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Final
Expanded Site Inspection Sampling and Analysis Plan Addendum for the Remedial Investigation at UXO 15

Former Vieques Naval Training Range
Vieques, Puerto Rico

Prepared for

Department of the Navy
NAVFAC ATLANTIC

Contract No.
N62470-08-D-1000
CTO-0037

July 2012

Prepared by

CH2MHILL

ES112111201738TPA

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Expanded Site Inspection Sampling and Analysis Plan Addendum for the Remedial Investigation at UXO 15

Former Vieques Naval Training Range Vieques, Puerto Rico

Contract Task Order 0037

July 2012

Prepared for

Department of the Navy
Naval Facilities Engineering Command
Atlantic Division

Under the

NAVFAC CLEAN 1000 Program
Contract N62470-08-D-1000

Prepared by

CH2MHILL

Virginia Beach, Virginia

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Contents

Section **Page**

Contents iii

Acronyms and Abbreviations v

Executive Summary ix

Resumen Ejecutivo xi

SAP Worksheet #2 — SAP Identifying Information 1

SAP Worksheet #9 — Project Scoping Session Participants Sheet 5

SAP Worksheet #10 — Problem Definition 9

SAP Worksheet #11 — Project Quality Objectives/Systematic Planning Process Statements 15

SAP Worksheet #13 — Secondary Data Criteria and Limitations Table 19

SAP Worksheet #14 — Summary of Project Tasks for UXO 15 21

SAP Worksheet #15-1 — Reference Limits and Evaluation Table 25

SAP Worksheet #15-1a — Reference Limits and Evaluation Table 26

SAP Worksheet #15-2 — Reference Limits and Evaluation Table 27

SAP Worksheet #15-2a — Reference Limits and Evaluation Table 28

SAP Worksheet #15-3 — Reference Limits and Evaluation Table 29

SAP Worksheet #15-4 — Reference Limits and Evaluation Table 30

SAP Worksheet #15-5 — Reference Limits and Evaluation Table 31

SAP Worksheet #16 - Project Schedule / Timeline 33

SAP Worksheet #17 – Sampling and Design and Rationale 35

References 37

List of Figures

1 Former VNTR Site Location Map
2 PI-9 East Location of Limestone Encrusted Munitions
3 Potential Contaminant Sources at UXO-15
4 Location of Transect Items
5 2003 Photo of Rusted Artillery Casings Near PI-9
6 2003 Photo of Rusted Artillery Casings at Boat Ramp of PI-9
7 Aerial and Hand Held Magnetometer Survey Results
8 Important Habitats
9 Results of Bedrock Survey

10 Results of Bedrock Survey and Biological Assessment PI-9 West
11 Proposed Transect Locations
12 Conceptual Site Model
13 Debris Piles
14 Expanded SI Evaluation Decision Tree
15 Proposed Sample Locations
16 Historical Trenching and Filling Operation – 1959 Aerial Photo of PI-9
17 Historical Trenching and Filling Operation – 1962 Aerial Photo of PI-9
18 Historical Trenching and Filling Operation – 1964 Aerial Photo of PI-9
19 Historical Trenching and Filling Operation – 1970 Aerial Photo of PI-9

Attachments

A Final Biological Assessment

B LiDAR Figures

C Final Responses to USEPA, PREQB, and USFWS Comments

Acronyms and Abbreviations

AMS	aerial magnetometer survey
AVS/SEM	Acid volatile sulfide/simultaneously extracted metals
BA	biological assessment
CCP	Comprehensive Conservation Plan
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLEAN	Comprehensive Long-term Environmental Action—Navy
CSM	Conceptual Site Model
CTO	Contract Task Order
DBH	diameter at breast height
DGM	digital geophysical mapping
DL	detection limits
DoD	U.S. Department of Defense
DOI	Department of the Interior
DQE	data quality evaluation
EADA	elevated anomaly density areas
EBS	Environmental Baseline Survey
ECA	Eastern Conservation Area
EIS	Environmental Information Specialist
EMA	Eastern Maneuver Area
EQB	Environmental Quality Board
ERA	Ecological Risk Assessment
ERA	Expanded Range Assessment
ERP	Environmental Restoration Program
ESI	Expanded Site Investigation
ESSD	Explosive Safety Submission Determination
ft	feet/foot
FWS	Fish and Wildlife Service
GPS	Global Positioning System
HQ	hazard quotient
IDW	investigation-derived waste
IR	Navy Installation Restoration
LCS	laboratory control sample
LCL	lower control limit
LIA	Live Impact Area
LODs	limits of detection
LOQs	limits of quantitation
LUCs	land use controls
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
MD	munitions debris
MDL	method detection limit

MEC	munitions and explosives of concern
mg/kg	milligrams per kilogram
MPC	Measurement Performance Criteria
MPPEH	munitions potentially presenting an explosive hazard
MRAs	Munitions Response Areas
MRP	Munitions Response Program
MSOPPPs	Master Standard Operating Procedures, Protocols, and Plans
MS/MSD	matrix spike/matrix spike duplicate
N/A	not applicable
NAVFAC	Naval Facilities Engineering Command
Navy	Department of the Navy
NIRIS	Navy Installation Restoration Information System
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
OB/OD	open burn/open detonation
OU	operable unit
PAL	project action limit
PDF	portable document format
PI	Photo Identified
PILs	project indicator limits
PM	Project Manager
POC	Point of Contact
PQO	Project Quality Objective
PREQB	Puerto Rico Environmental Quality Board
QA	quality assurance
QAMS	Quality Assurance Management Section
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	quality control
QL	quantitation limit
QSM	Quality Systems Manual
RAB	Restoration Advisory Board
RI	Remedial Investigation
RL	reporting limit
RPD	relative percent difference
RPM	Remedial Project Manager
RRT	relative retention times
RTK	Real Time Kinematic
SAP	Sampling and Analysis Plan
SI	Site Inspection
SIA	Surface Impact Area
SMP	Site Management Plan
SOP	standard operating procedure
SSL	Soil Screening Level
SW	surface water
TCLP	Toxicity Characteristic Leaching Procedure
TOC	Total organic carbon
TOI	Target of Interest

TRV	Toxicity Reference Value
U.S.	United States
UFP -QAPP	Uniform Federal Policy-Quality Assurance Project Plans
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
UTLs	upper tolerance limits
UXO	Unexploded Ordnance
VNTR	Vieques Naval Training Range
VSP	Visual Sampling Plan

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Executive Summary

This document is an addendum to the Expanded Site Investigation Sampling and Analysis Plan, Unexploded Ordnance (UXO) 15 (ESI SAP [CH2M HILL, 2011a]). However, because of the potential presence of munitions-related items encrusted in rock or "cemented" soil within the northeastern part of UXO 15 that will likely require remedial alternatives evaluation, this addendum includes the approach to conduct a remedial investigation (RI) at UXO 15. It is important to note that with respect to munitions constituents (MC), release assessment is still warranted since it is unknown whether there has been a release of these constituents to environmental media at the site. Photo Identified (PI) 9 and 13 are located within UXO Site 15, at the former Vieques Naval Training Range (VNTR) in the eastern portion of Vieques, Puerto Rico. The two sites represent the two areas where historical information suggests former military activities took place and, therefore, represent the most likely locations where releases associated with munitions activities took place. This addendum describes the modifications (and associated rationale) to the ESI SAP based on the results of the biological assessment (BA) and associated input from the United States Fish and Wildlife Service (USFWS), and on the results of a bedrock depth survey, both conducted subsequent to finalizing the ESI SAP in May 2011. It also incorporates information based on discussions held at the Vieques Technical Subcommittee Meeting in October 2011. Because this is an addendum to the SAP, it contains only those worksheets necessitating changes based on the ESI modifications. The sheets from the ESI SAP (CH2M HILL, 2011a) not included in this addendum remain applicable as written.

Modifications to the original approach include refocusing the Digital Geophysical Mapping (DGM) at PI 9 and 13, inclusion of a visual survey of some areas identified by community members, and delineation of areas where munitions-related objects are encrusted in limestone or "cemented" soils on the far eastern portion of PI 9.

The ESI SAP (CH2M HILL, 2011a) proposed clearing the vegetation within the entire study area of PI 9 and 13 in order to perform DGM over 100 percent of the PI sites. The objective of the DGM was to determine if munitions had been buried at the PI sites. Prior to implementation of the ESI, a BA for PI 9 and 13 and debris piles within UXO 15 was conducted (CH2M HILL, 2011b). The objectives of the BA were to identify the occurrence and location of protected or important ecological resources and to consider the potential effects of vegetation removal on these resources. The results of the BA indicated the presence of important habitats; however, no threatened or endangered plant or bird species were observed during the survey. Subsequent to the BA, a bedrock depth survey was performed to determine areas within PI 9 and 13 where bedrock depth is less than 6 inches, as these areas are unlikely to have been used to intentionally bury munitions. The combined results of the BA and bedrock depth survey indicate the amount of vegetation clearance within PI 9 and 13 can be significantly reduced and continue to meet the project objectives, while minimizing impacts to the important vegetation habitats at the site.

Based on the above information, uniformly spaced geophysical transects (which are 3 ft. wide) at a 60 ft. spacing across the PI 9 West site and the Elevated Anomaly Density Area (EADA) 45 where the depth to bedrock was found to be greater than 6 inches in depth will be conducted. All geophysical anomalies identified in the transects will be excavated and inspected for munitions potentially presenting an explosive hazard (MPPEH). Based on previous experience during the Expanded Range Assessment/Site Inspection (ERA/SI), this level of site coverage (approximately 5%) provides a high confidence level in the data for determining whether MPPEH is present at the site. In addition to the geophysical anomaly investigation, the previous depth to bedrock survey will be extended to include the entire EADA 44.

In addition to the above, community members have suggested other areas of potential munitions-related items and caves exist in portions of the UXO-15 site. Several of these areas will be visually inspected during the RI.

Note: This summary is presented in English and Spanish for the convenience of the reader. Every effort has been made for the translations to be as accurate as reasonably possible. However, readers should be aware that the English version of the text is the official version.
Nota: Este resumen se presenta en inglés y en español para la conveniencia del lector. Se han hecho todos los esfuerzos para que la traducción sea precisa en lo más razonablemente posible. Sin embargo, los lectores deben estar al tanto que el texto en inglés es la versión oficial.

Finally, it was noted during a Technical Subcommittee site visit in July 2011 that there are munitions-related items encrusted in the limestone or "cemented" soil at the far eastern portion of PI 9. The Technical Subcommittee is composed of representatives from the United States Environmental Protection Agency (USEPA), Puerto Rico Environmental Quality Board (PREQB), USFWS, the National Oceanic and Atmospheric Administration (NOAA), and Department of the Navy (Navy). Because it is unknown if any of the munitions-related items represent an explosive risk, no sampling in the area is possible (due to the safety risk to the workers). However, the area containing the encrusted items will be visually delineated during the RI to help make future remedial action determinations such as land use controls (LUCs).

As noted in the ESI SAP (CH2M HILL, 2011a), the investigation is being conducted at UXO 15 to assess whether there have been releases of contamination at UXO 15 attributable to past Navy activities and, if so, whether the contamination poses potentially unacceptable environmental and human health risks. Because it may be desirable to allow unrestricted public access to a portion of the site (e.g., lighthouse), a secondary objective of the RI is to collect sufficient data such that areas potentially requiring LUCs are minimized.

It is important to note that the site characterization activities defined herein focus on the areas most likely impacted by past Navy activities (i.e., PI 9, PI 13, and several other isolated areas) and therefore the findings and conclusions drawn based on these activities will be for UXO 15 as a whole unless otherwise stated in the RI Report.

