination
WP	Work Plan

Introduction

1.1 Introduction

This Biological Avoidance Plan was prepared for Naval Facilities Engineering Command (NAVFAC) Atlantic to address potential impacts on terrestrial biological resources resulting from munitions investigations and interim removal actions at the Former Atlantic Fleet Weapons Training Facility (AFWTF). This plan focuses on four separate operational areas of the Former AFWTF from west to east: the 11,000-acre Eastern Maneuver Area (EMA); the 2,500-acre Surface Impact Area (SIA); the 900-acre Live Impact Area (LIA); and the 200-acre Eastern Conservation Area (ECA). These areas have been further divided into Unexploded Ordnance (UXO) Sites 1 through 18, each of which is being addressed individually depending on historical activities and/or future land-use. An objective of the Department of the Navy (Navy) and the United States Fish and Wildlife Service (USFWS) is to avoid or minimize disturbance to federally protected (threatened and endangered [T&E]) species and resources deemed important to the management of the Vieques National Wildlife Refuge (VNWR) during environmental investigations and munitions and explosives of concern (MEC) and munitions constituent (MC) investigation and interim removal activities, while still achieving the objectives of the investigations and interim removal actions. Accordingly, this Biological Avoidance Plan was developed to (1) compile all published information on T&E species and resources deemed important to the management of the VNWR within the AFWTF, (2) describe the individual species and habitats, their status, and known or potential locations of occurrence, (3) evaluate preliminary potential effects of the proposed investigation and interim removal actions on these species and resources, and (4) describe a process for informing USFWS of proposed work activities and conferring on alternatives to obtain concurrence on areas where there will be no effect on T&E species, and conferring on alternatives for avoiding or minimizing affects on additional resources USFWS would like to conserve.

Discussions will be held with USFWS to develop work approaches before conducting investigation and interim removal activities. Specific work approaches for avoiding or minimizing site-specific impacts to resources are included in existing Work Plans (WPs), such as the Non-time-critical Removal Action (NTCRA) for UXO Site 13, or will be documented in subsequent Sampling and Analysis Plans (SAPs), WPs, and Work Area Determinations (WADs) in consultation with USFWS and other stakeholder agencies as needed.

This Biological Avoidance Plan is not intended to serve as a component of Section 7 of the Endangered Species Act (ESA) (such as a Biological Assessment [BA]). The Biological Avoidance Plan is only intended to inform USFWS of areas that will be worked where a no effect determination has been made for T&E species, and allow for USFWS to provide their input for conservation of additional resources they feel are important for the management of the VNWR. If resources important to the management of the VNWR may be affected, the site-specific WAD is expected to conclude that no vegetation removal work will be done. The documentation in this Biological Avoidance Plan provides a baseline of biological resource information and the potential for effects, and can be used to support future development of site-specific assessments where site actions may affect T&E species.

1.1.1 Site Location and History

Vieques is located in the Caribbean Sea approximately 7 miles southeast of the eastern tip of Puerto Rico and 20 miles southwest of St. Thomas, United States Virgin Islands. Vieques is the largest offshore island of the Commonwealth of Puerto Rico. It is approximately 20 miles long and 4.5 miles wide, and has an area of approximately 33,088 acres (51 square miles).

The Former AFWTF is located in the eastern half of Vieques and is bordered to the west by the community of Isabel Segunda, to the north by Vieques Sound, and to the south by the Caribbean Sea. The Former AFWTF provided logistics support, scheduling assistance and facilities for naval gunfire support (NGFS) and air-to-ground (ATG) ordnance delivery training for Atlantic Fleet ships. The Atlantic Fleet's ships, aircraft, and marine forces carried out training in all aspects of NGFS, ATG ordnance delivery, air-to-surface mine delivery, amphibious

landings, small-arms fire, artillery and tank fire, and combat engineering. The Former AFWTF encompasses approximately 14,500 acres (**Figure 1-1**).

The Navy began developing training facilities in the eastern part of Vieques in 1964, when it established a gunnery range in the LIA. In 1965, ATG training activity began in the LIA with the use of mock-up targets, such as old tanks and vehicles, for aerial bombing. By the 1970s, the LIA maintained several targets for aerial bombing, including mock-up targets, two bulls-eye targets, and a strafing target. Naval gunfire practice began in the LIA in the mid-1970s. Several point and area targets for ships to practice NGFS were constructed. As a result of the naval gunfire and ATG gunfire that occurred from the 1970s through 2003, the entire 900 acres of the LIA have been affected by MEC. On April 30, 2003, the Former AFWTF was transferred to the Department of the Interior (DOI) to be operated and managed by the USFWS as a National Wildlife Refuge, and in some places, as Wilderness Areas (USFWS, 2007). Although the DOI is directed to protect and conserve the transferred land as a wildlife refuge, the Navy retains the responsibility for conducting the environmental investigations and cleanup of the property, as warranted. In total, there are 18 Munitions Response (MR) Sites on the Former AFWTF that include:

- UXO 1 (ECA)
- UXO 2 (LIA Beaches)
- UXO 3 (LIA Roads)
- UXO 4 (LIA Interior)
- UXO 5 (SIA Restricted Roads)
- UXO 6 (EMA/SIA Public Roads)
- UXO 7 (EMA/SIA North Beaches)
- UXO 8 (SIA South Beaches)
- UXO 9 (SIA Exterior)
- UXO 10 (SIA Interior)
- UXO 11 (EMA Public Roads)
- UXO 12 (EMA Interior)
- UXO 13 (EMA West)
- UXO 14 (EMA South)
- UXO 15 (Puerto Ferro)
- UXO 16 (underwater areas)
- UXO 17 (other sites)
- UXO 18 (Cayo la Chiva)

UXO 16 includes the primary underwater areas in the EMA, SIA, LIA, ECA, Naval Ammunition Support Detachment (NASD), offshore anchorage points, and Mosquito Pier. UXO 16 is not included in this Biological Avoidance Plan. UXO sites are shown on **Figure 1-2**.

1.1.2 Previous Terrestrial Investigations

Munitions-related investigations, munitions removal actions, environmental investigations, and debris removal activities are required in the Former AFWTF to support environmental restoration activities. Restoration activities generally include identifying, investigating, and cleaning up hazardous substances and MEC, pollutants, and contaminants, and inspecting non-operational range lands containing MEC or MC contamination. Previous reports were prepared in the Former AFWTF to determine if the MR-related activities were likely to do the following:

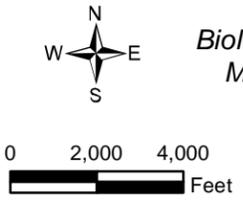
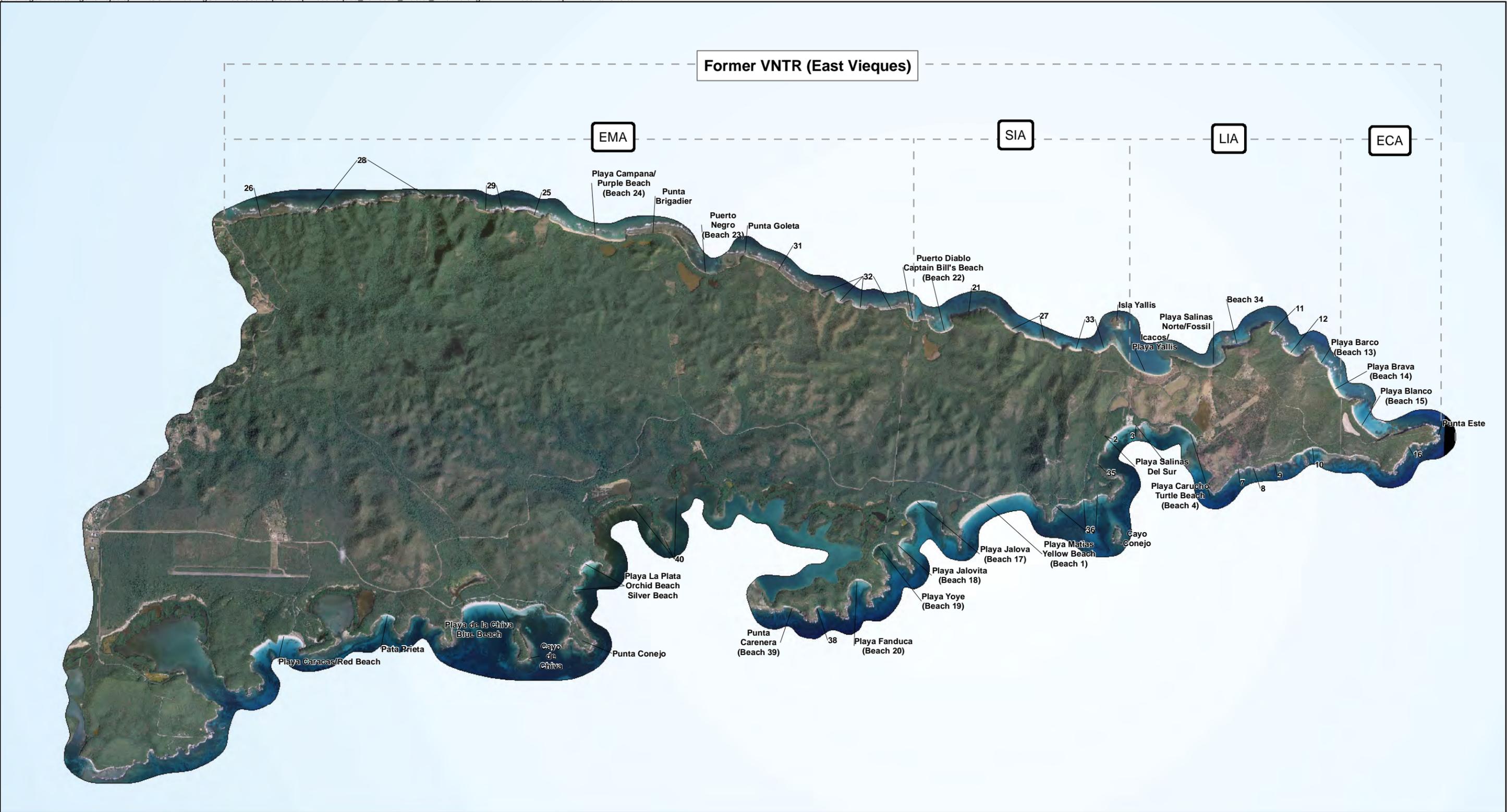
- Adversely affect listed species or designated critical habitat
- Jeopardize the continued existence of species that are proposed for listing
- Adversely modify proposed critical habitat identified in the Code of Federal Regulations (CFR).

Other long-term planning documents were also considered. **Table 1-1** presents the previous reports and long-term planning documents relevant to the Former AFWTF, including the year of evaluation and location or area of evaluation.

TABLE 1-1
Previous Biological Resource Reports and Long-term Planning Documents

Report	Year	Area
<i>Draft Environmental Impact Statement Vieques</i> (Navy, 1979)	1979	AFWTF, EMA, and NAF
<i>Land Use Management Plan for U.S. Naval Facilities Vieques</i> (NSRR, 1996)	1996	1996 Navy-owned land, approximately 22,437 acres on either end of Vieques
<i>Biological Assessment for Continuing Training Activities on the Inner Range, Vieques, Puerto Rico</i> (Geo-Marine, 2001)	2001	Training activities in the Inner Range or Former EMA, Former SIA, Former LIA, and Former ECA
<i>Integrated Natural Resource Management Plan (Vieques INRMP)</i> (Navy, 2003)	2003	2003 Navy-owned land
<i>Habitat Characterization at AOC-R, PI 4, PI 7, PAOC J, K, and S for the Former NASD and Former VNTR</i> (Geo-Marine, 2005)	2005	AOC R, PI 4, PI 7, PAOCs J, K, and S for Former VNTR and NASD
<i>Biological Assessment of the Former Live Impact Area within the Former Vieques Naval Training Range</i> (Geo-Marine, 2006)	2006	Former LIA
<i>Vieques National Wildlife Refuge Comprehensive Conservation Plan and Environmental Impact Statement</i> (USFWS, 2007)	2007	VNWR
<i>Live Impact Area Biological Assessment – Amendment I, Eastern Conservation Area</i> (Geo-Marine, 2007)	2007	Former ECA
<i>Biological Assessment for Select Portions of the Surface Impact Area and Eastern Maneuver Area Former Vieques Naval Training Range</i> (Geo-Marine, 2010)	2010	Portions of the Former SIA and EMA
<i>Final Preliminary Assessment/Site Inspection Work Plan for PAOC EE, Former Vieques Naval Training Range, Vieques, Puerto Rico</i> (CH2M HILL, 2010)	2010	Punta Conejo
<i>Final Biological Assessment for PI 9, PI 13, and Debris Piles within UXO 15, Former Vieques Naval Training Range</i> (CH2M HILL, 2012a)	2011	PI 9, PI 13, and Debris Piles within UXO 15
Vieques Report Library (contains nine CDs)	--	Vieques

AOC - Area of Concern; CD - compact disk; INRMP - Integrated Natural Resource Management Plan; NAF - Naval Ammunition Facility; PAOC – Potential Area of Concern; PI - Photo Identified; VNTR - Vieques Naval Training Range



**Figure 1-1
Location Map**
*Biological Avoidance Plan for Terrestrial MEC and
MC Investigations and Interim Removal Actions
Former AFWTF (East Vieques)
Vieques, Puerto Rico*



Former VNTR (East Vieques)

EMA

SIA

LIA

ECA

Municipality of Vieques

Isabel Segunda

Environmental Site Status	Munitions Response Sites	Vieques Land Ownership	Vieques Features
Expanded Site Inspection/Pilot Study	UXO 1 - ECA (Remedial Investigation)	Department of Interior	Road
Record of Decision Pending	UXO 2 - LIA Beaches	Municipality of Vieques	
Decision Document Pending	UXO 3 - LIA Roads		
Decision Document	UXO 4 - LIA Interior		
	UXO 5 - SIA Restricted Roads		
	UXO 6 - EMA/SIA Public Roads		
	UXO 7 - EMA/SIA North Beaches		
	UXO 8 - SIA South Beaches		
	UXO 9 - SIA Exterior		
	UXO 10 - SIA Interior		
	UXO 11 - EMA Public Roads		
	UXO 12 - EMA Interior		
	UXO 13 - EMA West		
	UXO 14 - EMA South		
	UXO 15 - Puerto Ferro (Expanded Site Inspection)		
	UXO 16 - Underwater Areas		
	UXO 17 - Camp Garcia Area - PI-14, PAOC-FF (Decision Document)		
	UXO 17 - PAOC-EE (Preliminary Assessment/Site Inspection)		
	UXO 18 - Cayo de la Chiva		

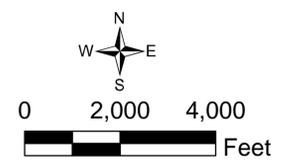
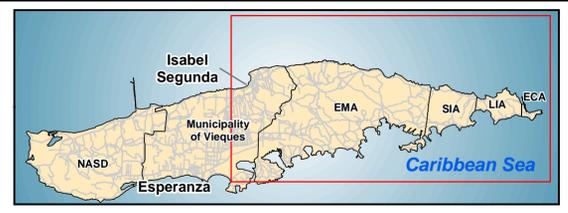


Figure 1-2
UXO and AOC Sites
 Biological Avoidance Plan for Terrestrial MEC and MC Investigations and Interim Removal Actions Former AFWTF (East Vieques) Vieques, Puerto Rico



SECTION 2

Purpose

This Biological Avoidance Plan was developed to compile all published information on T&E species and resources deemed important to the management of the VNWR within the AFWTF, describe the individual species and habitats, their statuses, and known or potential locations of occurrence, evaluate preliminary potential effects of the proposed investigation and interim removal actions on these species and resources, and describe a process for informing USFWS of proposed work activities and conferring on alternatives to obtain concurrence on areas where there will be no effect on T&E species, as well as conferring on alternatives for avoiding or minimizing affects on additional resources USFWS would like to conserve. Reference to T&E species in this document includes their supportive habitats.

The list of federally protected species is provided in **Table 2-1**, and a list of Puerto Rico protected species and VNWR important resources are provided in **Table 2-2**. These lists were developed for the island of Vieques based on species that could potentially occur and are known to occur on Vieques, previous reports and field surveys, and collaboration with USFWS.

These lists of protected or important species will be used to support all future site-specific WPs, SAPs, and WADs. The process for proposed activity notification is provided in **Section 3** of this Biological Avoidance Plan.

TABLE 2-1
Federally Protected Species Evaluated for Vieques, Puerto Rico

Scientific Name	Common Name	Spanish Name	Federal Status	State Status	Range & Habitat	Found on Vieques
Birds						
<i>Agelaius xanthomus</i>	Yellow-shouldered blackbird	Mariquita, Capitán	E, CH	EN	Coastal forest, mangroves	Possible
<i>Charadrius melodus</i>	Piping plover	Playero melódico	T	CR	Beaches, mudflats, and sandflats	Possible
<i>Sterna dougallii dougallii</i>	Roseate tern	Palometa	T	VU	Coastal areas and offshore cays, nesting	Yes
Reptiles						
<i>Chelonia mydas</i>	Green sea turtle	Peje blanco	T	EN	Coastal zones, beaches for nesting	Yes
<i>Dermochelys coriacea</i>	Leatherback sea turtle	Tinglar	E	EN	Coastal zones, beaches for nesting	Yes
<i>Eretmochelys imbricata</i>	Hawksbill Sea Turtle	Carey	E	EN	Coastal zones, beaches for nesting	Yes
<i>Caretta caretta</i>	Loggerhead sea turtle	Cabezona	T	--	Coastal zones, beaches for nesting	Yes
<i>Epicrates inornatus</i>	Puerto Rican Boa	Boa constrictora	E	VU	Forested volcanic and limestone (karst) hills	Possible
<i>Anolis roosevelti</i>	Culebra giant anole	Lagarto gigante de Culebra	E, CH	CR	Vieques in forested areas	Yes
Plants						
<i>Buxus vahlii</i>	Vahl's boxwood	--	E	EN	Remnants of dry forest, especially on limestone. Also semi-evergreen seasonal forest on limestone restricted to ledges and ravines	Possible
<i>Calypttranthes thomasi</i>	Thomas' lidflower	--	E	CR	Shaded rocky forest (volcanic), Monte Pirata summit	Yes

TABLE 2-1
Federally Protected Species Evaluated for Vieques, Puerto Rico

Scientific Name	Common Name	Spanish Name	Federal Status	State Status	Range & Habitat	Found on Vieques
<i>Catesbaea melanocarpa</i>	No common name	--	E	EN	Subtropical dry forest, and remnants of dry forest, especially on limestone	Possible
<i>Chamaecrista glandulosa</i> var. <i>mirabilis</i>	Puerto Rican senna	--	E	EN	Sandy areas adjacent to mangroves, previously found associated with mangroves in southwest portion of former Navy lands, Vieques	Yes
<i>Cordia rupicola</i>	Puerto Rican manjack	--	C	--	Subtropical dry forest, dry limestone forest	Yes
<i>Eugenia woodburyana</i>	Woodbury's stopper	--	E	CR	Remnants of dry forest. Currently known only from the Sierra Bermeja in the municipalities of Cabo Rojo and Lajas and from the Gunica Commonwealth Forest in Gunica, all in southwestern Puerto Rico, and subtropical dry forest life zone	Possible
<i>Goetzea elegans</i>	Beautiful goetzea	Matabuey	E	EN	Forested areas within 50 meters of stream in alluvial soils, along quebradas or seasonal water courses, gallery forests	Yes
<i>Leptocereus grantianus</i>	No common name	--	E	CR	Endemic to Culebra, subtropical dry forest, dry coastal forest and coastal cliffs	Possible
<i>Mitracarpus polycladus</i>	Cana gorda girdlepod	--	E	EN	Open dry limestone forest with exposed rocky plateau	Possible
<i>Peperomia wheeleri</i>	Wheeler's peperomia	--	E	EN	Shaded rocky forest (volcanic)	Possible
<i>Stahlia monosperma</i>	Cóbana negra	--	T	VU	Edge of salt flats in brackish, seasonally flooded wetlands, remnants of mangrove forests and salt flats	Yes
<i>Zanthoxylum thomasianum</i>	St. Thomas pricklyash	--	E	EN	Shaded rocky forest (volcanic) and dense pristine limestone forest	Possible

Source: Estado Libre Asociado de Puerto Rico Regulation No. 6766, Puerto Rico Comprehensive Wildlife Conservation Strategy Volume 1 (2005), Comprehensive Conservation Plan (CCP) (USFWS, 2007), USFWS Caribbean Endangered Species Map for Vieques, *Biological Assessment of Surface Impact Area Former Vieques U.S. Navy Training Range* (Geo-Marine, 2010).

Federal status:

E=Endangered

T=Threatened

CH=Critical Habitat on Vieques

C=Candidate

State status:

CR=Critically endangered

EN=Endangered

VU=Vulnerable

TABLE 2-2
Puerto Rico Protected Species and VNWR Important Resources Evaluated for Vieques, Puerto Rico

Scientific Name	Common Name	Spanish Name	Federal Status	State Status	Range & Habitat	Found on Vieques
Birds						
<i>Anas bahamensis</i>	White-cheeked Pintail	Pato Quijada Colorada	--	VU	Freshwater and brackish coastal areas including mangrove forests	Yes
<i>Charadrius alexandrinus</i>	Snowy plover	Playero Blanco, Chorlito Patinegro	--	CR	Beaches, mudflats, and sandflats	Possible
<i>Dendrocygna arborea</i>	West Indian Whistling Duck	Chiriría Caribeña	--	CR	Vieques lagoons (Laguna Kiani, Laguna Boca and Quebrada). Forested freshwater swamps and lakes, mangrove forests	Yes
<i>Setophaga petechia</i> *	Yellow warbler	Canario de mangle	--	VU	Vieques. Wetlands, edge of forests, areas with scattered trees, thick shrubs, and wet shady areas, mangrove forests	Yes
<i>Falco peregrinus</i>	Peregrine falcon	Halcón Peregrino	--	CR	Cays and rocks surrounding the rocks, forests	Yes
<i>Fulicia caribaea</i>	Caribbean Coot	Gallinazo Caribeño	--	VU	Vieques. Freshwater and brackish marshes and swamps with sparse vegetation	Yes
<i>Nomonyx dominicus</i>	Masked duck	Pato Dominicó	--	EN	Vieques (Laguna Zoní in freshwater and brackish water with floating vegetation), mangrove forests	Yes
<i>Oxyura jamaicensis</i>	Ruddy duck	Pato Chorizo	--	VU	Vieques in coastal bodies of freshwater with depths of more than 3 meters	Yes
<i>Pelecanus occidentalis occidentalis</i>	Caribbean Brown Pelican	Pelícano Pardo	D	EN	Roost and feed in coves, inlets, and lagoons of Vieques. Nests on Cayo Conejo, mangroves forests	Yes
Terrestrial Mammals						
<i>Erophylla sezekoni</i>	Brown flower bat		--	VU	Hot caves, karst areas	Possible
<i>Stenoderma rufum</i>	Red fruit bat	Murciélago frutero nativo	--	VU	Forested canopy, karst areas	Yes
Reptiles						
<i>Mabuya mabuya sloanei</i>	Slipperyback skink	Santa Lucía	--	VU	Dry and moist subtropical forest under leaf litter, rocks, and tree trunks	Yes
Plants						
<i>Guaiacum officinale</i>	Guayacan, lignum vitae tree	Guaiacum	--	CT (CITES)	Subtropical dry forest	Possible
<i>Guaiacum sanctum</i>	Hollywood, roughbark lignumvitae	Guayacán	--	--	Subtropical dry forest	Possible
<i>Krugiodendron ferreum</i>	Black ironwood tree	Palo de hierro	--	--	Subtropical dry forest	Yes
<i>Maytenus cymosa</i>	Caribbean mayten	--	--	--	Moist montane forest types, volcanic soils	Yes

Source: Estado Libre Asociado de Puerto Rico Regulation No. 6766, Puerto Rico Comprehensive Wildlife Conservation Strategy Volume 1 (2005), CCP (USFWS, 2007), USFWS Caribbean Endangered Species Map for Vieques, *Biological Assessment of Surface Impact Area Former Vieques U.S. Navy Training Range* (Geo-Marine, 2010).

*Formerly *Dendroica petechia* (American Ornithologist's Union, 2011).

Federal status:

D=Delisted

State status:

CR=Critically endangered

CT=Included in the *Convention on International Trade in Endangered Species (CITES), Appendix II* (Not necessarily threatened with extinction, but trade must be controlled).

EN=Endangered

VU=Vulnerable

Proposed Munitions-Related Activities

3.1 Primary Investigation Activities

The proposed action consists of munitions-related activities, interim removals, and environmental investigations within the Former AFWTF to support restoration activities (as defined in **Section 1.1.2**). These activities may require the removal of vegetation prior to implementation of the investigative or interim removal work within all of the 17 Former AFWTF terrestrial UXO sites.

Primary investigation activities include digital geophysical mapping (DGM), surface and subsurface interim removal actions, and remedial investigations (RIs) that involve environmental sampling of various media (such as soil and groundwater). Some of these activities necessitate an exposed ground surface that may require vegetation removal.

3.1.1 Digital Geophysical Mapping

Geophysical surveys will be conducted to identify geophysical anomalies that may represent MEC and/or material potentially presenting and explosive hazard (MPPEH) or other materials related to Former AFWTF site activities within the subsurface. Areas containing outcropping bedrock will be excluded from the DGM survey because any debris will be at the surface in those areas and will be visually observed. The DGM surveys typically require that vegetation be cleared to a height of 6 inches above the ground surface. The USFWS and the Navy may identify locations where vegetation removal should not occur and isolated stands of vegetation may be left in place to preserve important habitat. A handheld geophysical instrument, electromagnetic instrument, or metal detector may also be utilized to assist in the delineation of the extent of the subsurface anomalies within important habitat. The use of a handheld geophysical, electromagnetic, or metal detecting instrument does not provide the same level of detail as DGM and may not provide the level of certainty required to constitute a removal action. Geophysical equipment types and their appropriate applications are described in greater detail in *Work Plan for Munitions of Explosive Concern Subsurface Interim Removal Action Beaches and Select Roadways* (CH2M HILL, 2008a).

3.1.2 Interim Removal of Surface and Subsurface Geophysical Anomalies

Selected surface and subsurface anomalies will be excavated, and surface MEC not identified from anomalies will be removed. The excavation of the geophysical anomalies will be conducted in accordance with the procedures identified in the *Work Plan for Munitions and Explosives of Concern Subsurface Interim Removal Action Beaches and Select Roadways* (CH2M HILL, 2008a). The investigation and interim removal of geophysical anomalies necessitates the need for vegetation removal and soil disturbance.

3.1.3 Remedial Investigation

An RI is conducted to assess, in part, whether contamination was released as a result of activities conducted at the Former AFWTF. The disposition of the geophysical anomalies may result in the need for the collection of environmental samples for analysis. The Master SAP, East Vieques Terrestrial UXO Sites (CH2M HILL, 2012b), describes the types of investigations proposed. Vegetation removal may be required in some areas to support sample collection.

3.1.4 Vegetation Removal

Current approved methods for vegetation removal actions are described in the *Final Non-Time-Critical Removal Actions Work Plan, Surface Munitions and Explosives of Concern at Munitions Response Area –Surface Impact Area Munitions Response Sites 1 through 7* (CH2M HILL, 2009) and its subsequent amendments.

In accordance with this WP, vegetation removal is to be conducted by hand (manually), utilizing hand-carried tools (such as weed eaters). Unless it is necessary, cutting trees larger than 3 inches in diameter is prohibited.

Examples that may require the removal of trees larger than 3 inches would be to allow for equipment to move through an area or vine entanglements in the canopy that create a safety issue for the vegetation removal teams. Trees are to be felled into an area that has already been surface-swept. The vegetation will typically be cut to a height of approximately 6 inches above ground surface to eliminate interference with identifying items to be removed or survey activities and to facilitate the objectives of the WP. All cut vegetation is to be accumulated onsite and left in place.

Other WPs considered in this Biological Avoidance Plan are:

- *Final Amendment 1 Expanded Range Assessment and Phase II Site Inspection Work Plan, Former Vieques Naval Training Range, Vieques, Puerto Rico Phase II Site Inspection Work Plan (CH2M HILL, 2008b)*
- *Final Work Plan for Munitions and Explosives of Concern Subsurface Interim Removal Action Beaches and Select Roadways (CH2M HILL, 2008a).*

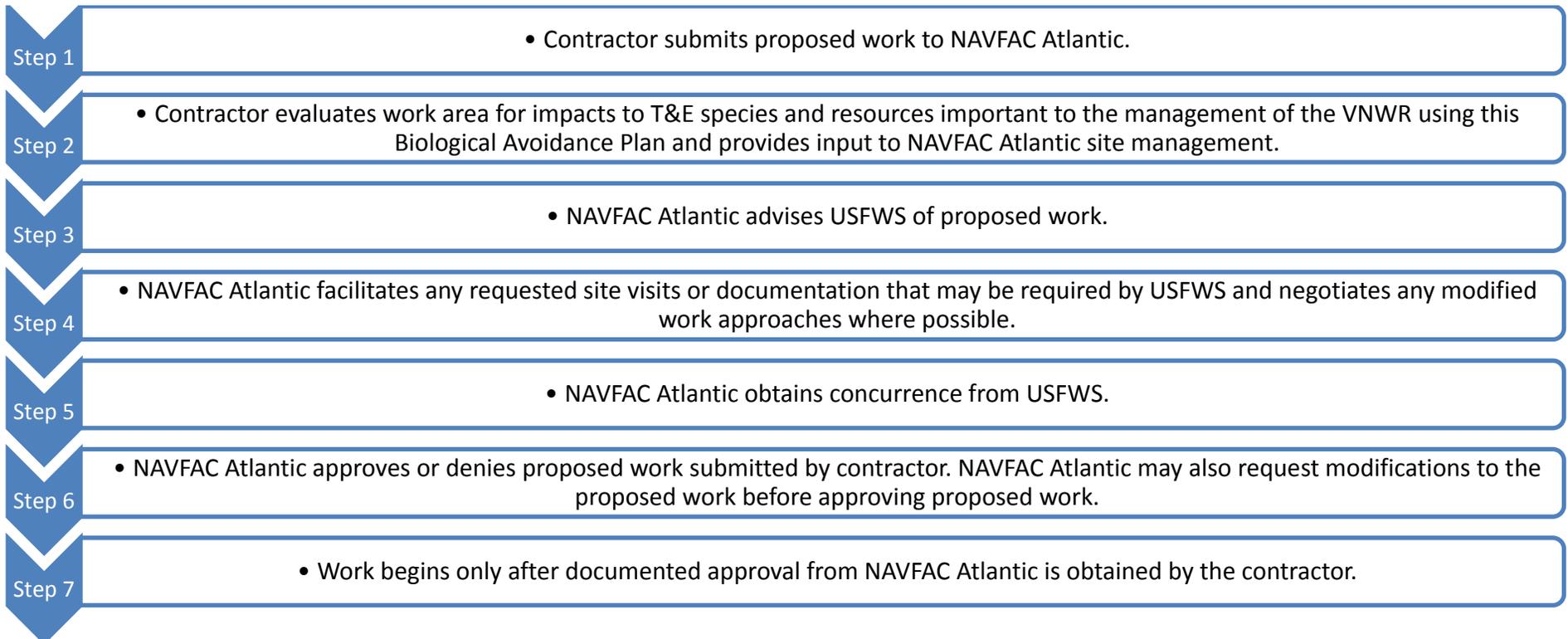
3.2 Work Area Determination Proposed Activity Notification

The proposed activity notification for the WAD process occurs prior to any work activity done in a work area to allow for USFWS input. This process evaluates the work area for potential impacts to T&E species and any resources that the USFWS service deems important for the management of the VNWR using this Biological Avoidance Plan. The evaluation process is documented using a WAD Assessment Check List that identifies the participants involved with the work activity and provides descriptions of the known target area, the type of vegetation, terrain, site features, demolition requirements, safety concerns, and collection points, and specific USFWS comments and concurrence. USFWS will be provided access to the NAVFAC Atlantic MapViewer Webtool, where all the WADs will be shown and overlays of all historical aerial photos and figures can be viewed. The proposed activity notification is achieved through the seven-step WAD process outlined on **Figure 3-1**.

If the USFWS agrees with NAVFAC Atlantic's determination of no effect for T&E species, and that there will be no unacceptable impacts to any resources valuable to the refuge in the work area described in a WAD, the WAD will be approved. If the USFWS does not concur with NAVFAC Atlantic's determination of no effect for T&E species, the WAD will not be approved. In addition, USFWS will evaluate the WAD to determine if there are any unacceptable impacts to important refuge resources and provide approval for the WAD in reference to these areas. NAVFAC Atlantic may be able to accommodate minimally restrictive measures on a case-by-case basis to allow for approval of the WAD and allow for conservation of a resource valuable to the VNWR. In the event the restrictive measures cannot be affected while maintaining compliance with the WP, the WAD will not be approved.

For work areas where it is determined that T&E species will be affected by the proposed activities, a BA conducted in accordance with Section 7 of the ESA would be required, followed by a Biological Opinion (BO) issued by the USFWS, before any work activity would begin. For areas where a resource valuable to the VNWR is present, and restrictions for working this area do not allow for completion of the work in accordance with the existing WP, the area will not be worked until the approach can be negotiated and approved by appropriate regulatory agencies.

FIGURE 3-1
Work Area Determination Process
Biological Avoidance Plan
Former AFWTF (East Vieques)
Vieques, Puerto Rico



Natural Environment

Since the proposed MR-related activities primarily involve the clearance of vegetation to support field investigations, this section focuses on describing the terrestrial habitats deemed important to the management of the VNWR that occur throughout the Former AFWTF and which could be affected by vegetation clearance activities.

4.1 Terrestrial Habitats

Historical impacts have occurred within the Former AFWTF and have altered the native vegetation. In 1742, lush vegetation was prevalent on Vieques. The vegetation was first affected by the timber industry in 1812. Timber was exported from Vieques and used to build houses, boats, and sugar presses. In 1851, the timber resource was depleted and Vieques began importing timber. Shortly afterwards, the sugarcane industry cut forests to grow sugarcane, plantains, cotton, and tobacco. In 1922, there were four processing mills on the island. The western end of Vieques was cultivated except for high elevations. The eastern end of Vieques was used to graze livestock. The sugarcane industry no longer dominated the land by 1950, allowing unmanaged land to convert to dense thorn thickets and secondary growth forest. The Navy owned the eastern end of Vieques until 2003, at which point they transferred the land to the DOI to be operated and managed by the USFWS as a National Wildlife Refuge and, in some places, as Wilderness Areas. Most of the Former AFWTF has been affected by these past disturbances to the vegetation, but the vast majority remains undeveloped and supports important habitats for native and naturalized, migratory, rare, and protected species (USFWS, 2007).

The Holdridge System classifies the habitats on Vieques into two broad life zones: the subtropical dry forest (eastern Vieques) and the subtropical moist forest (western Vieques). The subtropical moist forest represents the largest area in the Caribbean and was commonly deforested since post-Columbian habitation for cropland and agriculture. The subtropical dry forest is composed of mostly deciduous vegetation with spines or thorns and leaves that are succulent, coriaceous (leathery), or small (Navy, 2003). USFWS has identified two important habitats within the Former AFWTF, specifically in UXO 15: the subtropical dry forest and mangrove forests.

Important and distinct habitats that occur within the Former AFWTF were documented in previous Navy reports. Habitats discussed include:

- Sparse and thick thorn scrub
- Mixed native and naturalized invasives
- Entirely invasive species
- Mangrove forests
- Evergreen scrub
- Forest Scrub/Dry Scrub Forest/Lowland Forest
- Gallery forests
- Quebradas
- Inland lagoon
- Mixed woodland/Upland forest
- Grassland
- Bare ground
- Salt/sand flat
- Beach

Figure 4-1 illustrates previously identified coverage for most of these habitat types. The following sections provide descriptions of the habitat and dominant species that could occur within the Former AFWTF. Habitats within UXO 15 are provided in **Appendix A**.

4.2 Terrestrial Habitat Classification

4.2.1 Sparse and Thick Thorn Scrub

Thorn scrub habitat is dominated by low-growing shrub species with thorns that are generally less than 10 feet in height. The dominant species that compose this habitat are acacia (*Acacia* sp.), mesquite (*Prosopis juliflora*), white leadtree (*Leucaena glauca*), box-briar (*Randia aculeata*), goatbush (*Castela erecta*), sage (*Lantana* sp.), and Croton sp. (Buell and Dansereau, 1966). The sparse and thick thorn scrub habitats have generally the same species composition; however, the plant density is sparse in the sparse thorn scrub and thick in the thick thorn scrub (Navy, 2003).

4.2.2 Mixed Native and Naturalized Invasives

Forest areas of mixed native, naturalized, and invasive species generally consist of mixed native and naturalized species such as pink trumpet tree (*Tabebuia heterophylla*), cassia (*Senna bicapsularis*), torchwood (*Amyris elemifera*), gumbo limbo (*Bursera simaruba*), sapwood (*Comocladia dodonaea*), silver palm (*Coccothrinax* sp.), and monk orchids (*Oeceoclades maculata*), as well as invasive or noxious species including acacia sp. (*Acacia* sp.), lead tree (*Leucaena leucocephala*), and mesquite (*Prosopis juliflora*) (CH2M HILL, 2012a).

4.2.3 Entirely Invasive Species

Six invasive or noxious species are present on the Former AFWTF and include Acacia sp. (*Acacia* sp.), leadtree (*Leucaena leucocephala*), mesquite (*Prosopis juliflora*), Jerusalem thorn (*Parkinsonia aculeata*), portiatree (*Thespesia populnea*), and Guinea grass (*Panicum maximum*). These species displace native plants by outcompeting native species and grow relatively quickly compared to native plant species. Of the invasive noxious species, leadtree is the only species considered to be a native invasive species because it was introduced prior to 1492 (Navy, 2003; CH2M HILL, 2012a).

4.2.4 Mangrove Forests

Mangrove forests are often associated with lagoons, salt/sand flats, or tidal mud flats. The largest mangrove forests are found in Puerto Mosquito, Puerto Ferro, and Ensenada Honda along the south-central coast. Mangrove forests are dominated by red mangrove (*Rhizophora mangle*), white mangrove (*Laguncularia racemosa*), black mangrove (*Avicennia germinans*), and button mangrove (*Conocarpus erectus*). Mangrove forests are considered to be unique natural communities; in a few instances they surround bioluminescent bays. They provide habitat for aquatic and terrestrial species and stabilize the shoreline (Navy, 2003).

4.2.5 Evergreen Scrub

The vegetation within the evergreen scrub habitat varies depending on exposure to the sea breeze, rainfall, and the extent of limestone formation. The vegetation generally consists of very dense, low-growing, or dwarf drought-resistant shrubs with sclerophyllous (leathery) leaves and palms found on rocky coasts and limestone formations (Navy, 1979). The evergreen scrub is a unique and rare habitat that primarily occurs in two areas of Vieques: the southern coast and the eastern tip. Dominant species vary by location, but generally consist of low-creeping shrubs including seagrape (*Coccoloba uvifera*), pride of big pine (*Strumpfia maritime*), and tree seaside oxeye (*Borrhchia arborescens*). Taller species (up to 6.6 feet) are found landward of these spreading shrubs, including key thatch palm (*Thrinax morrisii*), bodywood (*Bourreria succulenta*), West Indian jasmine (*Plumeria alba*), balsam (*Croton flavens*), Damiana (*Turnera diffusa*), black torch (*Erithalis fruticosa*), crabwood (*Coccoloba krugii*), wild sage (*Lantana involucrata*), and maidenberry (*Crossopetalum rhacoma*). Of these species, *Thrinax morrisii* is the dominant species (Navy, 2003). The *Epidendrum bifidum* is a rare orchid species known to grow within the evergreen scrub community (NSRR, 1996).

4.2.6 Forest Scrub/Dry Scrub Forest/Lowland Forest

The forest scrub/dry scrub forest/lowland forest habitat is a unique and rare habitat that occurs along drainages, or quebradas (ravines), adjacent to and inland from Laguna Yanuel, and low areas bordering mangrove forests.

These areas are seasonal forests of high moisture and subject to a high or periodically high water table. Dominant vegetation includes oxborn bucida (*Bucida buceras*), box brier, tachuelo, goatbush, and Jamaican caper (*Capparis cynophallophora*), as well as dense stands of mesquite and acacia trees (NSRR, 1996; Navy, 2003).

4.2.7 Gallery Forests

Gallery forests are found along and within the quebradas and are unique vegetative communities that are different from the surrounding areas due to the increased humidity and unique microclimate (USFWS, 2011a, personal communication). This habitat often consists of evergreen forests found in the riparian zone along quebradas, drainages, or ravines. The alluvial soils found in the riparian zone are of high fertility and support unique habitat. Gallery forests cover 68 hectares (168 acres) of the island and are associated with microphyllus scrub or scrubby trees. The trees protect quebradas from erosion and prevent water quality degradation in coastal areas (Navy, 1979). Some remnant gallery forests have been present since at least the 1930's and therefore represent some of the oldest native vegetation in portions of the Former AFWTF.

4.2.8 Quebradas

Quebradas are drainageways, ravines, or seasonal water courses. The northwestern portion of the EMA in the Former AFWTF contains four major watersheds: Quebrada Hueca, Quebrada Amargura, Quebrada Marunguey, and an unnamed quebrada that flows into Bahía de la Chiva. Smaller unmapped quebradas exist along the north coast and are protected by conservation zones that were established by the Navy to protect these quebradas. Permanent freshwater streams have not been reported on Vieques due primarily to the geology characterized by rapid runoff and increased infiltration and percolation to aquifers. National Wetland Inventory (NWI) maps indicate the streams on Vieques are classified as temporarily flooded or ephemeral streams that typically flow during, and for brief periods of time after, rainfall events (USFWS, 2007). Quebradas typically have a forest scrub component limited to areas with perched water tables and can occur along the inland borders of mangrove forests. Typical species include dense stands of mesquite and acacia trees (Geo-Marine, 2010).

4.2.9 Inland Lagoon

Lagoons within the Former AFWTF are considered to be estuaries with varied tidal influence including subtidal, irregularly exposed, regularly flooded, and irregularly flooded. Lagoons are characterized as shallow sounds, channels, or ponds near or connected to a larger water body. The extent of the tidal connection dictates the lagoon's salinity regime. Subtidal lagoons are permanently inundated; the remaining inland lagoons depend on rainfall to maintain flooded or saturated conditions. Lagoons are associated with mangrove forests, shallow salt flats, sand flats, or tidal mud flats. Vegetation in lagoons is limited to primarily mangroves along the lagoon edge (Geo-Marine, 2010).

The INRMP lists 32 lagoons within the Former AFWTF, including closed, fringe, ephemeral, and open lagoons (Navy, 2003). Representative examples include Laguna Puerto Diablo, Laguna Anones, Bahía Playa Blanca, Cayo Canejo, Laguna Matías, Yellow Beach, and Bahía Jalova.

4.2.10 Mixed Woodland/Upland Forest

The mixed woodland/upland forest habitat is a moist deciduous formation that consists of widely scattered remnant stands located within the Inner Range, the hills east and west of Puerto Ferro, and north of the Laguna Yanuel, on several hilltops north of Camp García, and on the upper slopes of Cerro Matías. The mixed woodland/upland forest habitat is more common on the inner hills and slopes on the western side of Vieques. Common species found within the upland forest habitat include almacigo (*Bursera* sp.), caper trees, fiddlewood (*Citharexylum* sp.), ironwood (*Krugiodendron ferreum*), "fish poison" (*Piscidia carthagenensis*), candle berry (*Byrsonima lucida*), the legume "fustic" (*Pictetia* sp.), cat's claw, box brier, and myrtle trees (*Eugenia* sp.) (Geo-Marine, 2001; Navy, 2003).

4.2.11 Grassland

The grassland habitat was historically maintained for grazing pastures. Grasslands found in large interior areas are dominated by guinea grass (*Panicum maximum*) and are slowly reverting back to thorn scrub. Other grasslands include those surrounding Camp Garcia, gun ranges, and observational point areas. These areas include short clump and sod grasses such as pitted bluestem (*Bothriochloa pertusa*), southern crabgrass (*Digitaria ciliaris*), Bermuda grass (*Cynodon dactylon*), dutch grass (*Eleusine indica*), smutgrass (*Sporobolus indicus*), and sandbur (*Cenchrus brownii*) (Navy, 2003).

