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FINAL BIOLOGICAL ASSESSMENT FOR PHOTO IDENTIFIED 9 (PI 9), PHOTO IDENTIFIED
13 (PI 13), AND DEBRIS PILES WITHIN UNEXPLODED ORDNANCE 15 (UXO 15) FORMER
VIEQUES NAVAL TRAINING RANGE VIEQUES ISLAND PUERTO RICO

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Final

Biological Assessment for PI 9, PI 13, and Debris Piles within UXO 15

**Former Vieques Naval Training Range
Vieques, Puerto Rico**

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Acronyms and Abbreviations

BA	biological assessment
CCP	Comprehensive Conservation Plan
DBH	diameter at breast height
DEIS	Draft Environmental Impact Statement
DGM	digital geophysical mapping
EADA	Elevated Anomaly Density Area
EIS	Environmental Impact Statement
ESI	Environmental Site Investigation
INRMP	Integrated Natural Resource Management Plan
MD	munitions debris
MEC	munitions and explosives of concern
MPPEH	munitions potentially presenting an explosive hazard
Navy	Department of the Navy
NAD	North American Datum
PI	Photo Identified
SAP	Sampling and Analysis Plan
TM	Technical Memorandum
USFWS	United States Fish and Wildlife Service
UXO	Unexploded Ordnance
VNWR	Vieques National Wildlife Refuge
VNTR	Vieques Naval Training Range

Introduction

Munitions-related investigation and debris removal activities are planned for Photo Identified (PI) Sites PI 9 and PI 13, the Elevated Anomaly Density Area (EADA) identified from digital geophysical mapping (DGM) east of PI 13, and multiple small debris piles located within and just north of Unexploded Ordnance Site 15 (UXO 15) (Appendix A, Figure 1). Initial activities will include visual ground surface surveys within the boundaries of PI 9 and PI 13, as well as subsurface anomaly excavations using geophysical electromagnetic instrumentation. These survey methods necessitate an exposed ground surface and, as a result, will require the removal of vegetation down to a height of six inches above the ground so that geophysical equipment can access the areas to be investigated within PI 9 and PI 13.

Based on this proposed action, the objectives of this biological assessment (BA) are as follows:

- To document and map the extent of Federal- and State-listed species within PI 9 and PI 13, as well as the habitat types and biological resources considered important for the Vieques National Wildlife Refuge (VNWR)
- To evaluate how these ecological resources may or may not be affected by the vegetation removal activities required to effectively carry out the proposed action

It is the goal of both the Department of the Navy (Navy) and United States Fish and Wildlife Service (USFWS) to minimize disturbance to the listed species and important habitats during vegetation removal activities.

1.1 Project Description

The planned investigation and debris removal activities are documented in the *Draft Final Expanded Site Inspection Sampling and Analysis Plan, UXO 15, Former Vieques Naval Training Range, Vieques, Puerto Rico* (CH2M HILL, 2011b). This BA is specifically prepared for munitions constituent investigation areas PI 9 and PI 13, located within UXO 15, and for multiple small debris piles located within and just north of UXO 15, at the former Vieques Naval Training Range (VNTR) on Vieques Island, Puerto Rico. Figure 1 (Appendix A) illustrates the location and topography of UXO 15, as well as the boundaries of sites PI 9 and PI 13.

The SAP describes two primary investigation activities at UXO 15, an Environmental Site Investigation (ESI) and DGM. An ESI will be conducted to assess, in part, whether there have been releases of contamination from debris piles, munitions debris (MD), or munitions potentially presenting an explosive hazard (MPPEH). To date, there has not been any MPPEH identified on the land surface at UXO 15. Geophysical surveys and an excavation of subsurface anomalies will be conducted to determine if MPPEH is present within the subsurface. Field activities will include debris pile removal, followed by collection of surface soil and sediment samples from beneath the debris piles for analysis of constituents of interest (such as explosives, perchlorate, and metals).

DGM will be accomplished throughout PI 9 and PI 13 and additionally at two magnetic anomaly areas outside of the two site boundaries. The DGM results will be evaluated to determine if there are subsurface anomalies present at these sites. Selected subsurface anomalies identified will be excavated; if the item removed is munitions and explosives of concern (MEC), then a subsurface soil sample will be collected below it and analyzed for explosives, perchlorate, and metals.

DGM will require the removal of vegetation down to a height of six inches above the ground. Debris pile removal may also require some vegetation removal to allow for access and operation of large equipment. Current approved methods for vegetation removal actions are described in the *Non-time-critical Removal Action 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 workplan, vegetation removal is to be conducted by hand (manually), utilizing hand-carried tools (such as weed eaters). Unless it is absolutely necessary, cutting trees larger than 3 inches in diameter is prohibited. Trees are to be felled into an area that has already been surface swept for MEC. The vegetation will typically be cut to a height of

approximately 6 inches above ground surface to eliminate interference with MEC detection or survey activities. All cut vegetation is to be accumulated onsite and left in place.

Existing documentation, including the *Vieques National Wildlife Refuge Comprehensive Conservation Plan and Environmental Impact Statement (CCP/EIS)* (USFWS, 2007) and the *Integrated Natural Resources Management Plan* (Geo-Marine, 2003), suggests that threatened and endangered species may occur, and important vegetative communities (such as mangroves and dry scrub forests) do occur at UXO 15. As a result, the focus of this BA is to identify the occurrence and location of protected or important ecological resources within PI 9 and PI 13 and to consider the potential effects of vegetation removal on these resources.

SECTION 2

Biological Assessment Methods

The BA methods are based on the Technical Memorandum (TM), *Methods and Approach for Surveys of Endangered and Threatened Wildlife, Plant Species and Important Habitats at PI 9, PI 13, and Debris Piles within UXO 15*, from May 25, 2011, as reviewed and approved by USFWS (CH2M HILL, 2011a) (Appendix A).

2.1 Species and Critical Habitat Considered

The VNWR supports important habitats for native and naturalized, migratory, rare, and protected species. According to the CCP/EIS, approximately eighteen (18) federally listed plant and animal species are expected to occur on VNWR and in surrounding waters. These include four (4) plant species, three (3) bird species, four (4) reptile species, and five (5) mammal species. No federally designated critical habitat is present on the VNWR.

Table 1 lists the protected plant and bird species considered most likely to occur at UXO 15. Descriptions of these species, as well as important habitats (such as subtropical dry forest and mangroves), are based on key characteristics identified in the CCP/EIS. Additional important habitats and biological resource elements considered in this BA are also presented.

TABLE 2-1

Federally Endangered and Threatened Species Potentially Occurring at UXO 15, Vieques, Puerto Rico
Biological Assessment for PI 9 and PI 13, EADA East of PI 13 and Debris Piles within UXO 15

Scientific Name	Common Name	Federal Status	State Status
Plants			
<i>Calyptanthes thomasi</i>	None	Endangered	Endangered
<i>Chamaecrista glandulosa</i> var. <i>mirabilis</i>	None	Endangered	Endangered
<i>Goetzea elegans</i>	Beautiful goetzea	Endangered	Endangered
<i>Stahlia monosperma</i>	Cóbana negra	Threatened	Threatened
Birds			
<i>Agelaius xanthomus</i>	Yellow-shouldered blackbird	Endangered	Endangered
<i>Pelecanus occidentalis</i>	Brown pelican	Delisted ¹	Delisted ¹
<i>Sterna dougallii dougallii</i>	Roseate tern	Threatened	Threatened

Legend:

¹ - Formerly listed as endangered

Source: Vieques National Wildlife Refuge Comprehensive Conservation Plan and Environmental Impact Statement, 2007

2.1.1 Listed Plants

Four federally listed plant species may potentially occur within the habitats associated with UXO 15. These include Cóbana negra (*Stahlia monosperma*), *Calyptanthes thomasi*, *Chamaecrista glandulosa* var. *mirabilis*, and matabuey (*Goetzea elegans*). Detailed descriptions of listed plants are provided in the TM found in Appendix A.

- *Stahlia monosperma* is a federally and state-listed threatened evergreen tree that reaches 25 to 50 feet in height and 1 to 1.5 feet in diameter.
- *Calyptanthes thomasi* is a federally and state-listed endangered shrub or small tree that may reach 30 feet in height and 5 inches in diameter.

- *Chamaecrista glandulosa* var. *mirabilis* is a federally and state-listed threatened shrub that may reach up to 3 feet in height.
- *Goetzea elegans* (Matabuey) is a federally and state-listed endangered shrub or small tree reaching 30 feet in height with a stem diameter of 5 inches.

2.1.2 Listed Birds

Two federally listed birds potentially occur at UXO-15 (roseate tern and yellow-shouldered blackbird), as well as the recently delisted (formerly endangered) brown pelican. Detailed descriptions of listed birds are provided in the TM found in Appendix A.

- The Caribbean roseate tern (*Sterna dougallii*) is listed as threatened in the Caribbean. The yellow-shouldered blackbird (*Agelaius xanthomus*) is listed as endangered in Puerto Rico.
- Historic records of the yellow-shouldered blackbird (*Agelaius xanthomus*) from Vieques are available in literature (USFWS, 1983).
- The brown pelican (*Pelecanus o. occidentalis*) was removed from the federal list of endangered species in November 2009 due to its recovery; this includes all subspecies of the brown pelican.

2.1.3 Important Refuge Habitats

USFWS has identified two important habitats as occurring within UXO-15, including subtropical dry forest and mangrove wetland. Detailed descriptions of important habitats are provided in the TM found in Appendix A.

- The subtropical dry forest is the driest zone found in the region considering the area has a nearly complete cover of deciduous vegetation. The dry coastal forest is found in patches within the project area, usually at the higher elevations encountered on the interior of the island.
- Mangrove forests in UXO 15 are located on the northern coasts. Mangrove forests are characterized as open (fringe) and closed lagoon forests.