Resumen Ejecutivo

Este documento es un apéndice al Plan de Muestreo y Análisis de la Investigación Expandida del Sitio (ESI SPA por sus siglas en inglés) para el Sitio de Municiones sin Detonar (UXO por sus siglas en inglés) 15 (ESI SAP [CH2M HILL, 2011a]). Aunque, debido al potencial de que artículos relacionados a municiones estén presentes en la roca o tierra "compactada" dentro de la parte noreste del UXO 15 es posible que se requiera evaluar alternativas de remediación, este apéndice incluye el enfoque para llevar a cabo una investigación para la remediación (RI por sus siglas en inglés) en UXO 15. Es importante anotar que con debido a los compuestos relacionados a municiones (MC por sus siglas en inglés), todavía amerita evaluar los derrames, ya que no se conoce si es que ha habido un derrame de estos compuestos a los medios ambientales del sitio. Los sitios identificados por fotografías (PI por sus siglas en inglés) 9 y 13 se encuentran dentro del Sitio UXO 15, en el Antiguo Campo de Adiestramiento Naval de Vieques (VNTR por sus siglas en inglés) en la porción este de Vieques, Puerto Rico. Estos dos sitios representan las dos áreas donde la información histórica sugiere se llevaron a cabo actividades militares y, por lo tanto, representan la ubicación donde es más probable que hayan ocurrido derrames asociados con actividades relacionadas a municiones. Este apéndice describe las modificaciones (y el razonamiento asociado) al ESI en base a los resultados de la evaluación biológica (BA por sus siglas en inglés), los comentarios del Servicio de Pesca y Vida Silvestre de los Estados Unidos (UFWS por sus siglas en inglés), y los resultados de la investigación de la profundidad del lecho de roca; estas dos investigaciones se llevaron a cabo después de finalizar el ESI SAP en mayo de 2011. También incorpora información que proviene de discusiones que se llevaron a cabo durante la reunión del Subcomité Técnico de Vieques en octubre de 2011. Ya que este documento es adicional al SAP, contiene únicamente las hojas de trabajo que necesitaban cambios para reflejar las modificaciones que se hicieron al ESI. Las hojas que se encuentran en el ESI SAP (CH2M HILL, 2011a) y que no se incluyen en este documento seguirán siendo aplicables como están escritas.

Las modificaciones al enfoque original incluyen el reenfoque de la Cartografía Geofísica Digital (DGM por sus siglas en inglés) en PI 9 y 13, la inclusión de un monitoreo visual en algunas áreas identificadas por miembros de la comunidad, y la delineación de las áreas donde artículos relacionados a municiones están embebidos dentro de la piedra caliza o los suelos "compactados" en la porción más al este de PI 9.

El ESI SAP (CH2M HILL, 2011a) propuso el corte de toda la vegetación dentro área de estudio de PI 9 y 13 para poder llevar a cabo un DGM sobre el 100 por ciento de los sitios PI. El objetivo de la investigación DGM fue determinar si se habían enterrado municiones en los sitios PI. Antes de la implementación del ESI, se llevó a cabo un BA para PI 9 y 13 y para las pilas de escombros dentro de UXO 15 (CH2M HILL, 2011b). Los objetivos del BA fueron identificar la ocurrencia y ubicación de recursos protegidos o de importancia biológica, y considerar los efectos potenciales de la remoción de la vegetación sobre estos recursos. Los resultados del BA indicaron la presencia de hábitats importantes; sin embargo, durante la investigación no se observaron especies de plantas o animales amenazadas o en peligro de extinción. Posterior al BA, se llevó a cabo una investigación de la profundidad del lecho de roca para determinar las áreas dentro de PI 9 y 13 donde la profundidad del lecho de roca es menor de 6 pulgadas, ya que es poco probable que se hayan utilizado estas áreas para intencionalmente enterrar municiones. Los resultados combinados del BA y de la investigación de la profundidad del lecho de roca indican que la cantidad de vegetación a removerse dentro de PI 9 y 13 puede reducirse significativamente a la vez que se cumplen con los objetivos del proyecto, al mismo tiempo que se minimizarían los impactos sobre los hábitats de vegetación importantes del sitio.

En base a la información arriba mencionada, se llevaran a cabo transeptos geofísicos uniformemente espaciados (de 3 pies de ancho) cada 60 pies a través del oeste del sitio PI 9 el Área de Densidad Elevada de Anomalías (EADA por sus siglas en inglés) 45 donde se encontró que el lecho de roca es mayor a 6 pulgadas. Todas las anomalías

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geofísicas identificadas en los transeptos serán excavadas e inspeccionadas para evaluar si son municiones que presentan un peligro explosivo (MPPEH por sus siglas en inglés). En base a experiencias previas durante la Evaluación Expandida del Campo de Tiro/Inspección del Sitio (ERA/SI por sus siglas en inglés), este nivel de cobertura del sitio (aproximadamente 5%) provee una nivel de confianza alto de los datos que se usan para determinar si MPPEH está presente en el sitio. Además de la investigación geofísica de anomalías, se extenderá el estudio del lecho de roca previo para incluir EADA 44 en su totalidad.

Además de lo mencionado, miembros de la comunidad han sugerido otras áreas y cuevas que pueden existir en porciones de UXO-15 donde puede haber artículos relacionados a municiones. Algunas de estas áreas serán inspeccionadas visualmente durante el RI. Finalmente, durante la visita al sitio en julio de 2011 del Subcomité Técnico, se observó que artículos relacionados a municiones estaban embebidos en la roca caliza o en la tierra "compactada" en la porción más al este de PI 9. El Subcomité Técnico se compone de representantes de la Agencia de Protección Ambiental de los Estados Unidos (USEPA por sus siglas en inglés), la Junta de Calidad Ambiental de Puerto Rico (EQB por sus siglas en inglés), USFWS, la Administración Nacional Oceánica y de la Atmósfera (NOAA por sus siglas en inglés) y el Departamento de la Marina (la Marina). Ya que se desconoce si los artículos relacionados a municiones presentan un riesgo explosivo, no es posible obtener muestras del área (debido al riesgo potencial para los trabajadores). Sin embargo, el área donde se pueden observar artículos embebidos será visualmente delineada durante el RI para ayudar a determinar las acciones futuras de remediación tales como controles de uso de los terrenos (LUCs por sus siglas en inglés).

Como se indicó en el ESI SAP (CH2M HILL, 2011a), se está llevando a cabo una investigación en UXO 15 para evaluar si es que han habido escapes/derrames de contaminación en este sitio que puedan ser atribuidos a las actividades pasadas de la Marina y, de ser el caso, si es que esta contaminación presenta un riesgo potencialmente inaceptable para la salud humana. Ya que se desea permitir el ingreso sin restricciones del público a una porción del sitio (por ejemplo, el faro), un objetivo secundario del RI es obtener datos suficientes para minimizar las áreas que potencialmente necesiten LUCs.

Es importante señalar que las actividades de caracterización del sitio que se definen aquí se enfocan en las áreas que tienen una mayor probabilidad de que hayan sido impactadas por actividades pasadas de la Marina (por ejemplo PI 9, PI 13 y algunas otras áreas aisladas), por lo tanto los resultados y conclusiones que se extraigan de estas actividades representan el sitio UXO 15 en su totalidad, a menos que se indique lo contrario en el Informe ESI.

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SAP Worksheet #1 — Title and Approval Page

Final
Expanded Site Inspection
Sampling and Analysis Plan Addendum for the
Remedial Investigation at UXO 15

Former Vieques Naval Training Range
Vieques, Puerto Rico
Contract Task Order 0037
July 2012

Prepared for:

Department of the Navy
Naval Facilities Engineering Command
Atlantic Division
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Navy CLEAN 1000 Program
Contract N62470-08-D-1000
Contract Task Order – 0037

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USFWS – Remedial Project Manager

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SAP Worksheet #2 — SAP Identifying Information

Site Name/Number: UXO 15 at the former Vieques Naval Training Range (VNTR), Vieques, Puerto Rico
Operable Unit (OU):
Contractor Name: CH2M HILL
Contract Number: N62470-08-D-1000
Contract Title: Navy Comprehensive Long-term Environmental Action—Navy (CLEAN) Program 1000
Work Assignment Number (optional): Contract Task Order (CTO) 0037 (Post-Munitions Investigation)

1. This SAP addendum was prepared in general accordance with the requirements of the Uniform Federal Policy-Quality Assurance Project Plans (UFP-QAPP) (Intergovernmental Data Quality Task Force, 2005) and United States (U.S.) Environmental Protection Agency (USEPA) Guidance for QAPPs, USEPA QA/G-5, Quality Assurance Management Section (QAMS) (USEPA, 2002).
2. Regulatory program: Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).
3. This addendum is prepared as an addendum to the Final ESI SAP dated May 2011, and it is project-specific.
4. Dates of scoping sessions:

Scoping Session	Date
Environmental Restoration Program/Munitions Response Program (ERP/MRP) Technical Subcommittee Meeting—New York, New York	July 14 and 15, 2010
Environmental Restoration Program/Munitions Response Program (ERP/MRP) Technical Subcommittee Meeting—New York, New York	October 25, 2011

5. Dates and titles of any SAP documents written for previous site work that are relevant to the current investigation.

Title	Date
Master Standard Operating Procedures, Protocols, and Plans, Environmental Restoration Program, Vieques, Puerto Rico, April 2010 (CH2M HILL)	April 2010
Final Expanded Site Inspection Sampling and Analysis Plan UXO 15, Former Vieques Naval Training Range Vieques, Puerto Rico, May 2011 (CH2M HILL)	May 2011
Draft-Final Biological Assessment for PI 9, PI 13, and Debris Piles within UXO 15, Vieques, Puerto Rico, April 2010 (CH2M HILL)	October 2011

SAP Worksheet #2—SAP Identifying Information (continued)

6. Organizational partners (stakeholders) and connection with lead organization:

   - **USEPA Region 2 –** Federal regulatory stakeholder overseeing CERCLA Vieques ERP implemented by lead organization.
   - **Puerto Rico Environmental Quality Board (PREQB) –** Commonwealth regulatory stakeholder overseeing CERCLA Vieques ERP implemented by lead organization.
   - **United States Fish and Wildlife Service (USFWS)** – Land owner of land transferred from lead organization and on which UXO 15 ERP activities are conducted.
   - **National Oceanic and Atmospheric Administration (NOAA) –** Marine habitat stakeholder and technical advisor to USEPA.

7. Lead organization (see Worksheet #7 from the Final ESI SAP (CH2M HILL, 2011a) for detailed list of data users):

   - U.S. Department of Navy (Navy).

8. The omitted SAP elements excluded and provide an explanation for their exclusion below:

   This addendum includes only those sheets revised as a result of the ESI approach modification. Sheets from the Final ESI SAP (CH2M HILL, May 2011) prepared for this project previously but not included in this addendum remain applicable and will be followed during the RI.

SAP Worksheet #9 — Project Scoping Session Participants Sheet

Project Name: Expanded Site Investigation (ESI) Sampling, UXO 15, Former VNTR	
Projected Date(s) of Sampling: July 2012	**Site Name:** UXO 15
PM: John Swenfurth	**Site Location:** Vieques, Puerto Rico
Dates of Session: October 25-27, 2011 **Scoping Session Purpose:** Concur on any modifications necessary to UXO 15 SAP objectives and approach	

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
John Tomik	Activity Manager	CH2M HILL	757-671-6259	john.tomik@ch2m.com	Vieques Activity Manager
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Daniel Rodriguez	Vieques Remedial Project Manager (RPM)	USEPA	787-741-5201 787-671-9879 (cell)	Rodriguez.daniel@epamail.gov	Primary USEPA Point of Contact (POC)
Sandy Martinez	Meeting Facilitator	Fulton Communications	702-834-5877	fultoncom@fultoncom.com	Project Facilitator
Kevin Cloe	Vieques RPM	Navy	757-322-4736	kevin.cloe@navy.mil	Primary Navy POC
Daniel Hood	Vieques RPM	Navy	757-322-4630	daniel.r.hood@navy.mil	Navy POC for munitions related items
Bill Hannah	Technical Support	CH2M HILL	757- 671-6277	Bill.hannah@ch2m.com	Technical Input
Brett Doerr	Environmental Manager	CH2M HILL	757-671-6219	brett.doerr@ch2m.com	Navy contractor primary POC
John Martin	Ecological Risk Assessor	CH2M HILL	352-384-7122	john.martin@ch2m.com	Navy contractor lead ecological risk assessor
Dan Waddill	Vieques Program Coordinator	Navy	757-322-4815	Dan.waddill@navy.mil	No project-specific role
Barrie Selcoe	Human Health Risk Assessor	CH2M HILL	281-721-8527	barrie.selcoe@ch2m.com	Navy contractor lead human health risk assessor
Michael Sivak	Human Health Risk Assessment Lead	USEPA	212-637-4310	Sivak.michael@epa.gov	Technical input and review of human health risk evaluation
Katarina Rutkowski	Technical Support Contractor to PREQB, Human Health Risk Assessment Lead	TRC	860-298-6202	krutkowski@trcsolutions.com	Technical input and review of human health risk aspects on behalf of Environmental Quality Board (EQB); Primary TRC POC
Wilmarie Rivera	Vieques RPM	PREQB	787-767-8181 x 6129	wilmarierivera@jca.gobierno.pr	Primary PREQB POC.
Richard Henry	Vieques RPM	USFWS	732-906-6987	Richard_henry@fws.gov	Primary USFWS POC/No project-specific role
Angela Carpenter	Environmental Specialist	U.S. EPA	212-637-4435	Carpenter.angela@epa.gov	Special Projects
Diana Cutt	Geologist	U.S. EPA	212 637-4311	cutt.diana@epa.gov.	hydrogeology
Julio Vazquez	Remedial Project Manager	USEPA	212-637-4311	Vazquez.julio@epa.gov	USEPA POC West Vieques sites
Sergio Lopez	Quality Assurance	USEPA	732-321-6778	lopez.sergio@epa.gov	Quality Control (QC) Specialist/Technical input and draft document review
Mindy Pensak	Ecological Risk Assessment Lead	USEPA	732-321-6705	Pensak.mindy@epa.gov	Technical input and draft document review

SAP Worksheet #9 — Project Scoping Session Sheet (continued)

The following is a summary of the main points from the October 25, 2011 Environmental Restoration Program/ Munitions Response Program Technical Subcommittee Meeting Minutes. Figure numbers have been edited to match the current figures identified in this SAP Addendum.