4.2.12 Bare Ground

Bare ground areas are previously disturbed areas with an absence of vegetation cover. Sparse vegetation can occur and generally consists of milkweeds (*Calotropis procera*), low growing mesquite (*Prosopis juliflora*), and verbain (*Stachytarpheta jamaicensis*) (Navy, 2003). Bare ground also includes naturally exposed rock surfaces and areas where the rock is covered by only a thin veneer of soil, examples of which include portions of UXO 1 and UXO 15.

4.2.13 Salt/Sand Flat

Salt/sand flats are generally located inland of tidal mangrove areas and are generally not tidally flooded. The common herbaceous vegetation includes species such as saltwort (*Batis maritima*), shoreline seapurslane (*Sesuvium portulacastrum*), seaside heliotrope (*Heliotropium curassavicum*), buttonsage (*Lantana involucrata*), railroad vine (*Ipomoea pes-caprae*), seashore dropseed (*Sporobolus virginicus*), and other grasses and sedges. Common woody plants include white indigoberry (*Randia aculeata*), tachuelo (*Pictetia aculeata*), seagrape (*Coccoloba uvifera*), oxhorn bucida (*Bucida buceras*), and white cedar (*Tabebuia heterophylla*) (USFWS, 2007).

4.2.14 Beach

Beach community vegetation is found in the upper open sandy beaches, rocky shorelines, and adjacent salt spray zones. This vegetative community is under the influence of seawater, salt spray, coastal winds, desiccation under intense sun, fluctuating tides, and sometimes shifting sands. Most species in this zone occur throughout the tropics, such as beach morning glory (*Ipomea pes-caprae*) and coconut palm (*Cocos nucifera*). Closer to the shore are pioneering plants including seashore dropseed (*Sporobolus virginicus*), seashore paspalum (*Paspalum vaginatum*), saltmeadow cordgrass (*Spartina patens*), and seaside bean (*Canavalia maritima*). Various grasses and vines typically occur on the less disturbed upper beach, including coastal searocket (*Cakile lanceolata*), sand spur (*Cenchrus* spp.), beach sandmat (*Chamaesyce buxifolia*), inkberry (*Scaevola plumieri*), bay cedar (*Suriana maritima*), sea ox-eye (*Borrhchia arborescens*), and sea grape (*Coccoloba uvifera*). On disturbed beaches, milkweeds and a number of herbaceous plants, such as verbain (*Sida rhombifolia*) and scattered castor bean plants (*Ricinus communis*), are prominent (USFWS, 2007).

The open sandy beach is typically devoid of vegetation, but where there is a rocky shore component various adapted plants occur. Sand accumulated within the rocks can support species such as sea ox-eye, bay cedar, and beach sandmat. Spiny succulent vegetation occurs above the shore in areas of exposed rock or limestone slabs, including Turk's head (*Melocactus intortus*), tree cactus (*Opuntia rubescens*), pipe organ cactus (*Cephalocereus royenii*), Spanish stenocereus (*Lemaireocereus hystrix*), and spiny amaranth (*Amaranthus spinosus*) (USFWS, 2007).

The USFWS has conducted field work with the Navy for previous investigations to identify sea turtle nesting beaches. The Navy and the USFWS have collectively monitored these beaches for the past several years

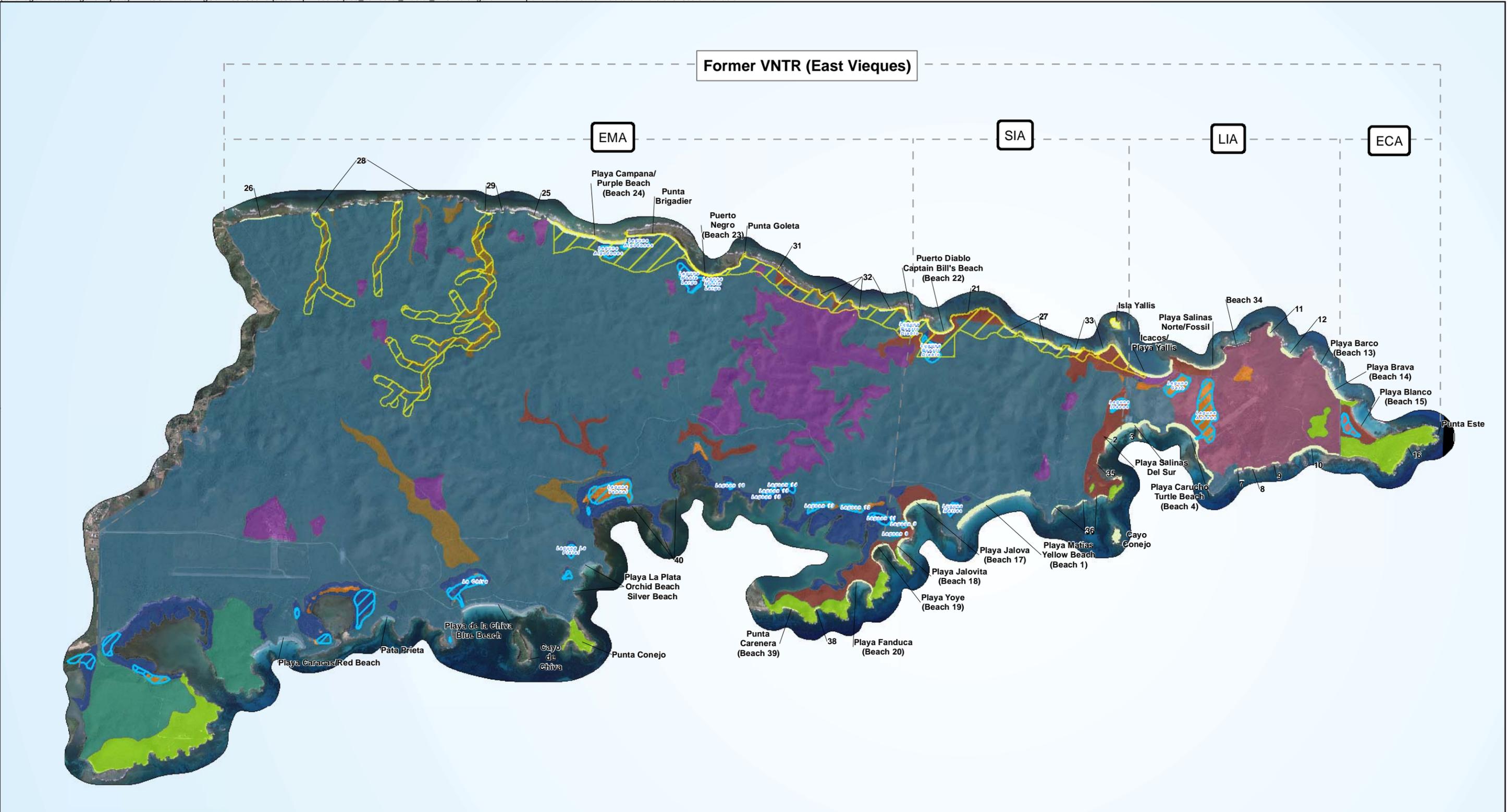
4.3 Terrestrial Habitat Mapping

Terrestrial habitat mapping was conducted in tandem with past reports and land management activities. The terrestrial habitat mapping was done to document the extent of habitats and the presence of listed and protected species. Previous habitat mapping sources were compiled and summarized in **Table 4-1**. **Figure 4-2** presents areas surveyed for reports prepared in 2001, 2006, 2007, and 2010 (Geo-Marine).

TABLE 4-1
Previous Habitat Mapping

Report	Year	Mapped Resource	Methodology
<i>Land Use Management Plan for U.S. Naval Facilities Vieques (NSRR, 1996)</i>	1996	Conservation zones for beaches, mangroves, bioluminescent bays, and mountainous areas	PRDNER, USFWS, IITF, published by the Defense Mapping Agency
<i>Biological Assessment for Continuing Training Activities on the Inner Range, Vieques, Puerto Rico (Geo-Marine, 2001)</i>	2001	Plant	Spatial predictive model using pedestrian transects
		Bird	Nine-point count stations in LIA
		Habitat	True color aerial photography from November 1999
<i>Sea Turtles Nesting</i>			Helicopter aerial surveys
<i>Integrated Natural Resource Management Plan (Vieques INRMP) (Navy, 2003)</i>	2003	Habitat	Wetlands and waters of the United States and lagoons using USFWS Classification (Cowardin et al., 1979), 1999 aerial photo-interpretation
<i>Habitat Characterization at AOC-R, PI 4, PI 7, PAOC J, K, and S for the Former NASD and Former VNTR (Geo-Marine, 2005)</i>	2005	Habitat	Pedestrian transects and 1999 true color aerial photographs
<i>Biological Assessment of the Former Live Impact Area within the Former Vieques Naval Training Range (Geo-Marine, 2006)</i>	2006	Plant, sea turtle, birds	Surveys from 2001 BA
<i>Live Impact Area Biological Assessment – Amendment I, Eastern Conservation Area (Geo-Marine, 2007)</i>	2007	Habitat, T&E species, and neotropical birds	Pedestrian transects
<i>Vieques National Wildlife Refuge Comprehensive Conservation Plan and Environmental Impact Statement (USFWS, 2007)</i>	2007	Birds	2005 island-wide bird census, 2001 USFWS bird banding program
		Habitat	Life Zone System and the International Classification of Ecological Communities System
<i>Biological Assessment for Select Portions of the Surface Impact Area and Eastern Maneuver Area Former Vieques Naval Training Range (Geo-Marine, 2010)</i>	2010	Critical or rare habitat	Pedestrian transects in areas of high probability
		Listed biological species (flora and fauna)	Pedestrian transects in areas of high probability
		Roads and trails	Pedestrian transects
<i>Final Preliminary Assessment/Site Inspection Work Plan for PAOC EE, Former Vieques Naval Training Range, Vieques, Puerto Rico (CH2M HILL, 2010)</i>	2010	Habitat	USFWS walk through determined a BA was not necessary
<i>Final Biological Assessment for PI 9, PI 13, and Debris Piles within UXO 15, Former Vieques Naval Training Range (CH2M HILL, 2012a)</i>	2011	Habitat	Pedestrian surveys
		Listed plants and animals	Pedestrian surveys

IITF - International Institute of Tropical Forestry; PRDNER - Puerto Rico Department of Natural and Environmental Resources



- General Habitats**
- Evergreen Scrub
 - Gallery Forest
 - Forest Scrub/Dry Scrub Forest/Lowland Forest
 - Grassland
 - Mangrove Forest
 - Mixed Woodland/Upland Forest
 - Salt/Sand Flat
 - Sparse Thorn Scrub
 - Thick Thorn Scrub
- Beach
 - Inland Lagoon
 - North Coast Quebradas Conservation Zone Class II

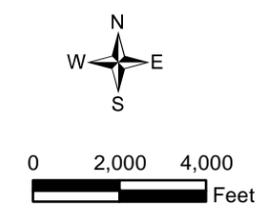
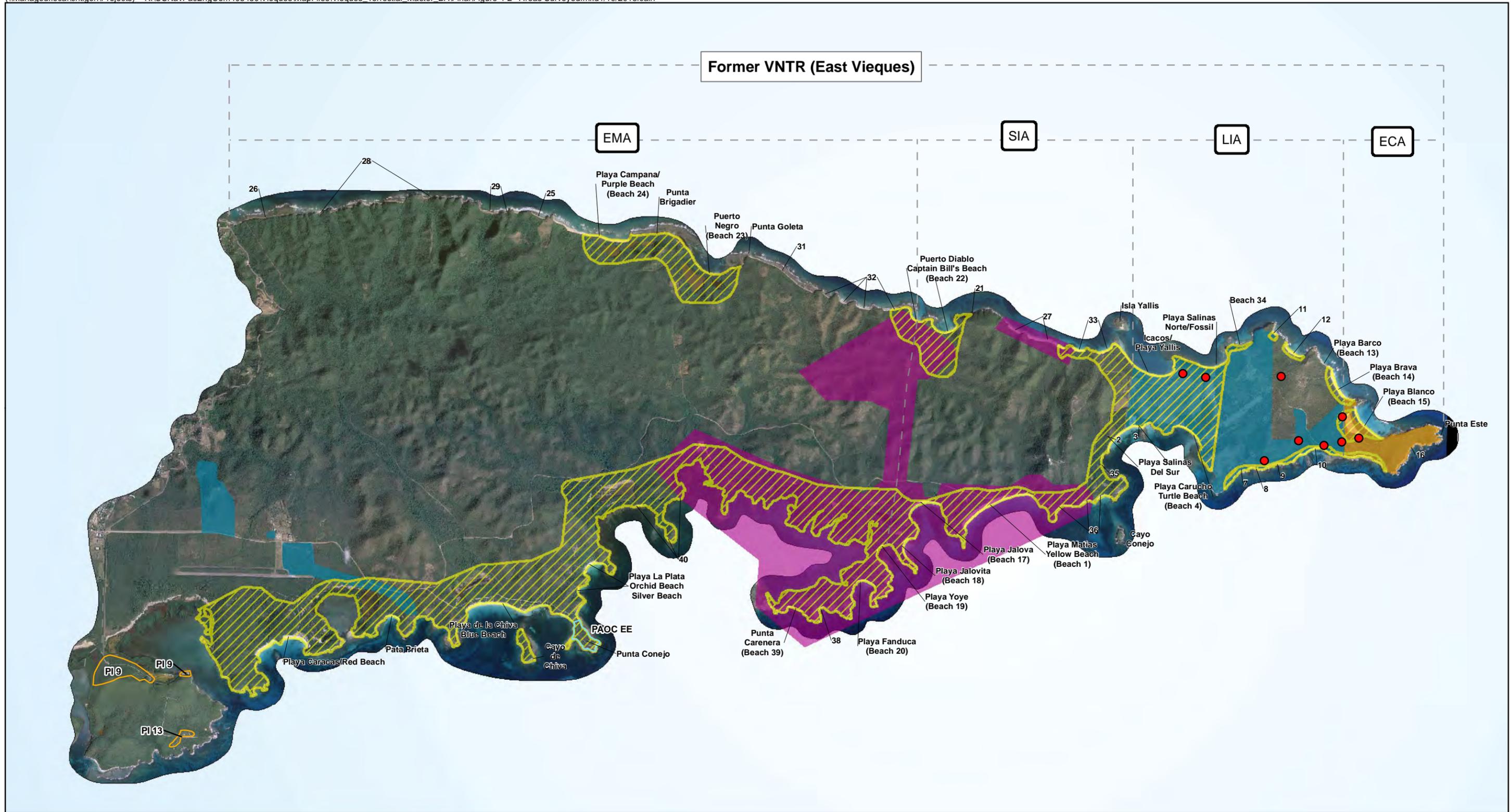


Figure 4-1
Important and Distinct Habitats
Biological Avoidance Plan for Terrestrial MEC and MC Investigations and Interim Removal Actions Former AFWTF (East Vieques) Vieques, Puerto Rico



- Geo-Marine 2006 Bird Count Locations
- PI Area
- PAOC Site
- Area Surveyed - Year**
- 2001
- 2005
- 2007
- 2010

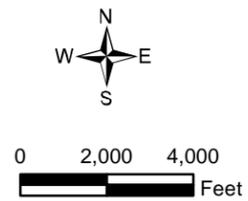


Figure 4-2
Areas Surveyed
 Biological Avoidance Plan for Terrestrial MEC and
 MC Investigations and Interim Removal Actions
 Former AFWTF (East Vieques)
 Vieques, Puerto Rico

Species Descriptions

The discussion of bird, terrestrial mammal, reptile, and plant species presented in the following subsections includes information regarding the current federal and state conservation status, species and habitat descriptions, distribution, and behavioral information. Where described, critical habitat (as defined in 50 CFR Chapter IV, Section 402.02) generally refers to a specific, Federally designated geographic area(s) that is essential for the conservation of a threatened or endangered species, as published in the Federal Register. Preferred habitat for a species is generally defined as the physical and biological features of a landscape frequented by a species that supports its survival and reproduction. Protected species observations are documented on **Figure 5-1**.

5.1 Federally Protected Species

5.1.1 Bird Species

5.1.1.1 Yellow-shouldered Blackbird (*Agelaius xanthomus*)

Status

The yellow-shouldered blackbird was listed as endangered throughout its range on November 19, 1976 (41 Federal Register [FR] 51019-51022). Critical habitat was designated for this species on the main island of Puerto Rico; however, critical habitat for this species does not exist on Vieques (USFWS, 2012a; PRDNER, 2005). The PRDNER has identified this species as endangered (PRDNER, 2005; 2007).

Species and Habitat Description

The yellow-shouldered blackbird is endemic to Puerto Rico and its adjacent islands. It is a non-migratory bird known to inhabit Mona and Monito islands, and occurs in three populations at locations in eastern (for example Roosevelt Roads), southern, and southwestern Puerto Rico.

This species prefers coastal subtropical dry forests; however, it is known to frequent mud and salt flats, offshore red mangrove cays, black mangrove forest, lowland pastures (dry coastal forest), suburban areas, coconut plantations, and coastal cliffs. The yellow-shouldered blackbird prefers black mangrove forest for nesting, where it does so in loose colonies. The breeding season can vary based on the start of the rainy season and ranges from April to August, but has been observed breeding from February to November. During the non-breeding season the birds travel inland to the subtropical wet forests. The yellow-shouldered blackbird is omnivorous, but primarily eats insects, and is known to eat arachnids, unidentified mollusks, and plant matter (fruits, seeds, and nectar).

On the main island of Puerto Rico the population size was estimated to be 200 to 300 individuals in the 1970s (Oberle, 2000). More recent estimates of postbreeding individuals have shown improvement, such as an increase from 2004 (794 individuals) to 2007 (994 individuals) in southwestern Puerto Rico (municipalities of Cabo Rojo and Lajas), and a slight increase in Salinas (southeastern Puerto Rico) from 2004 (97 individuals) to 2005 (113 individuals) (USFWS, 2011b).

The yellow-shouldered blackbird is not known to currently occur on Vieques. The last reported sightings were in April 1974 and in March 1978 (USFWS, 1996b). In 2007, biologists surveyed vegetation transects in the ECA and also observed for T&E species and neotropical migrant birds; the yellow-shouldered blackbird was not observed (Geo-Marine, 2007). However, suitable foraging and nesting habitats such as coastal subtropical dry forest and mangrove habitats do occur at various locations throughout the Former AFWTF.

Threats to this species include loss of habitat, predation, and disease. The yellow-shouldered blackbird nests and roosts in coastal mangrove habitat, which is being damaged or lost through land development. Nests are frequently parasitized by the shiny cowbird (*Molothrus bonariensis*) and predated by the black rat (*Rattus rattus*), Norway rat (*Rattus norvegicus*), and Indian mongoose (*Herpestes javanicus*). Fowl pox also affects some adult birds. A cooperative agreement between the PRDNER and USFSW includes the control of parasites and cowbird

parasitism (USFWS, 2011b). Shiny cowbird parasitism, however, has been reduced from 100 percent in 1982 to less than 3 percent (1996 to 1999) in southwest Puerto Rico, likely due to a reduction in cowbirds as a result of trapping and egg removal efforts (USFWS, 2011b).

5.1.1.2 Piping Plover (*Charadrius melodus*)

Status

The piping plover was listed as threatened throughout its range (except in the Great Lakes watershed where it is listed as endangered), which includes its wintering grounds such as in the Caribbean (50 FR 50726-50734, 1985, December 11). Critical habitat for wintering piping plovers was designated on July 10, 2001 (66 FR 36038-36143), but only at specific areas along the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas. PRDNER has identified this species as critically endangered (PRDNER, 2005; 2007).

Species and Habitat Description

Three piping plover populations, the Northern Great Plains, the Atlantic Coast, and the Great Lakes, winter in the Caribbean. While in their wintering range the piping plover is considered to be a federally threatened species.

Piping plovers feed on Caribbean beaches and barrier islands with very sparse vegetation, primarily on intertidal beaches, sand flats, and mud flats. The piping plover feeds primarily on worms, crustaceans, insects, and occasionally bivalve mollusks within the intertidal zone. At the time of the 1996 breeding census the Northern Great Plains breeding population was the largest with 1,398 pairs; the Atlantic Coast population was the second largest with 1,372 breeding pairs; the Great Lakes population was the third largest with 32 breeding pairs (USFWS, 2012b). The piping plover arrives in the wintering grounds between mid-July and late October and returns to breeding grounds in mid-March to mid-May (USFWS, 2012b). The United States Geological Survey conducts a Piping Plover International Census every 5 years to assess progress towards population recovery. Winter census results for Puerto Rico reported six birds in 2001 and two birds in 2006, with no birds counted in 1991 and 1996; Vieques was not included in the census (Elliott-Smith et. al., 2009).

The piping plover is a rare winter visitor to Puerto Rico, from August through April (Raffaele, 1989). No specific records from Vieques have been found in the literature reviewed, but suitable foraging habitat (such as intertidal beaches, sand flats, and mud flats) is available along much of the Former AFWTF coastline and some inland lagoons.

Piping plover populations have declined because the birds are sensitive to human exposure. Nests are destroyed or abandoned because of high amounts of shoreline traffic. Coastal development has displaced piping plover shoreline habitat (USFWS, 2012b).

5.1.1.3 Roseate Tern (*Sterna dougallii*)

Status

The roseate tern was listed as threatened in the Western Hemisphere and adjacent oceans, including Florida, Puerto Rico, and the United States Virgin Islands (52 FR 42064-42068, 1987 November 02). No critical habitat is currently designated for this species (USFWS, 2010a). PRDNER has identified this species as vulnerable (PRDNER, 2005; 2007).

Species and Habitat Description

The nominate subspecies of the roseate tern (*S. dougallii dougallii*) occurs as two widely separated breeding populations, one on the northeastern coast of North America (and federally listed as endangered), and the other occurring at several islands in the Caribbean Sea (including Puerto Rico) and in northwestern Europe. The federally threatened Caribbean population is described in this section.

The roseate tern feeds by plunge-diving for fish, almost invariably from the sea. They forage over sand bars and shoals, where tidal forces and shallow water depths make small prey fish more available to plunge-diving. It is

much more marine than allied terns; it may infrequently bathe in freshwater but does not feed in freshwater. Sand bars and shoals exposed during lower tides are favored habitats for resting and roosting.

In the Caribbean, where they rarely breed on large islands, roseate terns nest primarily on small offshore islands, rocks, cays, and islets (Burger and Gochfeld, 1988; Hoffman et al., 1993; USFWS, 1993; Saliva, 2000). They have been reported nesting near vegetation or jagged rock, on open sandy beaches, close to the water line on narrow ledges of emerging rocks, or among coral rubble (Saliva, 2000). In Puerto Rico and the Virgin Islands, roseate terns may choose a suitable nesting location one year and ignore it in other years, and the same islands may be used in successive years (Pierce, 1996; Douglas, 2000). Colonies are highly susceptible to disturbance in the early stages of egg-laying, and may relocate within the breeding season, often joining an established group of nesters (USFWS, 2010a).

The estimated number of nesting roseate terns for the Caribbean region in 2007 was in the range 3,571 to 7,095 pairs, with a central estimate of 5,412 pairs (Bradley and Norton, 2009). This compares with earlier estimates of 4,000 to 6,000 pairs (Saliva, 2000) and 2,500 to 4,000 pairs (van Halewyn and Norton, 1984). Given the incomplete and non-quantitative data for many sites, and the tendency for the species to move from site to site on a short time-scale, there is no clear evidence that the regional population has either decreased or increased over the 30-year time-scale of these surveys.

Roseate terns are not common nesters on Vieques Island, where they usually appear in small foraging flocks on the southeast coast in late May (Saliva, 2000). Reports indicate that roseate terns have nested on Vieques Island prior to 1990, and in 2001 up to 10 pairs were reported nesting at the easternmost point in mid-July (Saliva, 2009). Roseate terns in the Caribbean are known to be colony-shifters, and it is theorized that these late nesting birds on Vieques were birds that had abandoned a nesting area in nearby Punta Soldado in Culebra, in late June (Saliva, 2009). The species has not been observed nesting on Vieques Island again (USFWS, 2010a). In other studies, roseate terns have been documented to nest on Cayo Conejo, a small islet off the southeastern coast of Vieques, and on the inaccessible limestone cliffs of Punta Este at the far eastern end of Vieques (NMFS, 2012a; USFWS, 2012b). This species has also occurred in the SIA on Vieques (Navy, 1979), the LIA, the coastal waters of Cayo Canejo, Cayo Yallis, and Punte Este (Navy, 2003), and has occurred and/or nested on the beaches of the ECA (USFWS, 2007; Geo-Marine, 2007).

In the Caribbean, predation and human disturbance are major factors affecting the roseate tern population decline. The most common predators are crabs such as land crabs and hermit crabs, fire ants, birds such as frigatebirds, cattle egrets, and laughing gulls, and mammals including rats and mongoose. Human disturbance includes trampling of nests, flushing of adults and chicks, and collecting of eggs (USFWS, 1993).

5.1.2 Reptile Species

Protected sea turtle nesting habitats are provided on **Figure 5-2**.

5.1.2.1 Green Sea Turtle (*Chelonia mydas*)

Status

The green sea turtle was listed as threatened wherever found (except where it's listed as endangered in Florida and on the Pacific coast of Mexico) on July 28, 1978 (43 FR 32800). Critical habitat was designated for the green sea turtle in the coastal waters surrounding the island of Culebra, Puerto Rico, on September 2, 1998 (63 FR 46693); critical habitat does not exist on Vieques. The PRDNER has identified this species as endangered (PRDNER, 2005; 2007).

Species and Habitat Description

Green turtles are generally found in fairly shallow waters inside reefs, bays, and inlets, and are attracted to lagoons and shoals with an abundance of marine grass and algae. The range of the green sea turtle extends throughout tropical and subtropical oceans and seas worldwide. There are two major subpopulations: the Atlantic and Indo-Pacific subpopulations. Major nesting sites of the Atlantic subpopulation exist on various islands in the Caribbean, along the eastern coast of the United States, along the eastern coast of South America, and on isolated

islands in the North Atlantic. Hatchlings and juveniles are primarily carnivorous while adults are strictly herbivorous, feeding primarily on seagrasses and algae. The green sea turtle spends most of its first few years in convergence zones within the open ocean. Adults spend most of their time in shallow waters except when migrating. Adults migrate long distances between feeding sites and nesting sites (USFWS, 2012f).

Sexual maturity occurs between 20 and 50 years. Females return to the same beaches where they were born every 2 to 4 years to lay eggs, typically during summer months. Clutch size depends on the age of the female, and can range between 75 and 200 eggs. After 45 to 75 days, the eggs hatch at night and the hatchlings instinctively head directly toward the water (USFWS, 2012g). The nesting season varies by location, but green sea turtles nest on Vieques from June to October (USFWS, 2007).

The green sea turtle nests very rarely on Vieques, but immature green sea turtles are found in small numbers on turtle grass pastures around the island. This species was confirmed nesting on the island in 1992 and green sea turtles appear to be confined to sandy beaches on the east, south, and west coasts of the island (NSRR, 1996). The green sea turtle activity was confined to the eastern part of the island, particularly at Brava, Barco, and Blanca beaches and near the northeast end of the island at Tortuga Beach (Geo-Marine, 2001). In 2003, green sea turtle activity was recorded at Playa Brava, Playa de Barco, Tortuga beach, Playa Blanca, Tamarindo Sur, Conservation Zone, and yellow beaches (Navy, 2003). From 1992 to 2000, 165 green sea turtle nesting activities were documented on Vieques (NMFS, 2007).

The primary cause of the worldwide decline in green sea turtle populations has been the long-term human harvesting of eggs and adults on nesting beaches, and of juveniles and adults in feeding grounds. Harvesting still occurs in some parts of the world. Loss and degradation of nesting habitat is also a threat. Incidental capture in fishing gear, primarily in gillnets, but also in trawls, traps, pots, longlines, and dredges, is a serious ongoing source of mortality. The green sea turtle has also been impacted in some parts of the world by a disease known as fibropapillomatosis, which causes internal and external tumors that grow large enough to affect survival (USFWS, 2007).

5.1.2.2 Leatherback Sea Turtle (*Dermochelys coriacea*)

Status

The leatherback sea turtle was listed as endangered wherever found on June 2, 1970 (35 FR 8491). Critical habitat was designated for the leatherback sea turtle in the coastal waters adjacent to Sandy Point, St. Croix, United States Virgin Islands, on September 26, 1978 (43 FR 43688); critical habitat does not exist on Vieques. There is a petition currently under review to revise the critical habitat of the leatherback sea turtle to include the waters off the Northeast Ecological Corridor of Puerto Rico (posted August 4, 2011 [76 FR 47133]). The PRDNER has identified this species as endangered (PRDNER, 2005; 2007).

Species and Habitat Description

The leatherback turtle is distributed worldwide throughout the Atlantic, Pacific, and Indian Oceans, from as far north as Labrador and Alaska to as far south as Chile, the Cape of Good Hope, and the southern end of New Zealand. There are three major subpopulations: the Atlantic, Pacific, and Indian Ocean subpopulations. Leatherbacks feed exclusively on jellyfish and other soft-bodied marine animals. They spend most of their time in the open ocean but also forage in coastal waters. Adults migrate long distances between feeding and nesting sites. Nesting grounds are located around the world, with the largest remaining nesting assemblages found on the coasts of northern South America and western Africa. The United States Caribbean, primarily Puerto Rico and the United States Virgin Islands, and southeast Florida support minor nesting colonies, but represent the most significant nesting activity within the United States (USFWS, 2012h).

Females nest on tropical and subtropical beaches and tend to avoid beaches protected by coral reefs. While other sea turtle species almost always return to their hatching beach, leatherbacks may choose to nest on a different beach. Females nest several times during a nesting season and lay clutches of approximately 100 eggs. Nesting seasons vary by location, with nesting typically occurring during spring and summer months. After 60 to 70 days, the eggs hatch at night and the hatchlings instinctively head directly toward the water (USFWS, 2012h).

Leatherback sea turtle nests have been documented on at least 18 different beaches on Vieques, with the primary beach being Yellow Beach.

The primary cause of the worldwide decline in leatherback turtle populations has been the long-term human harvesting of eggs and adults on nesting beaches, and of juveniles and adults in feeding grounds. Harvesting still occurs in some parts of the world. Loss and degradation of nesting habitat is also a threat. Incidental capture in fishing gear, primarily in gillnets, but also in trawls, traps, pots, longlines, and dredges, is a serious ongoing source of mortality. Leatherbacks also die from malabsorption and intestinal blockage following ingestion of floating plastic, which they mistake for jellyfish (USFWS, 2012h).

5.1.2.3 Hawksbill Sea Turtle (*Eretmochelys imbricata*)

Status

The hawksbill sea turtle was listed as endangered wherever found on June 2, 1970 (35 FR 8491). Critical habitat was designated for the hawksbill sea turtle in the coastal waters surrounding Mona and Monito Islands, Puerto Rico, on September 2, 1998 (63 FR 46693), and select beachfronts associated with Isla Mona, Culebra Island, Cayo Norte, and Island Culebrita on June 24, 1982 (47 FR 27295); critical habitat does not exist on Vieques. The PRDNER has identified this species as endangered (PRDNER, 2005; 2007).

Species and Habitat Description

The range of the hawksbill sea turtle extends throughout tropical and subtropical oceans and seas worldwide. Of all the sea turtles, the hawksbill is most associated with tropical waters. There are two major subpopulations: the Atlantic and Indo-Pacific subpopulations. The hawksbill is widely distributed throughout the Caribbean and western Atlantic Ocean. Within the United States, hawksbills are most common in Puerto Rico and its associated islands and in the United States Virgin Islands (NMFS, 2012b).

The hawksbill spends most of its first few years in the open ocean. Adults spend most of their time in shallow waters except when migrating. The hawksbill feeds primarily on sponges and other invertebrates. The ledges and caves of coral reefs provide shelter for resting hawksbills both during the day and night. Females return to the same beaches where they were born every 2 to 3 years to lay eggs, typically during summer months. Females nest several times during a nesting season and lay clutches of approximately 130 eggs. Hawksbills usually nest high up on the beach underneath or in the beach and dune vegetation on both calm and turbulent beaches. They commonly nest on pocket beaches that have little or no sand. After approximately 60 days, the eggs hatch at night and the hatchlings instinctively head directly toward the water (NMFS, 2012b).

The most significant nesting within the United States occurs in Puerto Rico and the United States Virgin Islands, specifically on Mona Island and Buck Island, respectively. Nesting also occurs on other beaches in St. Croix and on St. John, St. Thomas, Culebra Island, Vieques Island, and mainland Puerto Rico. The hawksbill nests in low density on Vieques, and the species may be found in Vieques waters year-round (NMFS, 2012b).

The primary current threat to global hawksbill populations is loss of coral reef habitat. Hawksbills rely on coral reefs for food and shelter. As reefs decline in quantity and quality, hawksbills have reduced foraging and habitat options. Historically, commercial exploitation has been the primary cause of global hawksbill population declines. Hawksbills have been hunted for their shell, which is used to make jewelry and ornaments, and exploitation continues in some parts of the world despite prohibitions. Loss and degradation of nesting habitat is also a threat. Other causes of worldwide population declines include harvesting of hawksbills for their meat and eggs, loss and degradation of nesting habitat, incidental capture in fishing gear, and vessel strikes (NMFS, 2012b).

5.1.2.4 Loggerhead Sea Turtle (*Caretta caretta*)

Status

The loggerhead sea turtle was originally listed as threatened wherever found on July 28, 1978 (43 FR 32800). A determination of nine distinct population segments (DPSs) as threatened or endangered was made effective October 24, 2011 (76 FR 58868); loggerhead sea turtles that occur in the vicinity of Vieques are part of the

Northwest Atlantic DPS and are federally listed as threatened. There are currently no designated critical habitats for this species. The PRDNER has identified this species as vulnerable (PRDNER, 2007).

Species and Habitat Description

Loggerheads are circumglobal, occurring throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans, and are the most abundant species of sea turtle in United States coastal waters. In the Atlantic, the loggerhead sea turtle's range extends from Newfoundland to Argentina, with a majority of nesting occurring along the southeastern United States coastline. Females lay three to five nests each season, from late April to early September in the southeast United States. Loggerhead sea turtles nest on ocean beaches, generally preferring high-energy, steeply sloped, and relatively narrow beaches (NMFS, 2012c).

Post-hatchling loggerhead sea turtles take up residence offshore in areas where surface waters converge to form local downwellings. These are areas characterized by accumulations of floating material including seaweed such as *Sargassum*. In this habitat juvenile and subadult loggerhead sea turtles are omnivorous, foraging on pelagic crabs, mollusks, jellyfish, and vegetation captured at or near the surface. At an age of approximately 7 to 12 years old, oceanic juveniles migrate to near shore coastal areas and continue maturing until adulthood. Adult loggerheads are generalist carnivores that forage on nearshore benthic invertebrates. Sexual maturity is reached around the age of 35 years (NMFS, 2012c).

Complete population abundance estimates do not exist for the nine DPSs (NMFS, 2012c).

The loggerhead is extremely rare in Vieques waters (NSRR, 1996; Geo-Marine, 2001) and no nests have been documented on Vieques (NMFS, 2012c).

The greatest cause of population decline is incidental capture in fishing gear, primarily in longlines and gillnets, but also in trawls, traps, and dredges. Loss and degradation of nesting habitat is also a threat.

5.1.2.5 Puerto Rican Boa, Culebrón (*Epicrates inornatus*)

Status

The Puerto Rican boa is an endemic species that was listed as endangered wherever found on October 13, 1970 (35 FR 16047). There are currently no designated critical habitats for this species. The PRDNER has identified this species as vulnerable (USFWS, 2012a; PRDNER, 2005; 2007).

Species and Habitat Description

The Puerto Rican boa inhabits altered habitats, such as plantations and urban areas, and is widely distributed in Puerto Rico. This species feeds on birds, small mammals, and lizards (USFWS, 2012c). This species is typically found in the undisturbed karst areas of northwestern Puerto Rico and frequents rainforests, karst environments, and caves. Most Puerto Rican boas mate between February and April and give birth in September or October (USFWS, 1986).

Population studies in Puerto Rico are limited to a few localized surveys, none of which provide an adequate estimate of the island-wide population. A recent review of the species status indicated it is stable, although current population estimates are not available, and based on the information collected the species' distribution is broader than previously thought and seems to be more abundant than what was known. One focused study in Toa Baja estimated a mean monthly density of 5.6 boas per hectare for reforested valley, old valley, and karst hill top habitats (USFWS, 2011d).

Suitable habitat is present on Vieques to support the Puerto Rican boa, although one report concluded that this species is not known to currently inhabit Vieques (USFWS, 2007). However, local USFWS staff have stated that the Puerto Rican boa has been observed on Vieques and in the VNWR.

Reasons for population decline are difficult to determine because of insufficient data. Declines are supposedly due to deforestation, predation by mongoose, and human impacts for medicinal oil extraction (USFWS, 1986).

5.1.2.6 Culebra Giant Anole (*Anolis roosevelti*)

Status

The Culebra giant anole is endemic to the island of Puerto Rico and adjacent islands and was listed as endangered wherever found on August 22, 1977 (42 FR 37371). Critical habitat was also identified on Culebra at the time of its listing. The PRDNER has identified this species as critically endangered (PRDNER, 2007).

Species and Habitat Description

The Culebra giant anole is known to occur in Puerto Rico and the United States and British Virgin Islands, as well as the Culebra National Wildlife Refuge and the VNWR. This first report of this species occurred on Culebra in 1931. Despite several observations by Culebra residents, a formal search has not occurred on Culebra. The Culebra giant anole occurs in the subtropical dry forest (Ewel and Whitmore, 1973) with gumbo-limbo, cupey, fig, and thin palm. There is a lack of available information on the Culebra giant anole, but they are thought to be canopy inhabitants that can forage on the ground and sleep on low tree trunks and vine tangles at night (Kessler, 2010).

No information is available on population numbers and trends. Suitable habitat was identified in the Former AFWTF, but this species has not been reported (USFWS, 2007). The main threat to the Culebra giant anole is deforestation of forest habitat (Kessler, 2010).

5.1.3 Plant Species

Protected plant observations based on pedestrian surveys are provided on **Figure 5-3**.

5.1.3.1 Vahl's Boxwood (*Buxus vahlii*)

Status

Vahl's boxwood was listed as endangered wherever found on August 13, 1985 (50 FR 32572). No critical habitat has been identified. The PRDNER has identified this species as endangered (PRDNER, 2007).

Species and Habitat Description

Vahl's boxwood is a rare species of plant in the boxwood family where it is typically a shrub or small tree that can reach 5 meters in height (USFWS, 1987a). This plant typically grows on limestone substrates at elevations between 80 and 650 feet where it is typically limited to ravines and ledges (Geo-Marine, 2007).

It is endemic to Puerto Rico and St. Croix in the United States Virgin Islands, where it is known from no more than four occurrences. The two populations remaining in Puerto Rico total 40 to 85 individuals and none of them have been observed to successfully reproduce (USFWS, 2012a; PRDNER, 2005). A few individuals have been located in St. Croix, some of which are within the Sandy Point National Wildlife Refuge located on the southwest corner of Saint Croix, United States Virgin Islands. Two populations remain in Puerto Rico; one population is confirmed in Rincon near the beach at Punta Higuero, and a second is located in a forest near Hato Tejas in Bayamón (USFWS, 1987a).

The 2007 BA states the potential for Vahl's boxwood to occur on Vieques is possible since suitable habitat is present; however, no suitable habitat was found to exist within the ECA (Geo-Marine, 2007). No observations of this species were made in the SIA and EMA for the 2010 BA (Geo-Marine, 2010).

Vahl's boxwood has probably never been very common, but its distribution has been reduced by deforestation and the quarrying of limestone.

5.1.3.2 Thomas' Lidflower (*Calyptanthus thomasi*)

Status

Thomas' lidflower was listed as endangered wherever found on February 18, 1994 (59 FR 8138). No critical habitat has been identified for this species. The PRDNER has identified this species as critically endangered (PRDNER, 2007).

Species and Habitat Description

Thomas' lidflower, endemic to the island of Puerto Rico, is an evergreen shrub or small tree which can reach 10 meters in height (IUCN, 2012). This species occurs in moist, dense, semi-evergreen forests at altitudes of 300 to 800 feet (Navy, 2003). Its habitat is moist montane forest types. Three locations are currently known:

- Monte Pirata on Vieques Island, Puerto Rico
- Bordeaux Mountain on St. John (United States Virgin Islands)
- Virgin Gorda, British Virgin Islands

The Monte Pirata subpopulation is located on the western side of Vieques Island; 10 to 12 plants have been reported on the mountain summit (USFWS, 1989).

The 2001 BA states that Thomas' lidflower is not likely to be found on the Former AFWTF (east side of Vieques) because they usually occur on mountains at higher altitudes in dense vegetation. The predictive model used in the BA indicates this species would be most likely to occur on steep hills along the southern coast and central portions of the Former AFWTF or in the northern quebradas, but previous surveys have determined this species is not present along the southern coastal areas (Geo-Marine, 2001). Thomas' lidflower was not found during the 2001 Former AFWTF plant surveys, or during the May and August 2005 plant surveys in the Former LIA (Geo-Marine, 2006). As indicated in the 2010 BA, this species was not found within the SIA and EMA surveyed areas because of the lack of altitude and appropriate habitat (Geo-Marine, 2010).

On Virgin Gorda, located within Gorda Peak National Park, land development is negatively impacting Thomas' lidflower habitat. People, cattle, and hurricanes pose a threat to individual plants. Bats have been observed to feed on the fruit and may be an important dispersal agent.

5.1.3.3 *Catesbaea melanocarpa*

Status

Catesbaea melanocarpa was listed as endangered wherever found on March 17, 1999 (64 FR 13116). Critical habitat has been designated in St. Croix, United States Virgin Islands (August 28, 2007 [17 FR 49212]); there is no critical habitat designated on Vieques. The PRDNER has identified this species as endangered (PRDNER, 2007).

Species and Habitat Description

Catesbaea melanocarpa is a flowering plant in the coffee family. This spiny shrub is native to the Caribbean islands of Puerto Rico, St. Croix in the United States Virgin Islands, Antigua, Barbuda, and one island in Guadeloupe. The range of this species is limited to southwest Puerto Rico. This plant occurs in subtropical dry forests (especially on limestone) which are relatively dry compared to other habitat types on the islands, receiving up to 40 inches (100 centimeters) of rain yearly (USFWS, 2012d).

As of January 2011, the total number of populations in Puerto Rico and St. Croix was estimated to be at least four. The number of individuals was estimated at 132 plants (adults and seedlings) (USFWS, 2011e). There are no current records of occurrence on Vieques, though suitable habitat including subtropical dry forest does occur.

Catesbaea melanocarpa is threatened by habitat loss, as well as from catastrophic events such as hurricanes and human-induced fires.

5.1.3.4 Puerto Rican Senna, Jamaican broom (*Chamaecrista glandulosa* var. *mirabilis*)

Status

Puerto Rican senna was listed as endangered wherever found on April 5, 1990 (55 FR 12788). Critical habitat has not been designated. The PRDNER has identified this species as endangered (PRDNER, 2007).

Species and Habitat Description

Puerto Rican senna is an erect shrub that can reach up to 3 feet in height. It is scattered along the southern shore of the Tortuguero Lagoon in Puerto Rico and is also found at one location in Dorado and one in Vega Alta. The

vegetation in the area surrounding the Tortuguero Lagoon has been described as a dry evergreen or littoral forest (USFWS, 1994). This species is found in sandy soils in the Algarrobo-Coroza-Arecibo soil association. These soils are extremely acidic with low nutrients and are excessively drained with rapid percolation in the upper soils.