The primary plant community identified within PI 9 and PI 13, EADA east of PI 13, and surrounding the debris piles in UXO 15 was previously documented as subtropical dry forest as described by the Holdridge System (Ewel and Whitmore, 1973). The subtropical dry forest contains a variety of distinct habitat types previously identified in the following documents:

- *Integrated Natural Resource Management Plan* (Vieques INRMP) (Geo-Marine, 2003)
- *Vieques National Wildlife Refuge Comprehensive Conservation Plan and Environmental Impact Statement* CCP/EIS (USFWS, 2007)
- *Draft Environmental Impact Statement* (DEIS) (Navy, 1979)
- *Biological Assessment, Select Portions of the Surface Impact Area and Eastern Impact Area, Former Vieques Naval Training Range* (Geo-Marine, 2010)

Other important habitats considered include the following:

- Secondary growth forests containing large native and naturalized trees found within areas of mixed invasive vegetation
- Areas of sparsely vegetated barren limestone supporting unique plant species
- Areas containing a mix of native, naturalized, and invasive species
- Areas composed entirely of invasive species (such as acacia [*Acacia tortuosa*], tan tan [*Leucaena leucocephala*], and mesquite [*Prosopis juliflora*])
- Areas containing invasive species considered locally desirable by USFWS, including various palms (such as *Thrinax morrisii*), portia tree (*Thespesia populnea*), and gumbo limbo)

2.1.4 Other Biological Resources

Other biological resources include species of birds, mammals, reptiles, amphibians, and large terrestrial invertebrates (such as land crabs) using on-site habitats.

2.2 Survey Methodology

The BA survey consisted of two main components:

- A literature review of published sources regarding the listed biological species, species occurrence records, habitat associations, maps, and specific information available from the USFWS and the Navy regarding local knowledge of species and important habitats
- Ground surveys of listed biological species, habitats important for the VNTR, and other distinctive biological resources present within the boundaries of sites PI 9 (including the EADA adjacent to PI 9 on the northwest portion of the site) and PI 13, EADA east of PI 13, and at the debris piles associated with UXO 15.

2.2.1 Literature Review

The following resources were consulted:

- Vieques INRMP (Geo-Marine, 2003)
- *Vieques National Wildlife Refuge Comprehensive Conservation Plan and Environmental Impact Statement (CCP/EIS)* (USFWS, 2007)
- *Biological Assessment, Select Portions of the Surface Impact Area and Eastern Impact Area, Former Vieques Naval Training Range* (Geo-Marine, 2010)
- *Biological Assessment for Continuing Training Activities on the Inner Range, Vieques, Puerto Rico* (Geo-Marine, 2001)
- Field keys for identification of plant species

Recent 2007 aerial imagery was used to determine the limits of the vegetation survey areas based on PI site boundaries, evaluate vegetative signatures, and determine survey transects through habitat types. Transects were planned to ensure sufficient coverage of the habitat types and detailed review in areas where potential listed species may be present. The datum for the aerial imagery was North American Datum (NAD) 1983, UTM, Zone 20 North, meters.

2.2.2 Survey Method

In areas of subtropical dry forest where listed plant species were not expected, habitats were surveyed by spot checks. The field team walked the perimeter of the habitat type and hand cut narrow transects through the habitat to determine the dominant species and plant community characteristics to be mapped. Invasive species habitats were mapped in a similar way. In areas where listed species had a high potential to occur (mainly along the mangrove communities), the biologists surveyed approximately 100 percent of the area. This survey method included walking linear transects and spot checks. The listed plant species in Table 2-1 were not expected waterward of the mean low tide, so this habitat type was surveyed above the water line.

Surveys of PI 9 and PI 13 were conducted from May 31 through June 10, 2011. A team of two biologists walked each transect surveying 25 to 50 feet on either side of the centerline, depending on visibility and terrain. Biological resources, such as bird, mammal, and land crab colony occurrence, were documented. Photographs were taken of each representative habitat to document various habitat types and biological resources. A photo log is provided in Appendix B. The photos have corresponding photo stations shown on Figures 3, 4, and 5, in Appendix C. At each data point, an estimated density (percent cover) of vegetation was visually determined for each strata (for example, groundcover [<0.5 meter], shrub [0.5 to 5 meters], and tree canopy [>5 meters] strata). The purpose of the vegetation density assessment was to evaluate the extent of visibility of the ground surface to allow for clearing activities within important habitats, determine the effects of potential vegetation clearing on

the specific strata, and evaluate options for impact avoidance measures during vegetation clearing activities to preserve important plant species and habitats.

Trimble GPS Geo XT units loaded with CartoPac version 1.6.2 GIS mapping software with tailored forms and drop down menus were used for data collection of features such as:

- Habitat type
- Listed species observed
- Dominant vegetation species and strata
- Substrate type and percent cover
- Percent cover for canopy, shrub, and groundcover strata
- Animal species observed
- Photo number

2.3 Agency Consultation and Coordination

A meeting was conducted on April 5, 2011, with Mike Barandiaran and Rich Henry of USFWS to discuss the "Methods and Approach" TM (CH2M HILL, 2011a) and to obtain additional information regarding the specific survey areas. Concurrence regarding these survey methods was obtained in an email from Richard Henry of USFWS on May 16, 2011, (USFWS, 2011). USFWS representatives also accompanied the field team during the field survey on June 8 and 9, 2011, at the UXO 15 survey areas. The results of the field surveys documented in this report will be forwarded to the USFWS for their review and comment.

SECTION 3

Biological Assessment Survey Results

The results of this BA are as follows:

3.1 Listed Plants

The listed plant species *Calyptanthes thomasiana*, *Stahlia monosperma*, *Chamaecrista glandulosa* var. *mirabilis*, *Goetzea elegans* (Matabuey) were not sighted during the field survey.

3.2 Listed Birds

The listed bird species yellow-shouldered blackbird, roseate tern, and brown pelican were not sighted during the field survey.

3.3 Important Refuge Habitats

The important and distinct habitats and approximate acreages of each habitat type found in PI 9 East and West, PI 13, and EADA east of PI 13 are listed in Table 3-1 and are described in the following sections. PI 9 consists of three areas identified as East, West, and EADA north of PI 9 on the Overall Map provided in Figure 2, Appendix C. Debris pile locations are provided on Figure 5, Appendix C. Map delineations and representative photos of each habitat are provided in the appendixes.

TABLE 3-1

Habitats in PI 9, PI 13, and Debris Piles within UXO 15

Biological Assessment for PI 9 and PI 13 and Debris Piles within UXO 15

Habitat Type	PI 9 (acres)		PI 13 (acres)	
	East	West	EADA East of PI 13	PI 13
Dry Scrub Forest	1.14	18.21	-	1.36
Mangrove Forest	1.06	7.56	-	-
Secondary Growth Forest	-	1.18	-	-
Evergreen Scrub	-	-	0.25	6.61
Exposed Limestone	-	0.49	0.24	0.67
Areas of Mixed Native/Naturalized and Invasive Vegetation	-	22.70	-	-
Areas Composed Entirely of Invasive Species	-	2.70	-	0.52
Giant Wild Pine (air plant)	-	0.16	-	-
Exposed Sand	0.41	-	-	-
Road	-	1.53	-	0.22
Area Total	2.61	54.53	0.49	9.38

Table 3-2 summarizes the raw data collected in each of these habitat types during the site survey, including dominant vegetation species, percent cover of canopy, shrub, and groundcover strata, substrate type and percent cover, and biological resources observed. Supporting information is provided in the following sections.

3.3.1 Dry Scrub Forest

The habitat on the eastern end of Vieques was previously identified as subtropical dry forest. Years of anthropogenic activity has altered the dominant plant species that comprise this habitat. Today the subtropical dry forest is best described as dry scrub forest consisting of widely scattered native and naturalized and introduced species. The dry scrub forest is located on hilltops and ridges and is dominated by small diameter trees and shrubs (Table 3-2).

The dry scrub habitat found in PI 9 East, PI 9 West, and PI 13 is delineated on Figures 3 and 4 in Appendix C. Representative photos are provided in Appendix B, and photo locations are provided on Figures 3, 4, and 5 in Appendix C.

3.3.2 Mangrove Forest

The mangrove forest is dominated by five tree species (Table 3-2). Mangrove forest habitat is found within PI 9 East and PI 9 West is delineated on Figures 3 and 5 in Appendix C. Representative photos are provided in Appendix B and photo locations are provided on Figures 3 and 5 in Appendix C.

3.3.3 Secondary Growth Forest

The dominant species in the secondary growth forest habitat are listed in Table 3-2. The trees in the secondary growth forest are approximately 30 feet in height. The secondary growth forest habitat found in PI 9 West is delineated on Figure 3 in Appendix C. Representative photos are provided in Appendix B and photo locations are provided on Figure 3 in Appendix C.

3.3.4 Evergreen Scrub

The species within the evergreen scrub habitat vary depending on exposure to the sea breeze, rainfall, and the extent of the limestone formation. They generally consist of very dense low-growing, or dwarf, drought-resistant shrubs and palms found on rocky coasts and limestone formations (Navy, 1979). Table 3-2 describes the two distinct types of evergreen scrub habitats located in PI 13, one located north of the road that bisects PI 13 and one south of this road, as well as the EADA east of PI 13.

The evergreen scrub habitat is delineated on Figure 4 in Appendix C. Representative photos are provided in Appendix B and photo locations are provided on Figure 4 in Appendix C.

3.3.5 Exposed Limestone

Exposed limestone areas are typically devoid of most vegetation but occasionally have a very sparse and low shrub cover, consisting of the dominant species listed in Table 3-2. Exposed limestone can potentially provide nesting sites for bird species. These areas are 100 percent limestone and are delineated within PI 9 West, PI 13, and the EADA area east of PI 13 on Figures 3 and 4 in Appendix C. Representative photos are provided in Appendix B and photo locations are provided on Figures 3 and 4 in Appendix C.

3.3.6 Areas of Mixed Native/Naturalized and Invasive Species

Areas of mixed native, naturalized, and invasive species generally consist of mixed native and naturalized species as listed in Exhibit 3. The groundcover in areas of mixed native, naturalized, and invasive species is generally sparse, with a 25 percent shrub cover. This area occur within PI 9 West, as delineated on Figure 3 in Appendix C. Multiple monk orchids (*Oeceoclades maculata*) were observed growing on the forest floor; it is one of the most aggressive orchids, and is a terrestrial species able to adapt to a range of environmental conditions. Originally from tropical Africa, the monk orchid is now widespread in the neotropics (Cohen and Ackerman, 2007).