Daniel Hood/ Naval Facilities Engineering Command (NAVFAC) introduced this topic. The Navy is proposing to proceed with a different approach at UXO 15 than what was previously discussed because of (1) the presence of sensitive or otherwise desirable vegetation at the site and (2) the presence of encrusted items in the rock at the far eastern end of PI 9. Because it is unknown whether the encrusted items are innocuous debris or potentially explosive munitions items, at least this part of the site can no longer be considered for unrestricted use. Therefore, the Navy is proposing to modify the ESI approach to take this information into consideration. While the site will still proceed forward with an ESI, the data will likely be evaluated and documented in an Remedial Investigation (RI) Report to account for the need to implement land use controls for at least the far eastern portion of PI 9 where the encrusted items are located. The revised approach will be presented in an addendum to the ESI SAP and will provide the rationale for the new approach, as well as how the objectives for the site can still be met.

Danny Rodriguez/EPA added that a Vieques resident came to his office and identified areas where he believed the Navy conducted past military activities (e.g., grenades, tanks, munitions storage). Danny provided a map to CH2M HILL where the locals recollected where these areas were. The Navy agreed to consider the information during preparation of the ESI SAP addendum.

John Tomik/CH2M HILL led the discussion on the revised proposed UXO 15 investigation approach. He presented the results of the biological assessment at the site, where no threatened or endangered species were identified, but where important species or habitats were identified. Daniel Hood and Rich Henry/USFWS added that the mangrove forest, subtropic dry scrub forest, evergreen scrub forest, and the giant wild pine are the habitats on which the public and RAB place a high level of importance.

Danny Rodriguez added that the public mentioned that caves were built for munitions storage at this site. John Tomik added that the magnetometer (which provides data up to 4 feet/foot (ft) bgs) confirmed that there were no metallic items in the subsurface suggestive of large-scale munitions storage or burial. However, the potential for caves will be further evaluated using information such as the LIDAR data, and the evaluation of this information will be included in the SAP. John Tomik also noted that the area of the dry scrub forest was traversed using a probe rod, which confirmed that the dry scrub forest is within an area where bedrock is present at the surface or there is just a very thin soil veneer. This information suggests no munitions burial could have taken place in this area, so it is not necessary to clear the vegetation and perform a geophysical survey in this area to look for subsurface anomalies.

John Tomik described how the investigation would be performed using transects based on the Visual Sampling Plan (VSP) model and that subsurface anomalies would be excavated and sampling would occur as described in the ESI SAP. The proposed approach also takes into consideration a depth to bedrock survey recently completed that shows much of the area originally proposed to be cleared for investigation has a shallow depth to bedrock (less than 6 inches deep) where MEC would not likely occur. Based on the results of the bedrock survey and the VSP model, it is anticipated that only 1-2% of the original investigation area will require vegetation clearance, thereby minimizing the impacts to the important vegetation habitats at the site while still achieving the project objective. Katarina Rutkowski/TRC asked the details on how VSP selects transects and if it is influenced by the modeler. Sergio Lopez/EPA asked what the input parameter is to select the transect width. The team discussed the various parameters and John Tomik said the details of the VSP input parameters and results will be included in the ESI SAP addendum.

Rich Henry added that USFWS agrees with the investigation approach.

The team discussed that much of the information in the original Site Inspection (SI) SAP is still applicable, so the SAP Addendum will include only those worksheets that are modified as a result of the updated approach.

SAP Worksheet #9 — Project Scoping Session Sheet (continued)

Action Items

Navy/CH2M HILL – Proceed with preparing the SAP addendum; Navy will include an Site Management Plan (SMP) schedule update regarding UXO 15 in the Final SMP. Estimated submittal date for SAP addendum is end of 1FQ12. In addition, preparation of the SAP addendum will include:

- Evaluate the potential for caves to be present at the site and, if so, account for their potential presence in the investigation approach. Results of this evaluation will be included in the SAP Addendum.
- Include all of the surface munitions clearance information from the previous studies, the VSP model input parameters and results of the VSP model, and information from the bedrock depth survey.
- Evaluate the potential for the areas identified by the public member (map from Danny) to be present and, if the potential is legitimate, account for their presence in the investigation approach. Results of this evaluation will be included in the SAP Addendum.

Consensus Decision

The Navy will proceed forward with UXO 15 SAP Addendum in accordance with the revised path forward discussed during the October 2011 Technical Subcommittee meeting.

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SAP Worksheet #10 — Problem Definition

Introduction

This worksheet provides a summary of site background and key elements of the CSM, followed by a narrative description of the problems to be addressed during the proposed RI sampling activities.

Site Background

The former VNTR consists of approximately 14,600 acres and is divided operationally into four Munitions Response Areas (MRAs) that from west to east comprise: 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 133-acre Eastern Conservation Area (ECA) (**Figure 1**). The former VNTR was transferred from the Navy to the Department of Interior (DOI) in 2003 to be managed by United States Fish and Wildlife Service (USFWS) as part of the National Wildlife Refuge System. While all military activities have ceased at the former VNTR, the Navy retains responsibility for any munitions and explosives of concern (MEC) and/or environmental contaminant concerns attributable to past Navy activities that may exist.

UXO 15 is located within the EMA and comprises PI 9 and PI 13 as areas warranting investigation (**Figure 1**). Interviews conducted during the Environmental Baseline Survey (EBS) (ERM, 2003) suggest PI 9 was used for munitions storage and disposal and small open burn/open detonation (OB/OD). However, the OB/OD information was likely interpreted incorrectly from Spanish translation; OB/OD operations did not likely take place. It was documented in the EBS that PI 13 may have been the firing point from which rocket-related ordnance was launched to the LIA/SIA (ERM, 2003). However, no evidence of this use has been observed at the site during the site visits.

The ESI SAP was finalized in May 2011 (CH2M HILL, 2011a) and included clearing the vegetation within the entire study area of PI 9 and 13 in order to perform DGM over 100 percent of the PI sites to determine if munitions had been buried. However, a biological assessment performed in the areas of planned vegetation clearance following finalization of the ESI SAP identified the presence of important habitats/species. In addition, a bedrock survey conducted in the proposed study area determined bedrock depths across a significant portion of the area are less than approximately 6 inches.

In addition to the above, an area where munitions-related items are encrusted in the limestone was identified in the far eastern end of PI 9 during a July 2011 inter-agency site visit. **Figure 2** shows the far eastern end of PI 9, including where limestone was identified at or within 6 inches of the ground surface. Within this area, munitions-related items were observed during the site visit. Additionally, areas of possible munitions-related items and caves were as identified on a map by community members (**Figure 3**). **Figure 3** also shows subsurface magnetic anomalies identified in the Final Expanded Range Assessment/Site Inspection (ERA/SI) Report (CH2M HILL, 2010a).

Investigation History

In 2005, the VNTR was placed on the National Priorities List (NPL) and response activities are conducted under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The NPL requires environmental restoration activities for Navy Installation Restoration (IR) sites on Vieques to be conducted under CERCLA unless and until removed from CERCLA authority.

A Preliminary Range Assessment (CH2M HILL, 2003) identified PI 9 as a potential munitions response site based on aerial photograph analysis (ERI, 2000). The Phase I RCRA Facility Investigation (RFI) Report recommended PI 9 for further evaluation for munitions and munitions constituents under the Munitions Response Program (MRP) and an inspection of potential MEC at PI 13 (CH2M HILL, 2004).

The ERA/SI identified munitions debris (MD) and munitions potentially presenting an explosive hazard (MPPEH) items and five debris piles at UXO 15 based on transect and aerial survey results (**Figure 4, Figure 7, and Figure 13**). Small caliber casings and surface debris were located during visual evaluation of the debris piles. The location and description of the items identified in the debris piles are shown in **Figure 13**. Visual transects across UXO 15 identified 32 MD items on the surface. In addition, MD items were also identified offshore in the eastern portion

SAP Worksheet #10 — Problem Definition (continued)

of PI 9. The munitions items identified offshore are empty munitions casings that have been incorporated into the reef material (**Figures 5 and 6**). During an aerial magnetometer survey (AMS), two elevated anomaly density areas (EADAs) were identified (**Figure 7**). For the purposes of discussion, targets of interest (TOIs) are anomalies within the EADAs. A side-by-side comparison of **Figures 3 and 4** shows that transects have already been performed in the areas of several potential munitions-related features identified by community members (e.g., possible location of military artillery tanks, possible location of detonation areas, and possible location of caves). None of these features was identified during the transects. Further, historical aerial photographs from a number of years between the 1950s and 2000s do not indicate the presence of these features. In addition, **Figure 7** shows no EADAs were identified in the area of military artillery tanks identified by a community member. **Figure 7** identifies the polygons drawn by Sky Research, Inc. during an Aerial Magnetometer Survey (Sky Research, 2009). These data were evaluated by the Navy and two areas were added to the PI 9 and PI 13 study areas that included elevated anomalies. The two additional areas are shown in **Figures 8, 10, 11, 12, 13, and 15**. LIDAR data for the area identified as having possible caves was evaluated and no indication of caves was identified (Attachment B).

The ERA/SI recommended further investigation of the debris piles and near shore MD and evaluation of the potential ecological and human health risks. Offshore and underwater munitions items are associated with UXO 16 and generally will be addressed under UXO 16. The MD identified above the low tide water level just offshore of PI 9 are not part of UXO 15 and will likely not be removed because they are empty casings and have been incorporated into the reef structure. The boundary between UXO 15 and UXO 16 is the low-tide water line.

As noted previously, a BA was conducted within PI 9 and 13 and the debris areas (CH2M HILL, 2011b). The BA identified the existence of important habitats within the areas, as shown on **Figure 8**. No threatened or endangered plant or bird species were observed during the survey.

Subsequent to the completion of the BA, a bedrock survey was completed the week of October 10, 2011 as a means of further identifying potential locations of buried munitions. Areas with soil depths less than about 6 inches are unlikely to be useful for burying munitions. The survey was completed at PI-9 East, PI-9 West and PI-13. The bedrock survey was completed by following the GPS along transects and previously cleared areas. A 3/8-inch diameter piece of steel, approximately 3.5 feet long, was pounded into the ground at periodic intervals and the depth of penetration recorded. If downward penetration was prevented before reaching 2 feet bgs, the test was repeated within 5 feet of the previous test to ensure bedrock was encountered and not just a subsurface obstruction. These results were documented along with other observations including rock outcrops and anthropogenic debris. The results of the bedrock study are shown on **Figure 9**.

The combined results of the BA and bedrock depth survey indicate the original plan to clear all vegetation within PI 9 and 13 was not prudent and/or warranted in order to meet the project objectives and that the objectives could be met with focused vegetation clearance and associated DGM. The combined results of the BA and bedrock depth survey for the western part of PI 9 are shown on **Figure 10**. Neither the eastern portion of PI 9 nor any of PI 13 contained bedrock deeper than 6 inches below ground surface.