On Vieques, the 2001 BA states that suitable habitat exists for the Puerto Rican senna within areas of the LIA. This species was reportedly collected near Bahía Corcho on Vieques by Dr. George Proctor. This species was not found during a subsequent survey of Bahía Corcho (Red Beach) in 1996. This species was also not found during surveys conducted in 2000 along the south coast outside the LIA and along the western coast of Vieques (Geo-Marine, 2001; Navy, 2003). The Puerto Rican senna was not found during plant surveys conducted in May and August 2005 in the Former LIA (Geo-Marine, 2006). This species was also surveyed for in UXO 15 and Cayo Chiva and was not found (CH2M HILL, 2011a; 2011b).

This species is threatened by sand extraction and deforestation for urban, industrial, and agricultural expansion (USFWS, 1994).

5.1.3.5 Puerto Rican Manjack (*Cordia rupicola*)

Status

Puerto Rican manjack is currently listed as a candidate species by the USFWS (USFWS, 2012e; most recent status review October 26, 2011 [76 FR 66370]). The PRDNER has identified this species as a critical element (PRDNER, 2007).

Species and Habitat Description

The Puerto Rican manjack is a small woody shrub that can reach up to 16.4 feet in height and grows within the subtropical dry forest zone situated over a limestone substrate. Other tree species frequently found in association with Puerto Rican manjack include *Bourreria succulenta* var. *succulenta*, *Bucida buceras*, and *Bursera simaruba*, along with a shrub layer dominated by *Croton humilis*, *Eupatorium sinuatum*, *Lantana reticulata*, and *Turnera diffusa*. Previously thought to be endemic to Puerto Rico, the Puerto Rican manjack is known from small subpopulations in Puerto Rico (three sites in the dry southwestern Guánica region of Puerto Rico) and Anegada, British Virgin Islands. In Puerto Rico, approximately 226 individuals of Puerto Rican manjack are known from three localities: Peñuelas, Guánica Commonwealth Forest, and VNWR (USFWS, 2010b; Monsegur and Breckon, 2007). On Vieques, one specimen was reported from Punta Jálova (Proctor, 1994). In 2005, a specimen was found on the Lighthouse Peninsula on Vieques (Breckon and Kolterman, 2005).

Loss of habitat through private residential development threatens this species. The single known site in Puerto Rico is located on private land that is part of a residential development (USFWS, 2012e).

5.1.3.6 Woodbury's Stopper (*Eugenia woodburyana*)

Status

Woodbury's stopper was listed as endangered wherever found on September 9, 1994 (59 FR 46715). Critical habitat has not been designated. The PRDNER has identified this species as critically endangered (PRDNER, 2007)

Species and Habitat Description

Woodbury's stopper is endemic to southwestern Puerto Rico, and is a small evergreen tree that grows up to 19.7 feet in height (USFWS, 1998a). Woodbury's Stopper is found within the subtropical dry forest, commonly with succulent or coriaceous species and species with thorns and spines. Fire is common on many soils, and occurs frequently on lands where plants are located (USFWS, 1998a).

Woodbury's Stopper grows in the hills of the oldest geologic formation in Puerto Rico, the Sierra Bermeja, located on private and public land within the Laguna Cartagena National Wildlife Refuge. The soils in the Sierra Bermeja are described as Guayama cherty clay loam that covers the steep slopes of the Sierra Bermeja. This species is also found in the Guánica State Forest of Puerto Rico, located in semi-evergreen forests at the bottoms of mesic canyons (USFWS, 1998a).

The 2001 BA states that it is unlikely that Woodbury's Stopper would be found within the Inner Range because this species is usually found on mountains at higher altitudes than those present on the east end of Vieques. If this species were present it would occur on steep hillsides along the southern coast and central portions of the Inner Range, or along the quebradas in the north. Woodbury's Stopper was not found during previous surveys along the southern coastal areas. Surveys conducted in 1996 and 2000 reported the presence of this species on the steep southwestern slope of Monte Pirata located on the western end of Vieques. Two individuals were reported during a survey in 2000 on the north side of Monte Pirata (Geo-Marine, 2001). This species was not found during the surveys conducted in 2001 of the Inner Range or the 2005 surveys of the Former LIA (Geo-Marine, 2006). Based on the ecological requirements, previous surveys and existing vegetation, soil, and elevation data, this species could not be matched to any habitat areas within the ECA, SIA, or EMA (Geo-Marine, 2007; 2010). This species was not found during pre-action ground surveys of the SIA and EMA and is highly unlikely to occur in these areas (Geo-Marine, 2010).

Woodbury's Stopper is found on both public and privately owned lands in Puerto Rico. Primary threats occur on privately owned land that is subject to intense land clearing pressure for agricultural, rural, and tourist development. Critical habitat has not been designated for this species to prevent over-collection and vandalism (USFWS, 1998a).

5.1.3.7 Beautiful Goetzea, Matabuey (*Goetzea elegans*)

Status

Beautiful goetzea was listed as endangered wherever found on April 19, 1985 (50 FR 15564). Critical habitat has not been designated. The PRDNER has identified this species as endangered (PRDNER, 2007).

Species and Habitat Description

Beautiful goetzea, which is endemic to the island of Puerto Rico, is a rare shrub or small shrubby tree that can grow to 29.5 feet in height and is characterized by trumpet-shaped orange-yellow flowers. It is only found in the semi-evergreen, limestone forests of the subtropical moist forest zone and the foothills and karst limestone hills of northern Puerto Rico at elevations below 656 feet (CPC, 2012). Beautiful goetzea has been collected at six sites in northern Puerto Rico. Collection records are not clear; the species is believed to have been discovered in the Quebradilla area to the northwest, near where the largest known population exists today at Quebrada Bellaca (USFWS, 1987b). Today, fewer than 50 individuals remain on the mainland of Puerto Rico (CPC, 2012).

Approximately 80 individuals have been recorded on Vieques (Navy, 2003). Beautiful goetzea was found on the western end of Vieques in the NASD. This species may also occur within the Inner Range on the eastern end of the island. Suitable habitat may exist in the quebradas or seasonal water courses, along the north coast of the Inner Range; however, the quebradas were not surveyed for this species at the time of the 2001 BA. The north side of the EMA contains high-probability habitat for the beautiful goetzea (Geo-Marine, 2001). Surveys of the SIA and EMA conducted in 2010 indicate that the beautiful goetzea was not found within these survey areas (Geo-Marine, 2010). During the 2011 ground surveys of UXO 15, specifically PI 9 and PI 13, elevated anomaly density area east of PI 13, and the debris piles associated with UXO 15, the beautiful goetzea was not present (CH2M HILL, 2011a). Ground surveys of Cayo Chiva conducted in 2011 determined that suitable habitat for the beautiful goetzea is not present (CH2M HILL, 2011b).

Deforestation of Puerto Rico's lowlands due to agriculture threatens further distribution of beautiful goetzea.

5.1.3.8 *Leptocereus grantianus*

Status

Leptocereus grantianus (no common name) was listed as endangered wherever found on February 26, 1993 (58 FR 11550). Critical habitat has not been designated. The PRDNER has identified this species as critically endangered (PRDNER, 2007).

Species and Habitat Description

Leptocereus grantianus is endemic to the island of Culebra. It is a spineless, suberect cactus that can grow up to 6.6 feet in height with a diameter of up to 1.2 to 2 inches (USFWS, 1995). *Leptocereus grantianus* occurs in the subtropical dry forest in dry coastal forests and along coastal cliffs. The USFWS recovery plan for this species states there were only 50 individuals on Culebra known to exist (USFWS, 1995). *Leptocereus grantianus* has not been observed within the Former AFWTF; however, suitable habitat is available.

Intense agriculture and development pressure threatens this species (USFWS, 1995).

5.1.3.9 Cana Gorda Girdlepod (*Mitracarpus polycladus*)

Status

Cana gorda girdlepod was listed as endangered wherever found on September 9, 1994 (59 FR 46715). Critical habitat has not been designated. The PRDNER has identified this species as endangered (PRDNER, 2007).

Species and Habitat Description

Cana gorda girdlepod is a small shrub that grows to 49.2 feet in height and is branched near the base (USFWS, 1998a). It inhabits rocky outcrops with crevices and soil pockets within coastal dwarf forest, coastal shrub forest, cactus scrub forest, and coastal scrub on sandy soil. This species is found in open dry limestone forest with exposed rocky plateau. The Puerto Rican population consists of 1,400 individuals in the Guánica Commonwealth Forest, and adjacent to the forest on private property (USFWS, 2011c). In 2006, it was found at six locations in the Guánica Commonwealth Forest in Puerto Rico, one location adjacent to the forest on private property, and the island of Saba in the Lesser Antilles (USFWS, 2011c).

Cana gorda girdlepod has not been observed within the Former AFWTF, though suitable coastal habitat is available.

In Puerto Rico, populations of Cana gorda girdlepod are located along infrequently used road where they are threatened by future roadway improvements.

5.1.3.10 Wheeler's Peperomia (*Peperomia wheeleri*)

Status

Wheeler's peperomia was listed as endangered wherever found on January 14, 1987 (52 FR 1459). Critical habitat has not been designated. The PRDNER has identified this species as endangered (PRDNER, 2007).

Species and Habitat Description

Wheeler's peperomia, which is endemic to the island of Culebra, is an evergreen herb that grows to 3.3 feet in height (USFWS, 1990). This herbaceous species prefers semi-evergreen forests with an herbaceous layer and tree canopy. Associated canopy species include *Clusea rosea*, *Bursera simaruba*, and *Ficus citrifolia*. Associated herbaceous species include *Tillandsia* sp., *Anthurium acaule*, *Whittmackia lingulata*, and *Epidendrum cochleatum* (USFWS, 1990). In Culebra, the Wheeler's peperomia is found within the semi-evergreen forest at elevations of 650 feet and is restricted to the large granodiorite boulders and shady rocky forest of Monte Resaca and Flamenco.

Wheeler's peperomia has not been observed within the Former AFWTF; however, shaded rocky forest habitat over granitic volcanic rock may potentially support this species.

Threats to the Wheeler's peperomia include the removal of forest canopy that can alter the microclimate and destroy the humus substrate necessary for survival, as well as foraging by domestic fowl and cattle (USFWS, 1990).

5.1.3.11 Cóbana Negra (*Stahlia monosperma*)

Status

Cóbana negra was listed as threatened wherever found on April 5, 1990 (55 FR 12790). Critical habitat has not been designated. The PRDNER has identified this species as vulnerable (PRDNER, 2007).

Species and Habitat Description

Cóbana negra is a medium evergreen tree that reaches 25 to 50 feet in height and 1 to 1.5 feet in diameter. It is endemic to Puerto Rico and Hispaniola (USFWS, 1996a). Cóbana negra inhabits brackish, seasonally flooded wetlands with a mangrove component, the edge of salt flats or shallow lagoons, and remnants of mangrove forests and salt flats. Associated species include *Bucida buceras*, black mangrove, white mangrove, and buttonwood. This species is limited to slightly elevated microsites not occupied by mangroves. Wild populations exist in Cabo Rojo, Río Grande, and the island of Vieques (USFWS, 1996a).

Three known Cóbana negra populations on Vieques were reported in 2001, with 48 individuals described near Laguna Yanuel (Ensenada Honda), Laguna Kiani, and Yanuel Laguna (Geo-Marine, 2001). This species was not found within the areas surveyed within the SIA or EMA during the 2010 plant surveys; however, it was found in the EMA adjacent to the delineated survey areas (Geo-Marine, 2010).

Severe degradation of wetlands over the past two centuries, along with clearing of habitat and intensive agriculture, is responsible for this species decline (USFWS, 1996a).

5.1.3.12 St. Thomas Pricklyash (*Zanthoxylum thomasianum*)

Status

The St. Thomas pricklyash was listed as endangered wherever found on December 20, 1985 (50 FR 51867). Critical habitat has not been designated. The PRDNER has identified this species as endangered (PRDNER, 2005).

Species and Habitat Description

St. Thomas pricklyash is a small tree or tall shrub that grows to 20 feet in height and 4 inches in diameter. It is endemic to Puerto Rico and two of the United States Virgin Islands (USFWS, 1998b). St. Thomas pricklyash occurs in semideciduous forests with an evergreen component, including shaded rocky (volcanic) forests and dense pristine limestone forests. This habitat is composed of canopy species with little groundcover. Associate species include the deciduous gumbo-limbo (*Bursera simaruba*) and *Bucida buceras*, and evergreen species such as *Pictetia aculeata*, *Guaiacum officinale*, and *Amyris elemifera*. Drier sites contain *Agave missionum* and the cactus *Cephalocereus royenii* (USFWS, 1998b).

St. Thomas pricklyash has not been observed within the Former AFWTF; however, suitable habitat is available.

Deforestation and overgrazing threaten this species (USFWS, 1998b).

5.2 Puerto Rico Protected and VNWR Important Species

5.2.1 Bird Species

5.2.1.1 White-cheeked Pintail (*Anas bahamensis*)

Status

The white-cheeked pintail is state-listed as vulnerable (PRDNER, 2005; 2007). It has no federal conservation status (USFWS, 2012a).

Species and Habitat Description

The white-cheeked pintail is a small duck with a pointed tail and is readily identified by the pure white cheeks for which it is named. The white-cheeked pintail occurs in freshwater and brackish estuarine waters including

mangroves, and lagoons with deeper waters. This species is the most frequently seen waterfowl species in the Former AFWTF (USFWS, 2007).

The white-cheeked pintail has been documented as nesting in Laguna Anones, Laguna Salina del Sur, and Laguna El Gato (Navy, 1979). Nests typically occur on the ground among waterside vegetation and are often hidden in tree roots (NSRR, 1996). The bird was documented inhabiting the lagoons on the western side of Vieques, and undocumented observations were made on the east side of Vieques (NSRR, 1996). Observations of this species were made during surveys conducted between August 2000 and March 2001 in Laguna Gato, Bahía Icacos, and an unnamed lagoon on the east side of the Fanduca Peninsula, with numbers of individuals identified during a single survey ranging from 1 to 24 and 1 to 34, respectively (Geo-Marine, 2001). A group of white-cheeked pintails was observed in a mangrove pond in the SIA (Geo-Marine, 2010). No population information is available for this subspecies but its numbers are believed to be lower than they were prior to the introduction of the mongoose (NSRR, 1996).

The decline of the white-cheeked pintail population is attributed to habitat loss and degradation, illegal hunting, duckling depredation, and steeling of clutches (PRDNER, 2005).

5.2.1.2 Snowy Plover (*Charadrius alexandrinus*)

Status

The snowy plover is state-listed as critically endangered (PRDNER, 2005; 2007). It has no federal conservation status (USFWS, 2012a).

Species and Habitat Description

The snowy plover is a small migratory shorebird and is the smallest and palest of the plovers within North America (Simon, 2012). Snowy plovers inhabit sandy shores and exposed and protected sandy beaches, mud flats, salt flats, and dunes. This species feeds primarily on insects, small crustaceans, and other small invertebrates. Snowy plover populations have been in decline because of anthropogenic sources, such as destruction or abandonment of nest due to shoreline traffic and coastal development. Egg-laying typically begins in January in Puerto Rico. There could be up to three clutches with the third laid before the middle of July. The chicks stay with the parent for approximately 30 days after hatching (Simon, 2012). Their nests are shallow depressions lined with colored pebbles and shell fragments (USFWS, 2012a).

The United States Geological Survey conducts a Piping Plover International Census every 5 years to assess progress towards population recovery. This study also documented snowy plover occurrence. Winter census snowy plover results for Puerto Rico reported 17 birds in 2001 and one bird in 2006, with no birds counted in 1991 and 1996; Vieques was not included in the census (Elliott-Smith et. al., 2009). No specific records of snowy plover observations on Vieques were identified; however, suitable habitats do occur along the coastline of the Former AFWTF.

The snowy plover population has declined because the birds are sensitive to human exposure. Nests are destroyed or abandoned because of high amounts of shoreline traffic (Simon, 2012) and habitat lost to development.

5.2.1.3 West Indian Whistling Duck (*Dendrocygna arborea*)

Status

The West Indian whistling duck is state-listed as critically endangered (PRDNER, 2005; 2007). It has no federal conservation status (USFWS, 2012a).

Species and Habitat Description

The West Indian whistling duck is the only endemic waterfowl to the Caribbean and it does not migrate. It prefers to roost in flocks in mangroves and swamps. This species is nocturnal and flies to fresh, brackish, and salt ponds, lagoons, ephemeral wetlands, tidal flats, and agricultural fields to feed in the evening. This species prefers to nest in palm trees, bromeliads, or nest cavities, but can also nest on the ground. The birds breed in all months in the

Caribbean, and 4 to 16 eggs are laid (Raffaele et al., 1998). Nesting in lagoons on the western side of Vieques was documented by the USFWS; undocumented reports indicate the duck may also utilize lagoons on the eastern side of Vieques for nesting (NSRR, 1996; Navy, 2003). No population information for Vieques is available for this species but its numbers are believed to be lower than they were prior to the introduction of the mongoose (NSRR, 1996). There is an estimated population of 100 birds in Puerto Rico (Audubon, 2012).

Threats to the West Indian whistling duck include: hunting, loss and degradation of wetland habitats, and introduced predators like the mongoose (Raffaele et al., 1998).

5.2.1.4 Yellow Warbler (*Setophaga petechia*)

Status

The yellow warbler is state-listed as vulnerable (PRDNER, 2005). It has no federal conservation status (USFWS, 2012a).

Species and Habitat Description

The yellow warbler is a common small migratory songbird and is uniformly yellow; they are bright yellow and have reddish streaks on their underparts (Raffaele et al., 1998). The yellow warbler is one of the most common land birds on Vieques (Geo-Marine, 2001) and was observed in the ECA between January 30, 2007, and February 15, 2007 (Geo-Marine, 2007).

Yellow warblers inhabit mangrove forests, dry scrub, marshes, and forests occurring mostly in lowlands, but have been seen in mountain forests. The bird nests in trees such as willows along streams usually within 10 feet of the ground and two to three eggs are laid (Raffaele et al., 1998). Breeding occurs from February to June, but can occur in other months in Puerto Rico (Raffaele, 1989).

Brood parasitism by Shiny cowbirds threatens the yellow warbler population (Raffaele et al., 1998).

5.2.1.5 Peregrine Falcon (*Falco peregrinus*)

Status

The peregrine falcon is state-listed as critically endangered (PRDNER, 2005; 2007). It has no federal conservation status (USFWS, 2012a).

Species and Habitat Description

The peregrine falcon is a migratory species found near offshore cays and rocks, and water bodies with copious shorebirds, seabirds, or waterfowl prey (Raffaele et al., 1998). The peregrine falcon is a potential predator of roseate tern eggs and small chicks (Geo-Marine, 2001).

The peregrine falcon occurs on Vieques as a winter resident, but is very uncommon (Navy, 2003). An accurate population estimate on Vieques is not currently available.

Historically, the primary threat to the species was dichlorodiphenyltrichloroethane (DDT) poisoning, which caused the population in the United States to decline from 1950 to 1970.

5.2.1.6 Caribbean Coot (*Fulica caribaea*)

Status

The Caribbean coot is state-listed as vulnerable (PRDNER, 2005). It has no federal conservation status (USFWS, 2012a).

Species and Habitat Description

The Caribbean coot is a large waterbird in the rail family that is found in open freshwater habitats such as freshwater habitats, lakes, marshes, swamps, and ponds, and habitats with emergent vegetation. The species breeds year-round in Puerto Rico and peaks in spring and autumn. The nest appears to be floating and four to eight spotted white eggs are laid (Raffaele, 1989).

On Vieques, this species has been found in pairs on Laguna Salina del Sur, Laguna Anones, Laguna El Gato, Laguna Matias, and Laguna Monte Largo (NSRR, 1996). A population estimate for Vieques is not currently available.

The population has declined in Puerto Rico due to habitat fragmentation. Overhunting, habitat destruction, and introduced predators have contributed to the population decline (Raffaele et al., 1998).

5.2.1.7 Masked Duck (*Nomonyx dominicus*)

Status

The masked duck is state-listed as endangered (PRDNER, 2005; 2007). It has no federal conservation status (USFWS, 2012a).

Species and Habitat Description

The masked duck is a non-migratory bird and a very rare permanent resident of Puerto Rico (Raffaele, 1989).

The masked duck prefers shallow freshwater marshes with floating vegetation and rice fields, and also inhabits saltwater ponds while in transit. It also visits thick aquatic vegetation (Raffaele et al., 1998). The masked duck breeds from May to August, building a flat platform nest in dense aquatic vegetation just above or near the water (Raffaele et al., 1998).

Data collected in Puerto Rico indicate that the species is present on the island throughout the year (mean 12-month; range 0-20) but is more abundant from February until June. The greatest number of observations in the Caribbean occurred in the month of March. Sightings in Puerto Rico, compiled from 1997 to 2004, resulted in a cumulative 238 masked ducks (Eitniewski and Colon-Lopez, 2005). No information of records from Vieques was found, though lagoon and mangrove forest habitats are available in the Former AFWTF.

The decline in the masked duck population is attributed to habitat destruction, hunting, and egg predation by rats (Raffaele et al., 1998).

5.2.1.8 Ruddy Duck (*Oxyura jamaicensis*)

Status

The ruddy duck is state-listed as vulnerable (PRDNER, 2005; 2007). It has no federal conservation status (USFWS, 2012a).

Species and Habitat Description

The ruddy duck is a small duck and is similar in appearance to the masked duck described in this section. The ruddy duck migrates; however, it is found in the Caribbean year-round and considered to be a resident (USFWS, 2007). This species inhabits shallow freshwater marshes and brackish coastal bays. Breeding occurs between June and August predominately in freshwater marshes and ponds. Nests are built of grasses and cattails in emergent vegetation over open water (Brown and Collier, 2004).

The ruddy duck has occurred in the SIA and mangrove forests on Vieques (Navy, 1979). Broods were observed on Laguna Matias and adults have been observed at Laguna Monte Largo. Population estimates for the North American ruddy duck suggest a breeding population of approximately 600,000 birds in 1976; however, no estimates exist for the West Indian population but it is apparently small (NSRR, 1996; Navy, 2003).

Oil spills on wintering grounds have accounted for losses of large numbers of birds (NSRR, 1996).

5.2.1.9 Caribbean Brown Pelican (*Pelecanus occidentalis occidentalis*)

Status

The Caribbean brown pelican is a subspecies of the brown pelican (*Pelecanus occidentalis*) and is state-listed as endangered (PRDNER, 2005; 2007). The brown pelican, including all subspecies, was federally delisted in 2009 due to recovery of once declining populations (NMFS, 2012a; USFWS, 2012a).

Species and Habitat Description

The brown pelican occurs on both coasts of the Americas, while the Caribbean subspecies is restricted to the Caribbean region. The brown pelican feeds by diving from the air into the water to catch fish and crustaceans. Brown pelicans nest in colonies, usually on islands. The nest is built either on the ground or on top of a tree or bush. The female lays two to three eggs a few days after the nest is completed and the chicks hatch after approximately a month (NMFS, 2012a).

This species is known to occur in the SIA, and a nesting colony occurs on Cayo Conejo in Bahia Salina del Sur (Navy, 1979). The bird is commonly observed flying or roosting on rock outcrops along the north coast of the EMA and AFWTF. Monte Pirata and the Laguna Kiani Complex beach are important brown pelican roosting sites on the west side of the island (NSRR, 1996). Traditional roosting sites include rocky outcrops near Punta Vaca and Punta Boca Quebrada (Geo-Marine, 2001). Brown pelicans were observed daily feeding and/or resting at the west end of Playa Blanca either on the beach, in the water, or on the exposed coral outcrops (Geo-Marine, 2007).

Cayo Conejo, a small islet off the southeastern coast of Vieques, is one of the few locations on Vieques where Caribbean brown pelican nesting has been documented. Cayo Conejo was reported to be a major nesting site in the 1970s and 1980s, and historically has represented the majority of the nesting population in Puerto Rico (Schreiber, 1999). More recent data suggest the nesting population at this site has declined considerably. Past nesting is expected to have potentially occurred at two other sites on Vieques: Roca Alcatraz and Caballo Balnco (Schreiber, 1978; Wetmore, 1916); however, no nesting has been documented at these sites in recent years. Pelicans have been observed feeding throughout Vieques, primarily near fringing mangroves in bays and lagoons (NMFS, 2012a). A recent population estimate ranged from 1,500 to 1,800 brown pelicans in the Caribbean (NSRR, 1996).

The brown pelican was federally delisted in 2009 in response to rebounding populations that resulted primarily from the ban of the pesticide DDT in 1972, and the success of extensive recovery efforts (NMFS, 2012a). Additional threats include poaching of eggs, young, and adults, human disturbance, entanglement in fishing gear, and loss or degradation of mangrove forest habitat (NSRR, 1996).

5.2.2 Mammal Species

5.2.2.1 Brown Flower Bat (*Erophylla sezekorni*)

Status

The brown flower bat is state-listed as vulnerable (PRDNER, 2005; 2007). It has no federal conservation status (USFWS, 2012a).

Species and Habitat Description

The brown flower bat belongs to the American leaf-nosed bats, an endemic group of bats that have lived in the Caribbean for 15 million years (USDA, 2012). This is a small species of bat between 2.5 to 2.9 inches in length with a small tail between 0.4 to 0.6 inch (USDA, 2012).

The brown flower bat occurs in the Greater Antilles, some of the Bahamas, Caicos, and Cayman islands. The subspecies *E.s. bombifrons* occurs in Hispaniola and Puerto Rico (USDA, 2012). The brown flower bat feeds on fruit, flower, pollen, and nectar, and less frequently insects. This nocturnal species roosts in dark interior caves found at elevations less than 1,500 feet (USDA, 2012). Population estimates have not been identified for Vieques.

The species is threatened due to loss of habitat.

5.2.2.2 Red Fruit Bat (*Stenoderma rufum*)

Status

The red fruit bat is state-listed as vulnerable (PRDNER, 2005; 2007). It has no federal conservation status (USFWS, 2012a).

Species and Habitat Description

The red fruit bat occurs in the United States Virgin Islands and Puerto Rico. Occurrence of this species is rare in the United States Virgin Islands and uncommon in Puerto Rico. This species prefers dry arborescent vegetation and roosts in the forest canopy. This nocturnal species eats mainly fruit and prefers fruit from the trumpet tree, bullet-wood, and sierra palm. The red fruit bat is typically pregnant in January, March, June, July, and August (Rodríguez and Dávalos, 2011). Despite being uncommon in Puerto Rico, the red fruit bat is purportedly one of the most commonly observed species on Vieques (Navy, 2003).

This species is threatened by hurricanes and human disturbance (Rodríguez and Dávalos, 2011).

5.2.3 Reptile Species

5.2.3.1 Slipperyback Skink (*Mabuya mabouya sloanei*)

Status

The slipperyback skink is state-listed as vulnerable (PRDNER, 2005; 2007). It has no federal conservation status (USFWS, 2012a).

Species and Habitat Description

The slipperyback skink is a small, smooth, and bronzy-brown colored reptile with a pair of lateral stripes sometimes bordered by narrow cream stripes. This species, which is endemic to the Lesser Antilles, inhabits terrestrial habitats and has been observed on the islands of Culebra, Vieques, Desecheos, Cayo Icacos, Mona, and Monitas (PRE, 2012). The slipperyback skink has been documented as feeding on insects in low, dense vegetation on beaches and lower slopes of Cays, sheltering in grass and brush litter, under rocks and other surface debris, in rocky fissures, and on the branches of low shrubs (USFWS, 2010c). Population estimates have not been identified for Vieques.

5.2.4 Plant Species

5.2.4.1 Guayacán, Lignum Vitae Tree (*Guaiaacum officinale*)

Status

The Guayacán is not listed by the Commonwealth of Puerto Rico; however, it is listed as a critical element on the PRDNER Natural Heritage Critical Elements List (PRDNER, 2007). It is also included in the *CITES, Appendix II*, with a distinction that it is not necessarily threatened with extinction, but trade must be controlled. It has no federal conservation status (USFWS, 2012a).

Species and Habitat Description

Guayacán is a tree native to Puerto Rico that can grow up to 29.5 feet in height with a diameter of up to 10 inches. This species is characterized by extremely hard wood with knotty branches and deeply furrowed bark. (WAC, 2012). It is a slow growing tree found along the coast in lowland dry forests, woodlands, and thickets (Americas Regional Workshop, 2012).

Guayacán was observed during the ECA plant surveys in 2007 (Geo-Marine, 2007) and the SIA and EMA plant surveys in 2010 (Geo-Marine, 2010). Population estimates have not been identified for Vieques.

The population is dwindling where it is known to occur. The population decrease is mainly due to overexploitation for resin and medicinal purposes (Americas Regional Workshop, 2012).

5.2.4.2 Holywood (*Guaiaacum sanctum*)

Status

Hollywood is not listed by the Commonwealth of Puerto Rico; however, it is listed as a critical element on the PRDNER Natural Heritage Critical Elements List. The conservation of this species is important to the Puerto Rican heritage (PRDNER, 2007). It has no federal conservation status (USFWS, 2012a).

Species and Habitat Description

Hollywood is a small, slow growing tree that can grow to about 23 ft in height with a trunk diameter of 20 in. It is characterized by a white chalky bark and gnarled trunk, with twigs that are light gray and enlarged at the nodes. The species of *Guaiaacum* grow in lowland tropical to subtropical dry forest to scrub (Ewel and Whitmore, 1973), with *G. sanctum* typically growing near the coast and at lower elevations in woodlands, thickets, and on hillsides. The INRMP lists *G. sanctum* as a common plant within the subtropical dry forest life zone, though no other Vieques related reports list this species as present, therefore there is some uncertainty about whether it occurs in Vieques.

5.2.4.3 Black Ironwood Tree (*Krugiodendron ferreum*)

Status

This species is not state or federally listed, but is considered a valued resource for the VNWR.

Species and Habitat Description

The black ironwood tree is native to Puerto Rico, and is a small to medium evergreen tree that reaches 10 to 15 feet in height and 2 to 6 inches in diameter. The black ironwood is a slow growing tree found within the subtropical dry forest in thickets and woods in the limestone regions of Puerto Rico. This species has very dense, hard wood that is resistant to decay and dry-wood termites (Little and Wadsworth, 1964).

The 2003 INRMP indicates that the black ironwood tree is a component of the mixed woodland/upland forest habitat type (Navy, 2003; Geo-Marine, 2010). This species was observed during SIA plant surveys (Geo-Marine, 2010).

5.2.4.4 Caribbean Mayten (*Maytenus cymosa*)

Status

The Caribbean mayten is not listed by the Commonwealth of Puerto Rico; however, it is listed as a critical element on the PRDNER Natural Heritage Critical Elements List. The conservation of this species is important to the Puerto Rican heritage (PRDNER, 2007). It has no federal conservation status (USFWS, 2012a).

Species and Habitat Description

The Caribbean mayten is a rare shrub or small evergreen tree approximately 25 feet in height and 6 inches in diameter with drooping branches and long straight thorns (Keularts, 2012). It is found in coastal moist forests of lowlands below 100 feet altitude. The Puerto Rican population is composed of approximately 52 individuals spread over two locations. This species is found from eastern Puerto Rico to the Virgin Islands, including Piñeros, Vieques, St. Croix, St. Thomas, and Virgin Gorda (Keularts, 2012). The Caribbean mayten has been documented at Monte Pirata on the west side of Vieques, but has not been observed within the Former AFWTF; however, suitable habitat is available.

5.2.5 Terrestrial Habitats

Habitat types deemed important to the management of the VNWR that occur within the Former AFWTF were described in **Section 4.2**, and are therefore not repeated here. They include the following:

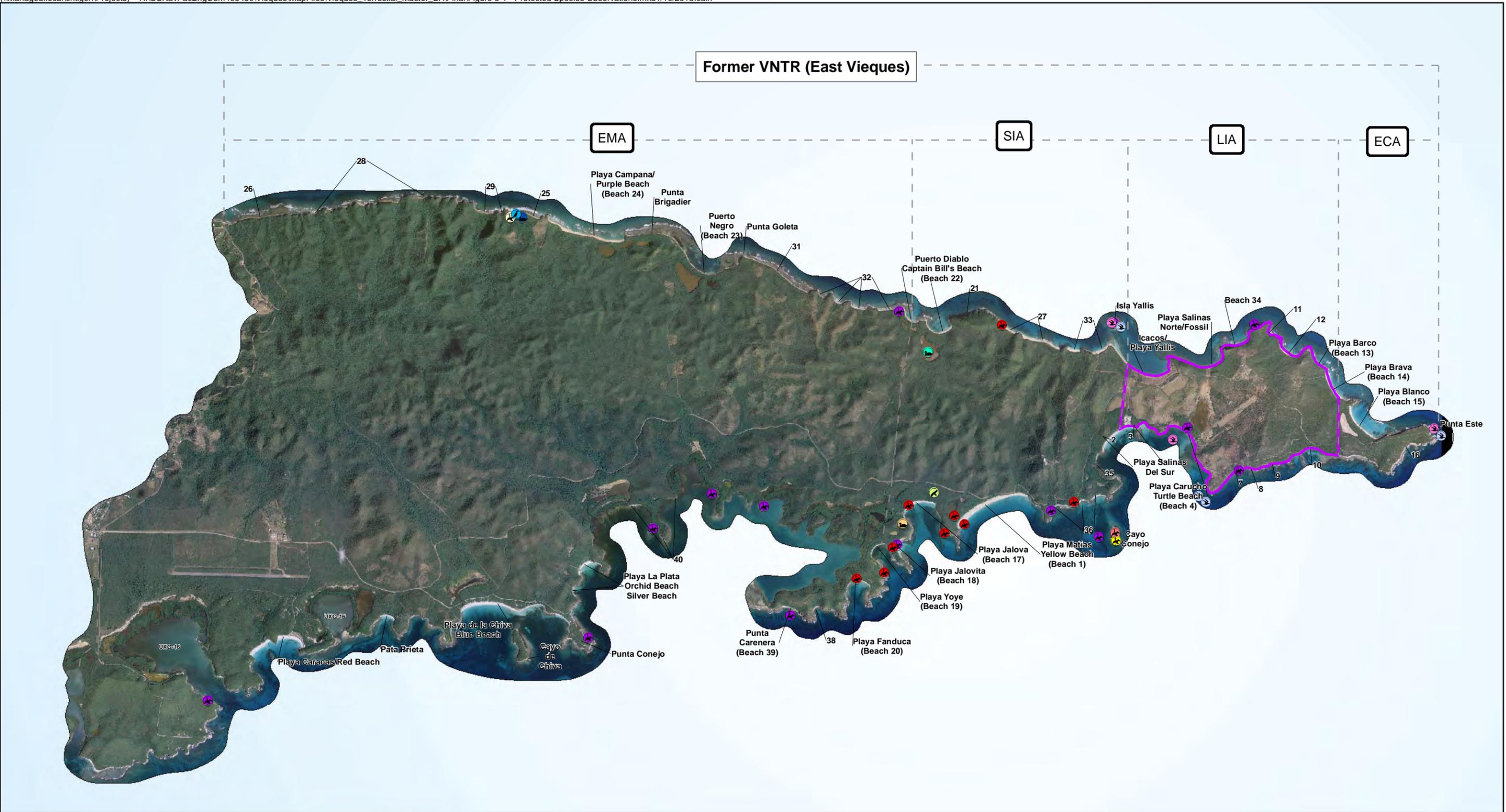
- Sparse and thick thorn scrub
- Mixed native and naturalized invasives
- Entirely invasive species
- Mangrove forests
- Evergreen scrub
- Forest Scrub/Dry Scrub Forest/Lowland Forest
- Gallery forests
- Quebradas
- Inland lagoon

- Mixed woodland/Upland forest
- Grassland
- Bare ground
- Salt/sand flat
- Beach

Rare plant communities represented in the Former AFWTF include the subtropical dry forest and mangroves. These plant communities are imperiled and threatened globally and have a high conservation priority (Ricketts et al., 1999; IUCN, 2012).

In accordance with the 1983 Memorandum of Understanding (MOU) between the Commonwealth of Puerto Rico and the Secretary of the Navy, seven conservation zones were established to restrict the military use (for example, off-road maneuvers) of sensitive habitats such as mangrove forests, evergreen scrub, and lowland forests, and provide protection for T&E species (**Figure 5-4**). During military training activities, conservation zones were not to be used for purposes other than conservation and were protected from damaging activities and managed to protect and maintain their natural values (NSRR, 1996).

Remnants of native vegetation are repositories of the original diversity and the genetic stock of the island. Some of these areas have a unique structure that creates a microhabitat that is difficult to restore or duplicate. In some forests, the understory may harbor populations of endangered plants such as *Peperomia wheeleri* and *Goetzea elegans*. The alteration of microhabitats could adversely impact conditions necessary for growth and reproduction of protected plant species. A compendium of historical aerial photography is provided in **Appendix B** and will be reviewed for the presence of expanding and contracting microhabitats prior to the development of site-specific SAPs and WPs.



- Species Observed, Year**
- Accipiter striatus*, 2010
 - Anas bahamensis*, 2003
 - Anas bahamensis*, 2010
 - Fulica caribaea*, 2003
 - Oxyura jamaicensis*, 2003
 - Pelecanus occidentalis*, 2001
 - Pelecanus occidentalis*, 2003
 - Pelecanus occidentalis*, 2006
 - Pelecanus occidentalis*, 2007
 - Pelecanus occidentalis*, 2010
 - Sterna dougallii*, 2003
 - Sterna dougallii*, 2001
 - Sterna dougallii*, 2006
- Live Impact Area

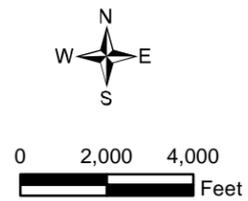
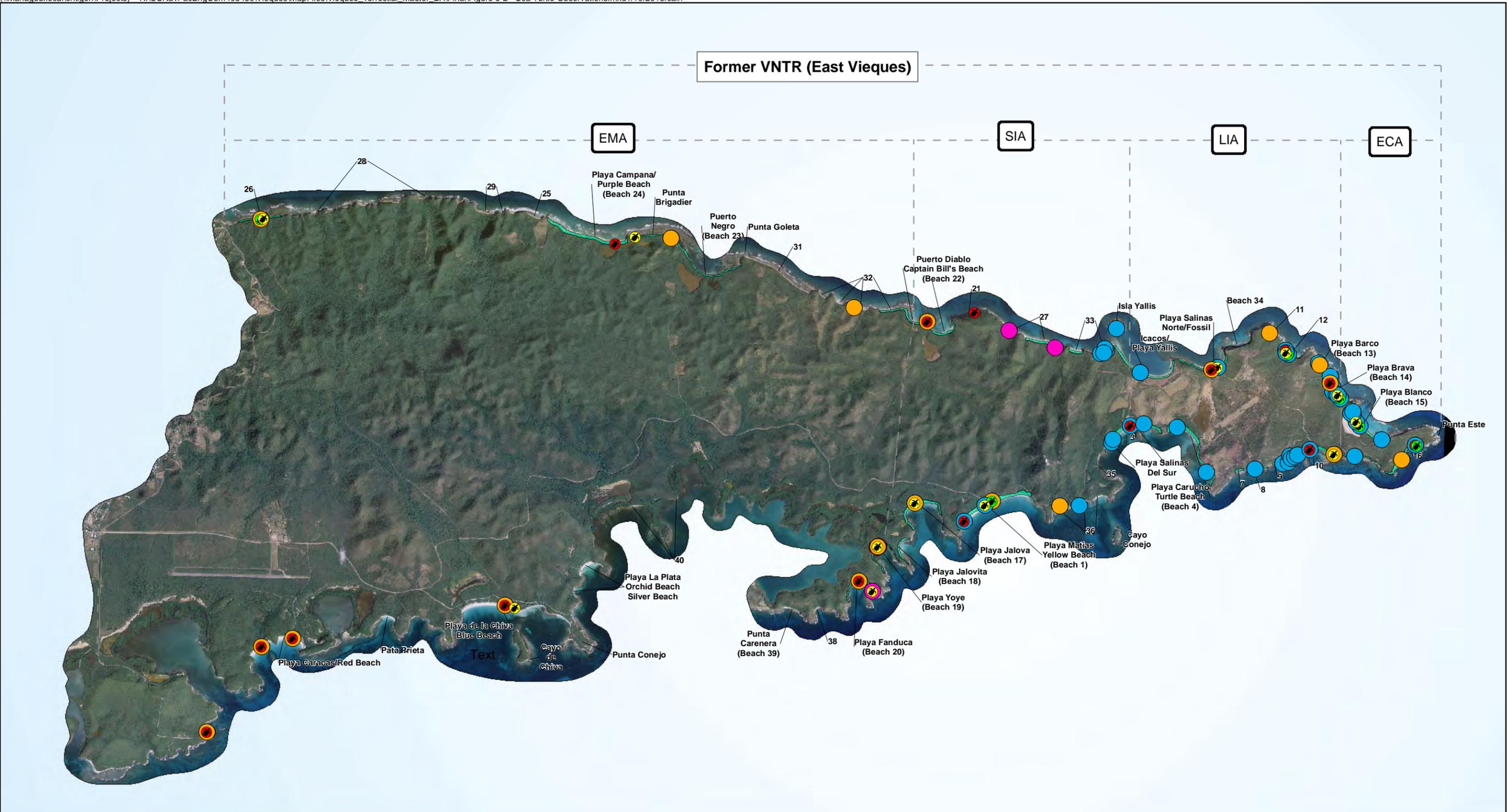


Figure 5-1
Protected Species Observations
 Biological Avoidance Plan for Terrestrial MEC and
 MC Investigations and Interim Removal Actions
 Former AFWTF (East Vieques)
 Vieques, Puerto Rico



Legend

Turtle Nest Location - Year

- 2000-2003
- 2007
- 2010

Species

- Green
- Hawksbill
- Leatherback

■ Turtle Nesting Beach

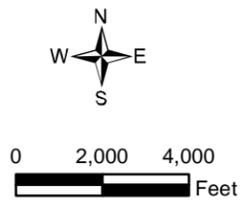
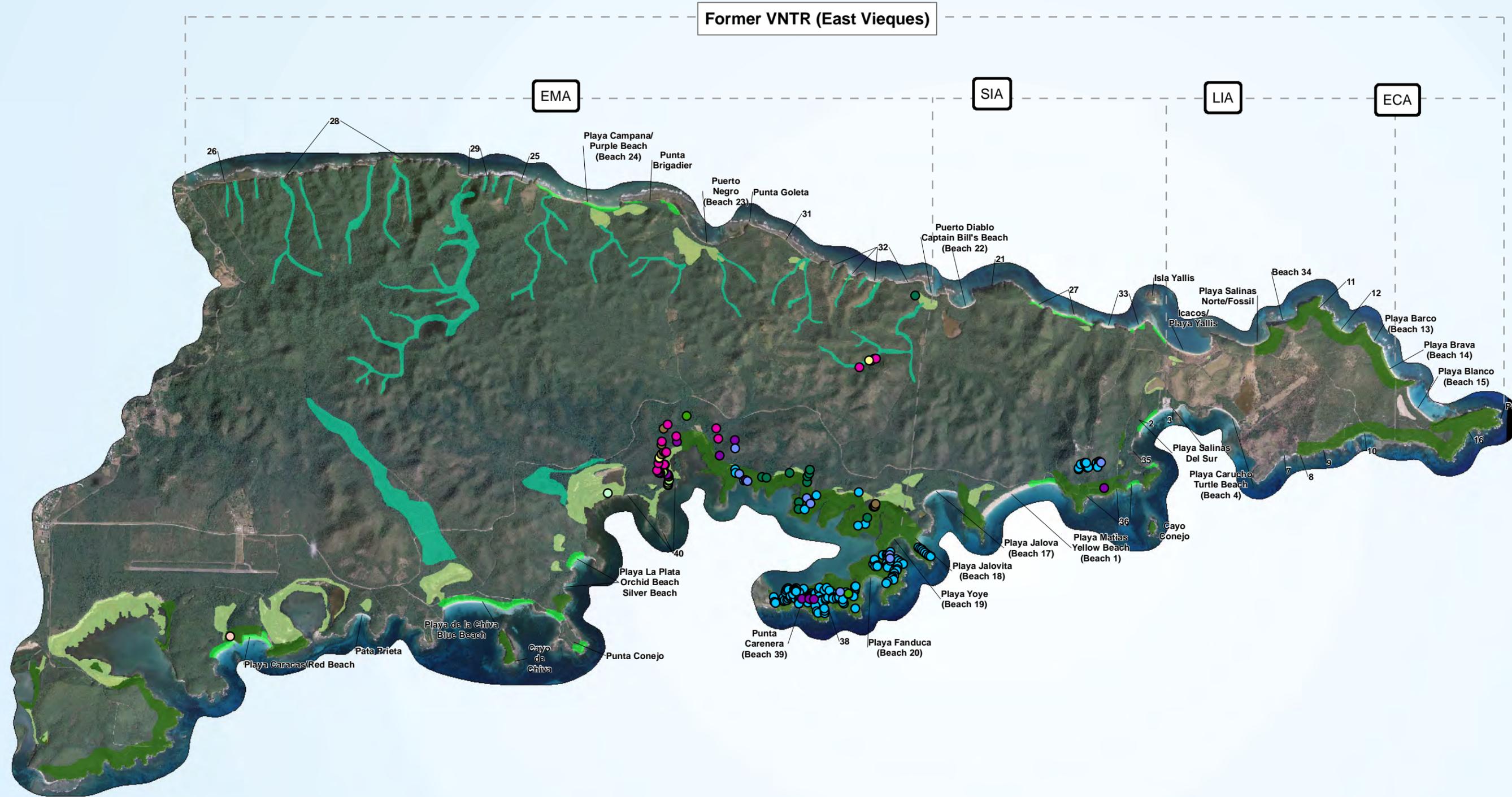