Representative photos are provided in Appendix B and photo locations are provided on Figure 3 in Appendix C.

TABLE 3-2

Habitat Characteristics

Biological Assessment for PI 9 and PI 13 and Debris Piles within UXO 15

Habitat Type	Dominant Vegetation	Percent Cover			Substrate Type	Other Biological Resources
		Canopy	Shrub	Ground-cover		
Dry Scrub Forest	calambreña (<i>Coccoloba venosa</i>), corcho bobo (<i>Pisonia subcordata</i>), gumbo limbo (<i>Bursera simaruba</i>), muñeco (<i>Cordia collococca</i>), torchwood (<i>Amyris elemifera</i>), Coccothrinax sp., tamarind (<i>Tamarindus indica</i>)	100% (15-20 feet height)	5%	5%	100% Soil	grey kingbird (<i>Tyrannus dominicensis</i>), monk orchid (<i>Oeceoclades maculata</i>)
Mangrove Forest	black mangrove (<i>Avicennia germinans</i>), red mangrove (<i>Rhizophora mangle</i>), white mangrove (<i>Laguncularia racemosa</i>), buttonwood (<i>Conocarpus erectus</i>), portia tree (<i>Thespesia populnea</i>)	Variable depending on location, 5-100%	Variable, depending on location, 0-40%	Variable depending on location, 5-100%	100% Soil	land crab (<i>Cardisoma guanhumii</i>) colonies, mangrove cuckoo (<i>Coccyzus minor</i>), clapper rail (<i>Rallus longirostris</i>), white-winged dove (<i>Zenaida asiatica</i>), bananaquit (<i>Coereba flaveola</i>), pearly-eyed thrasher (<i>Margarops fuscatus</i>), black-necked stilt (<i>Himantopus mexicanus</i>), yellow warbler (<i>Dendroica petechia</i>), Antillean grackle (<i>Quiscalus niger</i>), clapper rail (<i>Rallus longirostris</i>), black-bellied plover (<i>Pluvialis squatarola</i>), Wilson's plover (<i>Charadrius wilsonia</i>), and fulvous whistling duck (<i>Dendrocygna bicolor</i>)
Secondary Growth Forest	pink trumpet tree (<i>Tabebuia heterophylla</i>), cassia (<i>Senna bicapsularis</i>), torchwood (<i>Amyris elemifera</i>), gumbo limbo (<i>Bursera simaruba</i>)	100% (30 feet height)	50-75%	25-50%	100% Soil	None observed
Evergreen Scrub	PI 13 (area south of road) - <i>Thrinax morrisii</i> , <i>Erithalis fruticosa</i> , beach creeper (<i>Ernodea littoralis</i>), and <i>Coccoloba krugi</i> . PI 13 (area north of road) - low growing shrubs, including <i>Erithalis fruticosa</i> , beach creeper (<i>Ernodea littoralis</i>), Coccothrinax sp., and buttonsage (<i>Lantana involucrata</i>). EADA east of PI 13 - seagrape (<i>Coccoloba uvifera</i>), sea-oxeye (<i>Borrchia arborescens</i>), slender seapurslane (<i>Sesuvium portulacastrum</i>), and blacktorch (<i>Erithalis fruticosa</i>).	100%	75-100%	0-10%	100% Limestone	None observed

TABLE 3-2

Habitat Characteristics

Biological Assessment for PI 9 and PI 13 and Debris Piles within UXO 15

Habitat Type	Dominant Vegetation	Percent Cover			Substrate Type	Other Biological Resources
		Canopy	Shrub	Ground-cover		
Exposed Limestone	Sparse and low shrub cover consisting of blacktorch (<i>Erithalis fruticosa</i>), <i>Thrinax morrisii</i> , beach creeper (<i>Ernodea littoralis</i>), <i>Coccoloba krugii</i> , and <i>Lantana involucrata</i> .	5%	Variable, depending on location, 0- 25%	Variable, depending on location, 0- 25%	100% Limestone	Antillean nighthawk (<i>Chordeiles gundlachii</i>)
Mixed Native/ Naturalized and Invasives	Mixed native and naturalized species including pink trumpet tree (<i>Tabebuia heterophylla</i>), cassia (<i>Senna bicapsularis</i>), torchwood (<i>Amyris elemifera</i>), gumbo limbo (<i>Bursera simaruba</i>), sapwood (<i>Comocladia dodonaea</i>), and silver palm (<i>Coccothrinax</i> sp.). Multiple monk orchids (<i>Oeceoclades maculata</i>) on forest floor. Invasive or introduced species including acacia (<i>Acacia tortuosa</i>), tan tan (<i>Leucaena leucocephala</i>), and mesquite (<i>Prosopis juliflora</i>).	100%	Variable, depending on location, 50-75%	25%	100% Soil	Mangrove cuckoo (<i>Coccyzus minor</i>), grey kingbird (<i>Tyrannus dominicensis</i>), giant wild pine (<i>Tillandsia utriculata</i>)
Entirely Invasive Species	Acacia (<i>Acacia tortuosa</i>), tan tan (<i>Leucaena leucocephala</i>), and mesquite (<i>Prosopis juliflora</i>).	90-100%	50%	5%	100% Soil	None observed

3.3.7 Areas Composed Entirely of Invasive Species

Areas composed entirely of invasive species (Exhibit 3) are predominately located along the roads. This habitat type occurs within PI 9 West and PI 13, and is delineated on Figures 3 and 4 in Appendix C. Representative photos are provided in Appendix B and photo locations are provided on Figures 3 and 4 in Appendix C.

3.3.8 Other Biological Resources

Other biological resources observed during the site survey include giant wild pine (*Tillandsia utriculata*) colonies, land crab (*Cardisoma guanhumi*) colonies, greater Antillean grackle (*Quiscalus niger*), white-winged dove (*Zenaida asiatica*), yellow warbler (*Dendroica petechia*), mangrove cuckoo (*Coccyzus minor*), clapper rail (*Rallus longirostris*), bananaquit (*Coereba flaveola*), pearly-eyed thrasher (*Margarops fuscatus*), grey kingbird (*Tyrannus dominicensis*), black-necked stilt (*Himantopus mexicanus*), black-bellied plover (*Pluvialis squatarola*), Wilson's plover (*Charadrius wilsonia*), and fulvous whistling duck (*Dendrocygna bicolor*). Two Antillean nighthawks (*Chordeiles gundlachii*) on nests were located within an exposed limestone area.

Effects Analysis

The results of the literature review and ground survey were used to assess what potential effects the proposed investigation activities, including vegetation removal and debris removal, may or may not have on the listed plant and bird species, important refuge habitats, other biological resources previously described, and other wildlife, such as migratory and resident birds, mammals such as mongoose, rats, mice, reptiles, amphibians, and land invertebrates.

As part of this assessment, the following three general options for the degree of vegetation removal within each of the habitat types were considered:

- **Option 1** - 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 of site vegetation but would allow for the most effective detection of surface MEC, if present, and subsurface MEC anomalies (such as DGM).
- **Option 2** - includes the selective removal of vegetation, such that important characteristics of the habitat might be preserved, while allowing for detection of MEC anomalies across as much of the site as possible. Selective removal consists of the removal of all shrubs and small trees less than one meter (39 inches) in height and four centimeters (1.6 inches) DBH, and the complete removal of all invasive species including acacia (*Acacia tortuosa*), tan tan (*Leucaena leucocephala*), and mesquite (*Prosopis juliflora*). This method can result in the removal of vegetation from just a fraction of the site and therefore limit the effectiveness of the detection of surface MEC, if present, and subsurface MEC anomalies.
- **Option 3** – includes no vegetation removal of the important habitats, other than what may be necessary by hand to allow personnel to walk safely through various habitats. Depending on the density of existing vegetation, the detection of surface and subsurface MEC anomalies may be unachievable if no vegetation removal is conducted.

4.1 Listed Plants

Suitable habitats for *Calypttranthes thomasiana*, *Chamaecrista glandulosa* var. *mirabilis*, and *Goetzea elegans* (Matabuey) are not present within PI 9 and PI 13, EADA east of PI 13, and in the vicinity of the debris piles. The results of the ground survey indicate suitable habitat for the *Stahlia monosperma* to exist along the mangrove forest edge or in the upland areas; however, it was not sighted during the ground survey. The implementation of the proposed action is not likely to adversely affect listed plant species.

4.2 Listed Birds

The yellow-shouldered blackbird inhabits the mangrove zone of southwestern Puerto Rico, xeric scrub on Mona Island, and other areas of the Puerto Rico mainland (Cornell, 2011a). Because of the limited distribution of this species, it is unlikely to occur within PI 9, PI 13, and in the vicinity of the debris piles. The implementation of the proposed action is not likely to adversely affect the yellow-shouldered blackbird.

The Caribbean roseate tern is a marine waterbird known to inhabit the shoreline, including rocky offshore islands, barrier beaches, and salt marshes. The roseate tern nests in a variety of small offshore islands, marine rocks, cays, and islets, often near vegetation or jagged limestone rock, open sandy beaches, and among coral rubble (USFWS, 1993). A narrow strip of exposed sand is present at PI 9 East in the middle of the mangrove habitat and therefore is not likely to represent ideal nesting habitat for roseate terns as the roseate terns prefers open sandy beaches as opposed to narrow strips of sand. In addition, no vegetation removal is required for the proposed action within this sand habitat. If removal of adjacent mangroves occurs during the breeding season, mid-May to mid-June, it could adversely affect roseate terns nesting in the sand. If the beach is determined free of nests prior to

vegetation removal, or vegetation removal is done outside of nesting season, the implementation of the proposed action is not likely to adversely affect the Caribbean roseate tern.