Based on the above information, uniformly spaced geophysical transects (which are 3 ft. wide) at a 60 ft. spacing across the PI 9 West site and the EADA 45 where the depth to bedrock was found to be greater than 6 inches in depth will be conducted. All geophysical anomalies identified in the transects will be excavated and inspected for MPPEH. Based on our previous experience during the ERA/SI, this level of site inspection coverage (approximately 5%) provides a high confidence level in the data for determining whether MPPEH is present at the site. In addition to the geophysical anomaly investigation, the previous depth to bedrock survey will be extended to include the entire EADA 44. The locations of the transects are shown on **Figure 11**. It should be noted that the transect locations and lengths shown in **Figure 11** will be implemented to the extent practical in the field. Locations may be slightly altered due to field conditions, additional transects will be added to move from one defined transect to another, and transect lengths may be extended to facilitate implementation. However, what is

SAP Worksheet #10 — Problem Definition (continued)

displayed in **Figure 11** represents the minimum transect numbers and lengths that will be implemented in the field. Therefore, a higher percent confidence level will likely be achieved based on actual transect implementation.

Conceptual Site Model

Figure 12 presents the generalized conceptual site model of UXO 15, the key elements of which are described below. The purpose of this RI is to evaluate whether there have been contaminant releases at UXO 15 warranting further investigation or action. The elements of the CSM presented below are pertinent to developing the RI approach and therefore include the physical characteristics, potential release mechanisms, potential constituents released, future land use, and potential receptors.

Physical Characteristics

Most of UXO 15 is characterized as rocky land where rock outcrops exist on 50 to 70 percent of the surface. Bedrock is at or near the ground surface over the majority of PI 9 and 13 **(Figure 9)**. Loose stones with very shallow soil material are found between the outcrops. PI 9 additionally contains tidal flats and a tidal swamp. The tidal flats are slightly above sea level, affected by sea water at high tide, and have a high salt concentration. The tidal swamp is covered with thick mangroves and immersed in salt water the majority of the year.

UXO 15 is characterized by the TI geological zone of marine sedimentary rocks. In topographically elevated areas, such as in the central area of the peninsula and at the far eastern portion of PI 9 (**Figure 9),** limestone and dolomite are exposed at the ground surface.

Surface water bodies bound three sides of UXO 15. Puerto Mosquito is located to the west and Puerto Ferro to the east. The ocean is to the south. There is also a small lagoon between the two PI 9 areas, a small lagoon in the southwest portion of UXO 15, and a small lagoon adjacent to debris piles A and E (**Figure 13**). Debris pile E is located on sediment within the intertidal zone of the lagoon.

The results of the bedrock study indicate that the soil overburden is thin in most places. Groundwater is believed to exist solely or primarily in bedrock. Groundwater may exist in overburden closer to the surface water bodies if there is a sufficient thickness of overburden. Groundwater likely discharges to the lagoons to the east and west, and to the ocean to the south. Discharge is likely to be tidally influenced. Based on conditions encountered at similar sites around Vieques, the general groundwater geochemistry is believed to be brackish to saline and hard.

Future Land Use

The former VNTR was transferred to the DOI in 2003 to be managed by USFWS as part of the National Wildlife Refuge System, pursuant to Section 1049 of the National Defense Authorization Act for Fiscal Year 2002 (Public Law 107-107).

A Comprehensive Conservation Plan (CCP) for the Vieques National Wildlife Refuge was completed by USFWS, which outlines the land use plan for managing the former VNTR as a wildlife refuge (DOI, 2007). Hiking and biking trails have been proposed for the area encompassed by UXO 15 and public access to the lighthouse area may be desirable. Therefore, collecting sufficient data to help minimize areas requiring land use controls (LUCs) is a secondary objective of the RI.

Potential Source of a CERCLA Releases and Release Mechanisms

The potential sources of release at UXO 15 are:

- Munitions-related items, empty Marine artillery casings within UXO 15 (**Figure 4**); however, it is important to note that UXO was not identified at the site
- Five debris piles identified at various locations along the road within UXO 15 and just north of UXO 15 (**Figure 13**)

SAP Worksheet #10 — Problem Definition (continued)

- Potential subsurface items related to historical activities associated with PI 9 and PI 13
- Some of the potential munitions-related items identified by community members (**Figure 3**)

Based on the type of material present at the site and the historical information on potential munitions items, the release mechanism is listed below:

- Deterioration of material (debris or munitions) and its potential release by leaching to underlying soil

The UXO 15 RI will include the environmental characterization of soil and sediment beneath debris piles (including several of those identified in **Figure 3**) and any subsurface MEC identified. The potential area of military artillery tanks identified in **Figure 3** will not be further evaluated because existing information is sufficient to show military artillery tanks (or any other military activity) were not likely located in that area. Other features, such as caves used for munitions storage, are also not likely present, but because additional work will be conducted in the general vicinity, visual inspection (aided with a metal detector, as warranted) will be performed to evaluate their potential presence. Groundwater will not be characterized (at least initially) as part of this investigation, since: 1) the primary groundwater discharge points are the ocean and large lagoons; 2) groundwater will not flow to other areas of Vieques where it could impact existing or future groundwater users; 3) groundwater use cannot occur at UXO 15 due to development restriction at the site by a Congressional Order; and 4) the general groundwater geochemistry would be hard (due to the limestone bedrock) and brackish to saline as it is likely tidally influenced and subject to saltwater mixing. However, the final determination of whether groundwater evaluation is warranted will be deferred until after the other media have been sampled and their data evaluated. Evaluation of the data to help make this determination will include reviewing soil and sediment data to determine the potential for contaminants to leach to groundwater (i.e., fate and transport mechanisms).

Potential contaminants of interest from the munitions and debris items identified comprise explosives, perchlorate, and inorganic constituents (i.e., metals).

Receptors

Data collected as part of this RI will be compared to conservative ecological and human health screening values. If exceedances are identified, more realistic qualitative evaluations will be conducted (if possible), which may include consideration of actual or likely receptors. Quantitative risk assessments may be conducted as part of the RI, depending on they are warranted and whether sufficient data have been collected. Potential receptors at the site include both human and ecological, as discussed below.

Human Health

Recreational users may access UXO 15 by sea in some areas where steep cliffs are not present; recreational users may also access UXO 15 by land. In addition, USFWS workers may be present at the site to conduct law enforcement activities and maintenance activities of proposed roads and trails.

Ecological

Potentially complete exposure pathways exist for terrestrial receptors exposed to surface soil, and aquatic receptors exposed to surface sediment. The receptors include:

- Terrestrial – plants, soil invertebrates, birds, mammals, and reptiles exposed to surface soil
- Aquatic – benthic invertebrates, aquatic plants (e.g., mangroves), birds, and mammals exposed to surface sediment in mangrove wetland habitat

Problem Statement

The problem statement provided in the ESI SAP (CH2M HILL, 2011a) is still applicable. That statement is: Because the debris and munitions-related items have been identified within UXO 15, but it is unknown whether there have been releases of contaminants from this material, an RI is warranted to determine if there has been a release(s) of

SAP Worksheet #10 — Problem Definition (continued)

hazardous constituents from the debris piles or potential munitions items to environmental media and, if so, whether further investigation or action is warranted. Based on the CSM and secondary data evaluation, it is possible that explosives and inorganics have been released as a result of the historical operations.

The Technical Subcommittee met on October 25, 2011 to discuss the rationale and revised RI approach for UXO 15, based on information gathered since the ESI SAP was finalized in May 2011. While the additional information (i.e., BA, bedrock survey, community input) does not alter the overall project objective and problem statement, it does add additional environmental questions to be answered in order to meet the project objective.

Environmental Questions to be Answered by the RI Sampling:

To address the Problem Statement defined above, the following environmental questions will be answered via implementation of this SAP:

1. Have there been releases of hazardous constituents to the surrounding soil/sediment from the debris piles, including some areas identified on a map by community members?

   The debris piles (and any obviously contaminated soil) will be removed and one discrete soil/sediment sample will be collected beneath each of the five large debris piles identified (the samples beneath debris piles A through D are assumed to be soil and the sample beneath debris pile E is assumed to be sediment). Following vegetation clearance, a visual survey across PI 9 and PI 13 will be conducted for any debris on the surface to facilitate the DGM survey. If other debris piles of comparable size are found during the investigation, they will be removed and an additional discrete soil/sediment sample will be collected beneath each. One sample per debris pile was determined to be sufficient based on the relatively small size of the piles (i.e., less than approximately 10ft x 10ft). If, following visual inspection of the areas identified (other than the tank area) on a map by community members (**Figure 3**), additional debris is identified, additional soil sample(s) will be collected as described above.

2. Is there subsurface MEC present within PI 9?

   As noted previously, the bedrock survey demonstrated that only a portion of the area within PI 9 has a sufficient soil thickness for potential intentional burial of munitions. With this information, uniformly spaced geophysical transects were developed (**Figure 11**). Further, **Figure 3** shows subsurface anomalies identified with a metal detector during the ERA/SI. Excavation, identification, and removal of anomalies (if non native) will be used to determine if subsurface MEC is present. If subsurface MEC is identified, subsurface soil samples will be collected directly below them in a manner consistent with the aforementioned surface soil samples to determine if there have been releases to the underlying soil.

3. What is the area of munitions-related items encrusted in the limestone on the east portion of PI 9?

   Visual inspection, aided with a metal detector, will be conducted across the eastern portion of PI 9 (**Figure 2**) to identify areas where munitions and/or munitions-related debris are encrusted in the rock. This area will be delimited using global positioning system (GPS) equipment. This information will be used in making remedial determinations for the site, potentially including LUC boundaries.

4. If releases to soil and/or sediment are identified, what are the appropriate next steps?

   This determination will be made based on screening the data using the 7-step decision tree (**Figure 14**).

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SAP Worksheet #11 — Project Quality Objectives/Systematic Planning Process Statements

1. Who will use the data and what will the data be used for?

The Navy, USEPA, EQB, and USFWS will use the data collected during the RI Sampling (as well as relevant historical data) at UXO 15 to make determinations of whether CERCLA-related releases took place and, if so, whether further investigation or action is warranted. Site-specific data uses are defined in Item 5 of this worksheet.

2. What are the Project Action Limits (PALs)?

The PALs are defined in the Master Standard Operating Procedures, Protocols, and Plans (CH2M HILL, 2010a) and are listed, by constituent group and medium, in Worksheet #15. In general, the PALs are:

- Vieques human health screening values for soil are the current (as of the time the RI is being conducted) Regional Screening Levels (RSLs) (adjusted for a hazard quotient [HQ] of 0.1 for non-carcinogens) provided by USEPA.
- Vieques ecological screening values for soil and for marine sediment, which are listed in the Vieques Master Ecological Risk Assessment Protocol (CH2M HILL, 2010a) and associated Master ERA Protocol Update 1 (CH2M HILL, 2010b).
- Vieques soil-to-groundwater leaching screening values provided by USEPA.
- Vieques discrete surface soil inorganics screening values are the East Vieques background soil inorganics upper tolerance limits (UTLs) (CH2M HILL, 2007).
- Where a specific project action limit (PAL) deviates from the above, it is footnoted in the applicable Worksheet #15 table.
- Results for screening data (i.e., general chemistry parameter pH) collected to support the interpretation of ecological risk results will not be compared to strictly-defined PALs, but will be evaluated qualitatively. This parameter is identified in Worksheet #15. There are no project indicator limits (PILs); pH results will be the only screening data generated. Acid volatile sulfide/simultaneously extracted metals (AVS/SEM) and grain size are also needed for sediment.
- In addition to listing the particular analytes, project action limits (PALs), and limits of quantitation (LOQs), Worksheet #15 identifies where limits of detection (LODs) are greater than PALs. Even though LODs may be greater than certain PALs, detection limits (DLs) may be closer to or less than PALs. When this occurs, and if a constituent is detected in a sample at or at greater than the PAL, then it is reported, qualified as applicable. The majority of the constituents have LODs less than PALs. For the following constituents, the DL is still greater than the PAL: hexavalent chromium Soil Screening Level (SSL), RDX (SSL), 1,3-dinitrobenzene (SSL), nitrobenzene (SSL and marine sediment Toxicity Reference Value (TRV)), 2,4-dinitrotoluene (SSL), 2,6-dinitrotoluene (SSL), 2-nitrotoluene (SSL), 3-nitrotoluene (SSL), 4-nitrotoluene (SSL), PETN (SSL), and Nitroglycerin (SSL).
- The Vieques screening values on which the PALs are based are not of equal importance. Therefore, decisions with respect to a particular constituent can still be made when the DL is greater than the PAL. The SSLs are more qualitative than human health and ecological screening values. Past experience at Vieques has demonstrated that SSLs are not reliable predictors of leaching to groundwater; they are overly conservative (see multiple site-specific SSL discussions contained in the Site Inspection/Expanded Site Inspection Report [CH2M HILL, 2010b).