Figure 5-2
Sea Turtles Observations
 Biological Avoidance Plan for Terrestrial MEC and
 MC Investigations and Interim Removal Actions
 Former AFWTF (East Vieques)
 Vieques, Puerto Rico



- | | | |
|----------------------------------|-----------------------------------|-----------------------------------|
| ○ <i>Chameacrista glandulosa</i> | ● <i>Psychillis macconnelliae</i> | ■ <i>Chaemacrista glandulosa</i> |
| ● <i>Eugenia cordata</i> | ● <i>Schoepfia schreberi</i> | ■ <i>Goetzea elegans</i> |
| ● <i>Eugenia sessiliflora</i> | ○ <i>Stahlia monosperma</i> | ■ <i>Psychillis macconnelliae</i> |
| ● <i>Guaiacum officinale</i> | ● <i>Ximenia americana</i> | ■ <i>Stahlia monosperma</i> |
| ● <i>Malpighia woodburyana</i> | ● <i>Zanthoxylum punctatum</i> | |
| ● <i>Myrciaria floribunda</i> | | |

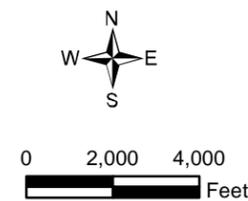
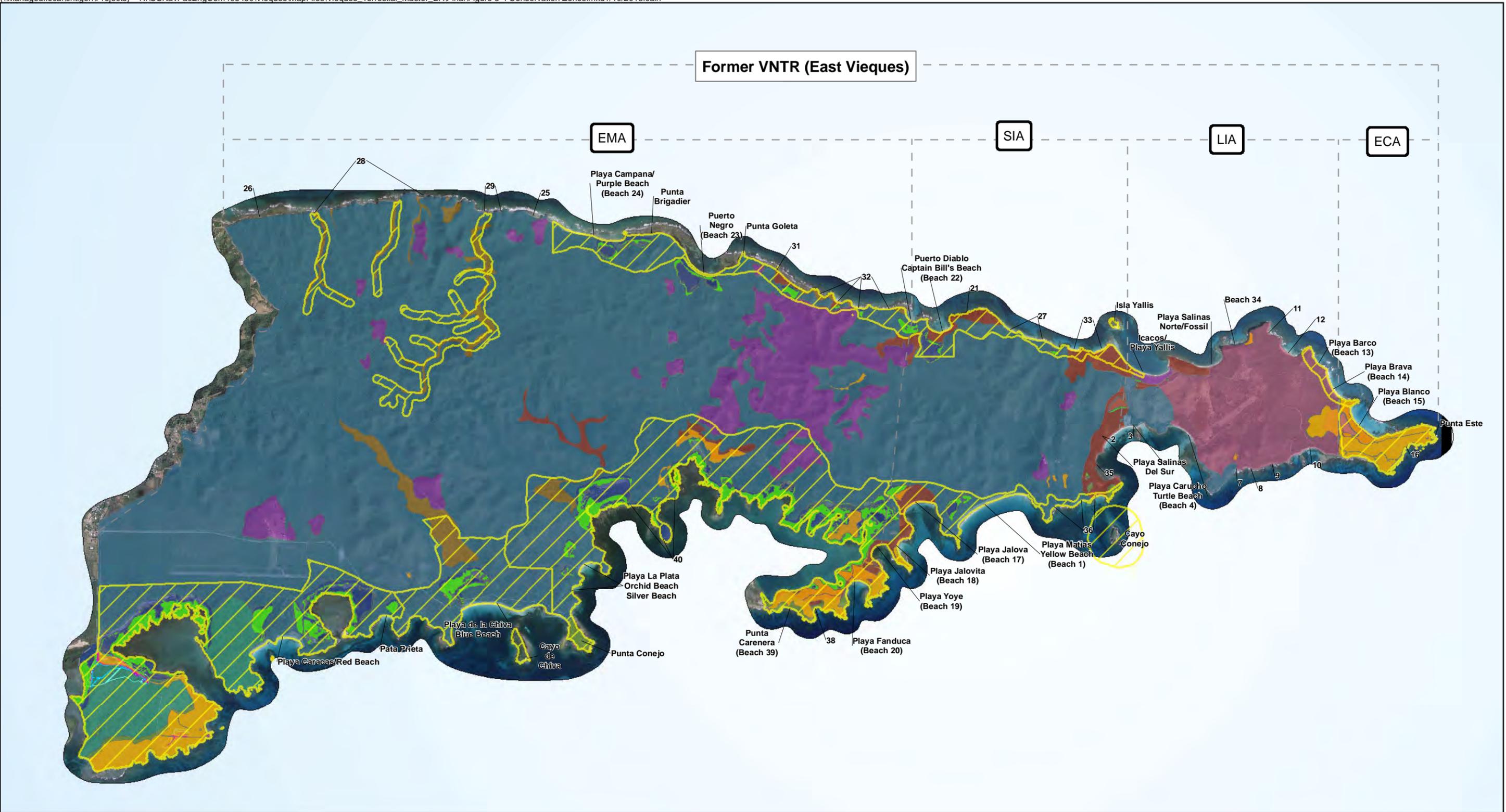


Figure 5-3
Protected Plant Observations
 Biological Avoidance Plan for Terrestrial MEC and
 MC Investigations and Interim Removal Actions
 Former AFWTF (East Vieques)
 Vieques, Puerto Rico



- ▭ Conservation Zone Class I/Class II
- ▭ Mangrove Habitat (Red, White, Black, Button)
- ▭ Undelineated Critical Habitat

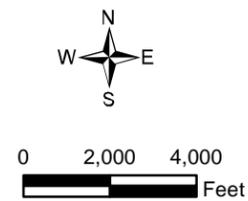


Figure 5-4
Conservation Zones
 Biological Avoidance Plan for Terrestrial MEC and
 MC Investigations and Interim Removal Actions
 Former AFWTF (East Vieques)
 Vieques, Puerto Rico

Effects Analysis

This section discusses the potential effects that MEC investigation and interim removal activities, as well as environmental investigations, may have on federally listed species and their habitat. The potential direct, indirect, and cumulative effects of the proposed MR-related activities on the federally listed species covered by this Biological Avoidance Plan are discussed in **Section 6.1**. A separate assessment of potential influences on non-federal species and habitats, including state-listed species and resources important to the management of the VNWR, is provided in **Section 6.2**.

For the purpose of this Biological Avoidance Plan, vegetation removal includes carrying out the currently approved vegetation removal method, which entails hand-cutting all vegetation to a height of approximately 6 inches, but not removing trees larger than 3 inches in diameter at breast height (DBH) unless absolutely necessary. This method can result in the cutting of most vegetation but is the most effective means approved by regulatory agencies for allowing detection of surface MEC, if present, and subsurface MEC anomalies (such as DGM).

6.1 Federally Listed Species

The results of the literature review and all past known or potential locations of federally listed species were used to assess what potential effects the proposed MR-related activities, specifically vegetation removal, may or may not have on the listed plants and animals previously described. Both direct and indirect effects are considered where applicable. Direct effects are effects from actions that would immediately harm (injure or kill) a protected or high-value species, or remove or adversely modify a sensitive habitat. Indirect effects are those caused by the proposed action (such as vegetation removal) that may manifest later in time, but are still reasonably certain to occur. An example of an indirect effect would be the removal of vegetation adjacent to a population of protected plants that are dependent on the microhabitat conditions (such as humidity and shade) supported by the removed vegetation, thus adversely impacting the conditions necessary for protected species growth and reproduction. Cumulative effects are those effects of future state or private activities, not involving federal activities that are reasonably certain to occur with the action area. The direct, indirect, and cumulative effects described in the following subsections are considered preliminary; in the future they may be further reviewed and adjusted on a site-specific basis as necessary. Based on analysis of these effects, preliminary effects determinations were identified for each species which could include one of the following: (1) no effect, (2) may affect, but not likely to adversely affect, or (3) may affect, and is likely to adversely affect. These determinations of effect are based on the USFWS and NMFS Endangered Species Consultation Handbook (USFWS and NMFS, 1998). "No effect" means there will be no impacts, positive or negative. "May affect, but not likely to adversely affect" means that all effects are beneficial, insignificant, or discountable. "May affect, and is likely to adversely affect" means that listed species are likely to be exposed to the activity and will respond in a negative manner to the exposure.

Conservation of federally listed species can be accomplished by careful, site-specific plans designed to avoid or mitigate effects resulting from the proposed munitions-related activities, where feasible. General conservation suggestions are included in this section where appropriate, but definitive work approaches for avoiding or minimizing impacts will be documented in subsequent site-specific SAPs and WPs and/or a WAD in consultation with USFWS and other appropriate stakeholder agencies.

6.1.1 Bird Species

6.1.1.1 Yellow-shouldered Blackbird (*Agelaius xanthomus*)

The yellow-shouldered blackbird is not known to currently occur on Vieques, though it has been historically found (last observed in 1978 [USFWS, 1996b]). Preferred habitats that are present in the Former AFWTF include coastal

subtropical dry forest and mangrove forests. Vegetation removal within these habitats could disturb this species, if found to be present.

Potential direct effects to the yellow-shouldered blackbird may include harassment during foraging, disruption of breeding efforts, and destruction of active nests. Avoidance measures can be taken to prevent direct effects to foraging or nesting yellow-shouldered blackbirds. If present, the area could be avoided during clearing activities, giving the observed species an appropriate buffer to reduce or eliminate any potential disturbance. The yellow-shouldered blackbird prefers to nest in mangrove forests between April and August. Adherence to these protective measures will help ensure that the yellow-shouldered blackbird will not be directly affected.

Potential indirect effects could be loss of habitat for nesting or foraging following vegetation removal. Removal of mangroves from identified nesting areas could result in a loss of future nesting habitat. Considering the wide availability of coastal mangroves, the yellow-shouldered blackbird could relocate to new nesting areas. They are known to use a variety of sites for nesting, such as various portions of the mangrove habitat, particularly open flats with small trees, the axils of palms, hollow stumps, and thorny scrubland trees (Raffaele, 1989). This nest site adaptability may limit the potential for indirect effects. However, any population newly identified on Vieques would likely be small and potentially sensitive to nest site disturbance, thus munitions-related activities within known nesting colonies would be avoided. Since the yellow-shouldered blackbird forages widely along the coast and inland in a variety of habitats, vegetation removal would not indirectly affect foraging success.

No reasonably foreseeable future state or private activities are proposed within the Former AFWTF. Following environmental cleanup activities the USFWS will solely manage the refuge, in part, to restore, protect, and conserve fish and wildlife resources and habitats, with special emphasis on endangered species, wetlands, and forest communities. Therefore, no cumulative effects to the yellow-shouldered blackbird are expected to occur.

Considering the previously described potential effects, the proposed munitions-related activity may affect, but not likely to adversely affect the yellow-shouldered blackbird, primarily based on implementation of appropriate avoidance measures to prevent direct effects, and avoidance of activities at known nesting sites.

6.1.1.2 Piping Plover (*Charadrius melodus*)

The piping plover is a rare winter visitor to Puerto Rico, and though no specific records from Vieques have been found in the literature reviewed, suitable open foraging habitat such as intertidal beaches, sand flats, and mud flats is available. Vegetation removal activities would not occur directly in these habitats since dense groundcover is not present. However, vegetation removal activities could occur in nearby fringe habitats such as the vegetated upper edge of the beaches or mangroves surrounding sand and mud flats.

A potential direct effect to the piping plover may include temporary disturbance while foraging in habitats adjacent to vegetation clearance activities. Avoidance measures can be taken to minimize disturbance to foraging birds. If present, the area could be avoided during clearing activities, giving the observed species an appropriate buffer to reduce or eliminate any potential disturbance. Adherence to appropriate protective measures will help ensure that the piping plover will not be directly affected.

The piping plover could be indirectly affected by vegetation removal in adjacent habitats via the temporary expansion of open mudflat or beach foraging habitats, which would benefit the species.

No reasonably foreseeable future state or private activities are proposed within the Former AFWTF. Following environmental cleanup activities the USFWS will solely manage the refuge, in part, to restore, protect, and conserve fish and wildlife resources and habitats, with special emphasis on endangered species, wetlands, and forest communities. Therefore, no cumulative effects to the piping plover are expected to occur.

Considering the previously described potential effects, the proposed munitions-related activity may affect, but is not likely to adversely affect the piping plover, considering that vegetation removal within foraging habitat would not be required, and the implementation of appropriate avoidance measures to prevent disturbance of foraging birds during the action.

6.1.1.3 Roseate Tern (*Sterna dougallii*)

Roseate terns breed from mid-May to mid-June. They have been reported nesting near vegetation or jagged rock on open sandy beaches, close to the water line on narrow ledges of emerging rocks, among coral rubble, and on salt flats. Roseate terns are not common nesters on Vieques but have been documented to nest on Cayo Conejo off the southeastern coast of Vieques, and on the inaccessible limestone cliffs of Punta Este. Colonies are highly susceptible to disturbance in the early stages of egg-laying; therefore, vegetation removal activities could adversely affect nesting. Foraging and roosting activities occur offshore and therefore would not be impacted by vegetation removal activities.

The potential direct effect to the roseate tern is disturbance during nesting activities. Vegetation removal would not occur directly within nesting areas due to a lack of dense groundcover vegetation in these coastal fringe habitats; however, removal activities in nearby vegetated uplands could disturb nesting birds and cause them to abandon their nests. Avoidance measures can be taken to prevent direct effects to nesting roseate terns. If present, the area could be avoided during clearing activities, giving the observed species an appropriate buffer to reduce or eliminate any potential disturbance. The roseate tern prefers to nest between mid-May to mid-June. Adherence to protective measures will help ensure that the roseate tern will not be directly affected during its nesting season.

Indirect effects are not expected. Potential nesting habitat occurs in areas where vegetation would not need to be removed, thus indirect effects on nesting sites would not occur.

No reasonably foreseeable future state or private activities are proposed within the Former AFWTF. Following environmental cleanup activities the USFWS will solely manage the refuge, in part, to restore, protect, and conserve fish and wildlife resources and habitats, with special emphasis on endangered species, wetlands, and forest communities. Therefore, no cumulative effects to the roseate tern are expected to occur.

Considering the previously described potential effects, the proposed munitions-related activity may affect, but is not likely to adversely affect the roseate tern, considering that vegetation removal within foraging habitat would not be required, and the implementation of appropriate avoidance measures to prevent disturbance of nesting birds during the action.

6.1.2 Reptile Species

6.1.2.1 Sea Turtles

The green sea turtle, leatherback sea turtle, and hawksbill sea turtle are known to nest on beaches on Vieques, while the loggerhead sea turtle rarely occurs in surrounding waters and has not been documented to nest on the island, though suitable habitat is available. Green sea turtles, leatherback sea turtles, and loggerhead sea turtles typically nest on open beaches, while the hawksbill sea turtle usually nests high up on the beach underneath or in the beach and dune vegetation. Sea turtle nesting beaches have been documented along the Former AFWTF coastline (**Figure 5-2**). Vegetation removal activity within or adjacent to known sea turtle nesting habitats could disturb nesting turtles or their eggs, if present.

Potential direct effects to all four species of sea turtle include direct mortality due to workers or equipment during turtle nesting or hatchling emergence, disruption of nest building efforts, removal of beach vegetation surrounding a nest which could affect soil and nest temperature, and destruction of active nests during the incubation period. Since turtle nesting and hatchling emergence usually occur at night, the potential for direct contact with turtles on the beaches is limited to infrequent daytime nesting or hatching events. A greater potential exists for damaging eggs in buried turtle nests during vegetation removal in the upper beach vegetated zone, and potentially nests in the adjacent open beach where workers or heavy equipment may occasionally maneuver. Direct impacts to sea turtles and their nests could be avoided by conducting vegetation removal activities during the non-nesting season, or by monitoring of turtle nesting activities on beaches where removal activities may occur during the nesting season so that the marked nest locations can be avoided. Based on historical data, nesting frequency for all sea turtle species is lowest from mid-December to mid-February and is therefore the optimal time to work on beaches; turtle nest monitoring would not be needed during this non-

nesting period. Vegetation removal on turtle nesting beaches could be conducted during this period without directly affecting sea turtles. Currently all activities conducted as part of ongoing cleanup operation on Vieques are completed so as not to create any adverse effects to sea turtles. When it is necessary to conduct activities within a sea turtle habitat during the nesting seasons, protective measures are put into place to insure no adverse effects to sea turtles occur. These protective measures include daily habitat monitoring during, and 75 days prior, to any work to be conducted within sea turtle habitat, as well as avoidance measures for any active nesting locations. These protective measures are detailed in the *Biological Assessment of the Former Live Impact Area within the Former Vieques Naval Training Range* (Geo-Marine, 2006). Adherence to these protective measures will help ensure that nesting sea turtles will not be directly affected.

Potential indirect effects of vegetation removal could be temporary modification of preferred nesting habitat (vegetated upper beach zone) for hawksbill sea turtles, and to a lesser extent for the remaining sea turtle species, which prefer to nest in the open sand. In order to clear the beaches and the vegetated buffer in which hawksbill sea turtles nest, it is necessary to remove vegetation up to 25 meters inland from the vegetation line. Indirect impacts to nesting hawksbill sea turtles will be minimized by controlled removal of beach vegetation with high ecological value (such as sea grape [*Coccolobis uvifera*] communities), where feasible. Ideally all vegetation up to 25 meters inland will be cut to a height of less than 6 inches; however, if an individual plant or vegetated area is identified in consultation with USFWS to be of high ecological value, selective removal or limited pruning of lower branches may be feasible to allow for adequate ground surface exposure. Specific approaches for any selective vegetation removal or pruning will be documented in a site-specific SAP/WP/WAD. Adherence to protective beach vegetation removal measures documented in the site-specific SAP/WP/WAD will minimize the potential for indirect effects to nesting hawksbill sea turtles. In addition, cutting of the vegetation buffer will be limited, when possible, with buffers not being cut from June through mid-December (Geo-Marine, 2006).

No reasonably foreseeable future state or private activities are proposed within the Former AFWTF. Following environmental cleanup activities the USFWS will solely manage the refuge, in part, to restore, protect, and conserve fish and wildlife resources and habitats, with special emphasis on endangered species, wetlands, and forest communities. Therefore, no cumulative effects to these sea turtle species are expected to occur.

Considering the previously described potential effects, the proposed munitions-related activity may affect, but is not likely to adversely affect sea turtles, considering the implementation of appropriate avoidance measures to prevent direct and indirect effects during the nesting season.

6.1.2.2 Puerto Rican Boa, Culebrón (*Epicrates inornatus*)

The Puerto Rican boa is typically found in undisturbed forested volcanic or karst (limestone) environments and caves. On Vieques, habitats where it could be found include evergreen scrub and forest scrub/dry scrub forest/lowland forest. It is not known to currently inhabit Vieques; however, suitable habitat is present. Vegetation removal within these habitats could disturb this species, if present.

Potential direct effects to the Puerto Rican boa may include disturbance while foraging and direct mortality during vegetation cutting. Avoidance measures can be taken to prevent direct effects. If present, the area could be avoided during clearing activities, giving the observed species an appropriate buffer to reduce or eliminate any potential disturbance. Adherence to appropriate protective measures will help ensure that the Puerto Rican boa will not be directly affected.

Potential indirect effects could be loss of habitat for foraging and reproduction following vegetation removal. Any population of boas identified on Vieques would likely be small, considering it has not been previously documented following various environmental surveys. Because these habitat types have a long recovery period, vegetation removal will likely have a long-term effect on the survival and reproductive success on the Puerto Rican boa, if present.

No reasonably foreseeable future state or private activities are proposed within the Former AFWTF. Following environmental cleanup activities the USFWS will solely manage the refuge, in part, to restore, protect, and conserve fish and wildlife resources and habitats, with special emphasis on endangered species, wetlands, and forest communities. Therefore, no cumulative effects to the Puerto Rican boa are expected to occur.

Considering the previously described potential effects, the proposed munitions-related activity may affect, and is likely to adversely affect the Puerto Rican boa, primarily based on the indirect effect of habitat loss on foraging and reproductive success.

6.1.2.3 Culebra Giant Anole (*Anolis roosevelti*)

The Culebra giant anole occurs in forested areas and is thought to be a canopy inhabitant that can forage on the ground and sleep on low tree trunks and vine tangles at night (Kessler, 2010). Its presence on Vieques is not well documented. Potentially suitable habitats on Vieques include forest scrub/dry scrub forest/lowland forest and gallery forests. Vegetation removal within these habitats could disturb this species, if present.

Potential direct effects to the Culebra giant anole may include disturbance while foraging and direct mortality during vegetation cutting. Avoidance measures can be taken to prevent direct effects. If the species is present, the area could be avoided during clearing activities, giving the observed species an appropriate buffer to reduce or eliminate any potential disturbance. Adherence to appropriate protective measures will help ensure that the Culebra giant anole will not be directly affected.

Potential indirect effects could be loss of habitat for foraging and reproduction following vegetation removal. Because these habitat types have a long recovery period, vegetation removal will likely have a long-term effect on the survival and reproductive success on the Culebra giant anole.

No reasonably foreseeable future state or private activities are proposed within the Former AFWTF. Following environmental cleanup activities the USFWS will solely manage the refuge, in part, to restore, protect, and conserve fish and wildlife resources and habitats, with special emphasis on endangered species, wetlands, and forest communities. Therefore, no cumulative effects to the Culebra giant anole are expected to occur.

Considering the previously described potential effects, the proposed munitions-related activity may affect, and is likely to adversely affect the Culebra giant anole, primarily based on the indirect effect of habitat loss on foraging and reproductive success.

6.1.3 Plant Species

6.1.3.1 Vahl's Boxwood (*Buxus vahlii*)

Vahl's boxwood typically grows on limestone substrates at elevations between 80 and 650 feet, where it is typically limited to ravines and ledges (Geo-Marine, 2007). There are no specific records of occurrence in the Former AFWTF; however, it could potentially occur on suitable substrates within evergreen scrub and forest scrub/dry scrub forest/lowland forest habitat. Vegetation removal within these habitat types could disturb this species, if present.

The direct effect of vegetation removal on the Vahl's boxwood may include direct mortality during vegetation cutting. Avoidance measures can be taken to prevent direct effects. If present, the area could be avoided by creating an appropriate buffer around the observed plants.

Indirectly, the effect of changed and disturbed habitat conditions following vegetation removal could create an environment unsuitable for the species long-term survival or reproductive success. The recovery time for evergreen scrub habitat is unknown due to its complexity, and likewise for forest scrub/dry scrub forest/lowland forest habitat except for one example, which indicates a period of at least 45 years (Colon and Lugo, 2006); thus, the removal of vegetation from these habitats would likely have a long-term effect on the Vahl's boxwood, where present.

No reasonably foreseeable future state or private activities are proposed within the Former AFWTF. Following environmental cleanup activities the USFWS will solely manage the refuge, in part, to restore, protect, and conserve fish and wildlife resources and habitats, with special emphasis on endangered species, wetlands, and forest communities. Therefore, no cumulative effects to the Vahl's boxwood are expected to occur.

Considering the previously described potential effects, the proposed munitions-related activity may affect, and is likely to adversely affect the Vahl's boxwood, primarily based on the indirect effect of changed and disturbed habitat conditions following vegetation removal and potentially long habitat recovery time.

6.1.3.2 Thomas' Lidflower (*Calyptanthus thomasiana*)

Thomas' lidflower occurs in moist, dense, semi-evergreen forests at high altitudes. Monte Pirata on the western side of Vieques Island contains 10 to 12 plants at the mountain summit; similar conditions are not found in the Former AFWTF. Though unlikely to occur, potentially suitable conditions could occur within evergreen scrub habitat of the Former AFWTF. Vegetation removal within this habitat type could disturb this species, if present.

The direct effect of vegetation removal on Thomas' lidflower may include direct mortality during vegetation cutting. Avoidance measures can be taken to prevent direct effects. If present, the area could be avoided by creating an appropriate buffer around the observed plants.

Indirectly, the effect of changed and disturbed habitat conditions following vegetation removal could create an environment unsuitable for the species long-term survival or reproductive success. The recovery time for evergreen scrub habitat is unknown due to its complexity; however, the removal of vegetation from this habitat would likely have a long-term effect on the Thomas' lidflower, where present.

No reasonably foreseeable future state or private activities are proposed within the Former AFWTF. Following environmental cleanup activities the USFWS will solely manage the refuge, in part, to restore, protect, and conserve fish and wildlife resources and habitats, with special emphasis on endangered species, wetlands, and forest communities. Therefore, no cumulative effects to the Thomas' lidflower are expected to occur.

Considering the previously described potential effects, the proposed munitions-related activity may affect, and is likely to adversely affect the Thomas' lidflower, primarily based on the indirect effect of changed and disturbed habitat conditions following vegetation removal and potentially long habitat recovery time.

6.1.3.3 *Catesbaea melanocarpa*

Catesbaea melanocarpa typically grows on limestone substrates in subtropical dry forest. There are no specific records of occurrence in the Former AFWTF; however, it could potentially occur on suitable substrates within evergreen scrub and forest scrub/dry scrub forest/lowland forest habitat. Vegetation removal within these habitat types could disturb this species, if present.

The direct effect of vegetation removal on *Catesbaea melanocarpa* may include direct mortality during vegetation cutting. Avoidance measures can be taken to prevent direct effects. If present, the area would be avoided by creating an appropriate buffer around the observed plants.

Indirectly, the effect of changed and disturbed habitat conditions following vegetation removal could create an environment unsuitable for the species long-term survival or reproductive success. The recovery time for evergreen scrub habitat is unknown due to its complexity, and likewise for forest scrub/dry scrub forest/lowland forest habitat except for one example, which indicates a period of at least 45 years (Colon and Lugo, 2006); thus, the removal of vegetation from these habitats would likely have a long-term effect on the *Catesbaea melanocarpa*, where present.

No reasonably foreseeable future state or private activities are proposed within the Former AFWTF. Following environmental cleanup activities the USFWS will solely manage the refuge, in part, to restore, protect, and conserve fish and wildlife resources and habitats, with special emphasis on endangered species, wetlands, and forest communities. Therefore, no cumulative effects to the *Catesbaea melanocarpa* are expected to occur.

Considering the previously described potential effects, the proposed munitions-related activity may affect, and is likely to adversely affect the *Catesbaea melanocarpa*, primarily based on the indirect effect of changed and disturbed habitat conditions following vegetation removal and potentially long habitat recovery time.

6.1.3.4 Puerto Rican Senna, Jamaican broom (*Chamaecrista glandulosa* var. *mirabilis*)

Puerto Rican senna is an erect shrub that grows along lagoon shorelines in sandy soils that are extremely acidic with low nutrients and are excessively drained, and has been collected near Bahía Corcho on Vieques. In the Former AFWTF, Puerto Rican senna can potentially occur in mangrove forest habitat and salt/sand habitat. Vegetation removal within these habitat types could disturb this species, if present.

The direct effect of vegetation removal on the Puerto Rican senna may include direct mortality during vegetation cutting. Avoidance measures can be taken to prevent direct effects. If present, the area could be avoided by creating an appropriate buffer around the observed plants.

Indirectly, the effect of changed and disturbed habitat conditions following vegetation removal could create an environment unsuitable for the species long-term survival or reproductive success. For mangrove forests, the length of time required for community recovery is 15 to 30 years if the hydrology is appropriate and the seeds and propagules are available from adjacent mangroves, while the length of time required for salt/sand flat vegetation to recover from extensive vegetation removal is unknown. The removal of vegetation from these habitats would likely have a long-term effect on the Puerto Rican senna, where present.

No reasonably foreseeable future state or private activities are proposed within the Former AFWTF. Following environmental cleanup activities the USFWS will solely manage the refuge, in part, to restore, protect, and conserve fish and wildlife resources and habitats, with special emphasis on endangered species, wetlands, and forest communities. Therefore, no cumulative effects to the Puerto Rican senna are expected to occur.

Considering the previously described potential effects, the proposed munitions-related activity may affect, and is likely to adversely affect the Puerto Rican senna, primarily based on the indirect effect of changed and disturbed habitat conditions following vegetation removal and potentially long habitat recovery time.

6.1.3.5 Puerto Rican Manjack (*Cordia rupicola*)

The Puerto Rican manjack is a small woody shrub that grows within the subtropical dry forest zone situated over a limestone substrate. On Vieques, single specimens have been reported from Punta Jálova (Proctor, 1994) and on the Lighthouse Peninsula on Vieques (Breckon and Kolterman, 2005). In the Former AFWTF, Puerto Rican manjack can potentially occur on suitable limestone substrate within the forest scrub/dry scrub forest/lowland forest habitat and the mixed woodland/upland forest habitat. Vegetation removal within these habitat types could disturb this species, if present.

The direct effect of vegetation removal on the Puerto Rican manjack may include direct mortality during vegetation cutting. Avoidance measures can be taken to prevent direct effects. If present, the area could be avoided by creating an appropriate buffer around the observed plants.

Indirectly, the effect of changed and disturbed habitat conditions following vegetation removal could create an environment unsuitable for the species long-term survival or reproductive success. The recovery time for these habitat types is unknown; however, the removal of vegetation from these habitats would likely have a long-term effect on the Puerto Rican manjack, where present.

No reasonably foreseeable future state or private activities are proposed within the Former AFWTF. Following environmental cleanup activities the USFWS will solely manage the refuge, in part, to restore, protect, and conserve fish and wildlife resources and habitats, with special emphasis on endangered species, wetlands, and forest communities. Therefore, no cumulative effects to the Puerto Rican manjack are expected to occur.

Considering the previously described potential effects, the proposed munitions-related activity may affect, and is likely to adversely affect the Puerto Rican manjack, primarily based on the indirect effect of changed and disturbed habitat conditions following vegetation removal and potentially long habitat recovery time.

6.1.3.6 Woodbury's Stopper (*Eugenia woodburyana*)

Woodbury's stopper is found within the subtropical dry forest, commonly with succulent or coriaceous species and species with thorns and spines. Two individuals were reported on Monte Pirata in west Vieques; however, there no records within the Former AFWTF. In the Former AFWTF, Woodbury's stopper can potentially occur

within gallery forest habitat, evergreen scrub habitat, and forest scrub/dry scrub forest/lowland forest habitat. Vegetation removal within these habitat types could disturb this species, if present.

The direct effect of vegetation removal on the Woodbury's stopper may include direct mortality during vegetation cutting. Avoidance measures can be taken to prevent direct effects. If present, the area would be avoided by creating a 25-foot buffer around the observed plants.

Indirectly, the effect of changed and disturbed habitat conditions following vegetation removal could create an environment unsuitable for the species long-term survival or reproductive success. The recovery time for these habitat types is unknown. For forest scrub/dry scrub forest/lowland forest habitat, one example indicates a period of at least 45 years (Colon and Lugo, 2006). The removal of vegetation from these habitats would likely have a long-term effect on the Woodbury's stopper, where present.

No reasonably foreseeable future state or private activities are proposed within the Former AFWTF. Following environmental cleanup activities the USFWS will solely manage the refuge, in part, to restore, protect, and conserve fish and wildlife resources and habitats, with special emphasis on endangered species, wetlands, and forest communities. Therefore, no cumulative effects to the Woodbury's stopper are expected to occur.

Considering the previously described potential effects, the proposed munitions-related activity may affect, and is likely to adversely affect the Woodbury's stopper, primarily based on the indirect effect of changed and disturbed habitat conditions following vegetation removal and potentially long habitat recovery time.

6.1.3.7 Beautiful Goetzea, Matabuey (*Goetzea elegans*)

Beautiful goetzea is a shrub or small shrubby tree that is found in semi-evergreen, limestone forests and foothills and karst limestone hills. Beautiful goetzea has been found on the western end of Vieques and may occur within the Former AFWTF in quebradas found in the gallery forest habitat type. Vegetation removal within this habitat type could disturb this species, if present.

The direct effect of vegetation removal on beautiful goetzea may include direct mortality during vegetation cutting. Avoidance measures can be taken to prevent direct effects. If present, the area could be avoided by creating an appropriate buffer around the observed plants.

Indirectly, the effect of changed and disturbed habitat conditions following vegetation removal could create an environment unsuitable for the species long-term survival or reproductive success. The length of time required for gallery forests to recover from extensive vegetation removal is unknown; however, removal of vegetation from this habitat would likely have a long-term effect on the beautiful goetzea, where present.

No reasonably foreseeable future state or private activities are proposed within the Former AFWTF. Following environmental cleanup activities the USFWS will solely manage the refuge, in part, to restore, protect, and conserve fish and wildlife resources and habitats, with special emphasis on endangered species, wetlands, and forest communities. Therefore, no cumulative effects to the beautiful goetzea are expected to occur.

Considering the previously described potential effects, the proposed munitions-related activity may affect, and is likely to adversely affect the beautiful goetzea, primarily based on the indirect effect of changed and disturbed habitat conditions following vegetation removal and potentially long habitat recovery time.

6.1.3.8 Leptocereus grantianus

Leptocereus grantianus occurs in the subtropical dry forest in dry coastal forests and along coastal cliffs. It has not been observed within the Former AFWTF; however, suitable habitat is available within the forest scrub/dry scrub forest/lowland forest habitat. Vegetation removal within this habitat type could disturb this species, if present.

The direct effect of vegetation removal on *Leptocereus grantianus* may include direct mortality during vegetation cutting. Avoidance measures can be taken to prevent direct effects. If present, the area could be avoided by creating an appropriate buffer around the observed plants.

Indirectly, the effect of changed and disturbed habitat conditions following vegetation removal could create an environment unsuitable for the species long-term survival or reproductive success. The recovery time is unknown

for forest scrub/dry scrub forest/lowland forest habitat except for one example, which indicates a period of at least 45 years (Colon and Lugo, 2006); thus, the removal of vegetation from this habitat would likely have a long-term effect on the *Leptocereus grantianus*, where present.

No reasonably foreseeable future state or private activities are proposed within the Former AFWTF. Following environmental cleanup activities the USFWS will solely manage the refuge, in part, to restore, protect, and conserve fish and wildlife resources and habitats, with special emphasis on endangered species, wetlands, and forest communities. Therefore, no cumulative effects to the *Leptocereus grantianus* are expected to occur.

Considering the previously described potential effects, the proposed munitions-related activity may affect, and is likely to adversely affect the *Leptocereus grantianus*, primarily based on the indirect effect of changed and disturbed habitat conditions following vegetation removal and potentially long habitat recovery time.

6.1.3.9 Cana Gorda Girdlepod (*Mitracarpus polycladus*)

Cana gorda girdlepod is a small shrub that inhabits rocky outcrops with crevices and soil pockets within coastal dwarf forest, coastal shrub forest, cactus scrub forest, and coastal scrub on sandy soil. Cana gorda girdlepod has not been observed within the Former AFWTF; however, it could potentially occur within forest scrub/dry scrub forest/lowland forest habitat. Vegetation removal within these habitat types could disturb this species, if present.

The direct effect of vegetation removal on Cana gorda girdlepod may include direct mortality during vegetation cutting. Avoidance measures can be taken to prevent direct effects. If present, the area would be avoided by creating an appropriate buffer around the observed plants.

Indirectly, the effect of changed and disturbed habitat conditions following vegetation removal could create an environment unsuitable for the species long-term survival or reproductive success. The recovery time is unknown for forest scrub/dry scrub forest/lowland forest habitat except for one example, which indicates a period of at least 45 years (Colon and Lugo, 2006); thus, the removal of vegetation from this habitat would likely have a long-term effect on the Cana gorda girdlepod, where present.

No reasonably foreseeable future state or private activities are proposed within the Former AFWTF. Following environmental cleanup activities the USFWS will solely manage the refuge, in part, to restore, protect, and conserve fish and wildlife resources and habitats, with special emphasis on endangered species, wetlands, and forest communities. Therefore, no cumulative effects to the Cana gorda girdlepod are expected to occur.

Considering the previously described potential effects, the proposed munitions-related activity may affect, and is likely to adversely affect the Cana gorda girdlepod, primarily based on the indirect effect of changed and disturbed habitat conditions following vegetation removal and potentially long habitat recovery time.

6.1.3.10 Wheeler's Peperomia (*Peperomia wheeleri*)

Wheeler's peperomia is an herbaceous species that prefers semi-evergreen forests with an herbaceous layer and tree canopy. In Culebra, the Wheeler's peperomia is found within the semi-evergreen forest at elevations of 650 feet, and is restricted to the large granodiorite boulders and shady rocky forest. There are no specific records of occurrence in the Former AFWTF; however, it could potentially occur within evergreen scrub and forest scrub/dry scrub forest/lowland forest habitat. Vegetation removal within these habitat types could disturb this species, if present.

The direct effect of vegetation removal on Wheeler's peperomia may include direct mortality during vegetation cutting. Avoidance measures can be taken to prevent direct effects. If present, the area would be avoided by creating an appropriate buffer around the observed plants.

Indirectly, the effect of changed and disturbed habitat conditions following vegetation removal could create an environment unsuitable for the species long-term survival or reproductive success. The recovery time for evergreen scrub habitat is unknown due to its complexity, and likewise for forest scrub/dry scrub forest/lowland forest habitat except for one example, which indicates a period of at least 45 years (Colon and Lugo, 2006); thus, the removal of vegetation from these habitats would likely have a long-term effect on the Wheeler's peperomia, where present.

No reasonably foreseeable future state or private activities are proposed within the Former AFWTF. Following environmental cleanup activities the USFWS will solely manage the refuge, in part, to restore, protect, and conserve fish and wildlife resources and habitats, with special emphasis on endangered species, wetlands, and forest communities. Therefore, no cumulative effects to the Wheeler's peperomia are expected to occur.

Considering the previously described potential effects, the proposed munitions-related activity may affect, and is likely to adversely affect the Wheeler's peperomia, primarily based on the indirect effect of changed and disturbed habitat conditions following vegetation removal and potentially long habitat recovery time.

6.1.3.11 Cóbana Negra (*Stahlia monosperma*)

Cóbana negra is a medium evergreen tree that inhabits brackish, seasonally flooded wetlands with a mangrove component, the edge of salt flats or shallow lagoons, and remnants of mangrove forests and salt flats. Three known Cóbana negra populations on Vieques have been reported near Laguna Yanuel (Ensenada Honda), Laguna Kiani, and Yanuel Laguna (Geo-Marine, 2001). In the Former AFWTF, Cóbana negra can potentially occur in mangrove forest habitat and salt/sand habitat. Vegetation removal within these habitat types could disturb this species, if present.

The direct effect of vegetation removal on the Cóbana negra may include direct mortality during vegetation cutting. Avoidance measures can be taken to prevent direct effects. If present, the area could be avoided by creating an appropriate buffer around the observed plants.

Indirectly, the effect of changed and disturbed habitat conditions following vegetation removal could create an environment unsuitable for the species long-term survival or reproductive success. For mangrove forests, the length of time required for community recovery is 15 to 30 years if the hydrology is appropriate and the seeds and propagules are available from adjacent mangroves, while the length of time required for salt/sand flat vegetation to recover from extensive vegetation removal is unknown. The removal of vegetation from these habitats would likely have a long-term effect on the Cóbana negra, where present.

No reasonably foreseeable future state or private activities are proposed within the Former AFWTF. Following environmental cleanup activities the USFWS will solely manage the refuge, in part, to restore, protect, and conserve fish and wildlife resources and habitats, with special emphasis on endangered species, wetlands, and forest communities. Therefore, no cumulative effects to the Cóbana negra are expected to occur.

Considering the previously described potential effects, the proposed munitions-related activity may affect, and is likely to adversely affect the Cóbana negra, primarily based on the indirect effect of changed and disturbed habitat conditions following vegetation removal and potentially long habitat recovery time.

6.1.3.12 St. Thomas Pricklyash (*Zanthoxylum thomasianum*)

St. Thomas pricklyash occurs in semideciduous forests with an evergreen component, including shaded rocky (volcanic) forests and dense pristine limestone forests. St. Thomas pricklyash has not been observed within the Former AFWTF, although it can potentially occur within gallery forest habitat, evergreen scrub habitat, mixed woodland/upland forest habitat, and forest scrub/dry scrub forest/lowland forest habitat in this area. Vegetation removal within these habitat types could disturb this species, if present.

The direct effect of vegetation removal on the St. Thomas pricklyash may include direct mortality during vegetation cutting. Avoidance measures can be taken to prevent direct effects. If present, the area could be avoided by creating an appropriate buffer around the observed plants.

Indirectly, the effect of changed and disturbed habitat conditions following vegetation removal could create an environment unsuitable for the species long-term survival or reproductive success. The recovery time for these habitat types is unknown. For forest scrub/dry scrub forest/lowland forest habitat, one example indicates a period of at least 45 years (Colon and Lugo, 2006). The removal of vegetation from these habitats would likely have a long-term effect on the St. Thomas pricklyash, where present.

No reasonably foreseeable future state or private activities are proposed within the Former AFWTF. Following environmental cleanup activities the USFWS will solely manage the refuge, in part, to restore, protect, and

conserve fish and wildlife resources and habitats, with special emphasis on endangered species, wetlands, and forest communities. Therefore no cumulative effects to the St. Thomas pricklyash are expected to occur.

Considering the previously described potential effects, the proposed munitions-related activity may affect, and is likely to adversely affect the St. Thomas pricklyash, primarily based on the indirect effect of changed and disturbed habitat conditions following vegetation removal and potentially long habitat recovery time.

6.2 Puerto Rico Protected and VNWR Important Species

Conservation of state-listed species and species important to the management of the VNWR can be accomplished by careful, site-specific plans designed to avoid or mitigate affects resulting from the proposed munitions-related activities, where feasible. General conservation suggestions are included in this section where appropriate, but definitive work approaches for avoiding or minimizing impacts will be documented in subsequent site-specific SAPs and WPs and/or a WAD in consultation with USFWS and other appropriate stakeholder agencies.

6.2.1 Bird Species

6.2.1.1 White-cheeked Pintail (*Anas bahamensis*)

The white-cheeked pintail occurs in freshwater and brackish estuarine waters and is known to forage and/or roost in the fringe mangrove forest habitat. It is found on Vieques, and has been documented as nesting in Laguna Anones, Laguna Salina del Sur, and Laguna El Gato.

Vegetation removal in mangrove habitat could directly impact white-cheeked pintails that are present during the action, such as by disturbing foraging activity. Avoidance measures can be taken to prevent direct effects to foraging white-cheeked pintails. If present, the area could be avoided during clearing activities, giving the observed species an appropriate buffer to reduce or eliminate any potential disturbance. Indirectly, the removal of mangrove vegetation could reduce foraging and roosting habitat for this species. Considering that the white-cheeked pintail also forages in open water habitat, and the availability of lagoons and mangrove communities at many locations within the Former AFWTF, there is unlikely to be a significant impact to foraging and roosting activities of this species.

Considering the previously described potential impacts and implementation of appropriate avoidance measures, the proposed munitions-related activity is not expected to adversely impact the white-cheeked pintail.