The brown pelican feeds in areas such as the coves, inlets, and lagoons of Vieques. An important nesting colony of the brown pelican in Puerto Rico is located in Cayo Conejo, a small island off the southeastern coast of Vieques, approximately eight miles east of UXO 15. The brown pelican nests in colonies of herons or waterbirds. No colonies were sighted during the ground survey. Suitable nesting colonies for the brown pelican are not present within PI 9 and PI 13, EADA east of PI 13, or the vicinity of the debris piles. The implementation of the proposed action is not likely to adversely affect the brown pelican.

4.3 Important Refuge Habitats

4.3.1 Dry Scrub Forest

- **Option 1** consists of approximately 100 percent vegetation removal, while selectively leaving trees with a DBH greater than three inches. The length of time required for this habitat to recover from extensive vegetation removal depends on the previous land alteration and soil impacts. In the literature, forests that had the entire canopy removed and altered soil conditions required a longer recovery time than forests that retained a canopy component after selective clearing (Colon and Lugo, 2006). If this option is carried out, the habitat could take up to 45 years to recover (Colon and Lugo, 2006). In addition, after 45 years, the species composition may not be fully replaced (Colon and Lugo, 2006). Incurred habitat loss would most likely have a long-term impact on wildlife because this habitat is rare and unique. The potential for recovery to pre-vegetation removal conditions (that is, re-planting) is low for dry scrub forest, and significant vegetation removal will most probably result in long-term effects on this habitat. If this option is carried out, the potential for recovery of this habitat is unknown; however, an example indicated it could take up to 45 years (Colon and Lugo, 2006).
- **Option 2** consists of selective vegetation removal. Selective removal of all shrubs and small trees less than one meter in height and four centimeters DBH would occur. This includes native, naturalized, or dominant species of the dry shrub forest, such as calambreña (*Coccoloba venosa*), corcho bobo (*Pisonia subcordata*), gumbo limbo (*Bursera simaruba*), muñeco (*Cordia collococca*), torchwood (*Amyris elemifera*), *Coccothrinax* sp., and tamarind (*Tamarindus indica*). In addition, complete removal of all invasive species, including acacia (*Acacia tortuosa*), tan tan (*Leucaena leucocephala*), and mesquite (*Prosopis juliflora*), would occur. After selective removal, the dry scrub forest habitat could take up to 45 years to recover (Colon and Lugo, 2006). Habitat loss incurred will most likely have a long-term impact on wildlife because this habitat is rare and unique. The potential for recovery to pre-vegetation removal conditions is low, and selective vegetation removal will have high long-term effects on the dry scrub forest.
- **Option 3** consists of no vegetation removal activities. This no-action option will have no adverse effects on the dry scrub forest.

4.3.2 Mangrove Forest

- **Option 1** consists of approximately 100 percent vegetation removal, while selectively leaving trees with a DBH greater than three inches. 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. Habitat loss incurred will most likely have a short-term impact on wildlife because of the abundance of mangrove forest in the general area. Erosion and turbidity control would be necessary to maintain water quality. The potential of recovery to pre-vegetation removal conditions is high, and the total removal will have a moderate impact on this habitat.

- **Option 2** consists of limited vegetation removal, such that all small mangroves (less than one meter in height and four centimeters DBH) would be removed, and complete removal of any invasive species along the upland fringe including acacia (*Acacia tortuosa*), tan tan (*Leucaena leucocephala*), and mesquite (*Prosopis juliflora*) would occur. This method would effectively thin out the mangrove sub-canopy, while maintaining low to moderate habitat quality. The mangrove forests would effectively be thinned out to mangrove islands that would coalesce over time, forming a complete mangrove forest in less than 15 to 30 years (Lewis and Streever, 2000). Incurred habitat loss would most likely have a short-term impact on wildlife because of the abundance of mangrove forest in the general area. The potential of recovery to pre-vegetation removal conditions is high, and the selective removal of vegetation will likely have a low impact on this habitat.
- **Option 3** consists of no vegetation removal activities. This no-action option will have no adverse effects on the mangrove forest.

4.3.3 Secondary Growth Forest

- **Option 1** consists of approximately 100 percent vegetation removal, while selectively leaving trees with a DBH greater than three inches. The dominant tree species in the secondary growth forest have growth rates considered slow (*Amyris elemifera*) (Regional Conservation, 2011a), moderate (*Tabebuia heterophylla* [Forest Service, 2011a] and *Senna bicapsularis* [Forest Service, 2011b]), and fast (*Bursera simaruba*) (Forest Service, 2011c). Given these growth rates, the secondary growth forest would recover in approximately 15 years. The potential of recovery to pre-vegetation removal conditions is low, and total vegetation removal will most likely have high long-term effects on wildlife and this habitat.
- **Option 2** consists of selective vegetation removal that removes shrubs and small trees less than one meter in height and four centimeters DBH and all invasive species, including acacia (*Acacia tortuosa*), tan tan (*Leucaena leucocephala*), and mesquite (*Prosopis juliflora*). This method would effectively thin out the shrub and groundcover strata, while maintaining low to moderate habitat quality. The potential for recovery to pre-vegetation removal conditions is moderate, and limited vegetation removal will most likely have moderate long-term effects on wildlife and this habitat.
- **Option 3** consists of no vegetation removal activities. This no-action option will have no adverse effects on the secondary growth forest.

4.3.4 Evergreen Scrub

- **Option 1** consists of approximately 100 percent vegetation removal, while selectively leaving trees with a DBH greater than three inches. The length of time required for secondary succession via natural recruitment is undetermined. Because of the complexity of this habitat type, the recovery time is unknown. Habitat loss incurred will have a long-term affect on wildlife because of the unknown recovery time. Therefore, the potential for recovery to pre-vegetation removal conditions is low, and total vegetation removal will probably result in long-term effects on this habitat.
- **Option 2** consists of selective vegetation removal that removes shrubs and small trees less than one meter in height and four centimeters DBH and all invasive species, including acacia (*Acacia tortuosa*), tan tan (*Leucaena leucocephala*), and mesquite (*Prosopis juliflora*). The dense scrub species found in this habitat type are typically less than three inches DBH; therefore, the results of selective clearing would likely resemble those of Option 1. Incurred habitat loss will most likely have a long-term impact on wildlife because of the unknown recovery time. Therefore, the potential of recovery to pre-vegetation removal conditions is low, and total vegetation removal will probably result in long-term effects on this habitat.
- **Option 3** consists of no vegetation removal activities. This no-action option will have no adverse effects on the evergreen scrub.

4.3.5 Exposed Limestone

- **Option 1** consists of 100 percent vegetation removal, while selectively leaving trees with a DBH greater than three inches. Based on the low density of vegetation in this habitat type, vegetation removal may not be warranted to enable surface and subsurface MEC anomaly surveys. In addition, the limestone substrate would likely prevent the occurrence of subsurface anomalies. However, if approximately 100 percent vegetation removal is necessary, the length of time required for secondary succession via natural recruitment is undetermined. Because of the complexity of this habitat type, the recovery time is unknown. Habitat loss incurred will most likely have a long-term impact on wildlife because of the unknown recovery time. Therefore, the potential for recovery to pre-vegetation removal conditions is low, and total vegetation removal will most likely have long-term effects on this habitat.
- **Option 2** consists of selective vegetation removal that removes shrubs and small trees less than one meter in height and four centimeters DBH and all invasive species, including acacia (*Acacia tortuosa*), tan tan (*Leucaena leucocephala*), and mesquite (*Prosopis juliflora*). The low shrub cover species found in this habitat are typically less than three inches DBH; therefore, the results of selective clearing would likely resemble those of Option 1. Because of the complexity of this habitat type, the recovery time is unknown. Incurred habitat loss will most likely have a long-term impact on wildlife because of the unknown recovery time. Therefore, the potential for recovery to pre-vegetation removal conditions is low, and total vegetation removal will most likely have long-term effects on this habitat.
- **Option 3** consists of no vegetation removal activities. This no-action option will have no adverse effects on the exposed limestone habitat.

4.3.6 Areas of Mixed Native, Naturalized, and Invasive Species

- **Option 1** consists of approximately 100 percent vegetation removal, while selectively leaving trees with a DBH greater than three inches. It is likely the invasive and introduced species present in this habitat would re-grow extremely fast; however re-growth of the native and naturalized species would occur in 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 total vegetation removal will most likely have moderate long-term effects on wildlife and this habitat.
- **Option 2** consists of selective vegetation removal that removes shrubs and small trees less than one meter in height and four centimeters DBH and all invasive species, including acacia (*Acacia tortuosa*), tan tan (*Leucaena leucocephala*), and mesquite (*Prosopis juliflora*). This method would effectively thin out the shrub and groundcover strata, while maintaining low to moderate habitat quality. The potential for recovery to pre-vegetation removal conditions is moderate, and limited vegetation removal will most likely have moderate long-term effects on wildlife and this habitat.
- **Option 3** consists of no vegetation removal activities. This no-action option will have no adverse effects on areas of mixed native/naturalized and invasive species.

4.3.7 Areas Composed Entirely of Invasive Species

- **Option 1** consists of approximately 100 percent vegetation removal, while selectively leaving trees with a DBH greater than three inches. It is likely all invasive species will be removed from areas entirely composed of invasive species. The length of time required for secondary succession via natural recruitment is presumed to be relatively fast, given the rapid growth rate of the invasive and introduced species. The potential for recovery to pre-vegetation removal conditions is high, and total vegetation removal will have minimal long-term effects on wildlife and this habitat.
- **Option 2** consists of selective vegetation removal and would not be necessary in this habitat type, as the resource would recover quickly.
- **Option 3** consists of no vegetation removal activities. This no-action option would have no adverse effects on areas composed entirely of invasive species.

4.4 Other Biological Resources

Other biological resources observed at UXO 15 during the site survey include giant wild pine or air plant (*Tillandsia utriculata*) colonies, land crab (*Cardisoma guanhumi*) colonies, greater Antillean grackle (*Quiscalus niger*), white-winged dove (*Zenaida asiatica*), yellow warbler (*Dendroica petechia*), mangrove cuckoo (*Coccyzus minor*), clapper rail (*Rallus longirostris*), bananaquit (*Coereba flaveola*), pearly-eyed thrasher (*Margarops fuscatus*), grey kingbird (*Tyrannus dominicensis*), black-necked stilt (*Himantopus mexicanus*), black-bellied plover (*Pluvialis squatarola*), Wilson's plover (*Charadrius wilsonia*), and fulvous whistling duck (*Dendrocygna bicolor*). Two Antillean nighthawks (*Chordeiles gundlachii*) on nests were located within an exposed limestone area.