SAP Worksheet #11 — Project Quality Objectives/Systematic Planning Process Statements (continued)

3. What types of data are needed (matrix, target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques)?

- Soil and sediment samples will be submitted to an offsite laboratory for analysis (Katahdin Analytical Services, Inc. of Scarborough, Maine and for perchlorate Test America West Sacramento.
- Chemicals of interest consist of explosives constituents and metals, as shown in Worksheet #15.
- Worksheets #15 and #18 define the matrices, analytical groups, and, where applicable, specific target analytes for UXO 15.

4. How "good" do the data need to be in order to support the environmental decision?

- The data will be of the quantity and quality necessary to provide technically sound and defensible assessments of the site conditions and potential risks at UXO 15. Laboratory methods will meet CERCLA, USEPA Region 2, and Navy guidance and the data will be validated by a third-party validator using national functional guidance, methodology, and laboratory Standard Operating Procedures (SOPs) as described in Worksheet #36.
- The laboratory will follow the Measurement Performance Criteria (MPC) in Worksheet #12 for field QC samples and Worksheet #28 for laboratory QC samples. These MPC are consistent with the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) as applicable and laboratory in-house limits where the QSM does not apply.

5. How much data should be collected (number of samples for each analytical group, matrix, and concentration)?

- Worksheet #18 contains the number of samples per matrix per analytical group for UXO 15. Worksheets #15 contain the particular analytes, PALs, and quantitation limits (QLs). Worksheet #17 provides the rationale for the particular sampling at each area.
- Four soil samples and one sediment sample will be collected at UXO 15 (**Figure 15**) and analyzed for explosives, perchlorate, metals, and pH, acid volatile sulfide/simultaneously extracted metals (AVS/SEM) and grain size.
- If other debris piles of comparable size are found during the investigation, an additional soil sample will be collected beneath each.
- If subsurface MEC is identified during the DGM, they will be excavated and soil samples will be collected beneath them in a manner consistent with the approach for any surficial MEC identified (see Worksheet #14).

6. Where, when, and how should the data be collected/generated?

- Samples will be collected during one field mobilization planned to occur in July 2012.
- Data will be collected and generated in accordance with the procedures outlined in the UFP-SAP. Specifically, see the SOPs in Appendix A of the Final ESI SAP (CH2M HILL, 2011a) for more details.

7. Who will collect and generate the data? How will the data be reported?

- CH2M HILL field staff will collect the samples.
- Laboratory analysis will be performed by Katahdin Analytical Services, Inc. of Scarborough, Maine and Test America – West Sacramento for perchlorate.
- While the site will still proceed forward as an RI, the data will be evaluated and documented in an RI Report to account for the need to implement LUCs for at least the far eastern portion of PI 9 where the encrusted items are located.

SAP Worksheet #11 — Project Quality Objectives/Systematic Planning Process Statements (continued)

8. How will the data be archived?

The data will be archived in accordance with procedures dictated in the Navy CLEAN program/contract. At the end of the project, archived data will be returned to the Navy.

9. List the Project Quality Objectives (PQOs) in the form of if/then qualitative and quantitative statements

The decision analysis process shown in **Figure 14** represents the PQOs for the UXO 15 work in this RI. The general objectives of the decision analysis process are:

1. To determine if a CERCLA-related release occurred and, if so,
2. Whether the release warrants further investigation or action

The 7-step decision analysis can be subdivided into five Project Quality Objective (PQO) categories, as described below.

CERCLA Eligibility (Step 1 of Figure 14)

CERCLA eligibility is determined in general accordance with USEPA guidance (USEPA, 1991, 1999a, and 1999b). The resulting PQO statement is:

> If the site is CERCLA eligible, then collect site-specific samples (if none exist); otherwise, prepare a no further action decision document or defer to another regulatory program.

The decision analysis process potentially applies to all sites initially identified in the Vieques Environmental Restoration Program. For the UXO 15 site included in this SAP, it is assumed that the site is CERCLA-eligible.

Data Quality Assessment (Step 2 of Figure 14)

The data quality assessment is performed via the Data Quality Evaluation (DQE) (see Worksheet #37). The resulting PQO statement is:

1. If the DQE indicates the data are available and useful for the intended purpose, then perform the release assessment (see Steps 3 and 4); otherwise, collect sufficient additional samples to achieve an available and useful data set.

Release Assessment (Steps 3 and 4 of Figure 14)

The PQO statements for release assessment are:

1. If any inorganics above the background UTL or non-inorganics are detected, then a release potentially occurred; otherwise, make a final evaluation of the adequacy of the data set (see Step 7).
2. If a release potentially occurred, then determine if it is CERCLA-related; otherwise, make a final evaluation of the adequacy of the data set (see Step 7).
3. If a release is CERCLA-related, then determine if the release warrants further action (see Steps 5 and 6); otherwise, make a final evaluation of the adequacy of the data set (see Step 7).

A “CERCLA-related release” is a release of hazardous substances, pollutants, and contaminants eligible for CERCLA response as defined in CERCLA Sections 101(14) and 101(33).

Further Investigation or Action Determination (Steps 5 and 6 of Figure 14)

Once a potential release is suspected, the need for further investigation or action is made by evaluating the data with respect to human health, ecological, leaching, or other regulatory criteria (i.e., Vieques screening values). If additional investigation is warranted, a SAP addendum or a new SAP will be prepared, as appropriate. The PQO statements associated with these steps are:

1. If the constituent concentrations exceed Vieques screening values, then determine if more realistic evaluations can be performed; otherwise (i.e., if no exceedances), make a final evaluation of the adequacy of the data set (see Step 7).

SAP Worksheet #11 — Project Quality Objectives/Systematic Planning Process Statements (continued)

2. If more realistic evaluations can be performed that suggest no further investigation or action is warranted, then make a final evaluation of the adequacy of the data set (see Step 7); otherwise, make a determination of whether additional source data would permit more realistic evaluations.
3. If additional source data would permit more realistic evaluations, then collect the data and make the more realistic evaluations; otherwise, make a determination of whether an interim action or expanded investigation is warranted.
4. If interim action is warranted, then perform interim action and collect confirmatory data for evaluation via the decision analysis process; otherwise, make a determination of the type of expanded investigation that is warranted.
5. If the data suggest a substantial release has occurred (e.g., release may be widespread and screening suggests risks are potentially very high with respect to regulatory threshold levels), then perform additional RI effort to further delineate nature and extent.

Examples of more realistic evaluations are presented in Section 1.1.2 of the Final PA/SI Report (CH2M HILL, June 2008).

As stated previously, the 7-step decision analysis process applies to the UXO 15 site in the release assessment decision analysis phase. The UXO 15 site which is in the RI will have additional, related PQOs, as follows:

- One soil sample will be collected beneath each large debris pile, at a minimum from beneath the five aforementioned piles. If other piles of comparable size (approximately 10 ft x 10 ft) are found during the investigation, an additional soil sample will be collected beneath each. If larger debris piles are found, multiple samples will be collected in comparable increments (i.e., one additional sample per approximate additional 10 ft x 10 ft area of debris. With respect to the interval from which the soil samples will be collected, if the debris or item at a particular location is solely MPPEH, the soil sample will be collected from the 2-inch interval beneath the debris/item following its (and any suspected contaminated soil) removal. If the debris or item at a particular location is not or does not contain MPPEH, the soil sample will be collected from the 6-inch interval beneath the debris/item following its (and any suspected contaminated soil) removal. If the debris at a particular location is a mixture of MPPEH and non-MPPEH items, the soil sample will be collected from the 6-inch interval beneath the debris/item following its (and any suspected contaminated soil) removal. The samples beneath debris piles A through D are assumed to be soil and the sample beneath debris pile E is assumed to be sediment.
- Areas where munitions are most likely to be buried are those areas shown on historical aerial photos that were identified as “storage areas” and where the depth to bedrock is greater than 6 inches. It is in these areas where uniformly spaced geophysical transects will be conducted (**Figure 11**). Excavation, identification, and removal of anomalies (if non native) will be used to determine if subsurface MPPEH is present. The goal is to determine with a high level of confidence whether or not MPPEH is present in the subsurface, while preserving to the extent possible, the ecological habitat. If subsurface MPPEH is identified, subsurface soil samples will be collected from the 2-inch interval directly below them to determine if there have been releases to the underlying soil.

SAP Worksheet #13 — Secondary Data Criteria and Limitations Table

The table below provides general information on how secondary data will be used in meeting the current project objectives and the limitations on their use in developing the SAP. Secondary data criteria and limitations tables are presented for each site where historical analytical data exist (applicable to the scope of work covered by this SAP), specifically to address the use and limitations of the historical analytical data.

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Elevated anomaly density areas (EADA)	Expanded Range Assessment/Site Inspection (ERA/SI)	EADAs identified during the ERA/SI using aerial magnetometer survey	Identification of sampling locations	Limited to the accuracy of the device performing the survey. (Sky Research, Inc 2009)
MD, MPPEH, scrap metal item locations	Expanded Range Assessment/Site Inspection (ERA/SI)	MD, MPPEH, scrap metal identified during SIs and associated geophysical surveys	Locations, varieties and concentrations of MD, MPPEH, scrap metal items have been used to locate systematic sampling	Locations of items limited to the accuracy of the Trimble GeoXT unit used to collect the data. The Trimble unit is accurate up to sub meter distances.
Federal-and State-listed species, habitat types and biological resources	Biological Assessment (BA)	Federal-and State-listed species, habitat types and biological resources will be documented	Assess what potential effects the proposed investigation activities, including vegetation removal and debris removal will have on listed plant and bird species, refuge habitats, and other wildlife	Location of species, habitat types and biological resources dependant on visual observations.

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SAP Worksheet #14 — Summary of Project Tasks for UXO 15

The *Master Standard Operating Procedures, Protocols, and Plans (MSOPPPs)* (CH2M HILL, 2010b) address the protocols and SOPs to be used for the RI. Specifically, SOPs A-2 and A-3 of the MSOPPs provide the protocols and SOPs for soil sampling activities, and SOPs A-3 and G-2 are applicable to sediment sampling activities. The modification to the vegetation removal prior to performing the DGM is described in the below. The technical approach and sample design for the proposed field activities are discussed in Worksheet #17 of the Final ESI SAP (CH2M HILL, 2011a).

Mobilization

Prior to mobilization, NAVFAC Atlantic, USEPA, PREQB, and USFWS will be notified to allow for appropriate oversight and coordination.

As part of the field mobilization, CH2M HILL will procure the following subcontractors to support investigation activities:

- Analytical laboratory
- Data validation
- Investigation-derived waste (IDW) disposal contractor
- Anomaly avoidance support
- Excavation contractor to support debris removal and excavation services

Mobilization for the field effort includes procurement of necessary field equipment and initial transport to the site. Equipment and supplies will be brought to the site when the CH2M HILL field team mobilizes for field activities.

Digital Geophysical Mapping

Biological Assessment Prior to Vegetation Clearance

Vegetation removal at UXO 15 is required to support related DGM. A BA of sensitive species and habitats was conducted in April 2011. A copy of the Final BA report is included with this SAP addendum as Attachment A. The results of the BA indicate that no threatened or endangered plant or bird species were observed during the survey; however, 63.5 acres of important habitats were identified within PI 9 and PI 13. Subsequent to the completion of the BA, a bedrock study was completed on PI 9 and PI 13. The results of the BA and the DGM were used to develop a statistical approach to implementing the DGM in the field. The DGM will be performed along lines of transect as shown in **Figure 11**. The explosive safety submission determination (ESSD) (CH2M HILL), 2006) indicates that Anomaly avoidance support for the vegetation clearance, DGM, and associated anomaly evaluation will be required.