6.2.1.2 Snowy Plover (*Charadrius alexandrinus*)

Snowy plovers inhabit sandy shores and exposed and protected sandy beaches, mud flats, salt flats, and dunes. No specific records of snowy plover observations on Vieques were identified in the literature; however, suitable habitats do occur along the coastline of the Former AFWTF. Vegetation removal activities would not occur directly in these habitats since dense groundcover is not present. However, vegetation removal activities could occur in nearby fringe habitats such as the vegetated upper edge of the beaches or mangroves surrounding sand and mud flats.

A potential direct impact to the snowy plover may include temporary disturbance while foraging or nesting in habitats adjacent to vegetation clearance activities. Avoidance measures can be taken to prevent direct effects to foraging or nesting snowy plovers. If present, the area could be avoided during clearing activities, giving the observed species an appropriate buffer to reduce or eliminate any potential disturbance. If an active nest is found, nearby work should not commence until nestlings have fledged. The snowy plover could be indirectly impacted by vegetation removal in adjacent habitats via the temporary expansion of open mudflat or beach foraging habitats, which would benefit the species.

Considering the previously described potential impacts and implementation of appropriate avoidance measures, the proposed munitions-related activity is not expected to adversely impact the snowy plover.

6.2.1.3 West Indian Whistling Duck (*Dendrocygna arborea*)

The West Indian whistling duck prefers to roost in flocks in mangroves and swamps, and in the evening flies to fresh, brackish, and salt ponds, lagoons, ephemeral wetlands, tidal flats, and agricultural fields to feed. Nesting in lagoons on the western side of Vieques has been documented by the USFWS; undocumented reports indicate the duck may also utilize lagoons on the eastern side of Vieques for nesting (NSRR, 1996; Navy, 2003).

Vegetation removal in mangrove habitat could directly impact West Indian whistling ducks that are present during the action, such as by disturbing roosting activity. Avoidance measures can be taken to prevent direct effects to roosting whistling ducks. If present, the area could be avoided during clearing activities, giving the observed species an appropriate buffer to reduce or eliminate any potential disturbance. Vegetation removal is not expected to occur in foraging habitats for this species. Indirectly, the removal of mangrove vegetation could reduce roosting habitat for this species. Considering the availability of lagoons and mangrove communities at many locations within the Former AFWTF, there is unlikely to be a significant impact to roosting activities of this species.

Considering the previously described potential impacts and implementation of appropriate avoidance measures, the proposed munitions-related activity is not expected to adversely impact the West Indian whistling duck.

6.2.1.4 Yellow Warbler (*Setophaga petechia*)

Yellow warblers, a common species on Vieques, inhabit mangrove forests, dry scrub, marshes, and forests occurring mostly in lowlands, but have been seen in mountain forests. The bird nests in trees, and breeding primarily occurs from February to June.

Potentially suitable habitats in the Former AFWTF for foraging and nesting include forest scrub/dry scrub forest/lowland forest and gallery forests. Vegetation removal within these habitats could directly impact yellow warblers that are present during the action, such as by disturbing foraging and nesting activity. Avoidance measures can be taken to prevent direct effects to foraging or nesting yellow warblers. If present, the area could be avoided during clearing activities, giving the observed species an appropriate buffer to reduce or eliminate any potential disturbance. If an active nest is found, nearby work should not commence until nestlings have fledged. Indirectly, the removal of forest vegetation could reduce foraging and nesting habitat for this species. Considering the availability of various forest types within the Former AFWTF, there is unlikely to be a significant impact to foraging and nesting activities of this species.

Considering the previously described potential impacts and the implementation of appropriate avoidance measures, the proposed munitions-related activity is not expected to adversely impact the yellow warbler.

6.2.1.5 Peregrine Falcon (*Falco peregrinus*)

The peregrine falcon is an uncommon winter resident on Vieques. It is typically found foraging or perched near offshore cays and rocks, and water bodies with shorebirds, seabirds, or waterfowl prey.

Potentially suitable habitats in the Former AFWTF include forested areas near aquatic foraging areas (such as lagoons or coastal areas). Peregrine falcons will use trees as temporary perches while searching for prey. Vegetation removal in forested habitats would temporarily disrupt peregrine falcons, which would quickly depart an area when disturbed. Direct contact causing mortality would not be expected. Indirectly, the removal of forest vegetation could reduce perching or roosting habitat for this species; however, there is sufficient availability of vegetation elsewhere within the Former AFWTF to support this species.

Considering the previously described potential impacts, the proposed munitions-related activity is not expected to adversely impact the peregrine falcon.

6.2.1.6 Caribbean Coot (*Fulica caribaea*)

The Caribbean coot prefers open freshwater habitats such as lakes, marshes, swamps, and ponds, and habitats with emergent vegetation. Occasionally it is found in coastal brackish lagoons. On Vieques, this species has been found in pairs on Laguna Salina del Sur, Laguna Anones, Laguna El Gato, Laguna Matias, and Laguna Monte Largo (NSRR, 1996). The species breeds year-round in Puerto Rico and nests on floating vegetation.

There are no freshwater lakes or ponds in the Former AFWTF; however, coastal lagoons are present that could possibly support the Caribbean coot. Vegetation removal in mangrove habitat associated with open lagoons could directly impact Caribbean coots that are present during the action, such as by disturbing foraging activity. Avoidance measures can be taken to prevent direct effects to foraging Caribbean coots. If present, the area could be avoided during clearing activities, giving the observed species an appropriate buffer to reduce or eliminate any potential disturbance. Indirectly, the removal of mangrove vegetation could increase foraging habitat for this species; however, no adverse indirect impacts are expected.

Considering the previously described limited potential for direct impacts and implementation of appropriate avoidance measures, the proposed munitions-related activity is not expected to adversely impact the Caribbean coot.

6.2.1.7 Masked Duck (*Nomonyx dominicus*)

The masked duck prefers shallow freshwater marshes with floating vegetation and rice fields, and also inhabits saltwater ponds while in transit, and breeds from May to August, building a flat platform nest in dense aquatic vegetation just above or near the water (Raffaele et al., 1998). On Vieques, this species has been found in pairs on Laguna Salina del Sur, Laguna Anones, Laguna El Gato, Laguna Matias, and Laguna Monte Largo (NSRR, 1996).

There are no freshwater marshes in the Former AFWTF; however, coastal lagoons are present that could possibly support the masked duck. Vegetation removal in mangrove habitat associated with open lagoons could directly impact masked duck that are present during the action, such as by disturbing foraging activity. Avoidance measures can be taken to prevent direct effects to foraging masked ducks. If present, the area could be avoided during clearing activities, giving the observed species an appropriate buffer to reduce or eliminate any potential disturbance. Indirectly, the removal of mangrove vegetation could increase foraging habitat for this species; however, no adverse indirect impacts are expected.

Considering the previously described limited potential for direct impacts and implementation of appropriate avoidance measures, the proposed munitions-related activity is not expected to adversely impact the masked duck.

6.2.1.8 Ruddy Duck (*Oxyura jamaicensis*)

The ruddy duck inhabits shallow freshwater marshes and brackish coastal bays. It has been observed in the SIA and mangrove forests on Vieques (Navy, 1979). Breeding occurs between June and August predominately in freshwater marshes and ponds, with nests built of grasses and cattails in emergent vegetation over open water (Brown and Collier, 2004).

There are no freshwater marshes in the Former AFWTF; however, coastal lagoons are present that could possibly support the ruddy duck. Vegetation removal in mangrove habitat associated with open lagoons could directly impact ruddy ducks that are present during the action, such as by disturbing foraging activity. Avoidance measures can be taken to prevent direct effects to foraging ruddy ducks. If present, the area could be avoided during clearing activities, giving the observed species an appropriate buffer to reduce or eliminate any potential disturbance. Indirectly, the removal of mangrove vegetation could increase foraging habitat for this species; however, no adverse indirect impacts are expected.

Considering the previously described limited potential for direct impacts and implementation of appropriate avoidance measures, the proposed munitions-related activity is not expected to adversely impact the ruddy duck.

6.2.1.9 Caribbean Brown Pelican (*Pelecanus occidentalis occidentalis*)

The brown pelican, which is commonly observed throughout Vieques, forages in coastal lagoons, typically roosts in mangroves or on rocky outcrops, and nests either on the ground or on top of a tree or bush in colonies, usually on islands.

Potentially suitable habitats in the Former AFWTF include inland lagoons, mangrove forests, and coastal islands (such as Cayo Conejo). Vegetation removal on coastal nesting islands is not anticipated at this time; therefore, no adverse impacts to nesting colonies are expected. Vegetation removal in mangrove habitat could directly impact

brown pelicans that are present during the action, such as by disturbing roosting activity. Avoidance measures can be taken to prevent direct effects to roosting brown pelicans. If present, the area could be avoided during clearing activities, giving the observed species an appropriate buffer to reduce or eliminate any potential disturbance. Indirectly, the removal of mangrove vegetation could reduce roosting habitat for this species. Considering the availability of lagoons and mangrove communities at many locations within the Former AFWTF, there is unlikely to be a significant impact to roosting activities of this species.

Considering the previously described limited potential for direct impacts and implementation of appropriate avoidance measures, the proposed munitions-related activity is not expected to adversely impact the Caribbean brown pelican.

6.2.2 Mammal Species

6.2.2.1 Brown Flower Bat (*Erophylla sezekoni*)

The brown flower bat, which possibly occurs on Vieques, roosts in dark interior caves found at elevations less than 1,500 feet. Caves are tied to the geology of an area and therefore could occur within multiple habitat types. The brown flower bat feeds on fruit, flower, pollen, and nectar, and less frequently insects that can be found in various habitat types.

Extensive vegetation removal is not likely to adversely impact the cave roosting habitat of this species. Direct impact to roosting bats could be temporary disturbance while working in the vicinity of a cave; however, this impact is likely to be minimal since there would be no intrusive activity in a cave. Indirectly, the removal of vegetation in the vicinity of a cave roost would not have an impact on foraging activity since bats could forage widely within unimpacted habitats throughout the Former AFWTF.

Based on the previously described limited potential for direct and indirect impacts, the proposed munitions-related activity is not expected to adversely impact the brown flower bat.

6.2.2.2 Red Fruit Bat (*Stenoderma rufum*)

The red fruit bat is purportedly one of the most commonly observed bat species on Vieques (Navy, 2003). The red fruit bat prefers dry arborescent vegetation and roosts in the forest canopy. It is solitary, frequently changes its roosting location, and roost sites are seldom occupied more than once (Rodriguez and Dávalos, 2011). This nocturnal species eats mainly fruit and prefers fruit from the trumpet tree, bullet-wood, and sierra palm.

Potentially suitable habitats in the Former AFWTF for foraging and nesting include forest scrub/dry scrub forest/lowland forest and gallery forests. Vegetation removal within these habitats could directly impact red fruit bats that are present during the action, such as by disturbing while roosting in the canopy. Avoidance measures can be taken to prevent direct effects to roosting red fruit bats. If an active roost is found, nearby work should not commence until the roost is found to be vacant, which is expected to be within 24 to 48 hours. The removal of forest vegetation could indirectly impact the species by reduced foraging and roosting habitat. Considering the availability of various forest habitat types within the Former AFWTF, there is unlikely to be a significant impact to foraging and roosting activities of this species.

Based on the previously described limited potential for direct and indirect impacts and implementation of appropriate avoidance measures, the proposed munitions-related activity is not expected to adversely impact the red fruit bat.

6.2.3 Reptile Species

6.2.3.1 Slipperyback Skink (*Mabuya mabouya sloanei*)

The slipperyback skink, which has been observed on Vieques, is known to inhabit dense vegetation on beaches and lower slopes of Cays, sheltering in grass and brush litter, under rocks and other surface debris, in rocky fissures, and on the branches of low shrubs (USFWS, 2010c). Potentially suitable habitats on Vieques include forest scrub/dry scrub forest/lowland forest and gallery forests. Potential direct impacts to the slipperyback skink may include disturbance while foraging and direct mortality during vegetation cutting. Avoidance measures can

be taken to prevent direct impacts. If present, the area will be avoided during clearing activities, giving the observed species an appropriate buffer to reduce or eliminate any potential disturbance. Adherence to appropriate protective measures will help ensure that the slipperyback skink will not be directly impacted.

Potential indirect impacts could be loss of habitat for foraging and reproduction following vegetation removal. Because these habitat types have a long recovery period, vegetation removal will likely have a long-term impact on the survival and reproductive success on the slipperyback skink.

Adherence to appropriate avoidance measures described above would minimize direct impact to the slipperyback skink; however, extensive vegetation removal in habitat where it occurs may adversely impact this species.

6.2.4 Plant Species

6.2.4.1 Guayacán, *Lignum Vitae* Tree (*Guaiacum officinale*)

Guayacán is a slow growing tree found along the coast in lowland dry forests, woodlands, and thickets. Guayacán has been observed in the Former AFWTF during plant surveys in the ECA, SIA, and EMA. In the Former AFWTF, guayacán can potentially occur in evergreen scrub habitat, forest scrub/dry scrub forest/lowland forest habitat, and mixed woodland/upland forest habitat.

The direct impact of vegetation removal on guayacán may include direct mortality during vegetation cutting. Avoidance measures can be taken to prevent direct effects. If present, the area would be avoided by creating an appropriate buffer around the observed plants.

Indirectly, the impact of changed and disturbed habitat conditions following vegetation removal could create an environment unsuitable for the species long-term survival or reproductive success. The recovery time for each of these habitat types is uncertain. For forest scrub/dry scrub forest/lowland forest habitat, one example indicates a period of at least 45 years (Colon and Lugo, 2006). Removal of vegetation from these habitats would likely have a long-term impact on the guayacán, where present.

Adherence to appropriate avoidance measures would prevent direct impact to the guayacán; however, extensive vegetation removal in habitat where it occurs may adversely impact this species.

6.2.4.2 Holywood (*Guaiacum sanctum*)

Hollywood is a slow growing tree that could occur along the coast in lowland dry forests, woodlands, and thickets, though no specific Vieques records have been identified. In the Former AFWTF, holywood can potentially occur in evergreen scrub habitat, forest scrub/dry scrub forest/lowland forest habitat, and mixed woodland/upland forest habitat.

The direct impact of vegetation removal on holywood may include direct mortality during vegetation cutting. Avoidance measures can be taken to prevent direct effects. If present, the area would be avoided by creating an appropriate buffer around the observed plants.

Indirectly, the impact of changed and disturbed habitat conditions following vegetation removal could create an environment unsuitable for the species long-term survival or reproductive success. The recovery time for each of these habitat types is uncertain. For forest scrub/dry scrub forest/lowland forest habitat, one example indicates a period of at least 45 years (Colon and Lugo, 2006). Removal of vegetation from these habitats would likely have a long-term impact on the holywood, where present.

Adherence to appropriate avoidance measures would prevent direct impact to the holywood; however, extensive vegetation removal in habitat where it occurs may adversely impact this species.

6.2.4.3 Black Ironwood Tree (*Krugiodendron ferreum*)

The black ironwood is a slow-growing tree found within the subtropical dry forest in thickets and woods in the limestone regions of Puerto Rico. It has been observed during SIA plant surveys (Geo-Marine, 2010). In the Former AFWTF, black ironwood can potentially occur in forest scrub/dry scrub forest/lowland forest habitat, and mixed woodland/upland forest habitat.

The direct impact of vegetation removal on black ironwood may include direct mortality during vegetation cutting. Avoidance measures can be taken to prevent direct effects. If present, the area would be avoided by creating an appropriate buffer around the observed plants.

Indirectly, the impact of changed and disturbed habitat conditions following vegetation removal could create an environment unsuitable for the species long-term survival or reproductive success. The recovery time for each of these habitat types is uncertain. For forest scrub/dry scrub forest/lowland forest habitat, one example indicates a period of at least 45 years (Colon and Lugo, 2006). Removal of vegetation from these habitats would likely have a long-term impact on the black ironwood, where present.

Adherence to appropriate avoidance measures would prevent direct impact to the black ironwood; however, extensive vegetation removal in habitat where it occurs may adversely impact this species.

6.2.4.4 Caribbean Mayten (*Maytenus cymosa*)

The Caribbean mayten is found in coastal moist forests of lowlands below 100 feet altitude, and has been documented at Monte Pirata on the west side of Vieques. It has not been observed within the Former AFWTF; however, Caribbean mayten can potentially occur in gallery forest habitat, forest scrub/dry scrub forest/lowland forest habitat, and mixed woodland/upland forest habitat.

The direct impact of vegetation removal on Caribbean mayten may include direct mortality during vegetation cutting. Avoidance measures can be taken to prevent direct effects. If present, the area would be avoided by creating an appropriate buffer around the observed plants.

Indirectly, the impact of changed and disturbed habitat conditions following vegetation removal could create an environment unsuitable for the species long-term survival or reproductive success. The recovery time for each of these habitat types is uncertain. For forest scrub/dry scrub forest/lowland forest habitat, one example indicates a period of at least 45 years (Colon and Lugo, 2006). Removal of vegetation from these habitats would likely have a long-term impact on the Caribbean mayten, where present.

Adherence to appropriate avoidance measures would prevent direct impact to the Caribbean mayten; however, extensive vegetation removal in habitat where it occurs may adversely impact this species.

6.2.5 Habitat Types

6.2.5.1 Sparse and Thick Thorn Scrub

The invasive species within the sparse and thick thorn scrub habitats will likely re-grow quickly following vegetation removal; however, re-growth of some of the native species within the habitat could take approximately 15 years. The potential for recovery to pre-vegetation removal conditions is low, and extensive vegetation removal will likely have moderate long-term impacts on this habitat. No protected plant or animal species are known or likely to occur in this habitat type; therefore, no direct or indirect impacts are expected.

6.2.5.2 Mixed Native and Naturalized Invasives

The invasive species within the mixed native and naturalized invasive habitat will likely re-grow quickly following vegetation removal; however, re-growth of the native and naturalized species could take approximately 15 years. The final ratio of invasive to native and naturalized species post-recovery is unknown. The potential for recovery to pre-vegetation removal conditions is low, and extensive vegetation removal will likely have moderate long-term impacts on this habitat. No protected plant or animal species are known or likely to occur in this habitat type; therefore, no direct or indirect impacts are expected to occur to protected species.

6.2.5.3 Entirely Invasive Species

Areas composed entirely of invasive species are presumed to recover relatively fast, given the rapid growth rate of invasive and introduced species. The potential for recovery to pre-vegetation conditions is high, and total vegetation removal will have minimal long-term impacts on this habitat. No protected plant or animal species are known or likely to occur in this habitat type; therefore, no direct or indirect impacts are expected to occur to protected species.

6.2.5.4 Mangrove Forests

For mangrove forests, the length of time required for secondary succession via natural recruitment is 15 to 30 years if the hydrology is appropriate and the seeds and propagules are available from adjacent mangrove forests (Lewis and Streever, 2000). Secondary succession could be obtained at a greater rate if mangrove seedlings are planted. Long-term maintenance would be required to limit invasive colonization. The potential for recovery to pre-vegetation removal conditions is high, and total vegetation removal will have a moderate impact on this habitat. Vegetation removal will cause direct impacts to this habitat and indirect impacts to adjacent lagoons and water bodies.

6.2.5.5 Evergreen Scrub

For evergreen scrub habitat, the length of time required for secondary succession via natural recruitment is undetermined. Because of the complexity of this habitat, the recovery time is unknown. The potential for recovery to pre-vegetation removal conditions is low, and total vegetation removal will probably result in long-term impacts to this habitat. The hand-cutting of all vegetation to a height of approximately 6 inches, but not removing trees larger than 3 inches in DBH will likely result in long-term impacts because many of the dense scrub species found in this habitat type are typically less than 3 inches DBH. In evergreen scrub areas where the limestone is in close proximity to the land surface or is exposed, the identification of UXO can frequently be accomplished without removing vegetation.

6.2.5.6 Forest Scrub/Dry Scrub Forest/Lowland Forest

The length of time required for forest scrub/dry scrub forest/lowland forest habitat to recover from extensive vegetation removal is unknown, but an example indicates it could take up to 45 years. After 45 years the plant composition may not be fully replaced (Colon and Lugo, 2006). The potential for recovery to pre-vegetation removal is low for dry scrub forest, and significant vegetation removal will likely have direct and long-term impacts on this habitat.

6.2.5.7 Gallery Forest and Quebradas

The length of time required for gallery forests to recover from extensive vegetation removal is unknown; therefore, the potential for recovery is low and significant vegetation removal will likely have direct and long-term impacts on this habitat.

The gallery forest provides suitable habitat for several protected plant and animal species. If vegetation removal is done within this habitat it will likely have a direct impact on the habitat and the protected species that reside within it. Removal of small vegetation (less than 3 inches DBH) within a mature gallery forest may also adversely impact the unique microclimate and humidity conditions that have developed over time and are important to some gallery forest plants. Because the recovery period is unknown it will likely have direct long-term impacts on the previously listed protected species. The removal of vegetation may have indirect impacts on the water quality released from steeply sloped quebradas due to increased soil erosion during storm events.

6.2.5.8 Inland Lagoon

Extensive vegetation removal is not likely to occur within inland lagoons; therefore, no direct impacts to this habitat are anticipated. Mangrove forests that typically fringe these lagoons are addressed separately. No direct or indirect impacts are expected to occur to protected animals species.

6.2.5.9 Mixed Woodland/Upland Forests

The length of time required for mixed woodland/upland forest to recover from extensive vegetation removal is unknown. The potential for recovery to pre-vegetation removal is low for mixed woodland/upland forest habitat, and significant vegetation removal will likely have direct and long-term impacts on this habitat.

6.2.5.10 Grassland

The cutting of grassland vegetation is not likely to adversely impact grassland habitat; therefore, no direct impacts to this habitat are anticipated.

6.2.5.11 Bare Ground

Vegetation removal in bare ground habitat is not likely necessary or would be very limited; therefore, no direct impacts to this habitat are anticipated. No protected plant or animal species are known or likely to occur in this habitat type; therefore, no direct or indirect impacts are expected.

6.2.5.12 Salt/Sand Flat

The length of time required for salt/sand flat groundcover vegetation to recover from extensive removal is unknown. Groundcover removal in this habitat is not likely necessary or would be very limited. The potential for recovery to pre-vegetation removal is moderate for salt/sand flat habitat. Vegetation removal will likely have limited indirect impacts on adjacent mangrove forest and lagoon habitat.

6.2.5.13 Beach

The length of time required for beach vegetation to recover from extensive vegetation removal is unknown. The potential for recovery to pre-vegetation removal is high for beach habitat, and significant vegetation removal will likely have direct and moderate impacts on this habitat.

Conclusions and Determination of Effect

Implementation of the proposed munitions-related activity (vegetation removal associated with munitions-related and environmental investigations) was evaluated for its potential effect on federally listed species, which included 3 birds, 6 reptiles, and 12 plants in the project area. Critical habitats do not occur on Vieques for any of the species evaluated. Adverse effects evaluated included direct, indirect, and cumulative effects. Preliminary effects determinations considered each of the following decision points: (1) no effect, (2) may affect, is not likely to adversely affect, and (3) may affect, is likely to adversely affect. **Table 7-1** presents the Navy's preliminary effects determination for each of the federally listed species.

This document also includes an evaluation of potential impacts to additional species and habitats that are not federally listed. Species evaluated included Puerto Rico protected species and resources important to the management of the VNWR. Potential direct and indirect impacts to these species and resources were individually evaluated, with preliminary impacts judged as either (1) not expected to adversely impact, or (2) may adversely impact. **Table 7-2** presents the Navy's preliminary impact evaluation for these species.

Proposed munitions-related activities could potentially result in impacts to T&E species and resources important to the management of the VNWR, as previously described. Conservation of these resources can be accomplished by careful, site-specific plans designed to avoid impacts resulting from the proposed munitions-related activities, where feasible. Definitive work approaches for avoiding or minimizing impacts will be documented in site-specific SAP/WPs or WADs in consultation with USFWS and other stakeholder agencies.

The proposed activity notification for the WAD process occurs prior to any work activity done in a work area to allow for USFWS input. This process evaluates the work area for potential impacts to T&E species and any resources that the USFWS service deems important for the management of the VNWR using this Biological Avoidance Plan. **Appendix C** contains composite maps of important habitats within the Former AFWTF, UXO sites, and grid map. These maps will be used to support the WAD process. If the USFWS agrees with NAVFAC Atlantic's determination of no effect for T&E species, and that there will be no unacceptable impacts to any resources important to the refuge in the work area described in a WAD, then the WAD will be approved. If the USFWS does not concur with NAVFAC Atlantic's determination of no effect for T&E species, the WAD will not be approved. In addition, USFWS will evaluate the WAD to determine if there are any unacceptable impacts to important refuge resources and provide approval for the WAD in reference to these areas. NAVFAC Atlantic may be able to accommodate minimally restrictive measures on a case-by-case basis to allow for approval of the WAD and to allow for conservation of a resource important to the VNWR. In the event the restrictive measures cannot be affected while maintaining compliance with the WP, the WAD will not be approved.

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TABLE 7-1
Determination of Effect Summary for Federally Protected Species

Habitat Potentially Affected		Preliminary Determination of Effect ¹	Basis of Determination
Birds			
Yellow-shouldered blackbird	Mangroves	May affect, not likely to adversely affect	The yellow-shouldered blackbird is not known to currently nest on Vieques. Adherence to avoidance measures would prevent direct and indirect effects at any future discovered nesting sites.
Piping plover	Beaches, mudflats, and sandflats	May affect, not likely to adversely affect	Foraging habitat would not require vegetation removal. Avoidance measures during nearby vegetation removal activities would prevent direct disturbance of foraging activities.
Roseate tern	Coastal areas and offshore cays; reported nesting on sandy beaches, close to the water line on narrow ledges of emerging rocks, among coral rubble, on salt flats, on limestone cliffs.	May affect, not likely to adversely affect	Nesting habitat would not require vegetation removal. Avoidance measures during nearby vegetation removal activities would prevent direct disturbance of nesting activities
Reptiles			
Green sea turtle	Coastal zones, beaches for nesting	May affect, not likely to adversely affect	Direct effects would be prevented by adherence to avoidance measures, primarily by conducting beach activities during the non-nesting period. Loss of beach vegetation may indirectly affect nest site selection; modified beach vegetation removal procedures, developed in consultation with USFWS, could minimize adverse effects.
Leatherback sea turtle	Coastal zones, beaches for nesting	May affect, not likely to adversely affect	Direct effects would be prevented by adherence to avoidance measures, primarily by conducting beach activities during the non-nesting period. Loss of beach vegetation may indirectly affect nest site selection; modified beach vegetation removal procedures, developed in consultation with USFWS, could minimize adverse effects.
Hawksbill Sea Turtle	Coastal zones, beaches for nesting, primarily upper vegetated zone	May affect, not likely to adversely affect	Direct effects would be prevented by adherence to avoidance measures, primarily by conducting beach activities during the non-nesting period. Loss of beach vegetation may indirectly affect nest site selection; modified beach vegetation removal procedures, developed in consultation with USFWS, could minimize adverse effects.
Loggerhead sea turtle	Coastal zones, beaches for nesting	May affect, not likely to adversely affect	Direct effects would be prevented by adherence to avoidance measures, primarily by conducting beach activities during the non-nesting period. Loss of beach vegetation may indirectly affect nest site selection; modified beach vegetation removal procedures, developed in consultation with USFWS, could minimize adverse effects.
Puerto Rican Boa	Forested volcanic and limestone (karst) hills	May affect, likely to adversely affect	Direct effects would be prevented by adherence to identification and avoidance measures during vegetation removal activities. Habitat removal would have an indirect effect on survival and reproductive success
Culebra giant anole	Vieques in forested areas	May affect, likely to adversely affect	Direct effects would be prevented by adherence to identification and avoidance measures during vegetation removal activities. Habitat removal would have an indirect effect on survival and reproductive success
Plants			
Vahl's boxwood	Remnants of dry forest, especially on limestone. Also semi-evergreen seasonal forest on limestone restricted to ledges and ravines	May affect, likely to adversely affect	Direct effects would be prevented by adherence to identification and avoidance measures during vegetation removal activities. Habitat removal would have an indirect effect on survival and reproductive success
Thomas' lidflower	Shaded rocky forest (volcanic), Monte Pirata summit	May affect, likely to adversely affect	Direct effects would be prevented by adherence to identification and avoidance measures during vegetation removal activities. Habitat removal would have an indirect effect on survival and reproductive success
<i>Catesbaea melanocarpa</i>	Subtropical dry forest, and remnants of dry forest, especially on limestone	May affect, likely to adversely affect	Direct effects would be prevented by adherence to identification and avoidance measures during vegetation removal activities. Habitat removal would have an indirect effect on survival and reproductive success
Puerto Rican senna	Sandy areas adjacent to mangroves, previously found associated with mangroves in southwest portion of former Navy lands, Vieques	May affect, likely to adversely affect	Direct effects would be prevented by adherence to identification and avoidance measures during vegetation removal activities. Habitat removal would have an indirect effect on survival and reproductive success
Puerto Rican manjack	Subtropical dry forest, dry limestone forest	May affect, likely to adversely affect	Direct effects would be prevented by adherence to identification and avoidance measures during vegetation removal activities. Habitat removal would have an indirect effect on survival and reproductive success
Woodbury's stopper	Remnants of dry forest. Currently known only from the Sierra Bermeja in the municipalities of Cabo Rojo and Lajas and from the Gunica Commonwealth Forest in Gunica, all in southwestern Puerto Rico, and subtropical dry forest life zone	May affect, likely to adversely affect	Direct effects would be prevented by adherence to identification and avoidance measures during vegetation removal activities. Habitat removal would have an indirect effect on survival and reproductive success
Beautiful goetzea	Forested areas within 50 meters of stream in alluvial soils, along quebradas or seasonal water courses, gallery forests	May affect, likely to adversely affect	Direct effects would be prevented by adherence to identification and avoidance measures during vegetation removal activities. Habitat removal would have an indirect effect on survival and reproductive success
<i>Leptocereus grantianus</i>	Endemic to Culebra, subtropical dry forest, dry coastal forest and coastal cliffs	May affect, likely to adversely affect	Direct effects would be prevented by adherence to identification and avoidance measures during vegetation removal activities. Habitat removal would have an indirect effect on survival and reproductive success
Cana gorda girdlepod	Open dry limestone forest with exposed rocky plateau	May affect, likely to adversely affect	Direct effects would be prevented by adherence to identification and avoidance measures during vegetation removal activities. Habitat removal would have an indirect effect on survival and reproductive success
Wheeler's peperomia	Shaded rocky forest (volcanic)	May affect, likely to adversely affect	Direct effects would be prevented by adherence to identification and avoidance measures during vegetation removal activities. Habitat removal would have an indirect effect on survival and reproductive success
Cóbana negra	Edge of salt flats in brackish, seasonally flooded wetlands, remnants of mangrove forests and salt flats	May affect, likely to adversely affect	Direct effects would be prevented by adherence to identification and avoidance measures during vegetation removal activities. Habitat removal would have an indirect effect on survival and reproductive success
St. Thomas pricklyash	Shaded rocky forest (volcanic) and dense pristine limestone forest	May affect, likely to adversely affect	Direct effects would be prevented by adherence to identification and avoidance measures during vegetation removal activities. Habitat removal would have an indirect effect on survival and reproductive success

1 - These are preliminary determinations of effect for Federal species and in the future may be further reviewed and adjusted on a site-specific basis when necessary.

TABLE 7-2
Summary of Potential Impacts to Puerto Rico Protected Species and VNWR Important Resources

Scientific Name	Habitat	Preliminary Potential for Impacts ¹	Basis of Conclusion
Birds			
White Cheeked Pintail	Freshwater and brackish coastal areas including mangrove forests	not expected to adversely impact	Adherence to avoidance measures would prevent direct impacts. Species has wide foraging range and ability to use other mangrove habitats/lagoons in eastern Vieques.
Snowy plover	Beaches, mudflats, and sandflats	not expected to adversely impact	Foraging/nesting habitat would not require vegetation removal. Avoidance measures during nearby vegetation removal activities would prevent direct disturbance of these activities.
West Indian Whistling Duck	Vieques lagoons (Laguna Kiani, Laguna Boca and Quebrada). Forested freshwater swamps and lakes, mangrove forests	not expected to adversely impact	Adherence to avoidance measures would prevent direct impacts. Many mangrove habitats/lagoons in eastern Vieques can support roosting of this species.
Yellow warbler	Vieques. Wetlands, edge of forests, areas with scattered trees, thick shrubs, and wet shady areas, mangrove forests	not expected to adversely impact	Adherence to avoidance measures would prevent direct impacts. Wide availability of forest types in eastern Vieques to support foraging/nesting.
Peregrine falcon	Cays and rocks surrounding the rocks, forests	not expected to adversely impact	Adherence to avoidance measures would prevent direct impacts. Perching or roosting habitat is widely available.
Caribbean Coot	Vieques. Freshwater and brackish marshes and swamps with sparse vegetation	not expected to adversely impact	Adherence to avoidance measures would prevent direct impacts. No adverse indirect impacts would occur.
Masked duck	Vieques (Laguna Zoni in freshwater and brackish water with floating vegetation), mangrove forests	not expected to adversely impact	Adherence to avoidance measures would prevent direct impacts. No adverse indirect impacts would occur.
Ruddy duck	Vieques in coastal bodies of freshwater with depths of more than three meters	not expected to adversely impact	Adherence to avoidance measures would prevent direct impacts. No adverse indirect impacts would occur.
Caribbean Brown Pelican	Roost and feed in coves, inlets, and lagoons of Vieques. Nests on Cayo Conejo, mangroves forests	not expected to adversely impact	Adherence to avoidance measures would prevent direct impacts. Wide availability of mangrove habitat in eastern Vieques to support roosting.
Terrestrial Mammals			
Brown flower bat	Hot caves, karst areas	not expected to adversely impact	Direct or indirect impacts to this cave roosting species is not expected.
Red fruit bat	Forested canopy, karst areas	not expected to adversely impact	Adherence to avoidance measures would prevent direct impacts. Limited potential for indirect impacts considering extensive foraging range.
Reptiles			
Slipperyback skink	Dry and moist subtropical forest under leaf litter, rocks, and tree trunks	may adversely impact	Adherence to avoidance measures would minimize direct impacts. Extensive vegetation removal in habitat where it occurs may adversely impact this species
Plants			
Guayacan, lignum vitae tree	Subtropical dry forest	may adversely impact	Direct effects would be prevented by adherence to identification and avoidance measures. Extensive vegetation removal in habitat where it occurs may adversely impact this species
Black ironwood tree	Subtropical dry forest	may adversely impact	Direct effects would be prevented by adherence to identification and avoidance measures. Extensive vegetation removal in habitat where it occurs may adversely impact this species
Caribbean mayten	Moist montane forest types, volcanic soils	may adversely impact	Direct effects would be prevented by adherence to identification and avoidance measures. Extensive vegetation removal in habitat where it occurs may adversely impact this species
Habitats			
	Sparse and thick thorn scrub	may adversely impact	Extensive vegetation removal will likely have moderate long-term impacts on this habitat which contains a mix of invasive an native species
	Mixed native/naturalized invasives	may adversely impact	Extensive vegetation removal will likely have moderate long-term impacts on this habitat which contains a mix of invasive an native species
	Entirely invasive species	not expected to adversely impact	Areas composed entirely of invasive species are presumed to recover relatively fast
	Mangrove forests	may adversely impact	Significant vegetation removal will likely have direct and long-term impacts on this habitat
	Evergreen scrub	may adversely impact	Significant vegetation removal will likely have direct and long-term impacts on this habitat
	Forest scrub/dry scrub forest/lowland forest	may adversely impact	Significant vegetation removal will likely have direct and long-term impacts on this habitat
	Gallery forests and quebradas	may adversely impact	Significant vegetation removal will likely have direct and long-term impacts on this habitat
	Inland lagoon	not expected to adversely impact	Open lagoon habitat would not require vegetation removal
	Mixed woodland/upland forest	may adversely impact	Significant vegetation removal will likely have direct and long-term impacts on this habitat
	Grassland	not expected to adversely impact	Cutting of grassland vegetation is not likely to adversely impact grassland habitat
	Bare ground	not expected to adversely impact	Vegetation removal in this habitat is not likely necessary or would be very limited
	Salt/sand flat	not expected to adversely impact	Groundcover removal in this habitat is not likely necessary or would be very limited
	Beach	may adversely impact	Vegetation removal will likely have direct but moderate impacts on this habitat

1 - These are preliminary determinations of potential impact for Puerto Rico protected species and VNWR important resources. In the future these may be furthered reviewed and adjusted on a site-specific basis when necessary.

SECTION 8

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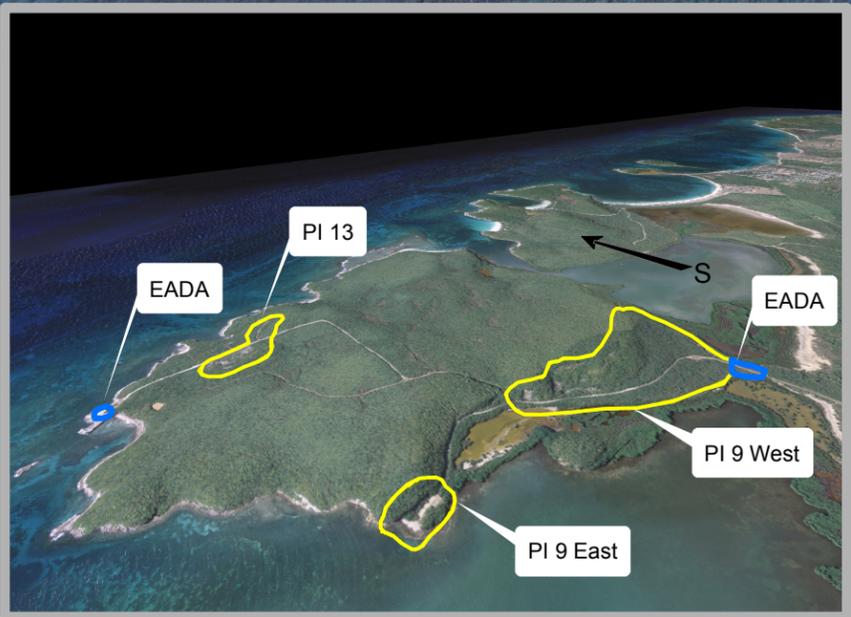
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Appendix A
UXO 15 Important and Distinct Habitats



- Legend**
- Debris Pile
 - Topographic Contour (USGS)
 - - 1 Meter Interval
 - 10 Meter Interval
 - Elevated Anomaly Density Area (EADA) from Digital Geophysical Mapping
 - PI Site
 - UXO15

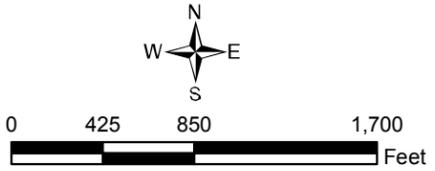


Figure 1
UXO 15 Biological Assessment
UXO 15 Overview
Former VNTR
Vieques, Puerto Rico

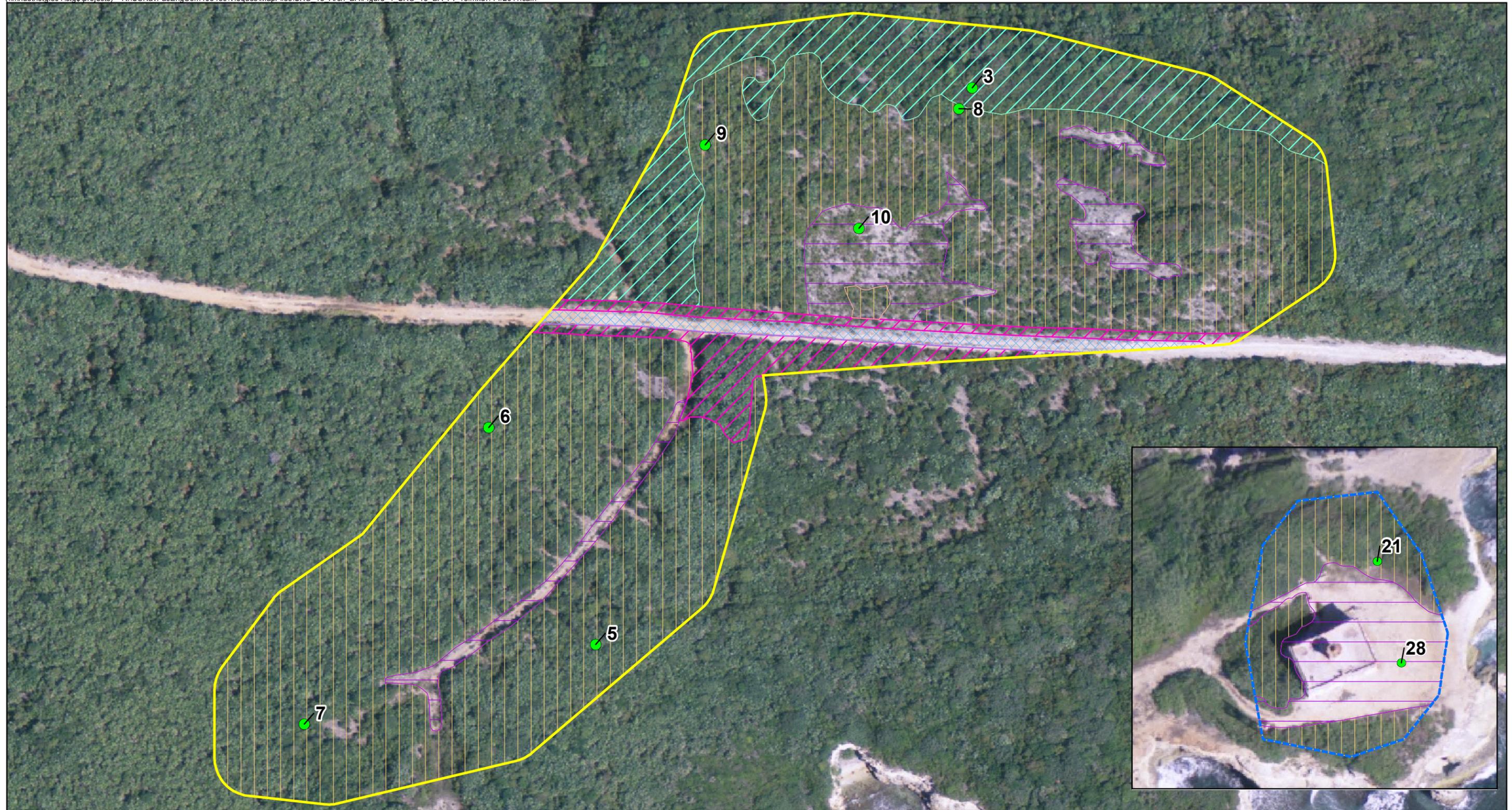


Legend

- Photo Point
- Elevated Anomaly Density Area (EADA) from Digital Geophysical Mapping
- PI 9 East
- PI 9 West
- 2007 Aerial Imagery
- Dry Scrub Forest
- Exposed Limestone
- Exposed Sand
- Giant Wild Pine (Air Plant)
- Invasive Vegetation
- Mangrove Forest
- Mixed Native and Invasive Vegetation
- Road
- Secondary Growth Forest