Locations of biological resources are provided on the maps in Appendix C.

4.4.1 Giant Wild Pine

- **Option 1** consists of approximately 100 percent vegetation removal, while selectively leaving trees with a DBH greater than three inches. Colonies of giant wild pine grow along the edge of the mangrove forest. These air plants are found typically in mesquite and on the ground. Because the growth rate is slow, the length of time required for secondary succession via natural recruitment is undetermined (Regional Conservation, 2011b). Because of the complexity of this habitat type, the recovery time is unknown. Incurred habitat loss will have a long-term impact on wildlife because of the unknown recovery time. Therefore, the mitigation potential is low, and total vegetation removal will have high long-term effects on this habitat.
- **Option 2** consists of selective vegetation removal that removes shrubs and small trees less than one meter in height and four centimeters DBH and all invasive species, including acacia (*Acacia tortuosa*), tan tan (*Leucaena leucocephala*), and mesquite (*Prosopis juliflora*). Removing the groundcover and shrub strata would likely have an effect on the species similar to Option 1. Incurred habitat loss would have a long-term impact on wildlife because of the unknown recovery time. Therefore, the mitigation potential is low, and selective vegetation removal will have long-term effects on this habitat.
- **Option 3** consists of no vegetation removal activities. This no-action option will have no adverse effects on the giant wild pine colonies.

4.4.2 Land Crab

- **Option 1** consists of approximately 100 percent vegetation removal, while selectively leaving trees with a DBH greater than three inches. Land crab colonies are located along the upper fringe of mangrove forests and into the adjacent wetland and landward low lying areas. Spawning occurs from June to December, peaking in October and November (Gifford, 1962). They are herbivores, feeding on native and naturalized vegetation. If approximately 100 percent of the mangrove forest is removed, habitat loss incurred will likely have a short-term impact on the land crab. Because of the abundance of habitat in the general vicinity, it is assumed the foraging habits of the land crab will be maintained.
- **Option 2** consists of selective vegetation removal that removes shrubs and small trees less than one meter in height and four centimeters DBH and all invasive species, including acacia (*Acacia tortuosa*), tan tan (*Leucaena leucocephala*), and mesquite (*Prosopis juliflora*). This option would likely have minimal effects on the land crab and maintain moderate habitat quality.
- **Option 3** consists of no vegetation removal activities. This no-action option will have no adverse effects on the land crab.

4.4.3 Birds

- **Option 1** consists of 100 percent vegetation removal, while selectively leaving trees with a DBH greater than three inches. Habitat loss incurred will have a short-term impact on birds because of the abundance of adjacent habitat within UXO 15 and the general area.

- **Option 2** consists of limited vegetation removal that removes shrubs and small trees less than one meter in height and four centimeters DBH and all invasive species, including acacia (*Acacia tortuosa*), tan tan (*Leucaena leucocephala*), and mesquite (*Prosopis juliflora*). This option would likely have minimal effects on the birds and maintain moderate habitat quality.
- **Option 3** consists of no vegetation removal activities. This no-action option will have no adverse effects on avian species.

4.4.4 Antillean Nighthawk

- **Option 1** consists of approximately 100 percent vegetation removal, while selectively leaving trees with a DBH greater than three inches. The Antillean nighthawk was found nesting in an exposed limestone area. Vegetation removal, and subsequent surveys for MEC anomalies, could disrupt nesting and cause nighthawks to abandon their nests during the nesting season, February 24 through July 1 (Cornell, 2011b). If vegetation removal is conducted during nesting season, this disturbance would likely have a moderate effect on the local nighthawk population.
- **Option 2** consists of selective vegetation removal that removes shrubs and small trees less than one meter in height and four centimeters DBH and all invasive species, including acacia (*Acacia tortuosa*), tan tan (*Leucaena leucocephala*), and mesquite (*Prosopis juliflora*). Any level of vegetation removal, and subsequent surveys for MEC anomalies, could disrupt nesting and cause nighthawks to abandon their nests. If vegetation removal is conducted during the nesting season, this disturbance would likely have a moderate effect on the local nighthawk population.
- **Option 3** consists of no vegetation removal activities. This no-action option will likely have no adverse effects on nesting nighthawks unless surveys for MEC anomalies are conducted in exposed areas. Surveys could disrupt nesting and cause nighthawks to abandon their nests. If surveys are conducted during the nesting season, this disturbance would likely have a moderate effect on the local nighthawk population.

4.5 Conservation Measures

The proposed action could potentially result in impacts to important habitats and biological resources, as previously described. The following conservation measures should be implemented to prevent, minimize, or otherwise mitigate adverse effects:

- Anywhere vegetation removal is to be conducted, a habitat-specific education of vegetation removal crews should occur to clearly identify the specific plants, community of plants, and biological resources to be avoided.
- To maintain water quality, erosion control (such as silt fence and floating turbidity barriers) should be implemented in areas upslope of mangrove forests and other areas likely to drain into surface waters.
- In exposed sand and limestone areas, which are habitats types that can support the nesting of roseate terns and Antillean nighthawks, it is recommended that a field survey be conducted to determine if these species are present on nests prior to vegetation removal or MEC survey activities, assuming work needs to be conducted during the nesting season. If nests are present, mitigative measures should be implemented to avoid disturbing these nests.

SECTION 5

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Appendix A

*Methods and Approach for Surveys of Endangered and Threatened
Wildlife, Plant Species and Important Habitats at PI 9, PI 13, and
Debris Piles within UXO 15 Technical Memorandum
dated May 25, 2011.*

Methods and Approach for Surveys of Endangered and Threatened Wildlife Plant Species and Important Habitats at PI-9, PI-13, and Debris Piles within UXO 15

TO: USFWS VNWR

COPIES: NAVFAC RPMs
John Swenfurth/CH2M HILL
John Martin/CH2M HILL
Dennis Ballam/CH2M HILL

FROM: CH2M HILL

DATE: May 25, 2011

Introduction

The Naval Facilities Engineering Command (NAVFAC) Atlantic will be preparing a Biological Assessment (BA) for Unexploded Ordnance Site 15 (UXO 15), located within the Vieques National Wildlife Refuge (VNWR) and currently managed by the United States Fish and Wildlife Service (USFWS). This BA will evaluate the potential effects of proposed vegetation clearance associated with munitions constituent (MC) investigation and munitions debris (and related debris) removal on threatened and endangered species and important habitats potentially present at UXO 15. The planned investigation and debris removal activities are documented in the *Draft Final Expanded Site Inspection Sampling and Analysis Plan, UXO 15, Former Vieques Naval Training Range, Vieques, Puerto Rico* (CH2M HILL, 2011). The BA will be specifically prepared for munitions constituent investigation areas PI-9 and PI-13, located within UXO 15, and for multiple small debris piles located within and just north of UXO 15 at the former Vieques Naval Training Range (VNTR) on Vieques Island, Puerto Rico. Figures 1 and 2 show the locations of these proposed survey areas. It is the goal of both the Department of the Navy (Navy) and USFWS to minimize disturbance to listed species and important habitats during vegetation clearance activities.

This Technical Memorandum (TM) presents field survey methods and approaches to documenting the potential presence of Federal- and State-listed biological species, both flora and fauna. It also details methods and approaches to documenting habitats considered important for the VNWR, such as subtropical dry forest or mangroves, and other distinctive biological resources, such as bird species or land crab colonies, within these specified areas of UXO 15. These methods could be subject to change based on habitats encountered, field conditions, or the planned investigation and debris removal requirements. Consensus from the USFWS regarding the results of this BA will be obtained prior to any vegetation-clearing activities at the site.

Basis of Methods and Approach

Munitions related investigation and debris removal activities are planned for sites PI-9, PI-13, and multiple small waste piles located within and just north of UXO 15 (Figure 1). Initial activities will include visual ground surface surveys within the boundaries of PI 9 and PI 13, as well as subsurface anomaly surveys using electromagnetic instrumentation (such as digital geophysical mapping [DGM]). These survey methods necessitate an exposed ground surface and, as a result, will require the clearing of vegetation where mapping may be completed in PI 9 and PI 13. The overall purpose of this BA is to document and map the presence of listed species, important refuge habitats, and biological resources within PI 9 and PI 13 so that decisions can be made concerning appropriate vegetation-clearance methods for minimizing or avoiding adverse effects on these resources.

The VNWR supports important habitats for native, migratory, rare, and protected species. According to the Vieques National Wildlife Refuge Conservation Plan (VNWRC), approximately 18 federally listed plants and animal species are expected to occur on VNWR and in surrounding waters (USFWS, 2007). These include four plant species, three bird species, four reptile species, and five mammal species. No federally designated critical habitat is present on the Vieques refuge.

The methods and approach plan will focus mainly on four plant species and two important habitat types (Table 1) that are considered most likely to occur at UXO 15. A description of these plant species and important habitats is included here, as described in the VNWRC. Additional important habitats and biological resource elements are also described.

Listed Plants

Four federally listed plant species occur in the Vieques refuge and may potentially occur within the environments associated with UXO 15, environments including rocky land (limestone and dolomitic rock), tidal swamp, and tidal flats (USFWS, 2007; Geo-Marine, 2003). Characteristics and typical habitat requirement of *Cóbana negra* (*Stahlia monosperma*), *Calyptanthes thomasiana*, *Chamaecrista glandulosa* var. *mirabilis*, and *matabuey* (*Goetzea elegans*) are listed below:

- *Stahlia monosperma* is a medium-sized, evergreen tree that reaches 25 to 50 feet in height and 1 to 1.5 feet in diameter. It produces yellow flowers between March and May, depending on rainfall. Scattered populations survive in Puerto Rico, Vieques, and the eastern portion of the Dominican Republic (USFWS, 1996). This species grows in brackish, seasonally flooded wetlands in association with mangrove communities and in upland areas, although cultivated plants have been reported from inland areas as well as on the Vieques Refuge. The species is known to occur in the Laguna Kiani and Laguna Yanuel areas.