Vegetation Clearance with Anomaly Avoidance

It is estimated that vegetation removal will only be required for the areas within the transects shown in **Figure 11** and in the areas where debris removal will take place. Areas within PI 9 and PI 13 where the bedrock is within about 6 inches of the ground surface will not require DGM; therefore, they will not require vegetation clearance. Within the transects, the vegetation will be removed through a selective removal process, such that only that vegetation allowing for detection of subsurface anomalies along the transects is facilitated. 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) diameter at breast height (DBH), and the complete removal of all invasive species such as acacia (Acacia tortuosa), tan tan (leucaena leucocephala), and mesquite (Prosopis juliflora). Cutting trees larger than 3 inches in diameter will be avoided (unless they are invasive species). Trees will be felled into an area whose surface has already been evaluated for MEC. All cut vegetation will be accumulated onsite and left at the site to provide mulching for future vegetation.

SAP Worksheet #14 — Summary of Project Tasks for UXO 15 (continued)

Following vegetation clearance, a visual survey along the transects will be conducted for the removal of any debris identified on the surface to facilitate the DGM survey. The surface clearance of metal debris 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, 2008).

DGM Operations

The DGM survey at PI 9 will be performed within the uniformly spaced transects shown on **Figure 11**. The geophysical operations will be conducted in accordance with Appendix B of the *Non-Time Critical Removal Action Work Plan, Surface Munitions and Explosives of Concern at Munitions Response Area-Surface Impact Area Munitions Response Sites 1-7, Former Vieques Naval Training Range (VNTR), Vieques, Puerto Rico* (CH2M HILL, 2009).

Excavation of Subsurface Anomalies

The excavation of the geophysical anomalies will be conducted in accordance with the procedures identified in *Work Plan for Munitions and Explosive of Concern Subsurface Interim Removal Action Beaches and Select Roadways* (CH2M HILL, 2008). Positions and information on any sources of anomalies not removed from the subsurface will be recorded, and the reasons for not removing them will be documented in accordance with the *Non-Time Critical Removal Action Work Plan, Surface Munitions and Explosives of Concern at Munitions Response Area-Surface Impact Area Munitions Response Sites 1-7, Former Vieques Naval Training Range (VNTR), Vieques, Puerto Rico* (CH2M HILL, 2009). Reasons for not removing the source of an anomaly include not finding the source (e.g., magnetic spot in bedrock), an object is below the water table and the hole will not remain open to continue excavation, etc. If encountered, these will be recorded in the field logbook and included in the RI report.

Test pitting of select EADA areas was originally identified in the scoping session held on July 14th and 15th 2010. However, the method employed to identify the EADA is not precise (i.e., does not identify individual anomaly locations). Therefore, the DGM approach discussed in the October 2011 scoping session for UXO 15 supersedes the approach discussed in July 2010. Any anomalies identified will be excavated. This will improve the efficiency of any excavation since it will be conducted only at locations positively identified by DGM, which can precisely identify the location of subsurface anomalies potentially associated with possible historical burial (see **Figures 16** through **19).** Soil samples will be collected beneath any MEC items identified and excavated during the DGM investigation at PI 9 In addition, the 85 magnetic anomalies identified with a metal detector during the ERA/SI (**Figure 3**) will be excavated. The subsurface soil samples will be collected, as applicable considering standard practices, in a similar manner as surface soil samples. These subsurface samples will be collected from the 2-inch interval beneath MEC following their removal.

The following documents provide additional explosives management procedures to be conducted during the Preliminary Assessment/ Site Inspection: *Explosives Safety Submission/ Site Approval Request, Former Vieques Naval Training Range (VNTR), Vieques, Puerto Rico (Revision 3)* (CH2M HILL, 2006a) and *Explosives Operations Site Approval, Former Vieques Naval Training Range, Vieques Island, Puerto Rico* (CH2M HILL, 2004a).

QC will be conducted according to Section 10 and Appendix B of the *Work Plan for Munitions and Explosives of Concern Subsurface Interim Removal Action Beaches and Select Roadways* (CH2M HILL, 2008).

Sample Location Recording

The sampling locations will be recorded using Real Time Kinematic (RTK) GPS coordinates, accurate to approximately 2 centimeters, depending on ambient conditions such as canopy cover. Each sampling area and sampling point will be walked by anomaly avoidance subcontractors prior to coordinate establishment and sampling for anomaly avoidance.

Limestone-Encrusted Munitions-related Items Survey

During a site visit conducted by the ERP/MRP Subcommittee in July 2011, munitions-related items encrusted within limestone were observed on the eastern-most area of PI 9. This area will not be sampled due to the potential

SAP Worksheet #14 — Summary of Project Tasks for UXO 15 (continued)

explosive danger. However, visual inspection, aided with a metal detector, will be conducted across the eastern portion of PI 9 (**Figure 2**) to identify areas where munitions and/or munitions-related debris are encrusted in the rock. This area will be delimited using GPS equipment. This information will be used in making remedial determinations for the site, potentially including LUC boundaries.

Visual Survey of Potential Debris Areas, Potential Caves, and Debris Pile Removal

Prior to debris removal and associated soil sampling, a visual inspection of the areas (other than the potential tank area) identified by community members (**Figure 3**) will be conducted to determine if debris other than in the five areas identified in **Figure 3** (i.e., Piles A through E) are present. Historical information such as LIDAR has been evaluated and no evidence of caves was identified (Attachment B); however, a visual inspection will still be done in the general area. As a general housekeeping measure, to remove potential sources of contamination, and to facilitate soil/sediment sampling, the debris piles will be removed; metal items and any munitions-related debris will be stockpiled at a consolidation point referred to as the Central Processing Center (CPC) within the VNTR and will ultimately be transferred for proper disposal and recycling. Although the CPC is no longer used for the processing of munitions related scrap metal, it is still maintained as a consolidation point for scrap metal that has been inspected and determined to be free of explosives material. Any munitions related scrap metal collected from UXO-15 will be inspected to ensure it is free of explosives, and then stockpiled at the former CPC for future disposition. Any non-hazardous solid waste will be disposed of at the Vieques Municipal landfill or off-island.

In addition, the 31 MD and scrap items and 1 MPPEH previously identified during the ERA/SI will be removed during this investigation. The locations of these items are shown in **Figure 4**.

Soil Sampling

Discrete Soil Sample Collection

At a minimum, four surface soil samples will be collected, one beneath each large debris pile located in the non-wetland areas of the site shown in **Figure 15** as samples VEUXO15-SS01-MMYY through VEUXO15-SS04-MMYY. If other piles of comparable size are found during the investigation, an additional soil sample will be collected, one beneath each. If larger debris piles are found, samples will be collected at the rate of one per approximate 10 ft x 10 ft debris area. With respect to the interval from which the soil samples will be collected, if the debris or item at a particular location is solely MEC, the soil sample will be collected from the 2-inch interval beneath the debris/item following its (and any suspected contaminated soil) removal. If the debris or item at a particular location is not or does not contain MEC, the soil sample will be collected from the 6-inch interval beneath the debris/item following its (and any suspected contaminated soil) removal. If the debris at a particular location is a mixture of MEC and non-MEC items, the soil sample will be collected from the 6-inch interval beneath the debris/item following its (and any suspected contaminated soil) removal. Samples will be collected with a hand auger or similar sampling device in accordance with the Master Protocols.

Sediment Sample Collection

One sediment sample will be collected. This sample will be collected at Debris Pile E shown in **Figure 15** as sample VEUXO15-SD05-MMYY where a mangrove swamp is known to exist. From an ecological risk perspective, the sample collected from beneath this pile will be evaluated as sediment, and therefore a sediment sample, rather than a soil sample, will be collected here.

Sample Analysis

The discrete soil and sediment samples collected will be homogenized in the field, and then sent to the laboratory in appropriate sample containers for explosives, perchlorate, metals, and general chemistry parameters. Acid volatile sulfide/simultaneously extracted metals (AVS/SEM) and grain size are also needed for sediment. Details of the laboratory analysis are included in Worksheet #28 and Appendix B of the Final ESI SAP (CH2M HILL, 2011a).

SAP Worksheet #14 — Summary of Project Tasks for UXO 15 (continued)

The laboratory will maintain, test, inspect, and calibrate analytical instruments [Worksheets #24 and #25 of the Final ESI SAP (CH2M HILL, 2011a)]. The laboratory will analyze soil and sediment samples for various groups of parameters as shown on Worksheets # 15 and #18 of the Final ESI SAP (CH2M HILL, 2011a).

Equipment Decontamination

Equipment decontamination will follow the Master Protocols Standard Operating Procedure (SOP) E-1.

Investigation-Derived Waste Management

IDW will be managed and disposed of in accordance with the Master Waste Management Plan (CH2M HILL 2010b). Liquid and solid IDW will be sampled for Toxicity Characteristic Leaching Procedure (TCLP) and RCI to determine the disposal options. The disposal subcontractor will determine the necessary parameters.

Shipments

All offsite analytical samples will be delivered to the laboratory by FedEx. All samples will be shipped in accordance with the Master SOP H-5 “Packaging and Shipping Procedures for Samples Not Considered Dangerous Goods.”

Quality Control

All quality control samples are listed on Worksheet #20 of the Final ESI SAP (CH2M HILL, 2011a). In reference to the field tasks, field work will be overseen by a field team leader, or his delegate, who is responsible for the quality control of the sampling and make sure the proper SOPs are followed for each task.

Data Management

The Project Environmental Information Specialist (EIS) is responsible for data tracking and storage. In addition a third party data validator will receive all analytical data from the laboratory and the data will be validated prior to its use by the Navy. All validated analytical data will be loaded into the Navy Installation Restoration Information System (NIRIS) database.

Procedures for Recording and Correcting Data

Field data will be recorded in field logbooks.

Project Assessment/Audit: Worksheets #31 and #32 of the Final ESI SAP (CH2M HILL, 2011a).

Data Validation: Worksheets #35 and #36 of the Final ESI SAP (CH2M HILL, 2011a).

Data Usability Assessment: Worksheet #37 of the Final ESI SAP (CH2M HILL, 2011a).

SAP Worksheet #15-1 — Reference Limits and Evaluation Table

Matrix: SS
Analytical Group: METAL

Analyte	CAS Number	Analysis Method	RSLs Residential Soil Adjusted (mg/kg)	SSLs[4] (mg/kg)	Soil TRVs (mg/kg)	Project Quantitation Limit Goal[1,2] (mg/kg)	Laboratory-specific			LCS, MS, and MSD %R and %RPD Limits[3]		
							LOQs (mg/kg)	LODs (mg/kg)	DLs (mg/kg)	LCL	UCL	RPD
Aluminum	7429-90-5	6010B	7700	23000	NC	3850	30	10	0.71	80	120	20
Antimony	7440-36-0	6010B	3.1	0.27	78	0.27	0.8	0.5	0.070	80	120	20
Arsenic	7440-38-2	6020	0.39	0.29	18	0.29	0.5	0.4	0.15	80	120	20
Barium	7440-39-3	6010B	1500	82	330	41	0.5	0.3	0.026	80	120	20
Beryllium	7440-41-7	6010B	16	3.2	40	1.6	0.5	0.05	0.026	80	120	20
Cadmium	7440-43-9	6010B	7	0.38	32	0.38	1	0.3	0.0079	80	120	20
Calcium	7440-70-2	6010B	NC	NC	NC	10	10	8	1.78	80	120	20
Hexavalent Chromium	18540-29-9	7196A	0.29	0.00059	NC	0.00059	0.5	0.25	0.152	85	115	30
Chromium	7440-47-3	6020	0.29	180000	64	0.29	0.3	0.2	0.05	80	120	20
Cobalt	7440-48-4	6010B	2.3	0.21	13	0.21	3	0.4	0.029	80	120	20
Copper	7440-50-8	6010B	310	46	70	23	2.5	1	0.06	80	120	20
Iron	7439-89-6	6010B	5500	270	NC	135	10	8	1.4	80	120	20
Lead	7439-92-1	6010B	400	14	120	7	0.5	0.4	0.087	80	120	20
Magnesium	7439-95-4	6010B	NC	NC	NC	10	10	8	0.68	80	120	20
Manganese	7439-96-5	6010B	180	21	220	10.5	0.5	0.4	0.16	80	120	20
Nickel	7440-02-0	6010B	150	20	38	10	4	0.4	0.044	80	120	20
Potassium	7440-09-7	6010B	NC	NC	NC	100	100	50	2.9	80	120	20
Selenium	7782-49-2	6010B	39	0.26	0.52	0.26	1	0.7	0.17	80	120	20
Silver	7440-22-4	6010B	39	0.6	560	0.3	0.5	0.4	0.027	80	120	20
Sodium	7440-23-5	6010B	NC	NC	NC	100	100	50	1.5	80	120	20
Thallium	7440-28-0	6020	0.078	0.14	1	0.078	0.1	0.04	0.0094	80	120	20
Vanadium	7440-62-2	6010B	39	78	130	19.5	2.5	0.4	0.037	80	120	20
Zinc	7440-66-6	6010B	2300	290	120	60	2.5	1	0.17	80	120	20

Shading represents cases where the PAL is less than the laboratory LOD. Refer to Worksheet #11 "What are the project action limits" for discussion on how the data will be used and how non-detections at the laboratory LOD will be addressed.