Figure 3
UXO 15 Biological Assessment
PI 9
Former VNTR
Vieques, Puerto Rico

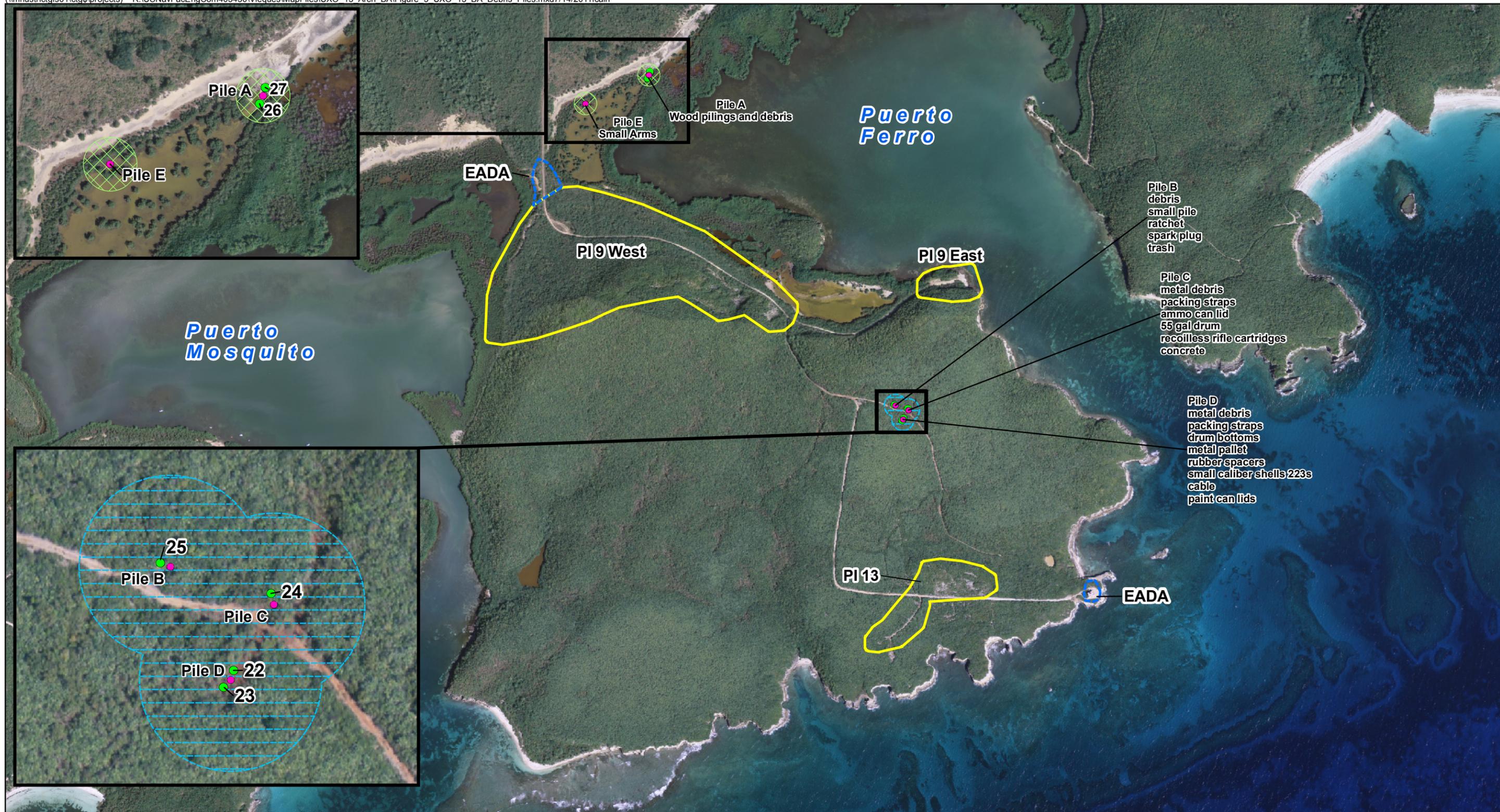


Legend

- Photo Point
- Elevated Anomaly Density Area (EADA) from Digital Geophysical Mapping
- PI 13
- Dry Scrub Forest
- Evergreen Scrub
- Exposed Limestone
- Invasive Vegetation
- Road



Figure 4
UXO 15 Biological Assessment
PI 13
Former VNTR
Vieques, Puerto Rico



- Legend**
- Debris Pile
 - Photo Point
 - ▨ Mangrove Forest
 - ▨ Mixed Native and Invasive Vegetation

- ▭ Elevated Anomaly Density Area (EADA) from Digital Geophysical Mapping
- ▭ PI Site

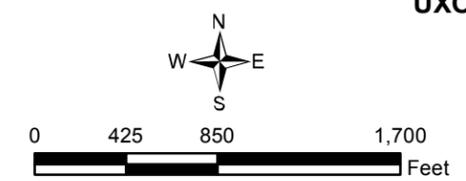
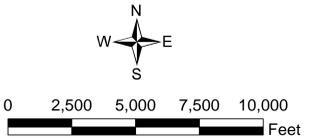
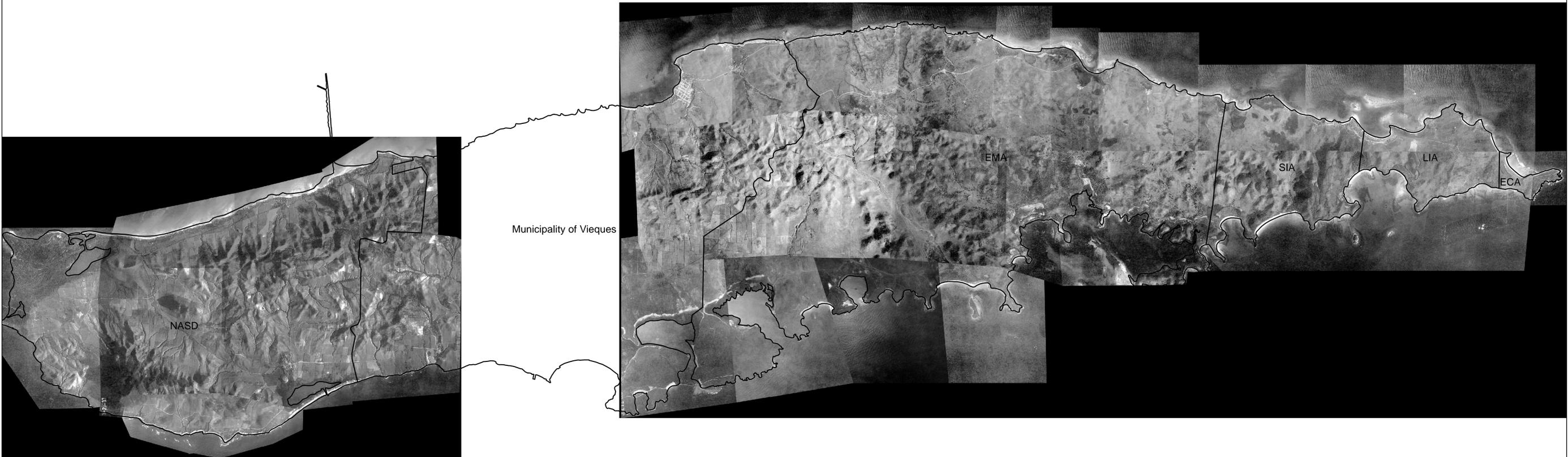
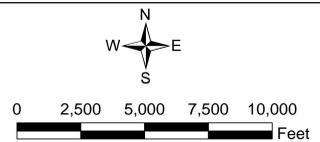
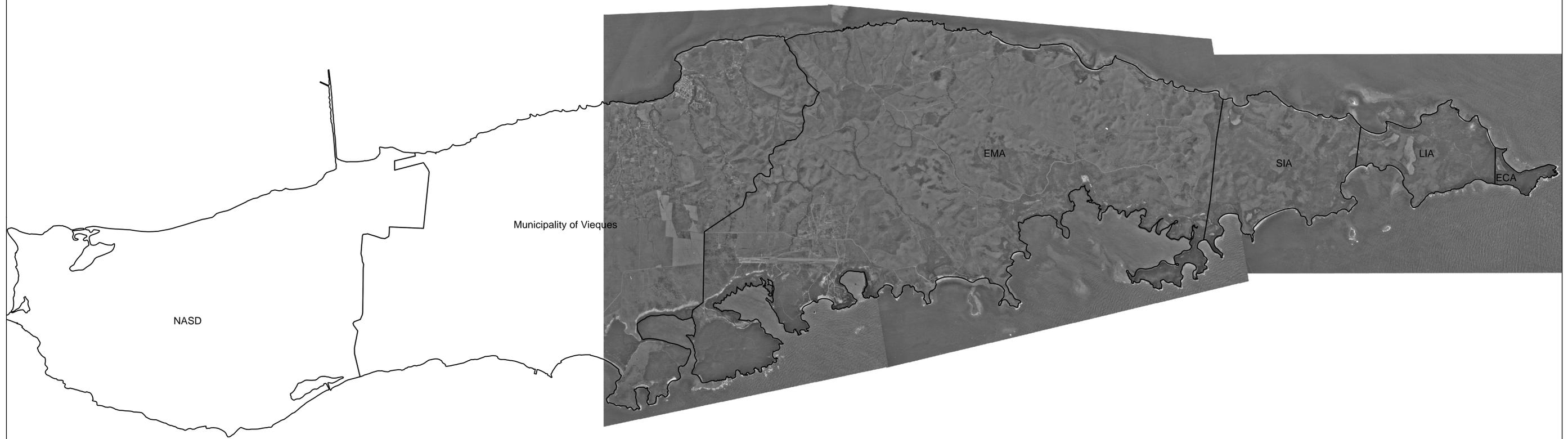


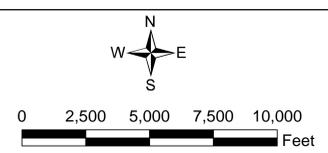
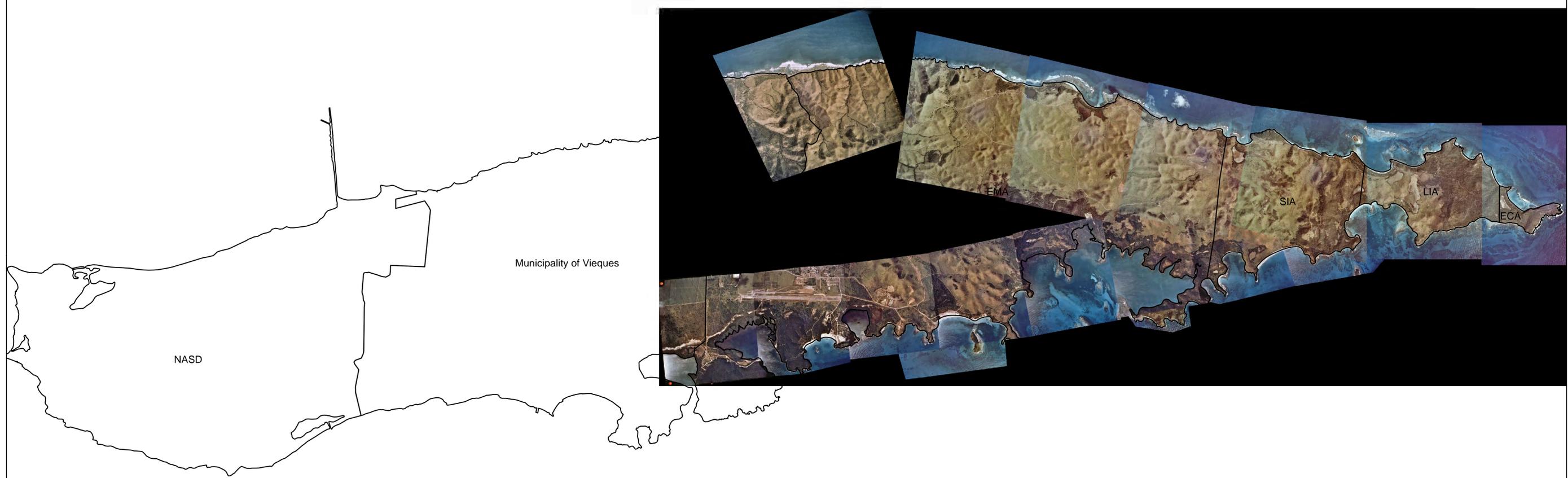
Figure 5
UXO 15 Biological Assessment
Debris Piles within UXO 15
Former VNTR
Vieques, Puerto Rico

Appendix B
Compendium of Historical Aerial Photography

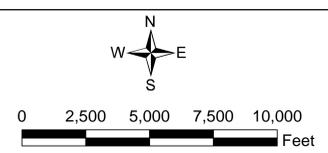
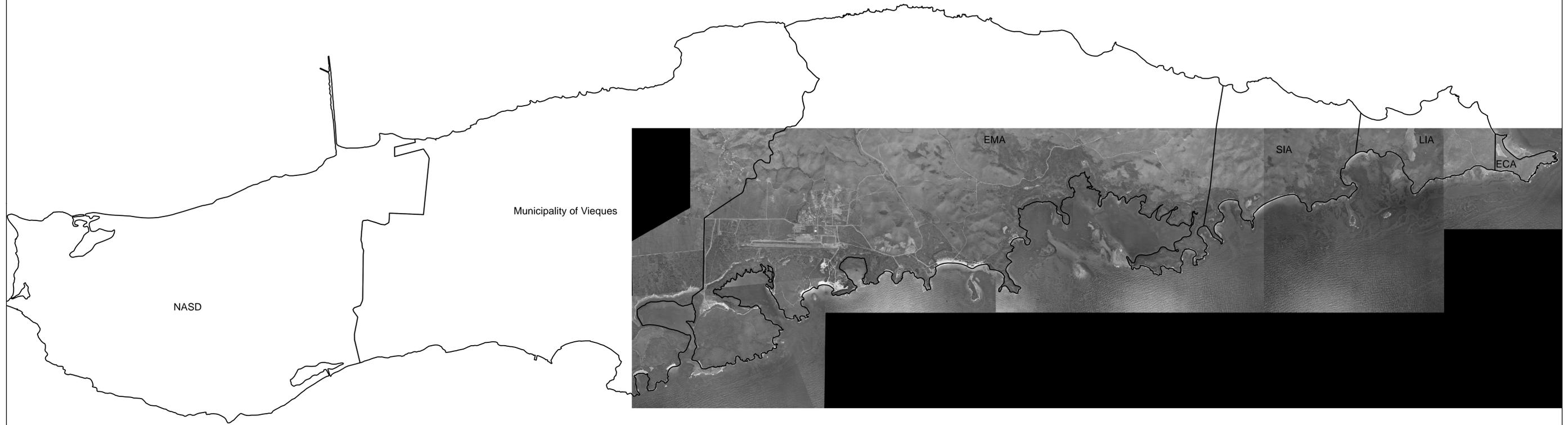




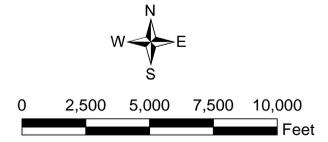
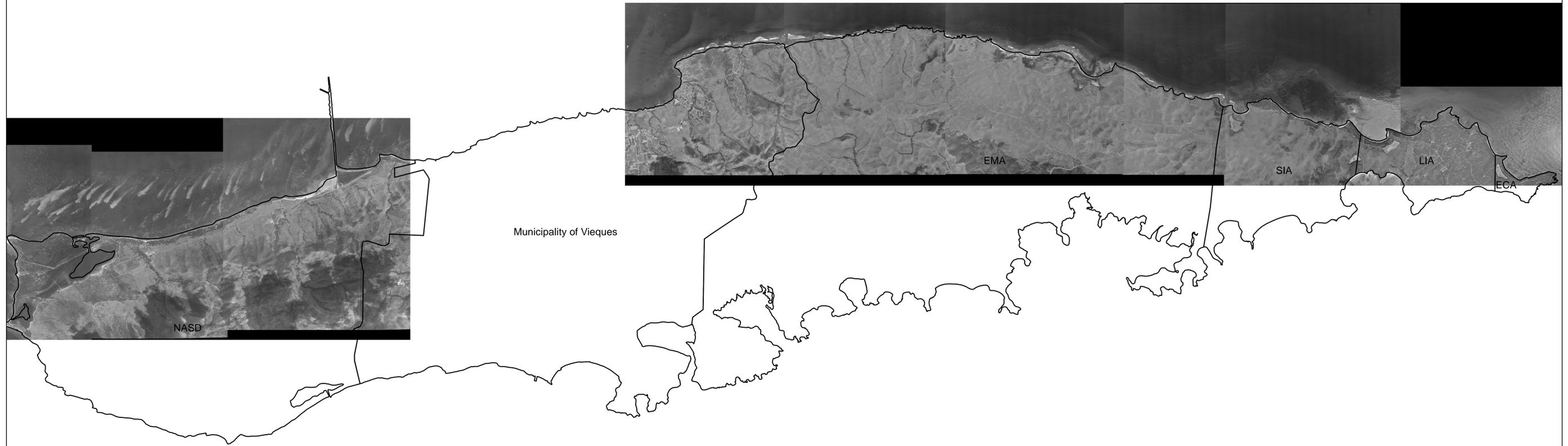
1959 Aerial Image
Vieques, Puerto Rico

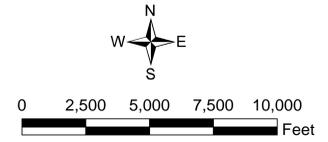
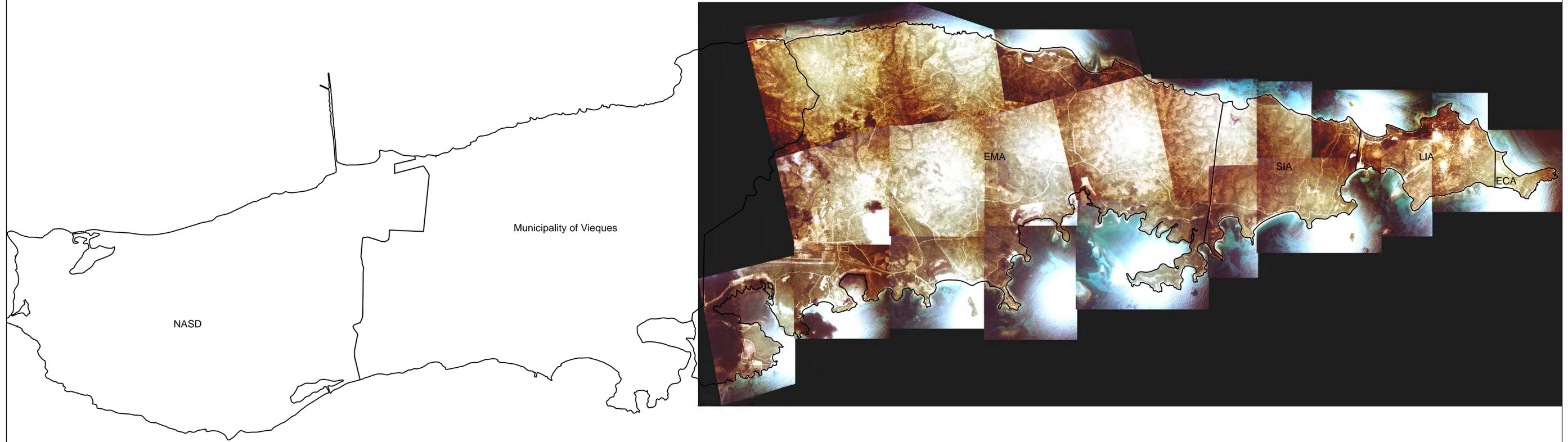


1962 Aerial Image
Vieques, Puerto Rico

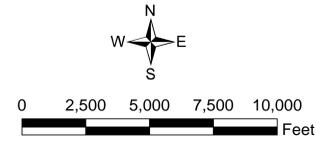
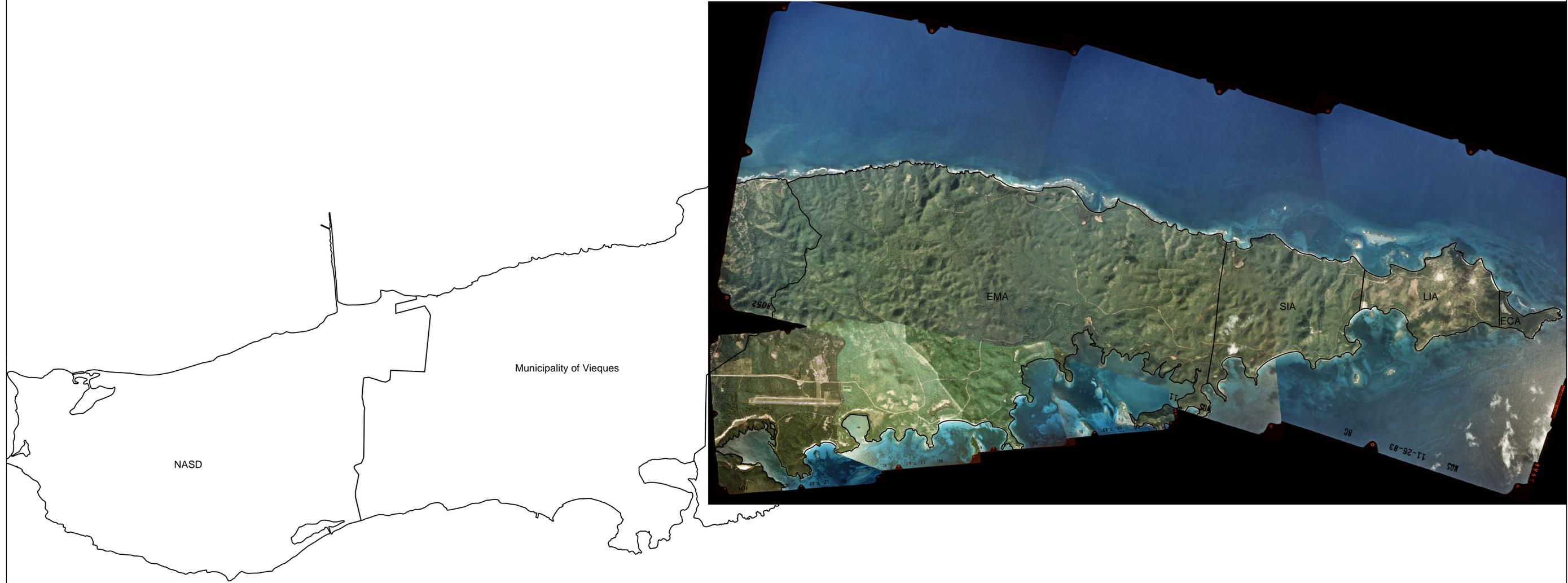


1964 Aerial Image
Vieques, Puerto Rico

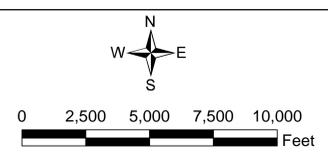
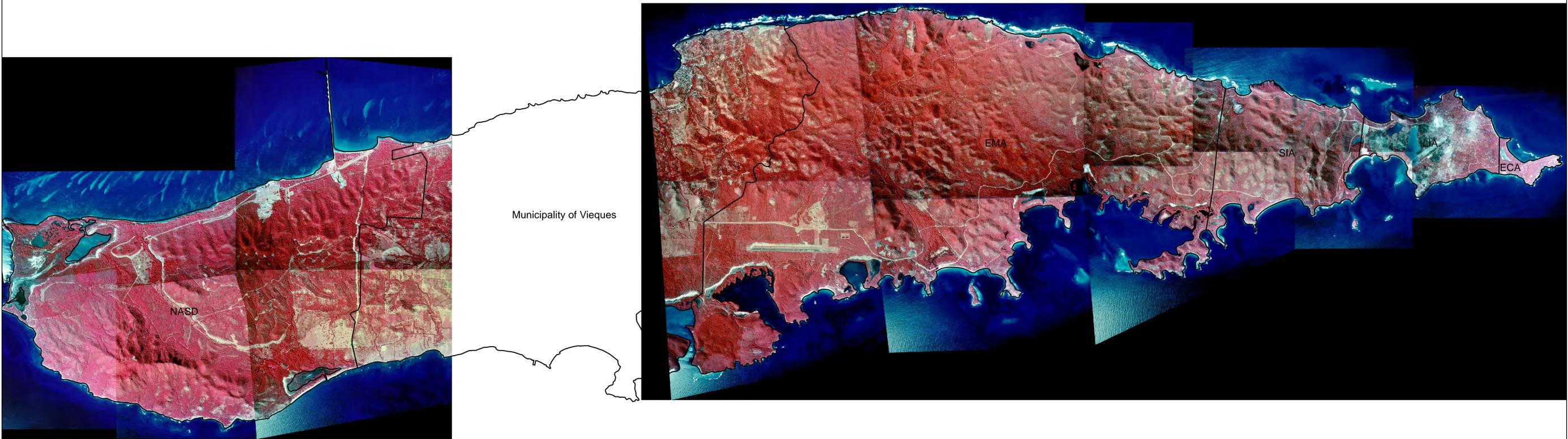




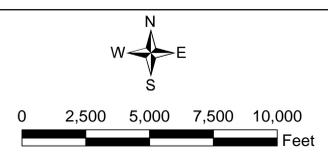
1970 Aerial Image
Vieques, Puerto Rico



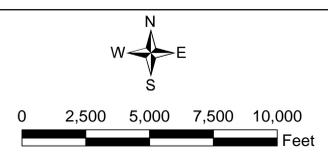
1983 Aerial Image
Vieques, Puerto Rico



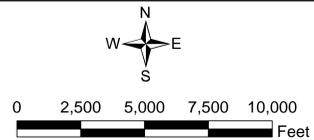
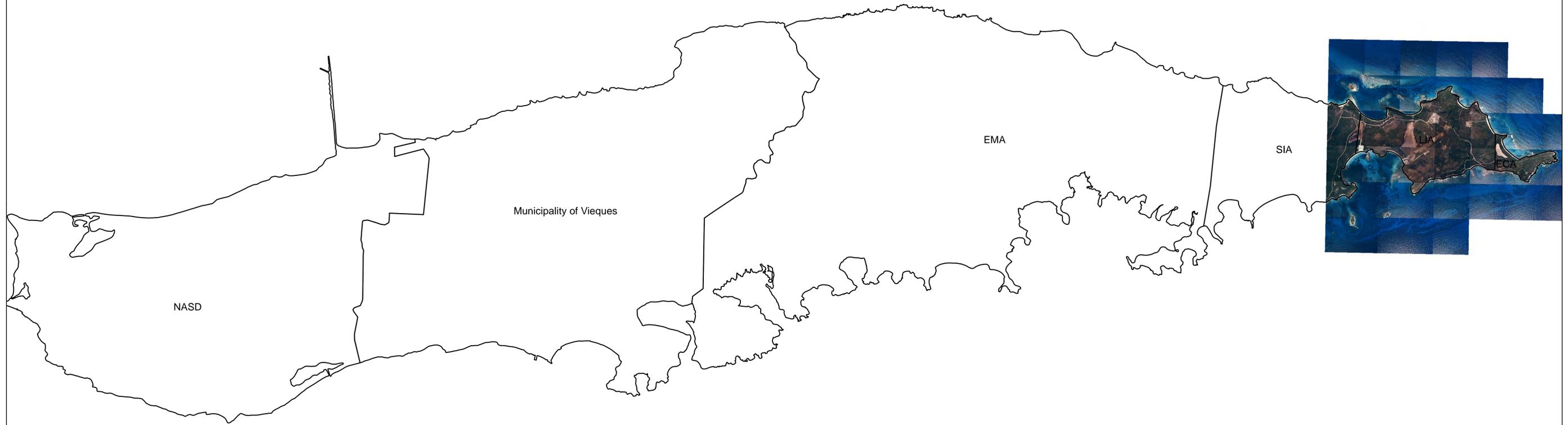
1985 Aerial Image
Vieques, Puerto Rico

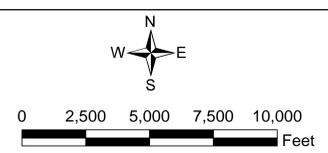
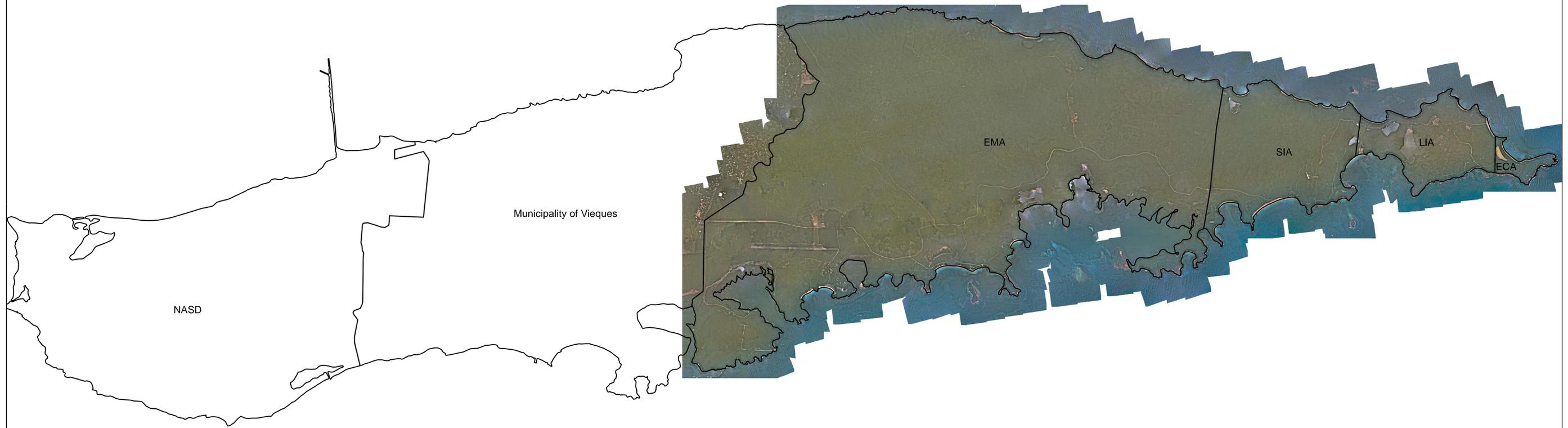


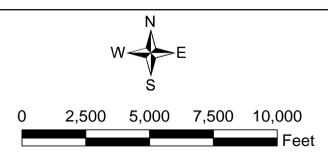
1994 Aerial Image
Vieques, Puerto Rico



1994 Aerial Image
Vieques, Puerto Rico

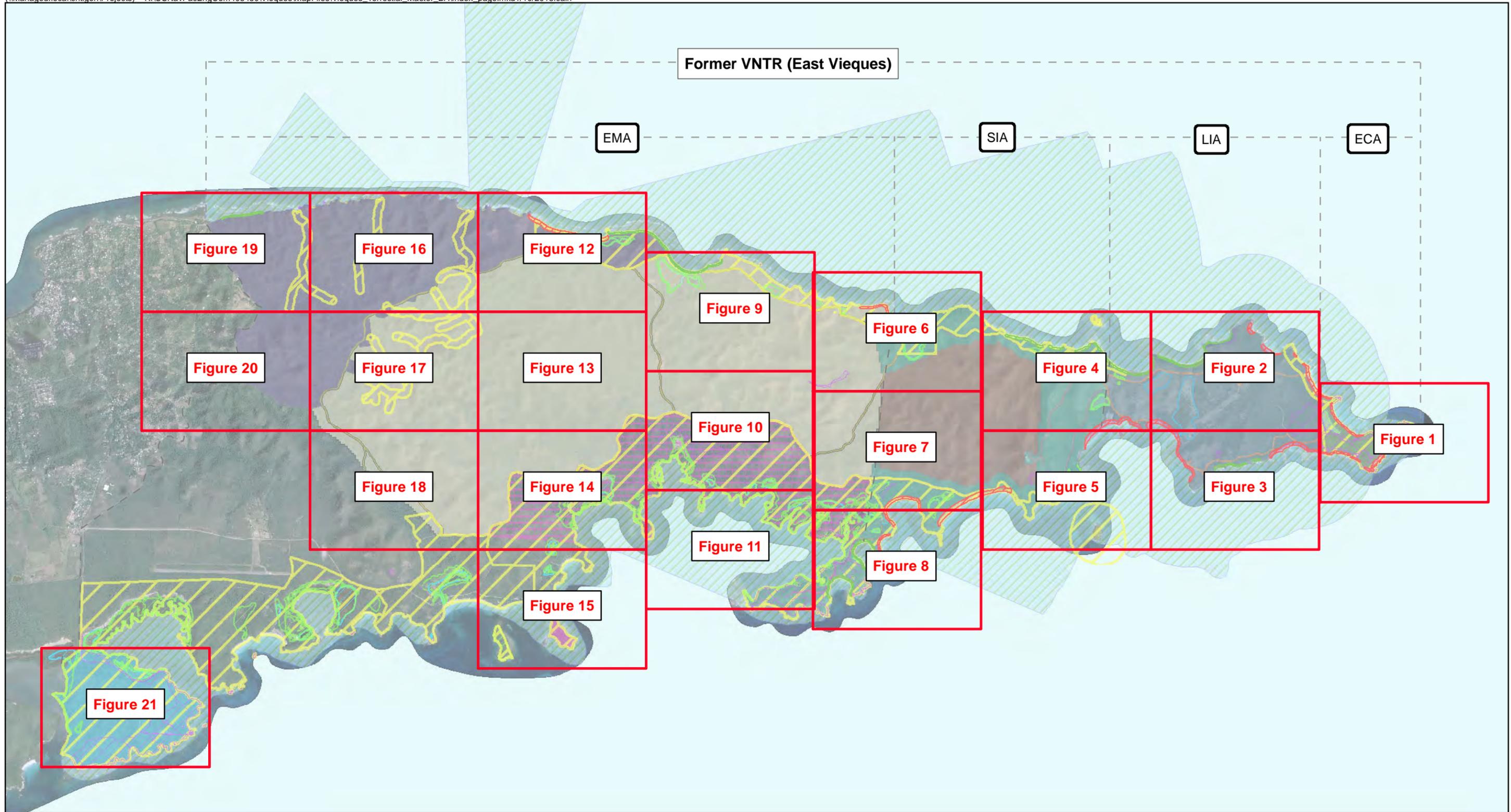






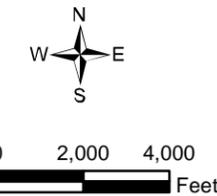
2007 Aerial Image
Vieques, Puerto Rico

Appendix C
Composite Maps of Important Habitats within the
Former AFWTF, UXO Sites, and Grid Map

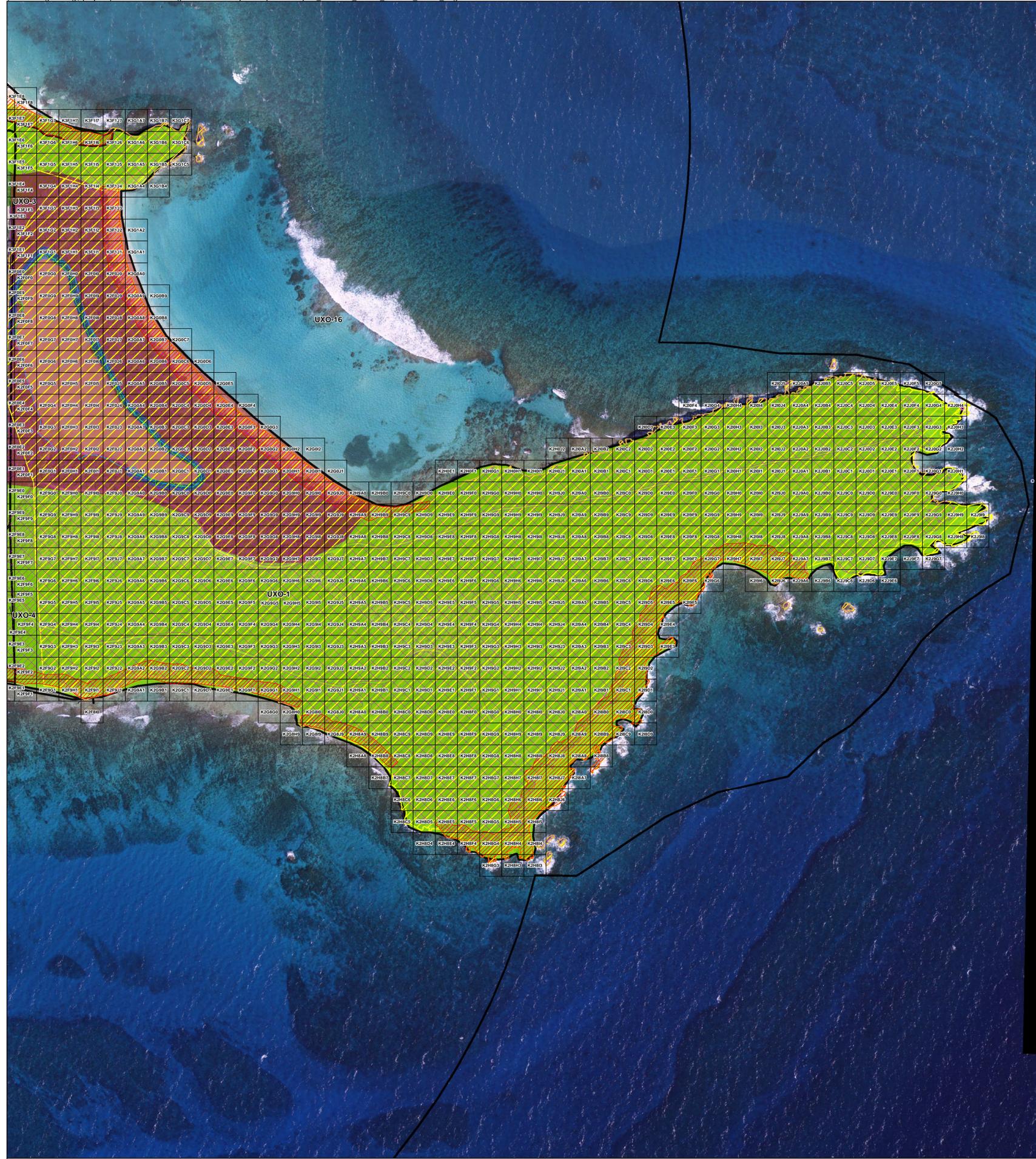


Legend

- | | | | | |
|--|--|-------------------------------|--|----------------------|
| Figure Extent | Mangrove Habitat (Red, White, Black, Button) | Undelineated Critical Habitat | Conservation Zone (Vieques INRMP 2003) | Lagoon |
| Turtle Beach Setbacks | Zone 2 - Minor Restrictions | Zone 3 - Major Restrictions | | |
| Munitions Response Sites | UXO 1 - ECA | UXO 2 - LIA Beaches | UXO 3 - LIA Roads | UXO 4 - LIA Interior |
| UXO 5 - SIA Restricted Roads | UXO 6 - EMA/SIA Public Roads | UXO 7 - EMA/SIA North Beaches | UXO 8 - SIA South Beaches | UXO 9 - SIA Exterior |
| UXO 10 - SIA Interior | UXO 11 - EMA Public Roads | UXO 12 - EMA Interior | UXO 13 - EMA West | UXO 14 - EMA South |
| UXO 15 - Puerto Ferro (Expanded Site Inspection) | UXO 16 - Underwater Areas | UXO 17 - PAOC EE | UXO 18 - Cayo de la Chiva | |



Index Map
*Biological Avoidance Plan for Terrestrial MEC and
 MC Investigations and Interim Removal Actions
 Former AFWTF (East Vieques)
 Vieques, Puerto Rico*



<p>Wildlife Observations</p> <ul style="list-style-type: none"> ● <i>Accipiter striatus</i>, 2010 ● <i>Anas bahamensis</i>, 2003 ● <i>Anas bahamensis</i>, 2010 ● <i>Fulica caribaea</i>, 2003 ● <i>Ocyura jamaicensis</i>, 2003 ● <i>Pelecanus occidentalis</i>, 2001 ● <i>Pelecanus occidentalis</i>, 2003 ● <i>Pelecanus occidentalis</i>, 2006 ● <i>Pelecanus occidentalis</i>, 2007 ● <i>Pelecanus occidentalis</i>, 2010 ● <i>Sterna dougalli</i>, 2003 ● <i>Sterna dougalli</i>, 2001 ● <i>Sterna dougalli</i>, 2006 	<p>Plant Observations</p> <ul style="list-style-type: none"> ○ <i>Chamaecrista glandulosa</i> ○ <i>Psychotria maccounelliae</i> ○ <i>Eugenia cordata</i> ○ <i>Eugenia sesaliflora</i> ○ <i>Guaiacum officinale</i> ○ <i>Melipha woodburyana</i> ○ <i>Myrciaria floribunda</i> ○ <i>Psychotria maccounelliae</i> ○ <i>Schoepfia schreberi</i> ○ <i>Stahliia monosperma</i> ○ <i>Ximenesia americana</i> ○ <i>Zanthoxylum puritatum</i> 	<p>Turtle Beach Setbacks</p> <ul style="list-style-type: none"> Zone 2 - Minor Restrictions Zone 3 - Major Restrictions 	<p>General Habitats</p> <ul style="list-style-type: none"> Evergreen Scrub Gallery Forest Forest Scrub/Dry Scrub Forest/Lowland Forest Mangrove Forest Mixed Woodland/Upland Forest Salt/Sand Flat Inland Lagoon
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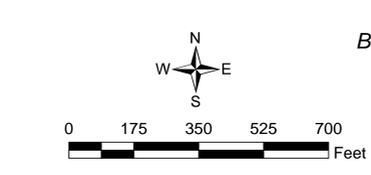
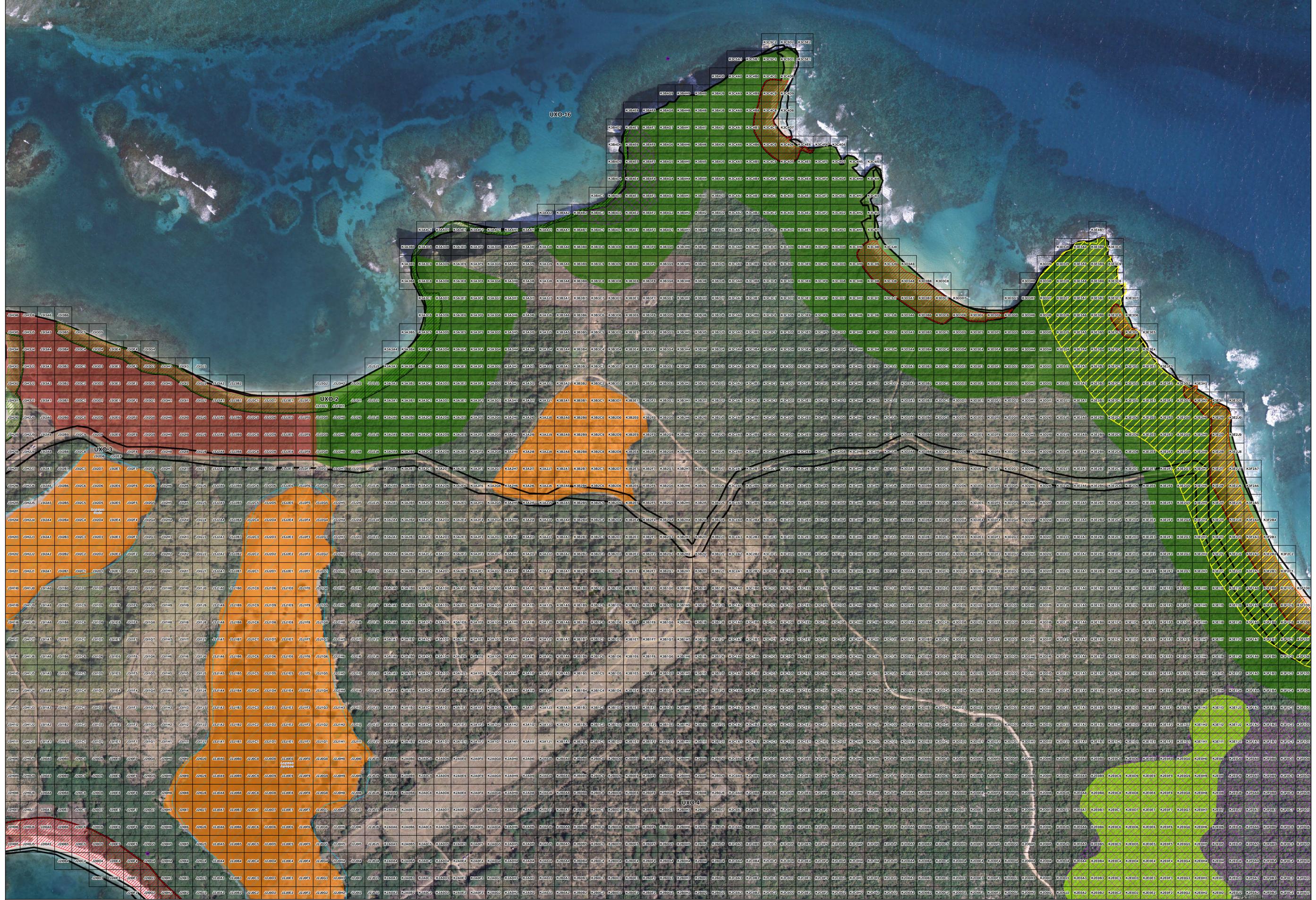