- *Calypttranthes thomasiana* is a shrub or small tree that may reach 30 feet in height and 5 inches in diameter. It is only known from three locations: Monte Pirata, in Vieques; Bordeaux Mountain, in St. John; and Gorda Peak, in Virgin Gorda. Approximately 10 to 12 individuals are known to occur on Vieques, near the summit of Monte Pirata. In Monte Pirata, *Calypttranthes thomasiana* is found in the moist deciduous formation of the inner hills and slopes, a forest type that also includes semi-evergreen forests (USFWS, 1997).
- *Chamaecrista glandulosa* var. *mirabilis* is a shrub that may reach up to 3 feet in height. This species is known from only scattered locations along the southern shore of Tortuguero Lagoon and one area in Dorado (USFWS, 1994). This species utilizes silica sands associated with limestone formations. A historical record indicated that the species had been collected near Red Beach or Bahía Corcho in Vieques. Surveys were conducted in 1996 and 2000 but no individuals were found (Geo-Marine, 2003).
- *Goetzea elegans* (Matabuey) is a shrub or small tree reaching 30 feet in height with a stem diameter of 5 inches. This species generally flowers and sets fruit between April and August, bearing funnel-shaped flowers that are yellow-orange in color. The fruit is an orange, one-seeded berry that is reputed to be poisonous (USFWS 1987). The species habitat consists of semi-evergreen forests of the subtropical moist forest zone (Ewel and Whitmore, 1973) and has been found in mainland Puerto Rico only below 660 feet (200 meters) elevation in the foothills and mogotes (karst limestone hills) in the north (USFWS, 1987). In 2000, the species was found in four locations along forested drainages in western Vieques.

TABLE 1
Federally Endangered and Threatened Species Potentially Occurring on Vieques, Puerto Rico

Scientific Name	Common Name	Federal Status	State Status
Plants			
<i>Calypttranthes thomasiana</i>	none	Endangered	Endangered
<i>Chamaecrista glandulosa</i> var. <i>mirabilis</i>	none	Endangered	Endangered
<i>Goetzea elegans</i>	Beautiful goetzea	Endangered	Endangered
<i>Stahlia monosperma</i>	Cóbana negra	Threatened	Threatened
Birds			
<i>Agelaius xanthomus</i>	Yellow-shouldered blackbird	Endangered	Endangered
<i>Pelecanus occidentalis</i>	Brown pelican	Delisted ¹	Delisted ¹
<i>Sterna dougallii dougallii</i>	Roseate tern	Threatened	Threatened

¹ Formerly listed as endangered
Source: USFWS, 2007

Listed Birds

Two federally listed birds potentially occur in the Vieques refuge (roseate tern and yellow-shouldered blackbird), as along with the recently delisted (formerly endangered) brown pelican:

- The Caribbean roseate tern (*Sterna dougallii*) is listed as threatened in the Caribbean. The species is distributed throughout the region, with the largest populations occurring in the Lesser Antilles (USFWS, 1993). The species utilizes different habitats for nesting, including small offshore islands, marine rocks, cays, islets, areas near vegetation or jagged limestone rock, open sandy beaches, and among coral rubble (USFWS, 1993). The species was reported nesting on the eastern tip of the island in 2001.
- Historic records of Vieques' Yellow-shouldered blackbird (*Agelaius xanthomus*) are available in literature (USFWS, 1978); however, no recent sightings of the species in Vieques have been documented.
- The brown pelican (*Pelecanus o. occidentalis*) has multiple roosting sites on the coast of the refuge, near Punta Vaca and Punta Boca Quebrada, within the Laguna Kiani, and east and west of the Mosquito Pier. The brown pelican feeds in such areas as the coves, inlets, and lagoons of Vieques. The most important brown pelican nesting colony in Puerto Rico is located in Cayo Conejo, a small island off the southeastern coast of Vieques, approximately eight miles east of UXO 15. The brown pelican was removed from the Federal list of endangered species in November 2009 due to its recovery; this removal includes all subspecies of the brown pelican.

Important Refuge Habitats

Two important habitats have been identified by USFWS as occurring within UXO 15, including subtropical dry forest and mangrove wetland (Figure 3):

- The subtropical dry forest is the driest zone that has a nearly complete cover of deciduous vegetation found in the region. Common species include Alelí (*Plumeria alba*), bitter-ash (*Rauvolfia nitida*), calambreña (*Coccoloba venosa*), common lignumvitae (*Guaiacum officinale*), corcho bobo (*Pisonia albida*), Royen's tree cactus (*Pilosocereus royenii*), fiddlewood (*Citharexylum fruticosum*), guayacán blanco (*Guaiacum sanctum*), gumbo limbo (*Bursera simaruba*), indio (*Erythroxylon areolatum*), leadtree (*Leucaena glauca*), mesquite (*Prosopis juliflora*), oxhorn bucida (*Bucida buceras*), pricklypear (*Opuntia rubescens*), red manjack (*Cordia nitida*), silk cotton tree (*Ceiba pentandra*), Spanish-lime (*Melicoccus bijugatus*), sweet acacia (*Acacia farnesiana*), tachuelo (*Pictetia aculeata*), tamarind (*Tamarindus indica*), and willow bustic (*Dipholis salicifolia*). This dry coastal forest is found in patches within the VNWR, usually at the higher elevations; UXO 15 has elevations ranging from sea-level to 30 meters.
- Mangrove forests in the project area are located on both the southern and northern coasts. Mangrove communities and their associated open-water lagoons, shallow salt and sand flats, or tidal mudflats occupy approximately 1,327 acres on Vieques. Mangrove forests are characterized as open- (fringe) and closed-lagoon forests. Mangrove species include red mangrove (*Rhizophora mangle*), white mangrove

(*Laguncularia racemosa*), black mangrove (*Avicennia germinans*), and button mangrove (*Conocarpus erectus*).

Other important habitats may be found and will be documented. These habitats can include, but are not limited, to the following:

- Secondary growth forests containing large native trees
- Areas of sparsely vegetated barren rock supporting unique plant species
- Areas that contain a mix of native and invasive species will be documented these are areas that may allow selective harvest of invasives to facilitate UXO surveying
- Areas composed entirely of invasive species (such as acacia [*Acacia smallii*], tan tan [*Leucaena leucocephala*], and mesquite [*Prosopis juliflora*]) will documented measures will be made of typical invasive tree diameter at breast height (dbh), since any tree with a dbh greater than 3 inches should not be harvested unless it interferes with UXO surveying
- Areas containing invasive species considered locally desirable by USFWS, including various palms such as *Thrinax morrisii*, portiatree (*Thespesia populnea*), and gumbo limbo will be documented

Other Biological Resources

Other biological resources observed during the site survey will be recorded. This will include noting species of birds, mammals, reptiles, amphibians, and large terrestrial invertebrates (such as land crabs and hermit crabs) using on-site habitats, as well as any notable behaviors such as nesting. Faunal species will be identified as best as possible based on visual or aural indications. Location information for land crab colonies will be collected for subsequent mapping.

Survey Methodology

The survey methodology will consist of two main components:

- Literature review of available published sources regarding the listed biological species, species occurrence records, habitat associations, maps, and specific information available from the USFWS regarding local knowledge of species and important habitats
- Ground surveys of listed biological species, habitats important for the VNWR, and other distinctive biological resources present within the boundaries of sites PI-9 and PI-13, and at the debris piles associated with other UXO 15 areas.

Literature Review

The following resources, in addition to others available, will be consulted, including experts and VNWR managers, as necessary:

- VNWRCP and Environmental Impact Statement (USFWS, 2007)
- Integrated Natural Resource Management Plan (Geo-Marine, 2003)

- Land Use Management Plan (NSSR, 1996)
- Biological Assessment, Select Portions of the Surface Impact Area and Eastern Impact Area, Former Vieques Naval Training Range (Ecology and Environment Inc. et al., 2010)
- Biological Assessment for Continuing Training Activities on the Inner Range, Vieques, Puerto Rico (Geo-Marine, 2001)
- Draft Environmental Impact Statement (DEIS) (DON, 1979)
- Maps of known vegetation communities, including topography (where available) based on natural history requirements for listed species and important habitats. USFWS will be consulted regarding any updated mapping information and integrated with any location specific data and local knowledge of refuge habitats

Prior to field surveys, contemporary aerial images will be used to determine the limits of the vegetation survey areas based on PI site boundaries, vegetative signatures, and known available literature. These limits will be used to establish the survey boundary and will be field-verified by spot checks. Planned transects will be established by Geographic Information System (GIS) software within the demarcated boundaries to ensure full coverage.

Survey Method

Field surveys will cover the entire investigation area where listed species or important habitats have a high potential to occur and/or would be known to occur. This survey method will include representative linear transects or other sampling methods that enable coverage of approximately 100 percent of the habitat type, with the exception of inundated mangrove habitat. The listed plant species in Table 1 are not expected waterward of the mean low water (MLW), so this habitat type would only be surveyed above this field-observed elevation or as appropriate in order to avoid unnecessary destruction of habitat for access. Inaccessible areas that cannot be surveyed by ground (because of access, steepness, or impenetrable conditions) will be evaluated using all other available information (such as species habitat requirements or habitat types known to occur onsite) to determine if listed species potentially occur elsewhere in the areas of investigation. Areas of limited or no access will be documented on maps, and the BA will note any uncertainties regarding the presence of listed species or important habitats in these areas. In cases where the terrain is very steep at PI 9 and PI 13, sparsely vegetated barren rock areas may occur and be visible from a distance; this important habitat would be mapped as best as possible.

In areas where important habitat types are found (such as subtropical dry forest or native secondary forests) but listed plant species are not expected, the survey may not require 100 percent coverage of the habitat by transects to enable accurate mapping and dominant species documentation. In these instances, the field team may walk the perimeter of the habitat type with occasional point surveys to determine dominant species and associated plant community characteristics. This type of evaluation would also apply to the mapping of areas composed entirely of invasive species.