NC: No screening level for this compound. Ca, Mg, K, and Na are nutrients. Although there are no PALs for nutrients, their analysis is useful for determining parent rock material. In addition, inclusion of nutrients can help interpret the other metals results. Soil TRVs for aluminum and iron are based on pH levels and thus are not included on this table. Soil pH levels are included when determining whether aluminum and iron pose risk to ecological receptors. N/A: Not applicable.

[1] The Project Action Limit for SS is "RSLs Residential Soil Adjusted" (May, 2012), "SSLs", and "Soil TRVs".
[2] The Project Quantitation Limit Goal is 1/2 the PAL, the PAL, or the Laboratory Specific QL, as applicable.
[3] DoD QSM v. 4.1 is the basis for LCS and MS/MSD limits.
[4] RSLs Risk-Based SSLs are used when RSLs MCL-Based SSLs do not exist.

LOQ/LOD/DL are as defined in DoD QSM v. 4.1.

LODs and results for solid samples are presented on a dry-weight basis.

SAP Worksheet #15-1a — Reference Limits and Evaluation Table

Matrix: SD
Analytical Group: METAL

Analyte	CAS Number	Analysis Method	RSLs Residential Soil Adjusted (mg/kg)	Marine Sediment TRVs (mg/kg)	Project Quantitation Limit Goal[1,2] (mg/kg)	Laboratory-specific			LCS, MS, and MSD %R and %RPD Limits[4]		
						LOQs (mg/kg)	LODs (mg/kg)	DLs (mg/kg)	LCL	UCL	RPD
Aluminum	7429-90-5	6010B	7700	18000	3850	30	10	0.71	80	120	20
Antimony	7440-36-0	6010B	3.1	2	1	0.8	0.5	0.070	80	120	20
Arsenic	7440-38-2	6020	0.39	8.2	0.39	0.5	0.4	0.15	80	120	20
Barium	7440-39-3	6010B	1500	48	24	0.5	0.3	0.026	80	120	20
Beryllium	7440-41-7	6010B	16	NC	8	0.5	0.05	0.068	80	120	20
Cadmium	7440-43-9	6010B	7	1.2	1.2	1	0.3	0.0079	80	120	20
Calcium	7440-70-2	6010B	NC	NC	10	10	8	1.78	80	120	20
Hexavalent Chromium	18540-29-9	7196A	0.29	NC	0.29	0.5	0.25	0.152	85	115	30
Chromium	7440-47-3	6020	0.29	81	0.29	0.3	0.2	0.08	80	120	20
Cobalt	7440-48-4	6010B	2.3	10	2.3	3	0.4	0.029	80	120	20
Copper	7440-50-8	6010B	310	34	17	2.5	1	0.06	80	120	20
Iron	7439-89-6	6010B	5500	220000	2750	10	8	1.4	80	120	20
Lead	7439-92-1	6010B	400	46.7	23.35	0.5	0.4	0.087	80	120	20
Magnesium	7439-95-4	6010B	NC	NC	10	10	8	0.68	80	120	20
Manganese	7439-96-5	6010B	180	260	90	0.5	0.4	0.16	80	120	20
Nickel	7440-02-0	6010B	150	20.9	10.45	4	0.4	0.044	80	120	20
Potassium	7440-09-7	6010B	NC	NC	100	100	50	2.9	80	120	20
Selenium	7782-49-2	6010B	39	1	1	1	0.7	0.17	80	120	20
Silver	7440-22-4	6010B	39	1	1	1.5	0.4	0.027	80	120	20
Sodium	7440-23-5	6010B	NC	NC	100	100	50	1.5	80	120	20
Thallium	7440-28-0	6020	0.078	NC	0.078	0.1	0.04	0.0094	80	120	20
Vanadium	7440-62-2	6010B	39	57	19.5	2.5	0.4	0.037	80	120	20
Zinc	7440-66-6	6010B	2300	150	75	2.5	1	0.17	80	120	20

Shading represents cases where the PAL is less than the laboratory LOD. Refer to Worksheet #11 "What are the project action limits" for discussion on how the data will be used and how non-detections at the laboratory LOD will be addressed.

NC: No screening level for this compound. Ca, Mg, K, and Na are nutrients. Although there are no PALs for nutrients, their analysis is useful for determining parent rock material. In addition, inclusion of nutrients can help interpret the other metals results. N/A: Not applicable.

[1] The Project Action Limit for SD is "RSLs Residential Soil Adjusted" (May, 2012) and "Marine Sediment TRVs".

[2] The Project Quantitation Limit Goal is 1/2 the PAL, the PAL, or the Laboratory Specific QL, as applicable.

[4] DoD QSM v. 4.1 is the basis for LCS and MS/MSD limits.

LOQ/LOD/DL are as defined in DoD QSM v. 4.1 .

LODs and results for solid samples are presented on a dry-weight basis.

SAP Worksheet #15-2 — Reference Limits and Evaluation Table

Matrix: SS
Analytical Group: EXPLO (SW-846 8330, 6850)

Analyte	CAS Number	Analysis Method	RSLs Residential Soil Adjusted (µg/kg)	SSLs[4] (µg/kg)	Soil TRVs (µg/kg)	Project Quantitation Limit Goal[1,2] (µg/kg)	Laboratory-specific			LCS, MS, and MSD %R and %RPD Limits[3]		
							LOQs (µg/kg)	LODs (µg/kg)	DLs (µg/kg)	LCL	UCL	RPD
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	8330	380000	990	10000	495	100	50	8.6	75	125	20
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	8330	5600	0.23	10000	0.23	100	50	6.8	70	135	20
1,3,5-Trinitrobenzene (1,3,5-TNB)	99-35-4	8330	220000	1700	NC	850	100	50	6.7	75	125	20
1,3-Dinitrobenzene (1,3-DNB)	99-65-0	8330	610	1.4	NC	1.4	100	50	6.2	80	125	20
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	479-45-8	8330	24000	590	10000	295	100	50	5.4	10	150	20
Nitrobenzene (NB)	98-95-3	8330	4800	0.079	2260	0.079	100	50	22	75	125	20
2,4,6-Trinitrotoluene (2,4,6-TNT)	118-96-7	8330	3600	13	10000	13	100	50	6.7	55	140	20
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	19406-51-0	8330	15000	23	NC	23	100	50	17	80	125	20
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	35572-78-2	8330	15000	23	80000	23	100	50	21	80	125	20
2,4-Dinitrotoluene (2,4-DNT)	121-14-2	8330	1600	0.28	11000	0.28	100	50	15	80	125	20
2,6-Dinitrotoluene (2,6-DNT)	606-20-2	8330	6100	20	8500	20	100	50	27	80	120	20
2-Nitrotoluene (2-NT)	88-72-2	8330	2900	0.25	NC	0.25	100	50	12	80	125	20
3-Nitrotoluene (3-NT)	99-08-1	8330	610	1.2	NC	1.2	100	50	7.9	75	120	20
4-Nitrotoluene (4-NT)	99-99-0	8330	24000	3.4	NC	3.4	100	50	27	75	125	20
Pentaerythritol tetranitrate (PETN)	78-11-5	8330	12000	24	NC	24	800	400	108	30	150	20
Nitroglycerin (NG)	55-63-0	8330	610	0.66	NC	0.66	800	400	124	30	150	20
3,5-Dinitroaniline (3,5-DNA)	618-87-1	8330	NC	NC	NC	100	100	50	4	30	150	20
Perchlorate	14797-73-0	6850	5500	NC	1000	500	5	0.4	0.26	80	120	15

Shading represents cases where the PAL is less than the laboratory LOD. Refer to Worksheet #11 "What are the project action limits" for discussion on how the data will be used and how non-detections at the laboratory LOD will be addressed.

NC: No screening level for this compound. N/A: Not applicable.

[1] The Project Action Limit for SS is "RSLs Residential Soil Adjusted" (May, 2012), "SSLs", and "Soil TRVs". Toxicity values for 3,5-Dinitroaniline are not available from any of the sources identified in EPA's toxicity hierarchy memo.

[2] The Project Quantitation Limit Goal is 1/2 the PAL, the PAL, or the Laboratory Specific QL, as applicable.

[3] DoD QSM v. 4.1 is the basis for LCS and MS/MSD limits.

[4] RSLs Risk-Based SSLs are used when RSLs MCL-Based SSLs do not exist.

DoD QSM v. 4.1 does not provide limits for this compound. In-house limits used.

LOQ/LOD/DL are as defined in DoD QSM v. 4.1.

LODs and results for solid samples are presented on a dry-weight basis.

SAP Worksheet #15-2a — Reference Limits and Evaluation Table

Matrix: SD
Analytical Group: EXPLO (SW-846 8330, 6850)

Analyte	CAS Number	Analysis Method	RSLs Residential Soil Adjusted (µg/kg)	Marine Sediment TRVs (µg/kg)	Project Quantitation Limit Goal[1,2] (µg/kg)	Laboratory-specific			LCS, MS, and MSD %R and %RPD Limits[3]		
						LOQs (µg/kg)	LODs (µg/kg)	DLs (µg/kg)	LCL	UCL	RPD
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	8330	380000	115000	57500	100	50	8.6	75	125	20
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	8330	5600	891000	2800	100	50	6.8	70	135	20
1,3,5-Trinitrobenzene (1,3,5-TNB)	99-35-4	8330	220000	7000	3500	100	50	6.7	75	125	20
1,3-Dinitrobenzene (1,3-DNB)	99-65-0	8330	610	NC	305	100	50	6.2	80	125	20
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	479-45-8	8330	24000	72	72	100	50	5.4	10	150	20
Nitrobenzene (NB)	98-95-3	8330	4800	21	21	100	50	22	75	125	20
2,4,6-Trinitrotoluene (2,4,6-TNT)	118-96-7	8330	3600	20000	1800	100	50	6.7	55	140	20
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	19406-51-0	8330	15000	NC	7500	100	50	17	80	125	20
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	35572-78-2	8330	15000	NC	7500	100	50	21	80	125	20
2,4-Dinitrotoluene (2,4-DNT)	121-14-2	8330	1600	NC	800	100	50	15	80	125	20
2,6-Dinitrotoluene (2,6-DNT)	606-20-2	8330	6100	549	274.5	100	50	27	80	120	20
2-Nitrotoluene (2-NT)	88-72-2	8330	2900	NC	1450	100	50	12	80	125	20
3-Nitrotoluene (3-NT)	99-08-1	8330	610	NC	305	100	50	7.9	75	120	20
4-Nitrotoluene (4-NT)	99-99-0	8330	24000	NC	12000	100	50	27	75	125	20
Pentaerythritol tetranitrate (PETN)	78-11-5	8330	12000	NC	6000	800	400	108	30	150	20
Nitroglycerin (NG)	55-63-0	8330	610	NC	610	800	400	124	30	150	20
3,5-Dinitroaniline (3,5-DNA)	618-87-1	8330	NC	NC	100	100	50	4	30	150	20
Perchlorate	14797-73-0	6850	5500	NC	2750	5	0.4	0.26	80	120	15

Shading represents cases where the PAL is less than the laboratory LOD. Refer to Worksheet #11 "What are the project action limits" for discussion on how the data will be used and how non-detections at the laboratory LOD will be addressed.

NC: No screening level for this compound. N/A: Not applicable.