Figure 1
 Biological Avoidance Plan for Terrestrial MEC and
 MC Investigations and Interim Removal Actions
 Former AFWTF (East Vieques)
 Vieques, Puerto Rico

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<p>Wildlife Observations</p> <ul style="list-style-type: none"> ● <i>Accipiter striatus</i>, 2010 ● <i>Anas bahamensis</i>, 2003 ● <i>Anas bahamensis</i>, 2010 ● <i>Fulica caribaea</i>, 2003 ● <i>Oxyura jamaicensis</i>, 2003 ● <i>Pelecanus occidentalis</i>, 2001 ● <i>Pelecanus occidentalis</i>, 2003 ● <i>Pelecanus occidentalis</i>, 2006 ● <i>Pelecanus occidentalis</i>, 2007 ● <i>Pelecanus occidentalis</i>, 2010 ● <i>Sterna dougalli</i>, 2003 ● <i>Sterna dougalli</i>, 2001 ● <i>Sterna dougalli</i>, 2006 	<p>Plant Observations</p> <ul style="list-style-type: none"> ○ <i>Myrciaria floribunda</i> ○ <i>Psychotria maccoulliae</i> ○ <i>Eugenia cordata</i> ○ <i>Eugenia sesalifera</i> ○ <i>Guaiacum officinale</i> ○ <i>Melipha woodburyana</i> ○ <i>Ximenesia americana</i> ○ <i>Zanthoxylum punctatum</i> ■ <i>Chaenactis glandulosa</i> ■ <i>Goetzea elegans</i> ■ <i>Psychotria maccoulliae</i> ■ <i>Stachytarpheta</i> 	<p>Turtle Beach Setbacks</p> <ul style="list-style-type: none"> ■ Zone 2 - Minor Restrictions ■ Zone 3 - Major Restrictions 	<p>General Habitats</p> <ul style="list-style-type: none"> ■ Evergreen Scrub ■ Gallery Forest ■ Forest Scrub/Dry Scrub Forest/Lowland Forest ■ Mangrove Forest ■ Mixed Woodland/Upland Forest ■ Salt/Sand Flat ■ Inland Lagoon
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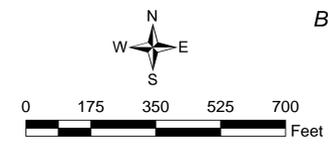
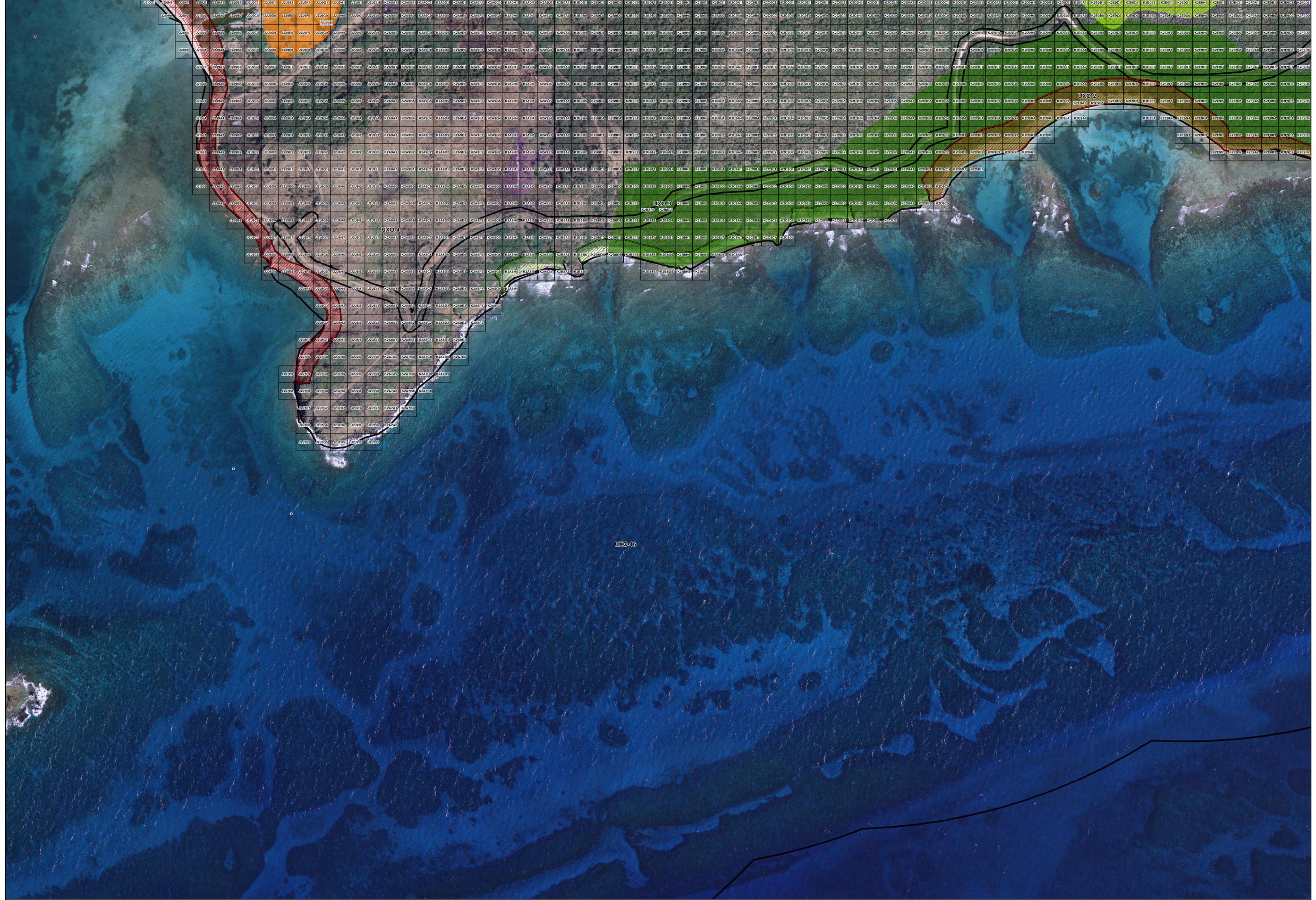


Figure 2
Biological Avoidance Plan for Terrestrial MEC and MC Investigations and Interim Removal Actions
 Former AFWTF (East Vieques)
 Vieques, Puerto Rico

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Wildlife Observations <ul style="list-style-type: none"> ● <i>Accipiter striatus</i>, 2010 ● <i>Anas bahamensis</i>, 2003 ● <i>Anas bahamensis</i>, 2010 ● <i>Fulica caribaea</i>, 2003 ● <i>Ocyura jamaicensis</i>, 2003 ● <i>Pelecanus occidentalis</i>, 2001 ● <i>Pelecanus occidentalis</i>, 2003 ● <i>Pelecanus occidentalis</i>, 2006 ● <i>Pelecanus occidentalis</i>, 2007 ● <i>Pelecanus occidentalis</i>, 2010 ● <i>Sterna dougalli</i>, 2001 ● <i>Sterna dougalli</i>, 2003 ● <i>Sterna dougalli</i>, 2006 	Plant Observations <ul style="list-style-type: none"> ○ <i>Chamaecrista glandulosa</i> ○ <i>Eugenia cordata</i> ○ <i>Eugenia sesaliflora</i> ○ <i>Guaiacum officinale</i> ○ <i>Melipha woodburyana</i> ○ <i>Myrciaria floribunda</i> ○ <i>Psychotria maccouelliae</i> ○ <i>Schoepfia schreberi</i> ○ <i>Stachnia monoperma</i> ○ <i>Ximenesia americana</i> ○ <i>Zanthoxylum puritatum</i> ■ <i>Chamaecrista glandulosa</i> ■ <i>Goetzea elegans</i> ■ <i>Psychotria maccouelliae</i> ■ <i>Stachnia monoperma</i> 	<ul style="list-style-type: none"> ■ Mangrove Habitat (Red, White, Black, Button) ■ Undelineated Critical Habitat ■ Conservation Zone (Vieques INRMP 2003) ■ 30 Meter Grid ■ UXO Site 	Turtle Beach Setbacks <ul style="list-style-type: none"> ■ Zone 2 - Minor Restrictions ■ Zone 3 - Major Restrictions 	General Habitats <ul style="list-style-type: none"> ■ Evergreen Scrub ■ Gallery Forest ■ Forest Scrub/Dry Scrub Forest/Lowland Forest ■ Mangrove Forest ■ Mixed Woodland/Upland Forest ■ Salt/Sand Flat ■ Inland Lagoon
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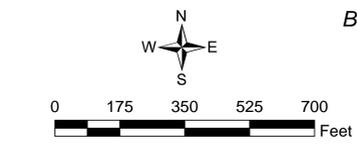
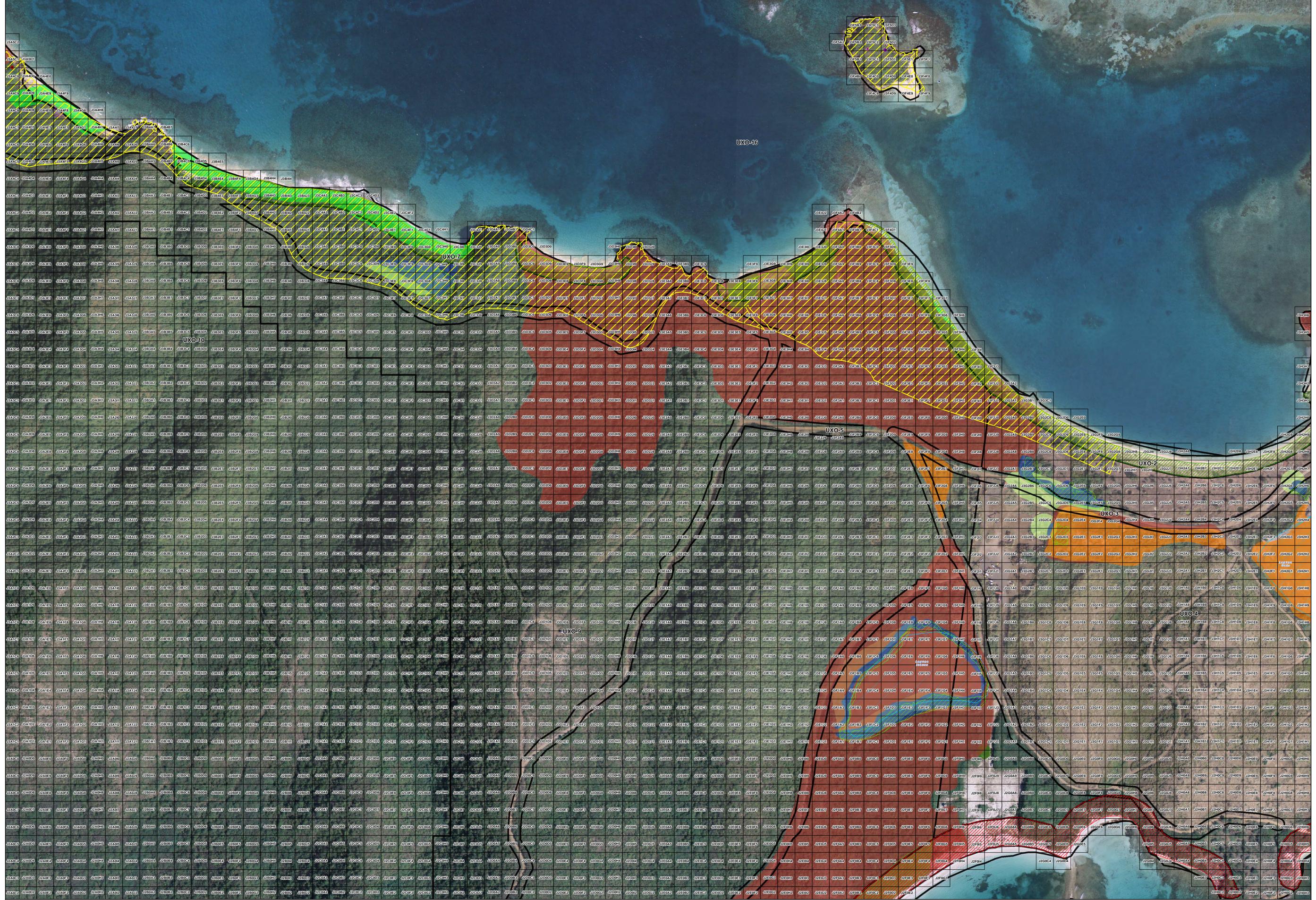


Figure 3
 Biological Avoidance Plan for Terrestrial MEC and MC Investigations and Interim Removal Actions Former AFWTF (East Vieques) Vieques, Puerto Rico
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Wildlife Observations <ul style="list-style-type: none"> ● <i>Accipiter striatus</i>, 2010 ● <i>Anas bahamensis</i>, 2003 ● <i>Anas bahamensis</i>, 2010 ● <i>Fulica caribaea</i>, 2003 ● <i>Oxyura jamaicensis</i>, 2003 ● <i>Pelecanus occidentalis</i>, 2001 ● <i>Pelecanus occidentalis</i>, 2003 ● <i>Pelecanus occidentalis</i>, 2006 ● <i>Pelecanus occidentalis</i>, 2007 ● <i>Pelecanus occidentalis</i>, 2010 ● <i>Sterna dougalli</i>, 2003 ● <i>Sterna dougalli</i>, 2001 ● <i>Sterna dougalli</i>, 2006 	Plant Observations <ul style="list-style-type: none"> ○ <i>Chamaecrista glandulosa</i> ○ <i>Psychotria macconnelliae</i> ○ <i>Eugenia cordata</i> ○ <i>Eugenia sessiliflora</i> ○ <i>Guaiacum officinale</i> ○ <i>Melipha woodburyana</i> ○ <i>Myrciaria floribunda</i> ○ <i>Psychotria macconnelliae</i> ○ <i>Schoepfia schreberii</i> ○ <i>Stachia monosperma</i> ○ <i>Ximenesia americana</i> ○ <i>Zanthoxylum punctatum</i> 	Turtle Beach Setbacks <ul style="list-style-type: none"> Zone 2 - Minor Restrictions Zone 3 - Major Restrictions 	General Habitats <ul style="list-style-type: none"> Evergreen Scrub Gallery Forest Forest Scrub/Dry Scrub Forest/Lowland Forest Mangrove Forest Mixed Woodland/Upland Forest Salt/Sand Flat Inland Lagoon
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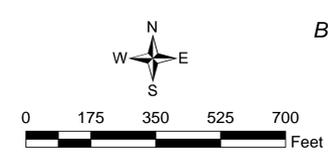
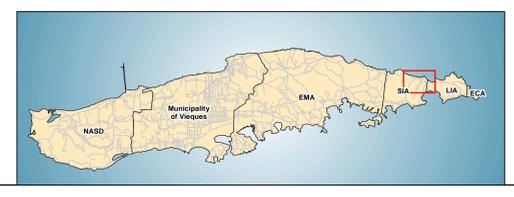


Figure 4
Biological Avoidance Plan for Terrestrial MEC and MC Investigations and Interim Removal Actions Former AFWTF (East Vieques) Vieques, Puerto Rico
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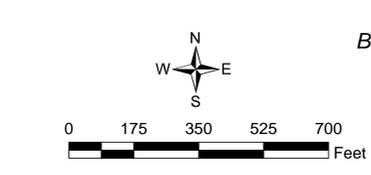
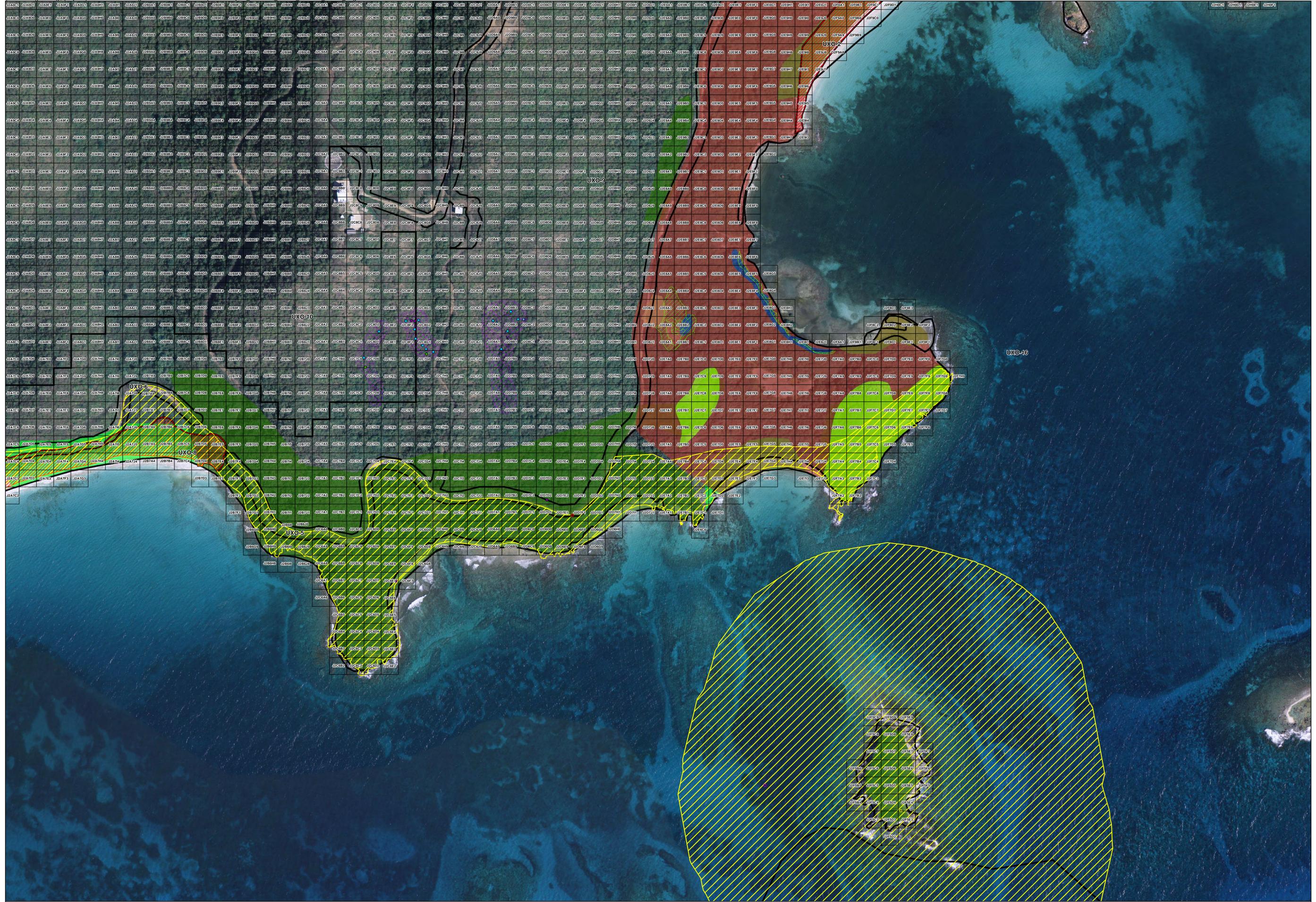
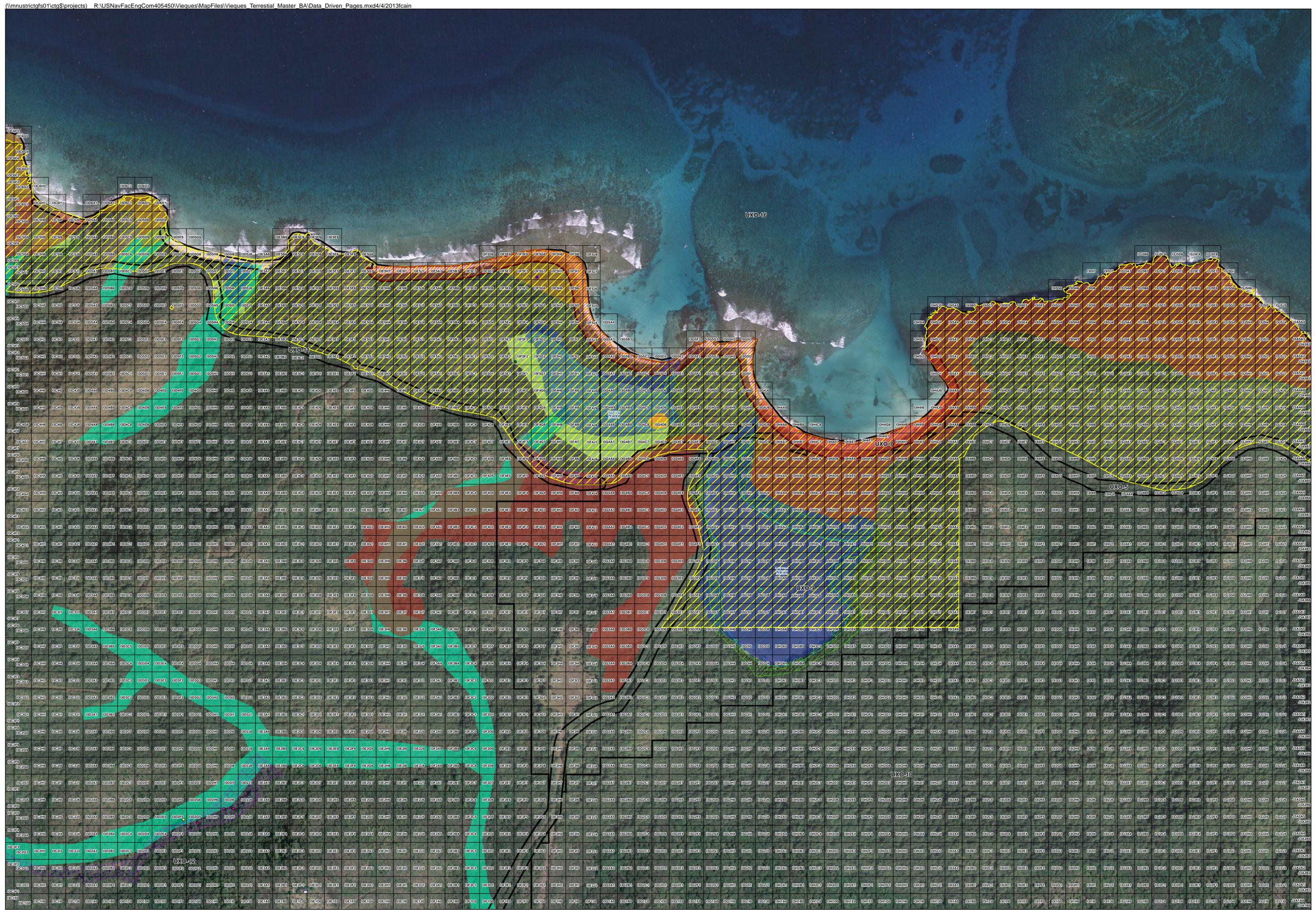


Figure 5
 Biological Avoidance Plan for Terrestrial MEC and
 MC Investigations and Interim Removal Actions
 Former AFWTF (East Vieques)
 Vieques, Puerto Rico



N
W
E
S

0 175 350 525 700 Feet

Figure 6
Biological Avoidance Plan for Terrestrial MEC and MC Investigations and Interim Removal Actions
Former AFWTF (East Vieques)
Vieques, Puerto Rico

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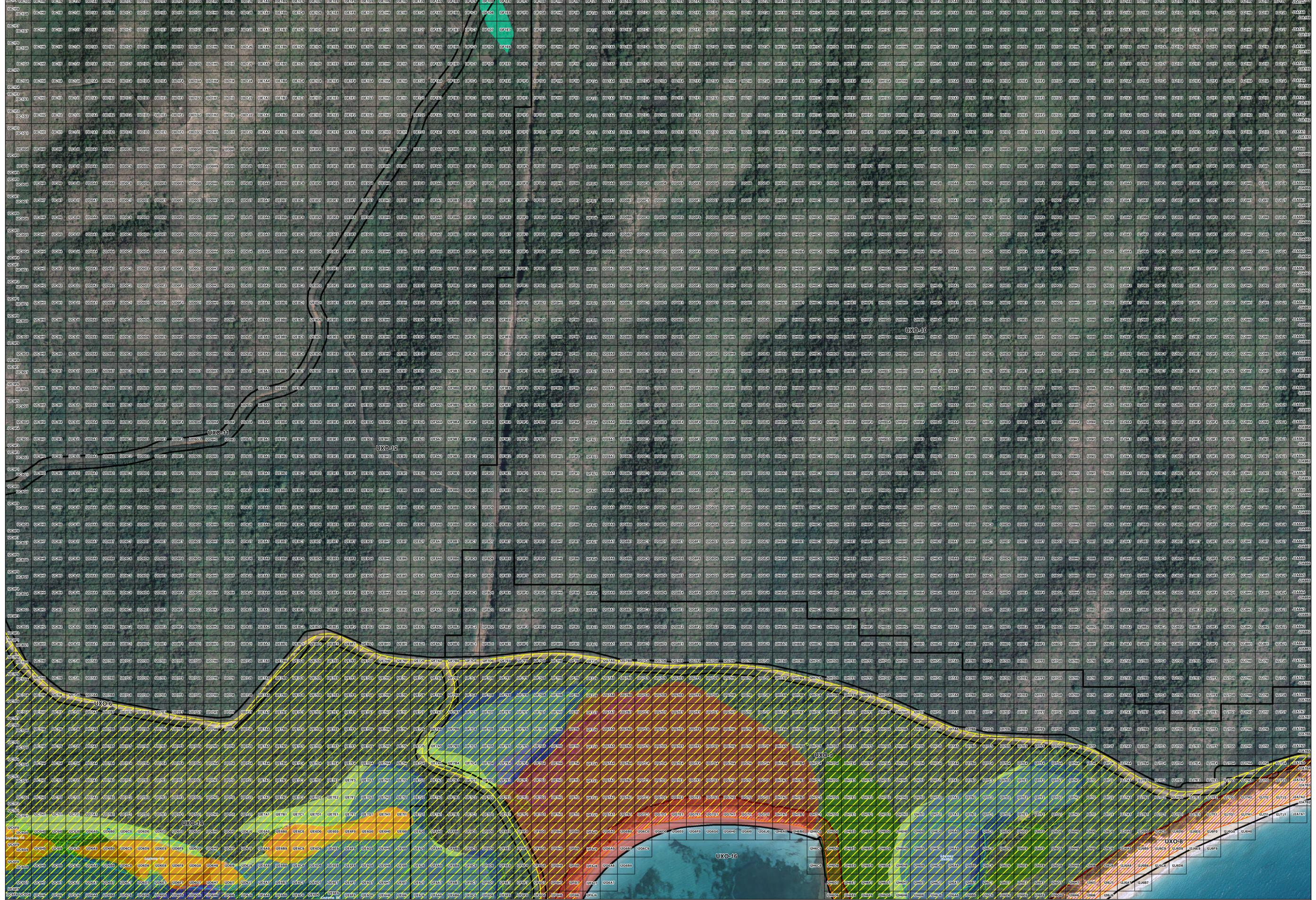


Figure 7
Biological Avoidance Plan for Terrestrial MEC and MC Investigations and Interim Removal Actions
Former AFWTF (East Vieques)
Vieques, Puerto Rico

0 175 350 525 700 Feet

CH2MHILL

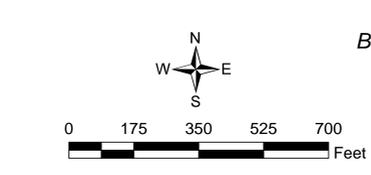
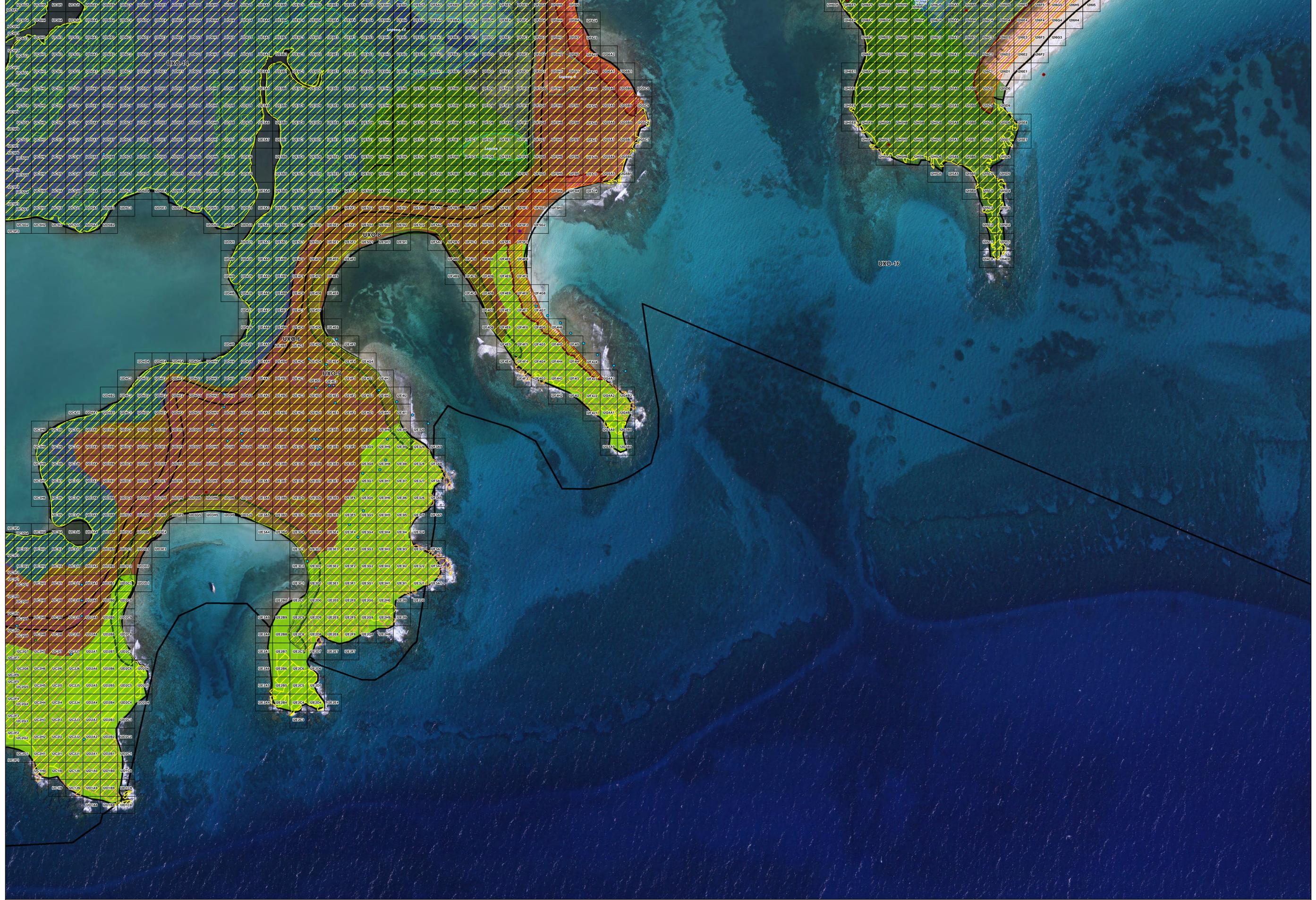
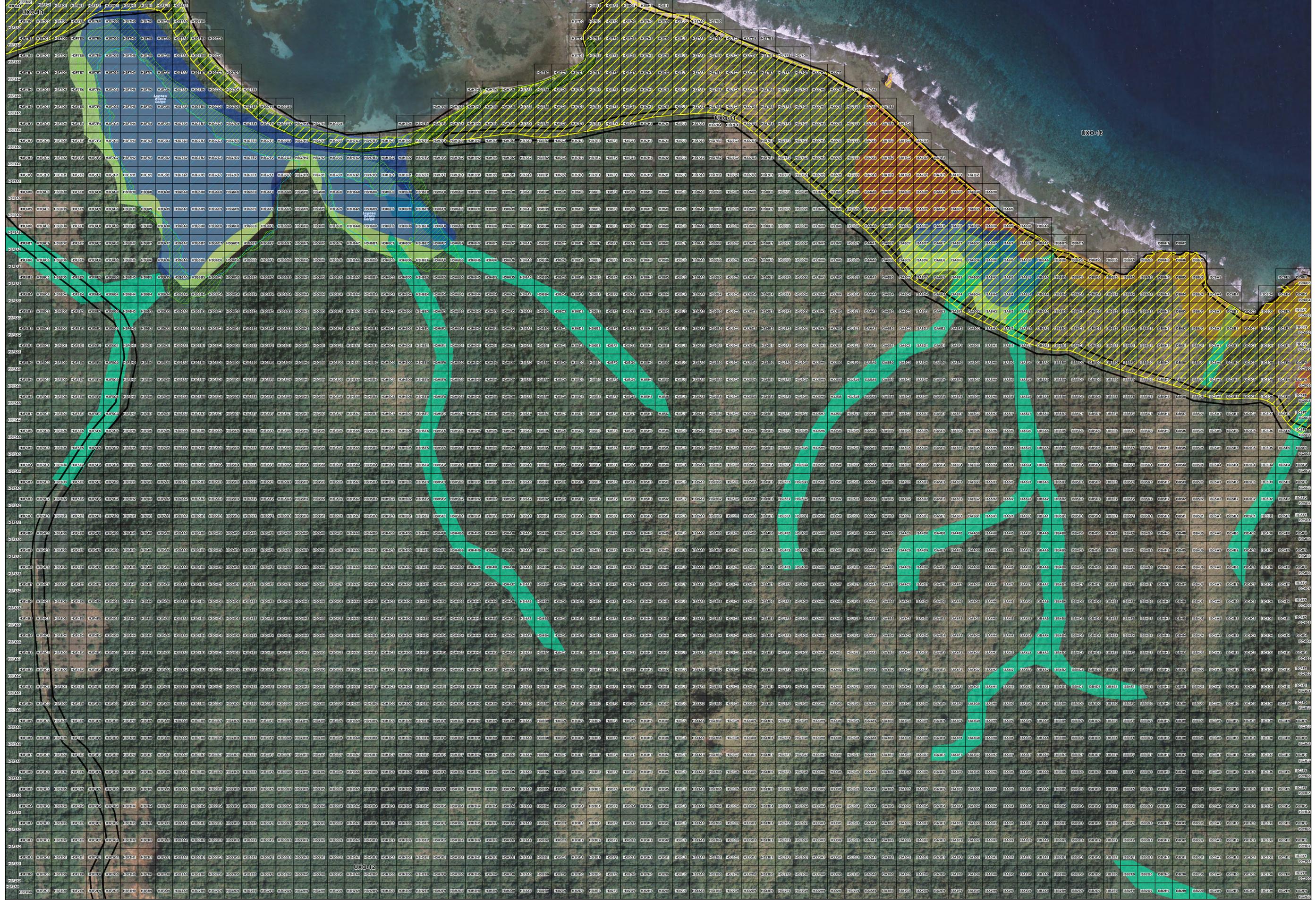


Figure 8
 Biological Avoidance Plan for Terrestrial MEC and
 MC Investigations and Interim Removal Actions
 Former AFWTF (East Veiques)
 Veiques, Puerto Rico

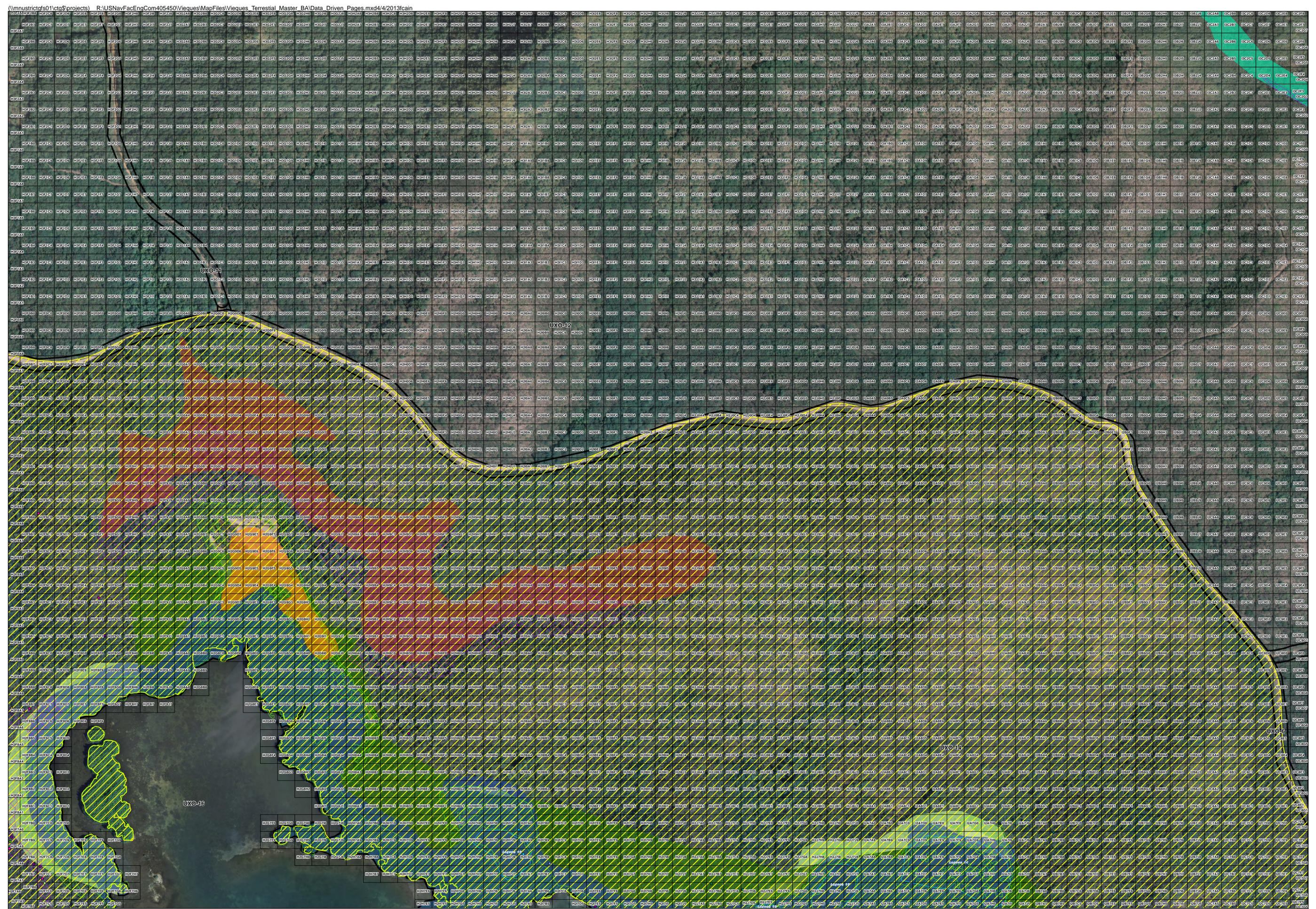


Wildlife Observations <ul style="list-style-type: none"> ● <i>Accipiter striatus</i>, 2010 ● <i>Anas bahamensis</i>, 2003 ● <i>Anas bahamensis</i>, 2010 ● <i>Falca caribbaea</i>, 2003 ● <i>Ocyura jamaicensis</i>, 2003 ● <i>Pelecanus occidentalis</i>, 2001 ● <i>Pelecanus occidentalis</i>, 2003 ● <i>Pelecanus occidentalis</i>, 2006 ● <i>Pelecanus occidentalis</i>, 2007 ● <i>Pelecanus occidentalis</i>, 2010 ● <i>Sterna dougalli</i>, 2003 ● <i>Sterna dougalli</i>, 2001 ● <i>Sterna dougalli</i>, 2006 	Plant Observations <ul style="list-style-type: none"> ● <i>Chamaecrista glandulosa</i> ● <i>Psychotria macconelliae</i> ● <i>Eugenia cordata</i> ● <i>Scaevola prostrata</i> ● <i>Stachya monoperma</i> ● <i>Guaiacum officinale</i> ● <i>Melipha woodburyana</i> ● <i>Zanthoxylum punctatum</i> 	Mycelia floribunda <ul style="list-style-type: none"> ● <i>Chamaecrista glandulosa</i> ● <i>Psychotria macconelliae</i> ● <i>Eugenia cordata</i> ● <i>Scaevola prostrata</i> ● <i>Stachya monoperma</i> ● <i>Guaiacum officinale</i> ● <i>Melipha woodburyana</i> ● <i>Zanthoxylum punctatum</i> 	Turtle Beach Setbacks <ul style="list-style-type: none"> Zone 2 - Minor Restrictions Zone 3 - Major Restrictions 	General Habitats <ul style="list-style-type: none"> Evergreen Scrub Gallery Forest Forest Scrub/Dry Scrub Forest/Lowland Forest Mangrove Forest Mixed Woodland/Upland Forest Salt/Sand Flat Inland Lagoon
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Figure 9
Biological Avoidance Plan for Terrestrial MEC and MC Investigations and Interim Removal Actions
 Former AFWTF (East Vieques)
 Vieques, Puerto Rico

0 175 350 525 700 Feet

CH2MHILL



Wildlife Observations

- Pelecanus occidentalis*, 2003
- Accipiter striatus*, 2010
- Anas bahamensis*, 2003
- Anas bahamensis*, 2010
- Fulica caribaea*, 2003
- Oxyura jamaicensis*, 2003
- Pelecanus occidentalis*, 2001
- Pelecanus occidentalis*, 2006
- Pelecanus occidentalis*, 2007
- Pelecanus occidentalis*, 2010
- Sterna dougalli*, 2003
- Sterna dougalli*, 2001
- Sterna dougalli*, 2006

Plant Observations

- Chamaecrista glandulosa*
- Eugenia cordata*
- Eugenia sesalifera*
- Guaiacum officinale*
- Melipha woodburyana*
- Zanthoxylum punctatum*
- Myrciaria floribunda*
- Psychyllis macconnelliae*
- Schoepfia schreberii*
- Stachya monosperma*
- Ximenesia americana*
- Zanthoxylum punctatum*

Turtle Beach Setbacks

- Zone 2 - Minor Restrictions
- Zone 3 - Major Restrictions

General Habitats

- Evergreen Scrub
- Gallery Forest
- Forest Scrub/Dry Scrub Forest/Lowland Forest
- Mangrove Forest
- Mixed Woodland/Upland Forest
- Salt/Sand Flat
- Inland Lagoon