Biological resources such as bird, mammal, and land crab colony occurrence will be documented during the conduction of the listed species and important habitat surveys previously described. Any listed bird species occurring within these habitats will also be recorded.

Proposed survey transects, each spaced 30 meters apart, are shown on Figures 1 and 3. A team of two biologists will walk each transect, surveying as much as 15 meters on either side of the transect centerline depending on visibility and terrain. Field maps will be prepared ahead of time for all survey staff and will provide information on the extent of the areas to be investigated, transect locations, known species or important habitat occurrences, and global positioning system (GPS) coordinates at the ends and midpoint of each transect, to assist with on-the-ground navigation. Transects may be adjusted for example, segments may be moved, added, or deleted) in the field based on environmental conditions (such as extreme terrain) or professional judgments regarding habitat types that have either been fully characterized by completed transects or that require more intensive survey based on habitat complexity. Photographs will be taken as necessary to document protected species observations, various habitat types, and biological resources.

Within each important habitat assessment area, an estimated density (percent cover) of vegetation will be determined visually for each strata (for example, groundcover [<0.5 m], shrub [0.5 to 5m], and tree canopy [>5 m] strata) by survey staff. The purpose of the vegetation density assessment is to evaluate the extent of the visibility of the ground surface to allow for clearing activities within important habitats, to determine the effects of potential vegetation clearing on the specific strata, and to evaluate options for impact avoidance measures during vegetation clearing activities to preserve protected or important plant species and important habitats, if feasible.

Agency Consultation and Coordination

It is anticipated that meetings will be arranged with USFWS at the VNWR in Vieques, Puerto Rico, as necessary. An initial meeting will be conducted to discuss the methods and approach presented in this TM and to obtain additional information regarding the specific survey areas. Other meetings will be arranged as needed to discuss progress during the field survey, survey results, or unusual findings. Close coordination with the USFWS will ensure active participation by all agencies and result in mutually agreed-upon outcomes.

Biological Assessment Documentation

A final BA report for submittal to USFWS will be prepared upon completion of field surveys.

The BA will include information such as:

- Description of the biological assessment methodologies employed during the investigation, including concurrence letters from FWS
- Description of the existing environment at each of the investigation areas, listing dominant species for each habitat type

- Clear identification of all areas of concern regarding listed species (if found) and their associated habitats, as well as important refuge habitats and other biological resources; this information will be presented in hard copy maps with electronic GIS mapping information of these areas
- Documentation of all field observations and other pertinent information, including vegetation density and representative photographs
- Potential effects on listed species, as well as important refuge habitats and other biological resources, based on the proposed investigation and debris removal activities
- Appropriate conservation or mitigation measures for listed species, as required, for anticipated vegetation removal and debris removal activities
- Description of proposed vegetation removal areas and methodologies based on the results of the BA

The anticipated report format will include the following information:

- Introduction
- Purpose
- Proposed Action
- Natural Environment and Species Description
- Effects Analysis
- Conclusions and Determination of Effect
- References

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Legend
— Transect (30 meter spacing)
□ PI-9



Figure 1
PI-9 Biological Assessment
Former VNTR, Vieques, Puerto Rico



PI-13
6.52 Acres

Legend
— Transect (30 meter spacing)
□ PI-13



Figure 2
PI-13 Biological Assessment
Former VNTR, Vieques, Puerto Rico



FIGURE 3
 Significant and Sensitive Habitats
 Former Vieques Naval Training Range
 Vieques, Puerto Rico

Source: FWS, 2010 (Draft)

Appendix B
Photograph Log

PHOTO LOG



Photo Station #1: Dry Scrub Forest in PI 9 West



Photo Station #2: Exposed Limestone in PI 9 West

PHOTO LOG



Photo Station #3: Dry Scrub Forest in PI 13



Photo Station #4: Mangrove Forest in PI 9 West

PHOTO LOG



Photo Station #5: Evergreen Scrub in PI 13



Photo Station #6: Evergreen Scrub in PI 13

PHOTO LOG



Photo Station #7: Evergreen Scrub in PI 13



Photo Station #8: Evergreen Scrub in PI 13

PHOTO LOG



Photo Station #9: Evergreen Scrub in PI 13



Photo Station #10: Exposed Limestone in PI 13

PHOTO LOG



Photo Station #11: Exposed Limestone in PI 9 West



Photo Station #11: Antillean Nighthawk (*Chordeiles gundlachi*)

PHOTO LOG



Photo Station #12: Exposed Limestone in PI 9 West



Photo Station #13: Mixed Native and Invasive Vegetation in PI 9 West

PHOTO LOG



Photo Station #14: Mixed Native and Invasive Vegetation in PI 9 West



Photo Station #15: Mixed Native and Invasive Vegetation in PI 9 West

PHOTO LOG



Photo Station #16: Invasive Vegetation in PI 9 West



Photo Station #17: Invasive Vegetation in PI 9 West

PHOTO LOG



Photo Station #18: Giant Wild Pine (*Tillandsia utriculata*) Colony in PI 9 West



Photo Station #19: Giant Wild Pine (*Tillandsia utriculata*) Colony in PI 9 West

PHOTO LOG



Photo Station #20: Monk Orchid (*Oeceoclades maculata*) PI 9 West



Photo Station #21: Evergreen Scrub in Elevated Anomaly Density Area East of PI 13

PHOTO LOG



Photo Station #22: Pile D



Photo Station #23: Pile D

PHOTO LOG



Photo Station #24: Pile C



Photo Station #25: Pile B

PHOTO LOG



Photo Station #26: Pile A



Photo Station #27: Pile A

PHOTO LOG



Photo Station #28: Exposed Limestone in Elevated Anomaly Density Area East of PI 13



Photo Station #29: Exposed Sand in PI 9 East

PHOTO LOG



Photo Station #30: Exposed Sand in PI 9 East



Photo Station #31: Exposed Sand and Mangroves in PI 9 East

PHOTO LOG



Photo Station #32: Exposed Sand and Mangroves in PI 9 East

Appendix C Figures



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

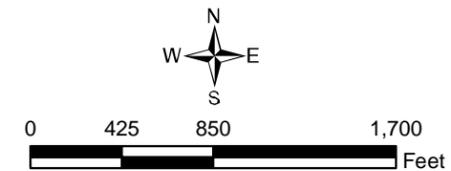


Figure 1
UXO 15 Biological Assessment
UXO 15 Overview
Former VNTR
Vieques, Puerto Rico

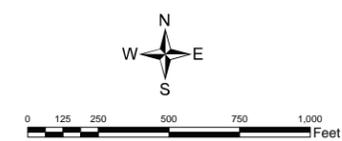
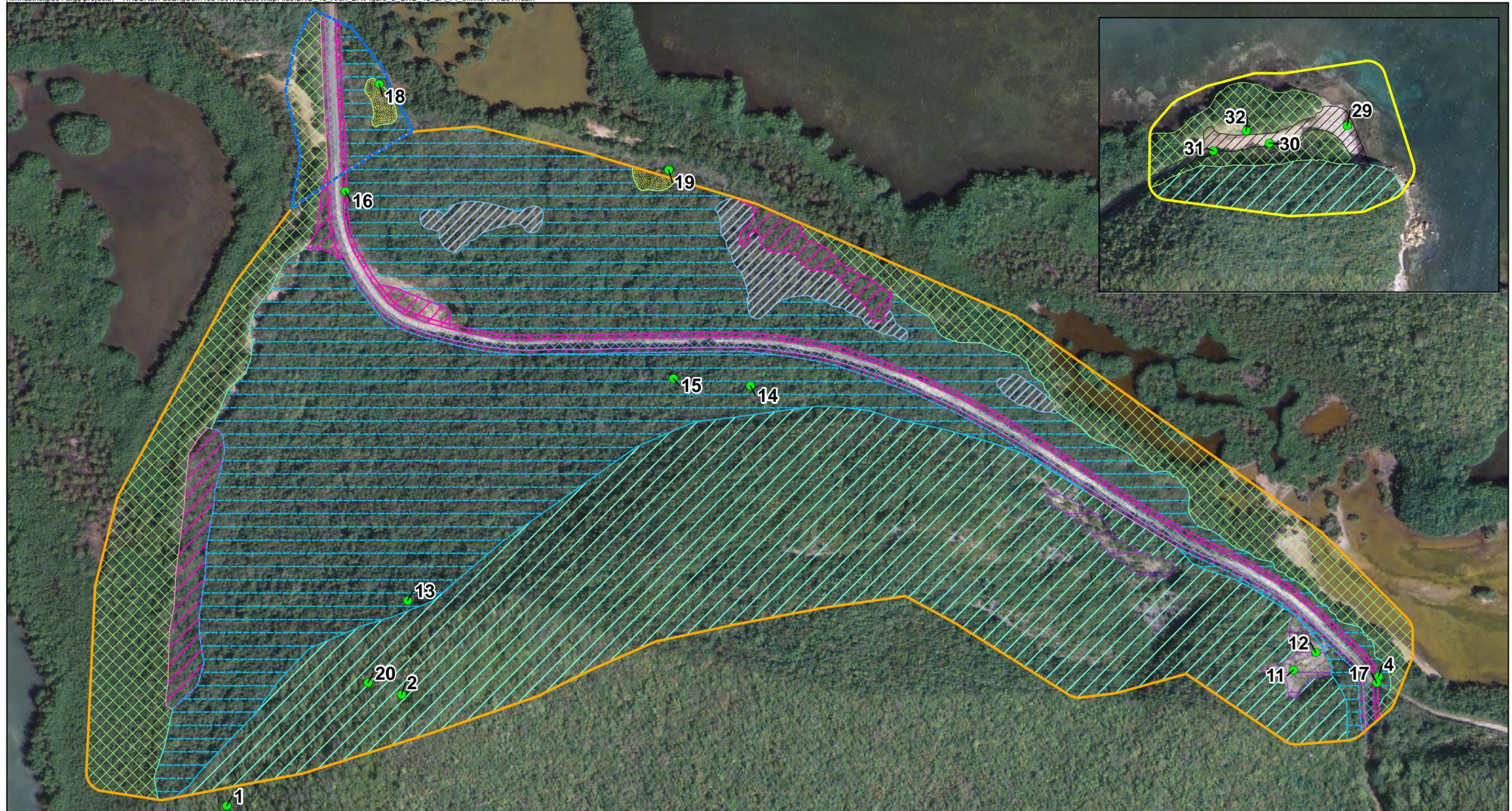