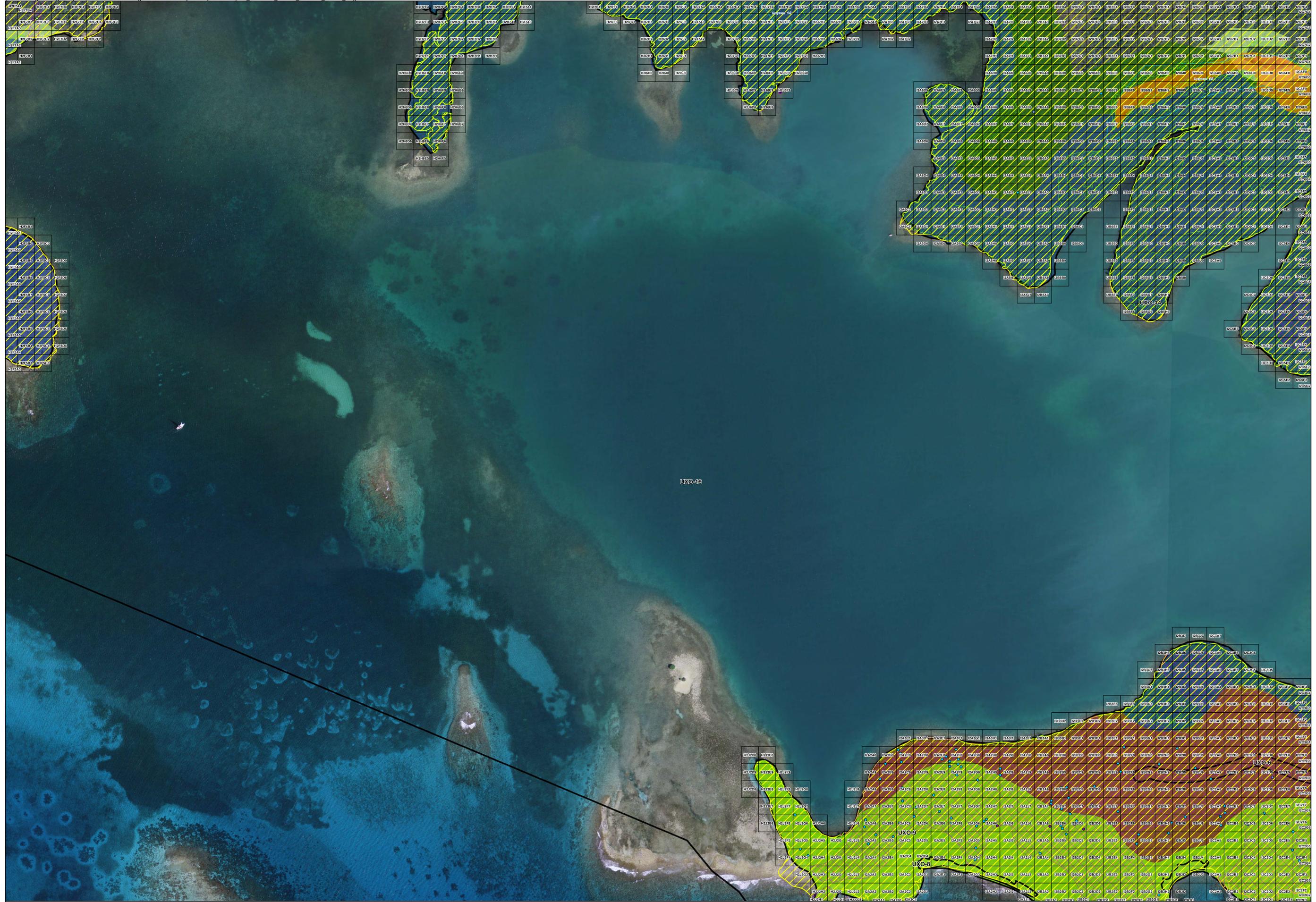
Other Symbols:

- Mangrove Habitat (Red, White, Black, Button)
- Undelineated Critical Habitat
- Conservation Zone (Vieques INRMP 2003)
- 30 Meter Grid
- UXO Site

Figure 10
 Biological Avoidance Plan for Terrestrial MEC and MC Investigations and Interim Removal Actions
 Former AFWTF (East Vieques)
 Vieques, Puerto Rico

0 175 350 525 700 Feet

CH2MHILL



<p>Wildlife Observations</p> <ul style="list-style-type: none"> ● <i>Accipiter striatus</i>, 2010 ● <i>Anas bahamensis</i>, 2003 ● <i>Anas bahamensis</i>, 2010 ● <i>Fulica caribaea</i>, 2003 ● <i>Ocyura jamaicensis</i>, 2003 ● <i>Pelecanus occidentalis</i>, 2001 ● <i>Pelecanus occidentalis</i>, 2003 ● <i>Pelecanus occidentalis</i>, 2006 ● <i>Pelecanus occidentalis</i>, 2007 ● <i>Pelecanus occidentalis</i>, 2010 ● <i>Sterna dougalli</i>, 2001 ● <i>Sterna dougalli</i>, 2006 	<p>Plant Observations</p> <ul style="list-style-type: none"> ● <i>Chaenactis glandulosa</i> ● <i>Goetzea elegans</i> ● <i>Psychotria macconnelliae</i> ● <i>Psychotria schrebleri</i> ● <i>Stachnia monoperma</i> ● <i>Stachnia monoperma</i> ● <i>Myrciaria floribunda</i> ● <i>Chamaecrista glandulosa</i> ● <i>Goetzea elegans</i> ● <i>Psychotria schrebleri</i> ● <i>Stachnia monoperma</i> ● <i>Stachnia monoperma</i> ● <i>Myrciaria floribunda</i> ● <i>Chaenactis glandulosa</i> ● <i>Goetzea elegans</i> ● <i>Psychotria schrebleri</i> ● <i>Stachnia monoperma</i> ● <i>Stachnia monoperma</i> 	<p>Turtle Beach Setbacks</p> <ul style="list-style-type: none"> Zone 2 - Minor Restrictions Zone 3 - Major Restrictions 	<p>General Habitats</p> <ul style="list-style-type: none"> Evergreen Scrub Gallery Forest Forest Scrub/Dry Scrub Forest/Lowland Forest Mangrove Forest Mixed Woodland/Upland Forest Salt/Sand Flat Inland Lagoon
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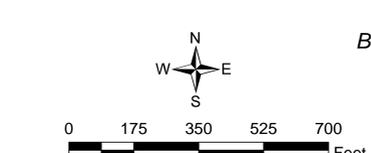


Figure 11
 Biological Avoidance Plan for Terrestrial MEC and
 MC Investigations and Interim Removal Actions
 Former AFWTF (East Vieques)
 Vieques, Puerto Rico

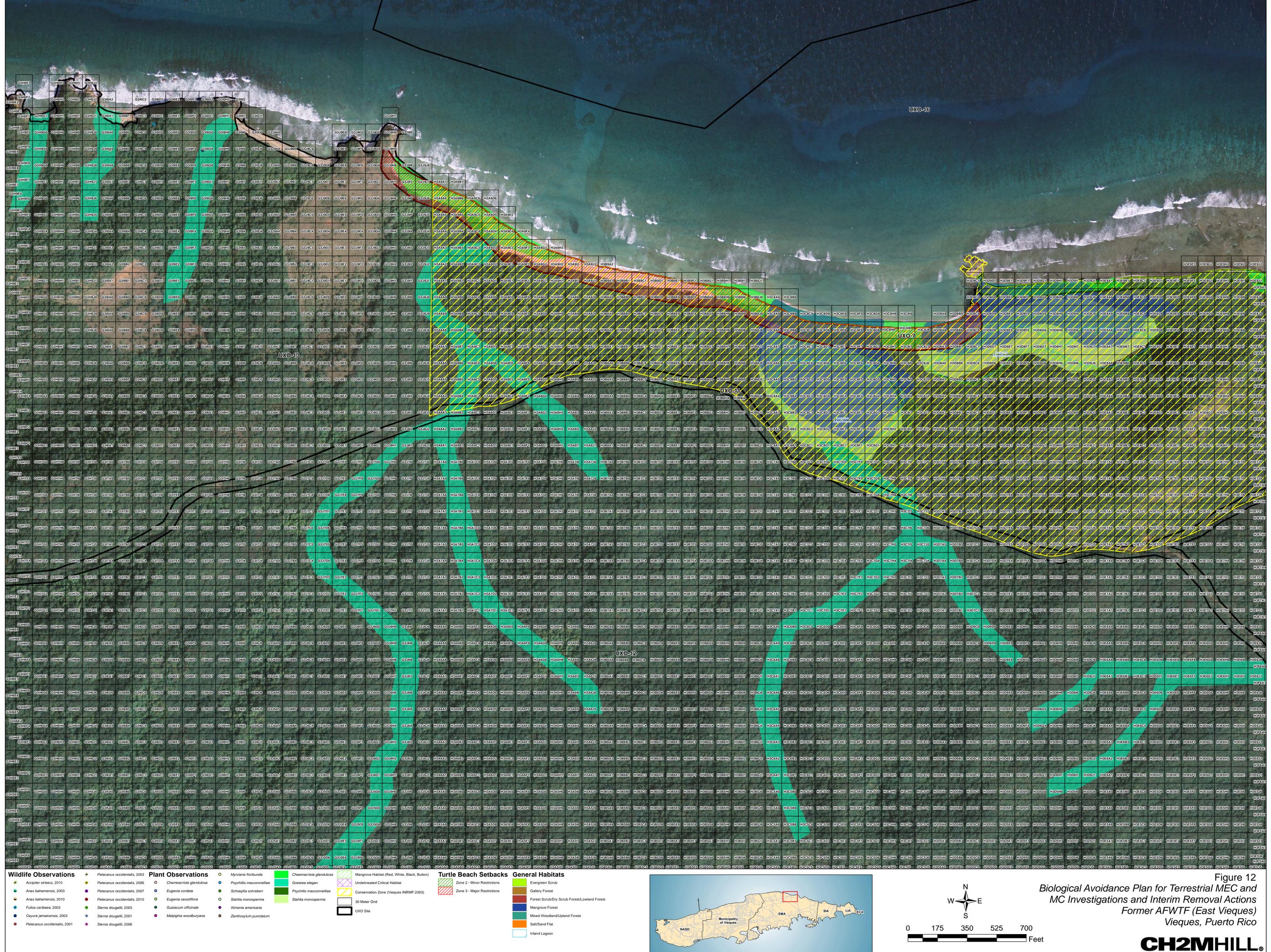
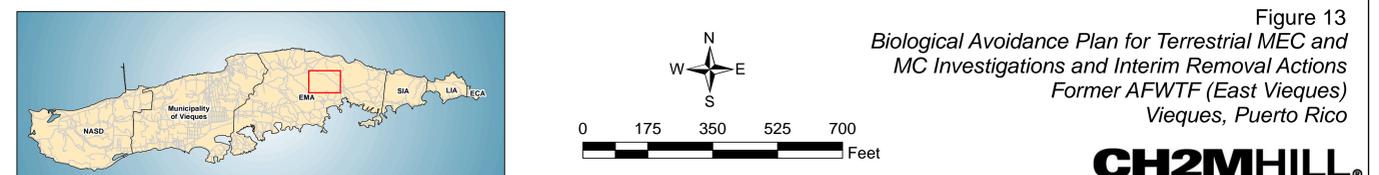
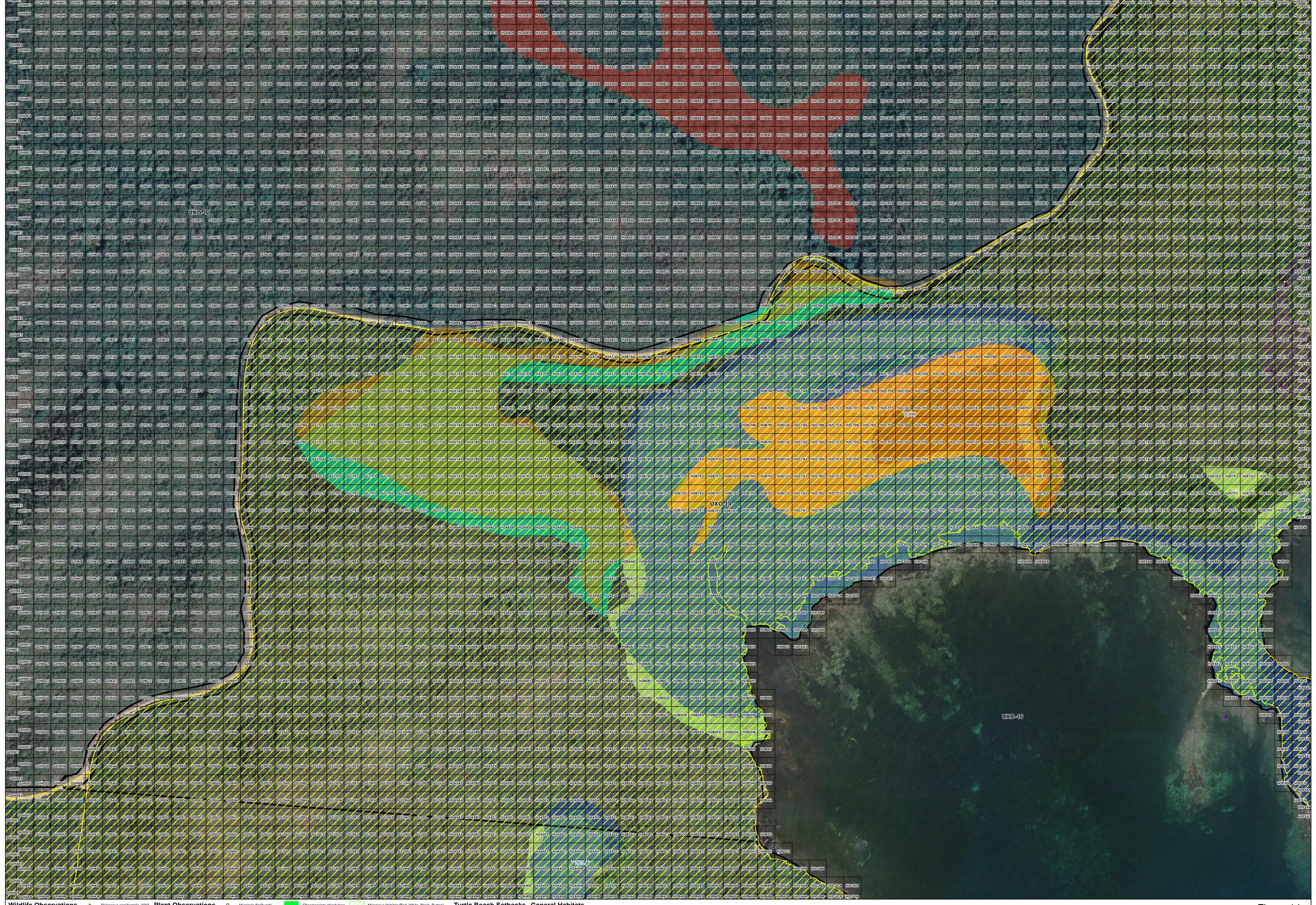


Figure 12
 Biological Avoidance Plan for Terrestrial MEC and
 MC Investigations and Interim Removal Actions
 Former AFWTF (East Vieques)
 Vieques, Puerto Rico



- Wildlife Observations**
- *Accipiter striatus*, 2010
 - *Anas bahamensis*, 2003
 - *Anas bahamensis*, 2010
 - *Fulica caribaea*, 2003
 - *Ocyura jamaicensis*, 2003
 - *Pelecanus occidentalis*, 2001
 - *Pelecanus occidentalis*, 2006
 - *Pelecanus occidentalis*, 2007
 - *Pelecanus occidentalis*, 2010
 - *Sterna dougalli*, 2003
 - *Sterna dougalli*, 2001
 - *Sterna dougalli*, 2006
- Plant Observations**
- *Chamaecrista glandulosa*
 - *Psychotria macconelliae*
 - *Eugenia cordata*
 - *Schoepfia schroberii*
 - *Stachya monosperma*
 - *Guaiacum officinale*
 - *Melipha woodburyana*
 - *Zanthoxylum punctatum*
- Mycorrhiza floribunda**
- *Chamaecrista glandulosa*
 - *Psychotria macconelliae*
- Turtle Beach Setbacks**
- Zone 2 - Minor Restrictions
 - Zone 3 - Major Restrictions
- General Habitats**
- Evergreen Scrub
 - Gallery Forest
 - Forest Scrub/Dry Scrub Forest/Lowland Forest
 - Mangrove Forest
 - Mixed Woodland/Upland Forest
 - Salt/Sand Flat
 - Inland Lagoon
- Mangrove Habitat (Red, White, Black, Button)**
- Undelineated Critical Habitat
 - Conservation Zone (Veiques INRMP 2003)
 - 30 Meter Grid
 - UXO Site





- Wildlife Observations**
- *Accipiter striatus*, 2010
 - *Anas bahamensis*, 2003
 - *Anas bahamensis*, 2010
 - *Fulica caribaea*, 2003
 - *Oxyura jamaicensis*, 2003
 - *Pelecanus occidentalis*, 2001
 - *Pelecanus occidentalis*, 2003
 - *Pelecanus occidentalis*, 2007
 - *Pelecanus occidentalis*, 2010
 - *Sterna dougalli*, 2003
 - *Sterna dougalli*, 2001
 - *Sterna dougalli*, 2006

- Plant Observations**
- *Chaerocystis glandulosa*
 - *Psychotria maccoulliae*
 - *Eugenia cordata*
 - *Schoepfia schroberi*
 - *Stachya monosperma*
 - *Guaiacum officinale*
 - *Ximenesia americana*
 - *Zanthoxylum punctatum*

- Turtle Beach Setbacks**
- Zone 2 - Minor Restrictions
 - Zone 3 - Major Restrictions

- General Habitats**
- Evergreen Scrub
 - Gallery Forest
 - Forest Scrub/Dry Scrub Forest/Lowland Forest
 - Mangrove Forest
 - Mixed Woodland/Upland Forest
 - Salt/Sand Flat
 - Inland Lagoon

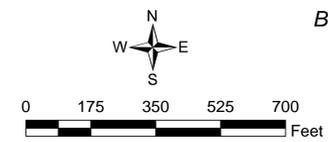
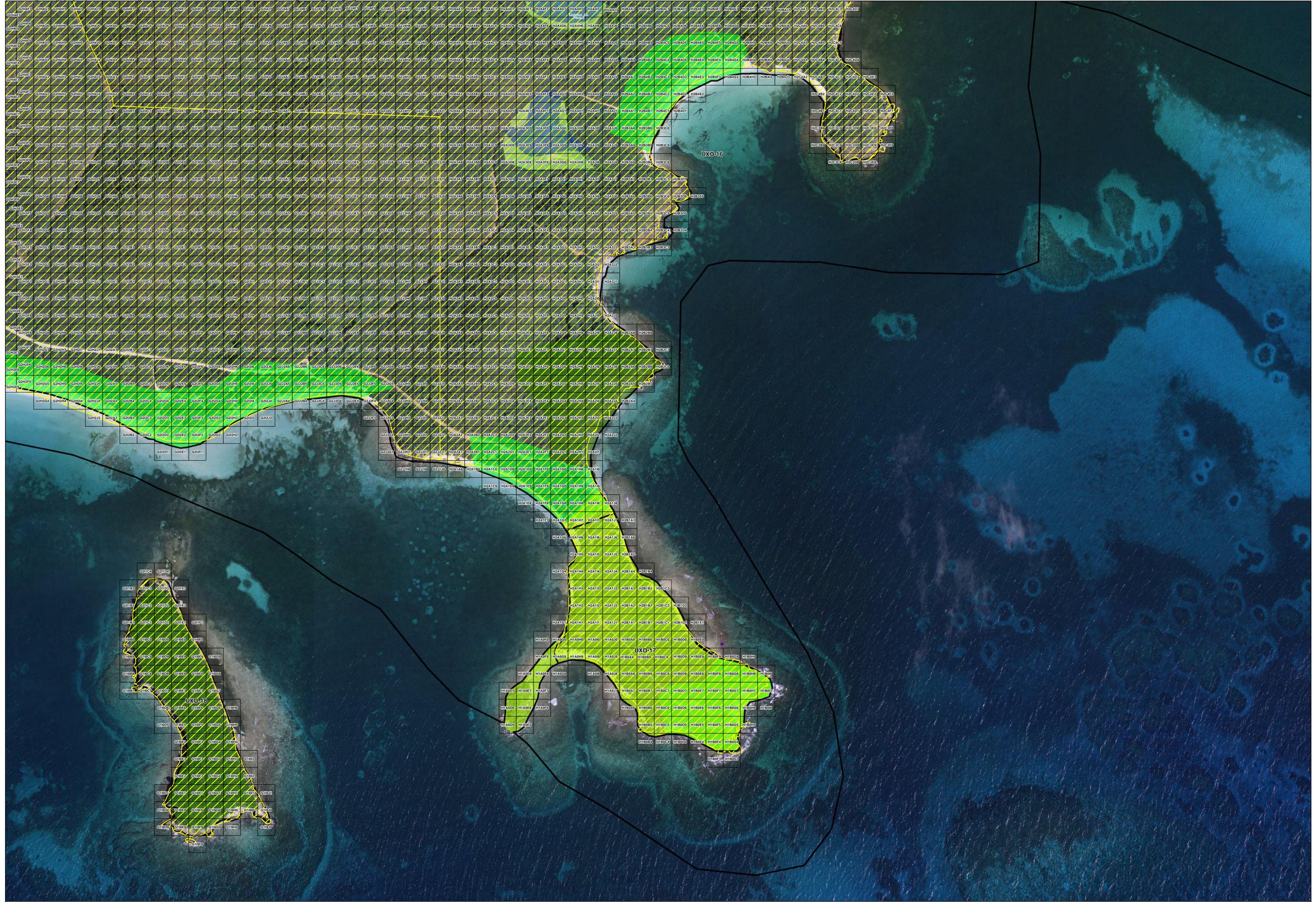


Figure 14
 Biological Avoidance Plan for Terrestrial MEC and MC Investigations and Interim Removal Actions
 Former AFWTF (East Veiques)
 Veiques, Puerto Rico



Wildlife Observations <ul style="list-style-type: none"> ● <i>Accipiter striatus</i>, 2010 ● <i>Anas bahamensis</i>, 2003 ● <i>Anas bahamensis</i>, 2010 ● <i>Fulica caribaea</i>, 2003 ● <i>Oxyura jamaicensis</i>, 2003 ● <i>Pelecanus occidentalis</i>, 2001 ● <i>Pelecanus occidentalis</i>, 2003 ● <i>Pelecanus occidentalis</i>, 2006 ● <i>Pelecanus occidentalis</i>, 2007 ● <i>Pelecanus occidentalis</i>, 2010 ● <i>Sterna dougalli</i>, 2003 ● <i>Sterna dougalli</i>, 2001 ● <i>Sterna dougalli</i>, 2006 	Plant Observations <ul style="list-style-type: none"> ● <i>Chamaecrista glandulosa</i> ● <i>Psychyllis macconnelliae</i> ● <i>Eugenia cordata</i> ● <i>Eugenia sesaliflora</i> ● <i>Guaiacum officinale</i> ● <i>Melipha woodburyana</i> ● <i>Myrciaria floribunda</i> ● <i>Psychyllis macconnelliae</i> ● <i>Scaevola schrebleri</i> ● <i>Stachnia monosperma</i> ● <i>Ximenesia americana</i> ● <i>Zanthoxylum portoricense</i> 	<ul style="list-style-type: none"> Mangrove Habitat (Red, White, Black, Button) Undelineated Critical Habitat Conservation Zone (Veiques INRMP 2003) 30 Meter Grid UXO Site 	Turtle Beach Setbacks <ul style="list-style-type: none"> Zone 2 - Minor Restrictions Zone 3 - Major Restrictions 	General Habitats <ul style="list-style-type: none"> Evergreen Scrub Gallery Forest Forest Scrub/Dry Scrub Forest/Lowland Forest Mangrove Forest Mixed Woodland/Upland Forest Salt/Sand Flat Inland Lagoon
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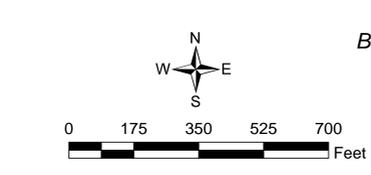


Figure 15
 Biological Avoidance Plan for Terrestrial MEC and MC Investigations and Interim Removal Actions Former AFWTF (East Veiques) Veiques, Puerto Rico

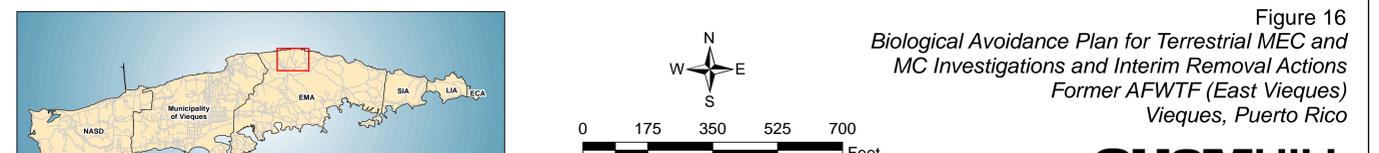
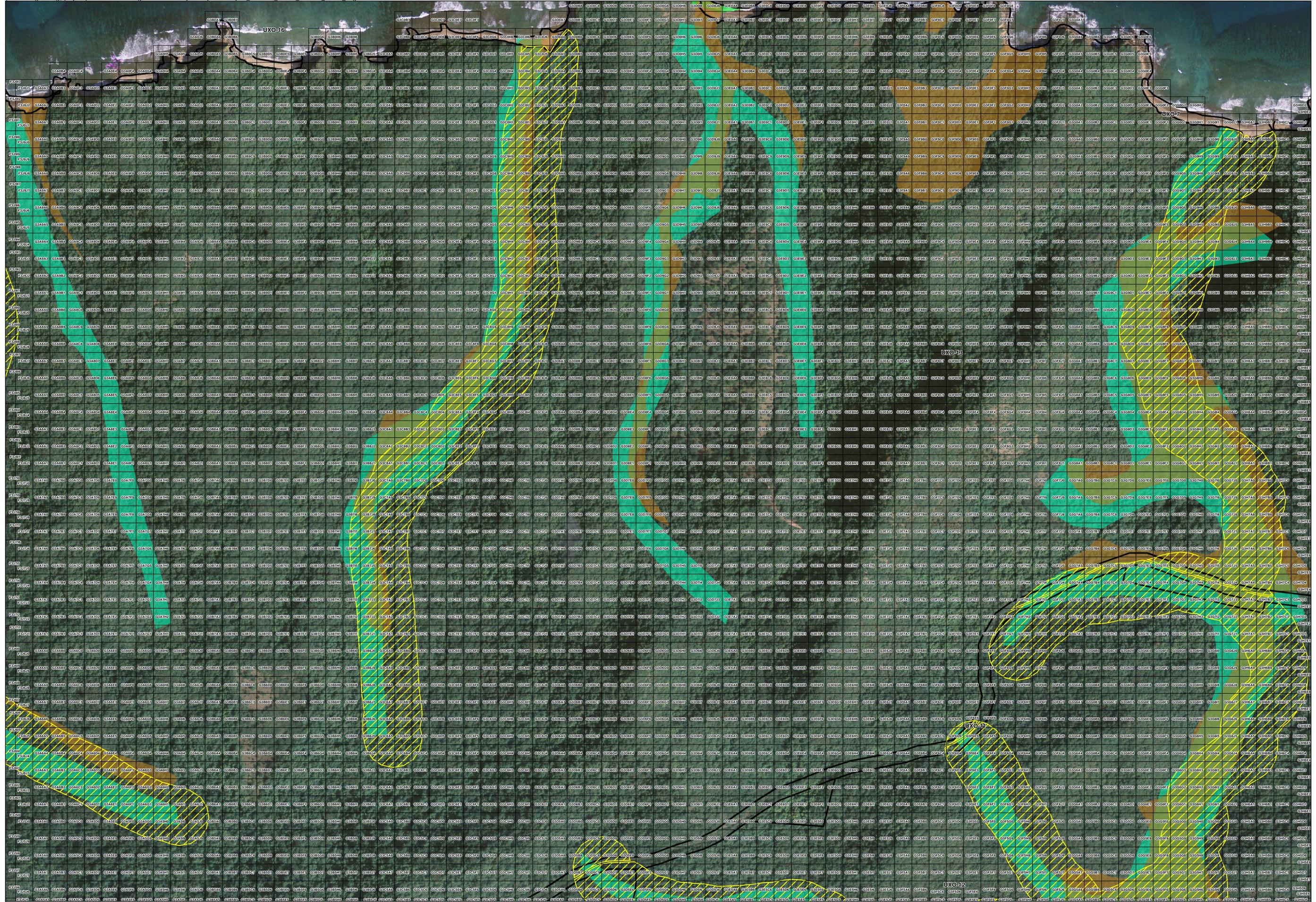


Figure 16
 Biological Avoidance Plan for Terrestrial MEC and MC Investigations and Interim Removal Actions
 Former AFWTF (East Vieques)
 Vieques, Puerto Rico



- | | | | | | | | |
|------------------------------|---|---------------------------|--|------------------------------|---|-------------------------|--|
| Wildlife Observations | <ul style="list-style-type: none"> ● Pelicanus occidentalis, 2003 ● Pelicanus occidentalis, 2006 ● Anas bahamensis, 2003 ● Anas bahamensis, 2010 ● Fulica caribaea, 2003 ● Ocyura jamaicensis, 2003 ● Pelicanus occidentalis, 2001 | Plant Observations | <ul style="list-style-type: none"> ● Myrciaria floribunda ● Psychotria glandulosa ● Psychotria glandulosa ● Eugenia cordata ● Schoepfia schroberii ● Stachnia monoperma ● Guaiacum officinale ● Ximenia americana ● Melipha woodburyana ● Zanthoxylum punctatum | Turtle Beach Setbacks | <ul style="list-style-type: none"> Zone 2 - Minor Restrictions Zone 3 - Major Restrictions | General Habitats | <ul style="list-style-type: none"> Evergreen Scrub Gallery Forest Forest Scrub/Dry Scrub Forest/Lowland Forest Mangrove Forest Mixed Woodland/Upland Forest Salt/Sand Flat Inland Lagoon |
|------------------------------|---|---------------------------|--|------------------------------|---|-------------------------|--|

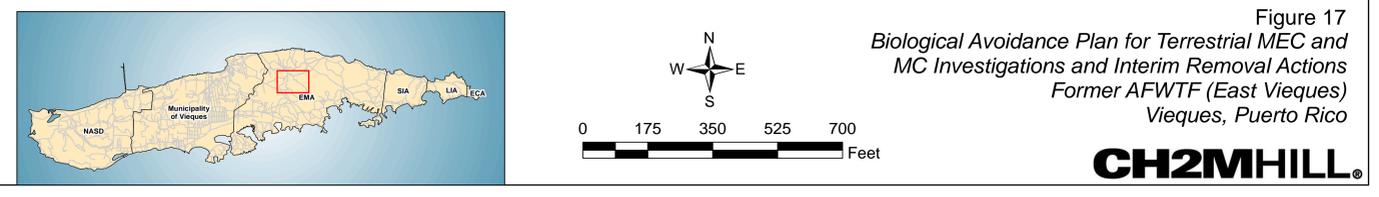


Figure 17
 Biological Avoidance Plan for Terrestrial MEC and MC Investigations and Interim Removal Actions
 Former AFWTF (East Vieques)
 Vieques, Puerto Rico



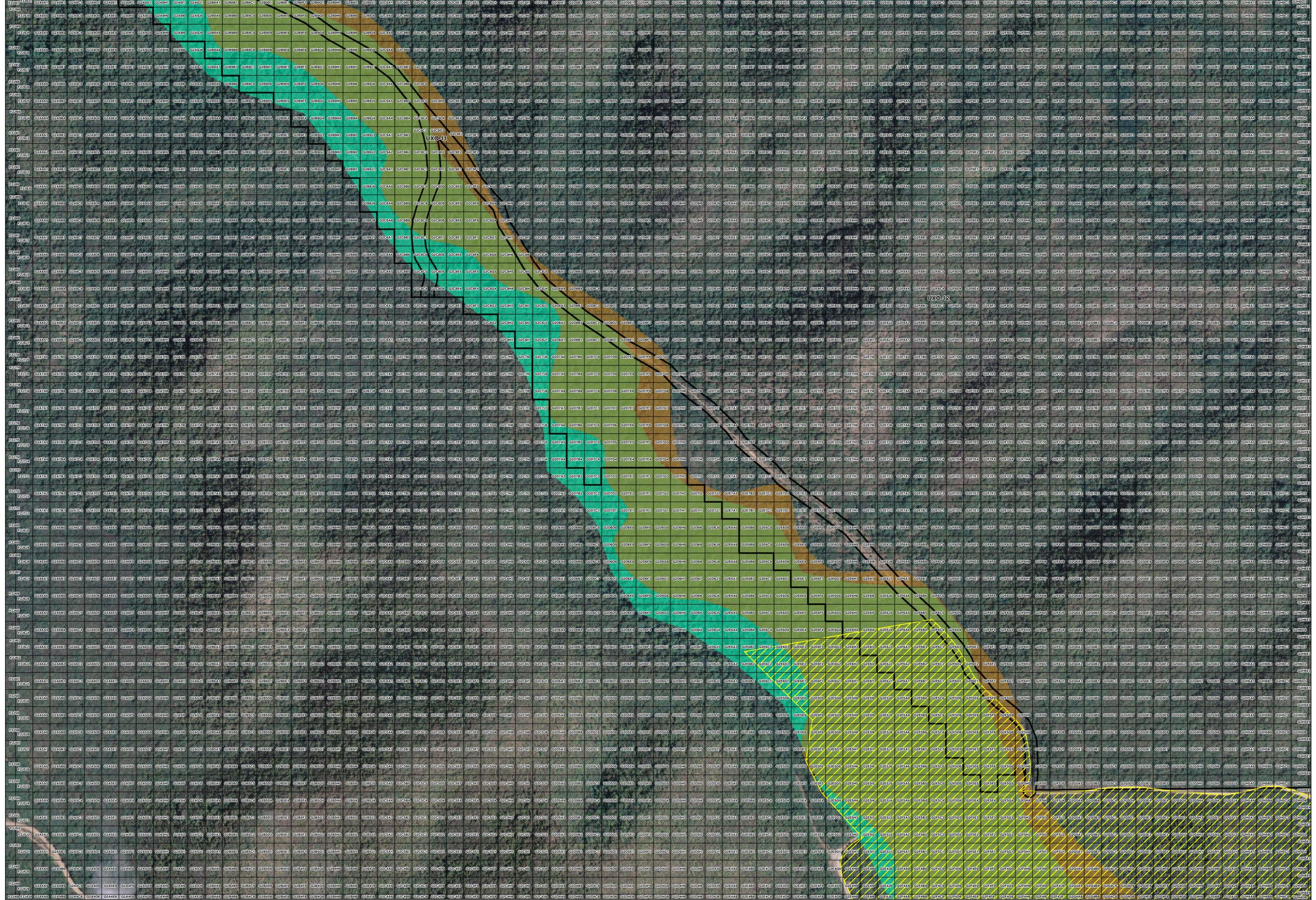
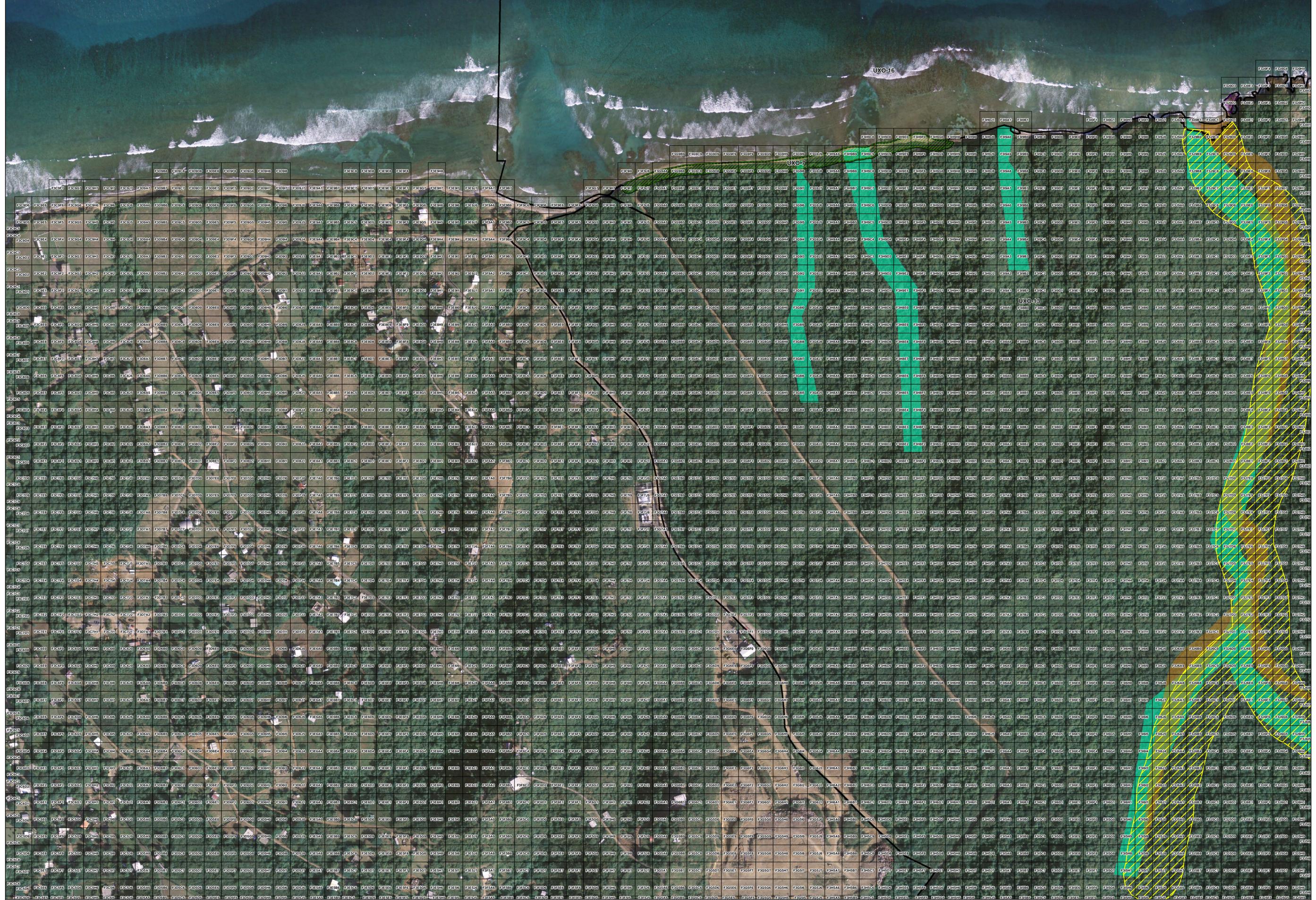


Figure 18
 Biological Avoidance Plan for Terrestrial MEC and MC Investigations and Interim Removal Actions
 Former AFWTF (East Vieques)
 Vieques, Puerto Rico

0 175 350 525 700 Feet

CH2MHILL



<p>Wildlife Observations</p> <ul style="list-style-type: none"> ● <i>Accipiter striatus</i>, 2010 ● <i>Anas bahamensis</i>, 2010 ● <i>Anas bahamensis</i>, 2013 ● <i>Pelecanus occidentalis</i>, 2003 ● <i>Fulica caribaea</i>, 2003 ● <i>Oxyura jamaicensis</i>, 2003 ● <i>Pelecanus occidentalis</i>, 2001 ● <i>Pelecanus occidentalis</i>, 2003 ● <i>Chamaea glandulosa</i>, 2006 ● <i>Pelecanus occidentalis</i>, 2007 ● <i>Pelecanus occidentalis</i>, 2010 ● <i>Sterna dougalli</i>, 2003 ● <i>Oxyura jamaicensis</i>, 2003 ● <i>Pelecanus occidentalis</i>, 2001 ● <i>Sterna dougalli</i>, 2006 	<p>Plant Observations</p> <ul style="list-style-type: none"> ● <i>Chamaecrista glandulosa</i> ● <i>Psychotria maccoulliae</i> ● <i>Eugenia cordata</i> ● <i>Schoepfia schroberii</i> ● <i>Stachya monosperma</i> ● <i>Ximenesia americana</i> ● <i>Zanthoxylum punctatum</i> ● <i>Myrciaria floribunda</i> ● <i>Psychotria maccoulliae</i> ● <i>Goetzea elegant</i> ● <i>Schoepfia schroberii</i> ● <i>Stachya monosperma</i> ● <i>Ximenesia americana</i> ● <i>Zanthoxylum punctatum</i> 	<p>Turtle Beach Setbacks</p> <ul style="list-style-type: none"> Zone 2 - Minor Restrictions Zone 3 - Major Restrictions 	<p>General Habitats</p> <ul style="list-style-type: none"> Evergreen Scrub Gallery Forest Forest Scrub/Dry Scrub Forest/Lowland Forest Mangrove Forest Mixed Woodland/Upland Forest Salt/Sand Flat Inland Lagoon 	<p>Mangrove Habitat (Red, White, Black, Button)</p> <ul style="list-style-type: none"> Undelineated Critical Habitat Conservation Zone (Vieques INRMP 2003) 30 Meter Grid UXO Site
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Figure 19
Biological Avoidance Plan for Terrestrial MEC and MC Investigations and Interim Removal Actions Former AFWTF (East Vieques) Vieques, Puerto Rico



<p>Wildlife Observations</p> <ul style="list-style-type: none"> ● <i>Accipiter striatus</i>, 2010 ● <i>Anas bahamensis</i>, 2003 ● <i>Anas bahamensis</i>, 2010 ● <i>Fulica caribaea</i>, 2003 ● <i>Oxyura jamaicensis</i>, 2003 ● <i>Pelecanus occidentalis</i>, 2001 ● <i>Pelecanus occidentalis</i>, 2003 ● <i>Pelecanus occidentalis</i>, 2006 ● <i>Pelecanus occidentalis</i>, 2007 ● <i>Pelecanus occidentalis</i>, 2010 ● <i>Sterna dougalli</i>, 2003 ● <i>Sterna dougalli</i>, 2001 ● <i>Sterna dougalli</i>, 2006 	<p>Plant Observations</p> <ul style="list-style-type: none"> ● <i>Chamaecrista glandulosa</i> ● <i>Psychotria maccoulliae</i> ● <i>Eugenia cordata</i> ● <i>Schoepfia schreberii</i> ● <i>Stachya monosperma</i> ● <i>Guaiacum officinale</i> ● <i>Melipha woodburyana</i> ● <i>Zanthoxylum punctatum</i> ● <i>Myrciaria floribunda</i> ● <i>Chamaecrista glandulosa</i> ● <i>Psychotria maccoulliae</i> ● <i>Stachya monosperma</i> 	<p>Turtle Beach Setbacks</p> <ul style="list-style-type: none"> Zone 2 - Minor Restrictions Zone 3 - Major Restrictions 	<p>General Habitats</p> <ul style="list-style-type: none"> Evergreen Scrub Gallery Forest Forest Scrub/Dry Scrub Forest/Lowland Forest Mangrove Forest Mixed Woodland/Upland Forest Salt/Sand Flat Inland Lagoon
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Figure 20
Biological Avoidance Plan for Terrestrial MEC and MC Investigations and Interim Removal Actions
Former AFWTF (East Veiques)
Veiques, Puerto Rico



- | | | | |
|---|---|--|--|
| <p>Wildlife Observations</p> <ul style="list-style-type: none"> ● <i>Accipiter striatus</i>, 2010 ● <i>Anas bahamensis</i>, 2003 ● <i>Anas bahamensis</i>, 2010 ● <i>Fulica caribaea</i>, 2003 ● <i>Oxyura jamaicensis</i>, 2003 ● <i>Pelecanus occidentalis</i>, 2001 ● <i>Pelecanus occidentalis</i>, 2003 ● <i>Pelecanus occidentalis</i>, 2006 ● <i>Pelecanus occidentalis</i>, 2007 ● <i>Pelecanus occidentalis</i>, 2010 ● <i>Sterna dougalli</i>, 2003 ● <i>Sterna dougalli</i>, 2001 ● <i>Sterna dougalli</i>, 2006 | <p>Plant Observations</p> <ul style="list-style-type: none"> ○ <i>Chaenactis glandulosa</i> ○ <i>Eugenia cordata</i> ○ <i>Eugenia sesuviflora</i> ○ <i>Guaiacum officinale</i> ○ <i>Melipha woodburyana</i> ○ <i>Myrciaria floribunda</i> ○ <i>Psychotria maccoulliae</i> ○ <i>Schoepfia schreberi</i> ○ <i>Stachnia monosperma</i> ○ <i>Ximenesia americana</i> ○ <i>Zanthoxylum punctatum</i> | <p>Turtle Beach Setbacks</p> <ul style="list-style-type: none"> ■ Zone 2 - Minor Restrictions ■ Zone 3 - Major Restrictions | <p>General Habitats</p> <ul style="list-style-type: none"> ■ Evergreen Scrub ■ Gallery Forest ■ Forest Scrub/Dry Scrub Forest/Lowland Forest ■ Mangrove Forest ■ Mixed Woodland/Upland Forest ■ Salt/Sand Flat ■ Inland Lagoon |
|---|---|--|--|

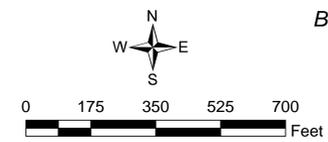


Figure 21
 Biological Avoidance Plan for Terrestrial MEC and
 MC Investigations and Interim Removal Actions
 Former AFWTF (East Vieques)
 Vieques, Puerto Rico