Figure 2
UXO 15 Biological Assessment
 Overall Map for PI 9, PI 13, and Debris Piles within UXO 15
 Former VNTR
 Vieques, Puerto Rico
CH2MHILL

2007 Aerial Imagery
(\nasrc\g1\img\proj\m1\1\UXO15\Fig\Com\45450\Map\Fig\UXO_15_Air_BA\Fig_2_UXO_15_BA_Overall.mxd/14/2011)



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

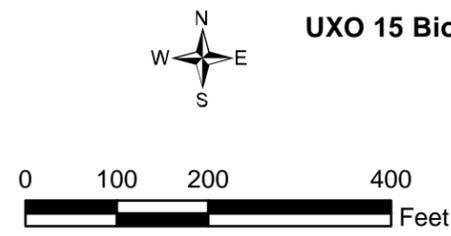
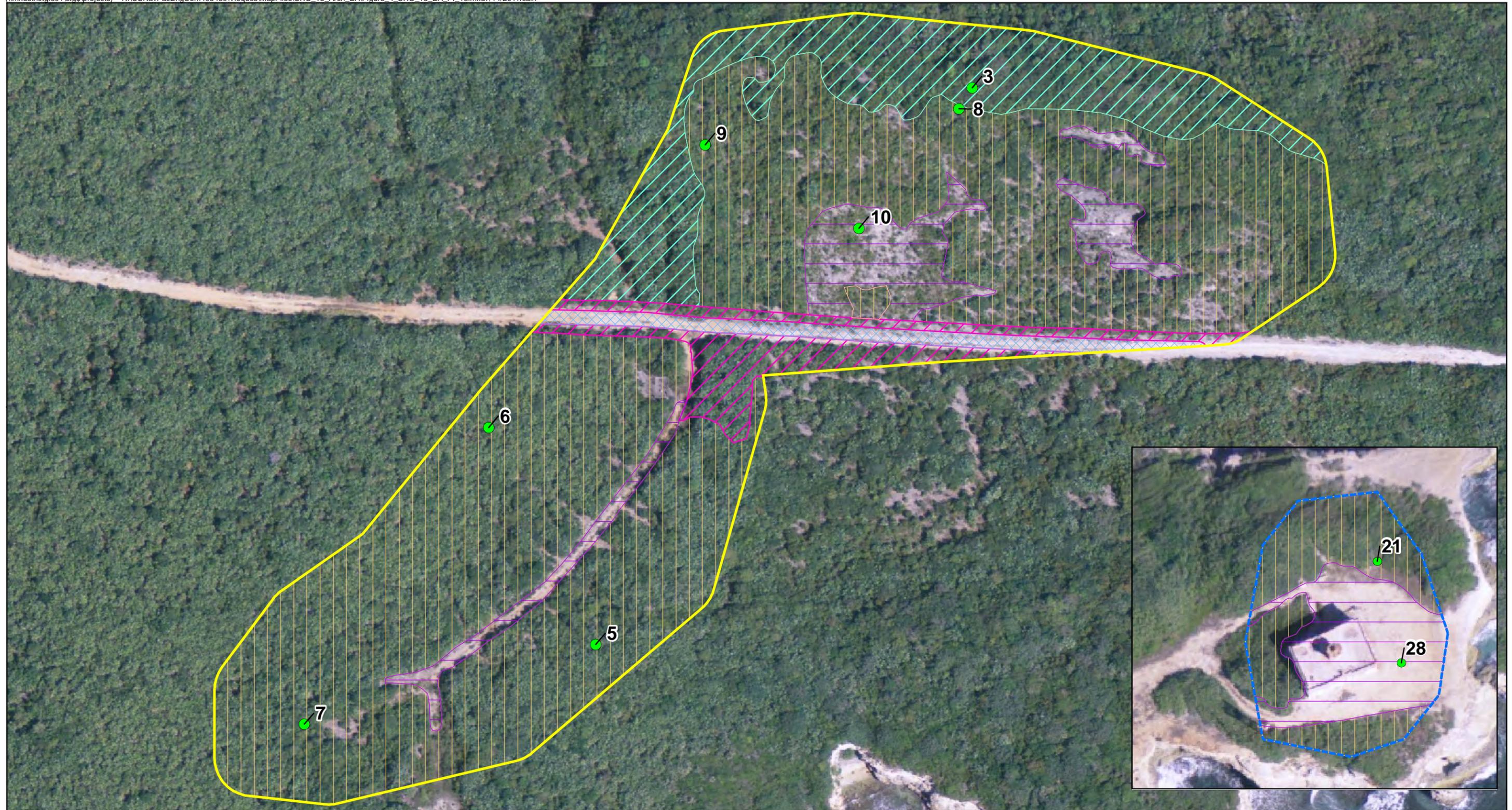


Figure 3
UXO 15 Biological Assessment
PI 9
Former VNTR
Vieques, Puerto Rico



Legend

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

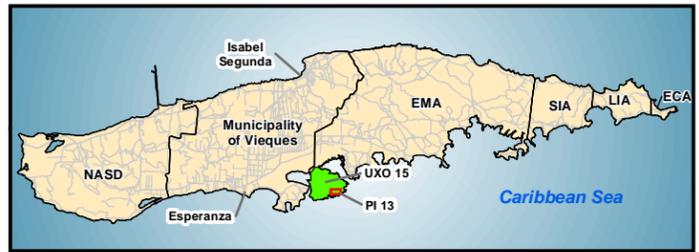
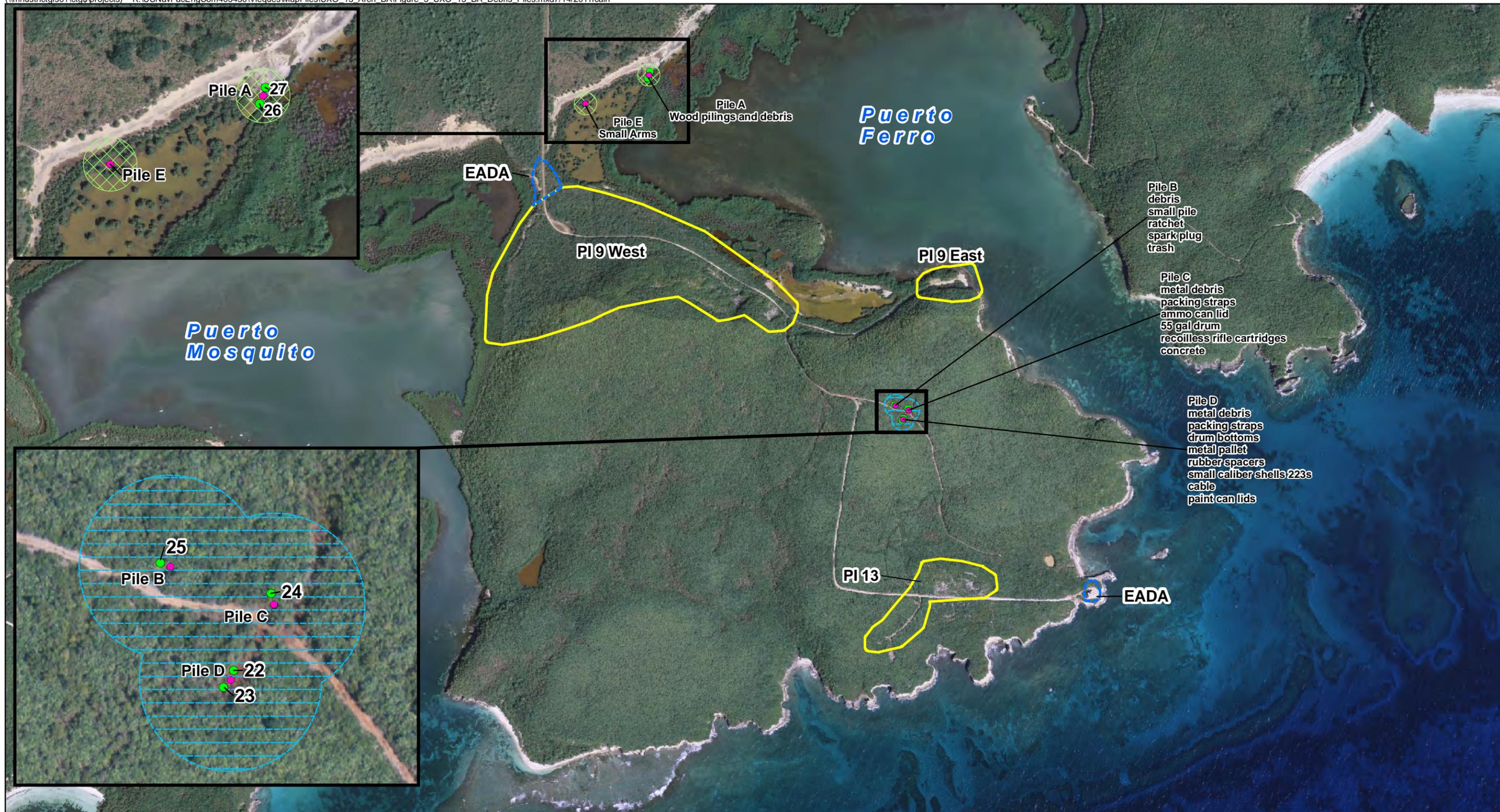


Figure 4
UXO 15 Biological Assessment
PI 13
Former VNTR
Vieques, Puerto Rico



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

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

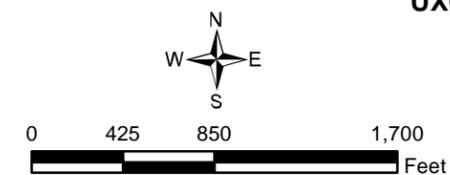


Figure 5
UXO 15 Biological Assessment
Debris Piles within UXO 15
Former VNTR
Vieques, Puerto Rico