[1] The Project Action Limit for SD is "RSLs Residential Soil Adjusted" (May, 2012) and "Marine Sediment TRVs". Toxicity values for 3,5-Dinitroaniline are not available from any of the sources identified in EPA's toxicity hierarchy memo.

[2] The Project Quantitation Limit Goal is 1/2 the PAL, the PAL, or the Laboratory Specific QL, as applicable.

3 DoD QSM v. 4.1 is the basis for LCS and MS/MSD limits.

DoD QSM v. 4.1 does not provide limits for this compound. In-house limits used.

LOQ/LOD/DL are as defined in DoD QSM v. 4.1.

LODs and results for solid samples are presented on a dry-weight basis.

SAP Worksheet #15-3 — Reference Limits and Evaluation Table

Matrix: SD and SS
Analytical Group: WCHEM

Analyte	CAS Number	Analysis Method	Project Quantitation Limit Goal[1,2]	Laboratory-specific		LCS, MS, and MSD %R and %RPD Limits[3]		
				QLs	MDLs	LCL	UCL	RPD
pH	PH	9045	N/A	N/A	N/A	N/A	N/A	N/A

NC: No screening level for this compound. N/A: Not applicable.

[1] There are no project action limits for these wet chemistry analyses (they are screening data).

[2] The Project Quantitation Limit Goal is 1/2 the PIL, the PIL, or the Laboratory Specific QL, as applicable.

[3] DoD QSM v. 4.1 is the basis for LCS and MS/MSD limits.

QLs and results for solid samples are presented on a dry weight basis.

SAP Worksheet #15-4 — Reference Limits and Evaluation Table

Matrix: AQ (blanks only)
Analytical Group: METAL

Analyte	CAS Number	Analysis Method	Project Quantitation Limit Goal[1,2] (µg/L)	Laboratory-specific			LCS, MS, and MSD %R and %RPD Limits[3]		
				LOQs (µg/L)	LODs (µg/L)	DLs (µg/L)	LCL	UCL	RPD
Aluminum	7429-90-5	6010B	300	300	100	13	80	120	20
Antimony	7440-36-0	6010B	8	8	5	1.3	80	120	20
Arsenic	7440-38-2	6020	5	5	4	2.2	80	120	20
Barium	7440-39-3	6010B	5	5	4	0.35	80	120	20
Beryllium	7440-41-7	6010B	5	5	0.5	0.091	80	120	20
Cadmium	7440-43-9	6010B	10	10	3	0.12	80	120	20
Calcium	7440-70-2	6010B	100	100	80	6.8	80	120	20
Hexavalent Chromium	18540-29-9	7196A	25	25	12.5	5.4	85	115	20
Chromium	7440-47-3	6020	3	3	2	0.22	80	120	20
Cobalt	7440-48-4	6010B	30	30	2	0.27	80	120	20
Copper	7440-50-8	6010B	25	25	10	0.7	80	120	20
Iron	7439-89-6	6010B	100	100	80	5.2	80	120	20
Lead	7439-92-1	6010B	5	5	4	1	80	120	20
Magnesium	7439-95-4	6010B	100	100	80	9.4	80	120	20
Manganese	7439-96-5	6010B	5	5	4	0.67	80	120	20
Nickel	7440-02-0	6010B	40	40	4	0.24	80	120	20
Potassium	7440-09-7	6010B	1000	1000	400	95	80	120	20
Selenium	7782-49-2	6010B	10	10	7	3	80	120	20
Silver	7440-22-4	6010B	15	15	5	0.79	80	120	20
Sodium	7440-23-5	6010B	1000	1000	500	22	80	120	20
Thallium	7440-28-0	6020	2	2	0.04	0.015	80	120	20
Vanadium	7440-62-2	6010B	25	25	4	0.35	80	120	20
Zinc	7440-66-6	6010B	25	25	12	1.7	80	120	20

NC: No screening level for this compound. Ca, Mg, K, and Na are nutrients. N/A: Not applicable.

[1] There are no project action limits for AQ because these samples are blanks only.

[2] The Project Quantitation Limit Goal is 1/2 the PAL, the PAL, or the Laboratory Specific QL, as applicable.

[3] DoD QSM v. 4.1 is the basis for LCS and MS/MSD limits.

LOQ/LOD/DL are as defined in DoD QSM v. 4.1.

SAP Worksheet #15-5 — Reference Limits and Evaluation Table

Matrix: AQ
Analytical Group: EXPLO (SW-846 8330, 6850)

Analyte	CAS Number	Analysis Method	Project Quantitation Limit Goal1,2 (µg/L)	Laboratory-specific			LCS, MS, and MSD %R and %RPD Limits3		
				LOQs (µg/L)	LODs (µg/L)	DLs (µg/L)	LCL	UCL	RPD
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	8330	0.25	0.25	0.125	0.043	80	115	20
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	8330	0.25	0.25	0.125	0.046	50	160	20
1,3,5-Trinitrobenzene (1,3,5-TNB)	99-35-4	8330	0.25	0.25	0.125	0.04	65	140	20
1,3-Dinitrobenzene (1,3-DNB)	99-65-0	8330	0.25	0.25	0.125	0.045	45	160	20
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	479-45-8	8330	0.25	0.25	0.125	0.06	20	175	20
Nitrobenzene (NB)	98-95-3	8330	0.25	0.25	0.125	0.071	50	140	20
2,4,6-Trinitrotoluene (2,4,6-TNT)	118-96-7	8330	0.25	0.25	0.125	0.064	50	145	20
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	19406-51-0	8330	0.25	0.25	0.125	0.053	55	155	20
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	35572-78-2	8330	0.25	0.25	0.125	0.038	50	155	20
2,4-Dinitrotoluene (2,4-DNT)	121-14-2	8330	0.25	0.25	0.125	0.052	60	135	20
2,6-Dinitrotoluene (2,6-DNT)	606-20-2	8330	0.25	0.25	0.125	0.056	60	135	20
2-Nitrotoluene (2-NT)	88-72-2	8330	0.25	0.25	0.125	0.071	45	135	20
3-Nitrotoluene (3-NT)	99-08-1	8330	0.25	0.25	0.125	0.063	50	130	20
4-Nitrotoluene (4-NT)	99-99-0	8330	0.25	0.25	0.125	0.06	50	130	20
Perchlorate	14797-73-0	6850	0.5	0.5	0.25	0.082	80	120	15

NC: No screening level for this compound. N/A: Not applicable.
[1] There are no project action limits for AQ because these samples are blanks only.
[2] The Project Quantitation Limit Goal is 1/2 the PAL, the PAL, or the Laboratory Specific QL, as applicable.
[3] DoD QSM v. 4.1 is the basis for LCS and MS/MSD limits.
DoD QSM v. 4.1 does not provide limits for this compound. In-house limits used.
LOQ/LOD/DL are as defined in DoD QSM v. 4.1.

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SAP Worksheet #16 - Project Schedule / Timeline

The field investigation activities are anticipated to occur in July 2012. The official schedule is the Site Management Plan (SMP) schedule that is distributed and updated separately.

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SAP Worksheet #17 – Sampling and Design and Rationale

The SAP addendum reflects the analytical protocol jointly developed and concurred upon in the scoping session by EPA, PREQB, FWS, and the Navy and documented in the Final SAP. Additionally, there are no widely-accepted human health or ecological screening values for Explosive D for the media to be sampled at UXO 15.

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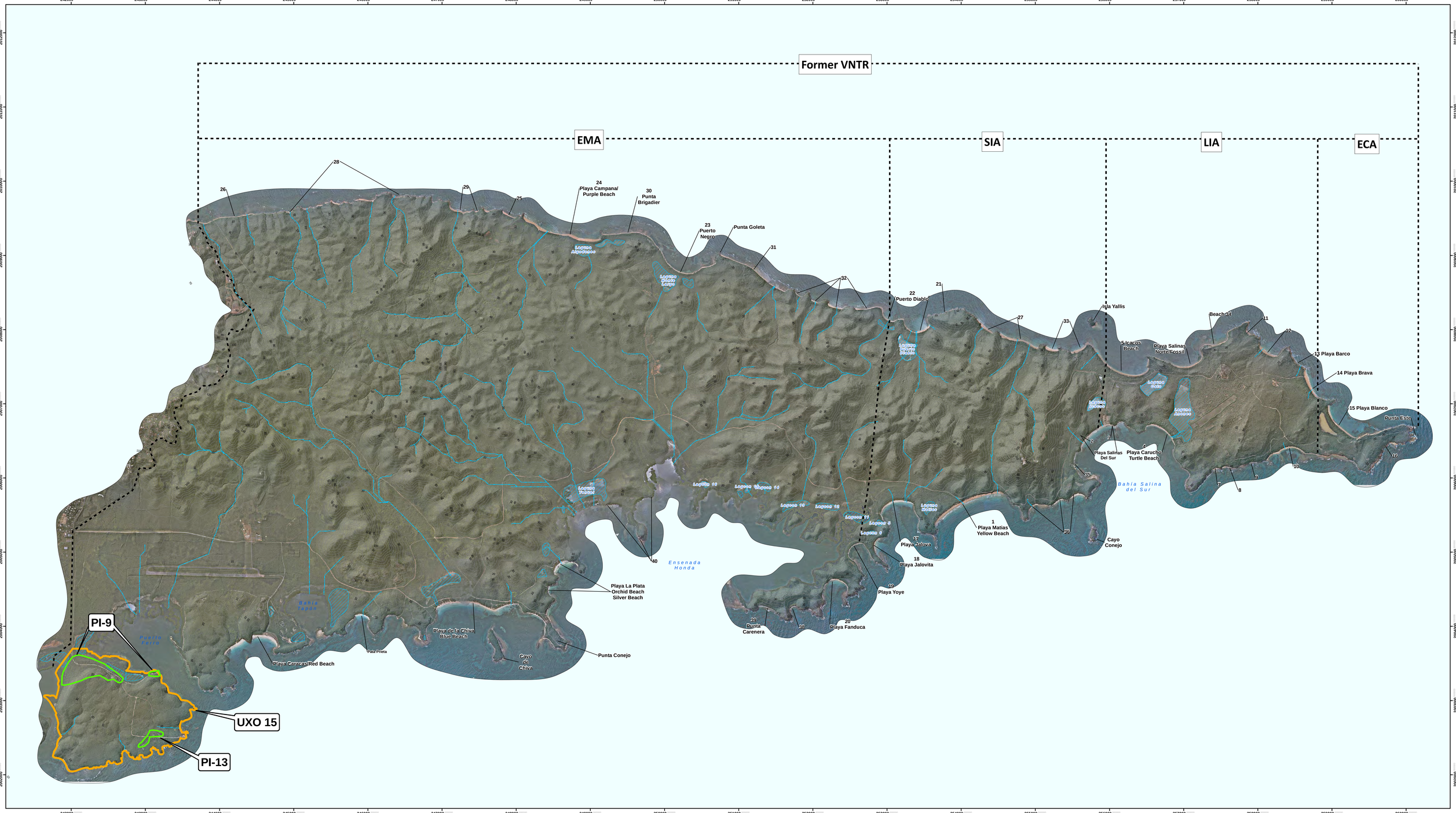
Figures



Legend

- Photo Identified Site
- UXO 15 Site Boundary
- Topographic Contours (10 Meter)
- Stream
- Lagoon

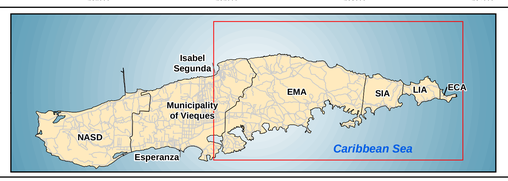
2005 Aerial Imagery
2005 Hillshade

Notes:

SIA - Surface Impact Area
LIA - Live Impact Area
ECA - Eastern Conservation Area
EMA - Eastern Manuever Area
VNTR - Vieques Naval Training Range

Topographic Contours derived from United States Geological Survey 30 Meter Digital Elevation Model.

Coordinate System - NAD 1983 UTM Zone 20 (Meters)



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0 1,500 3,000 4,500 6,000 Feet

Figure 1
Former VNTR Site Location Map
Expanded Site Inspection
Sampling and Analysis Plan Addendum, UXO 15
Former Vieques Naval Training Range
Vieques, Puerto Rico

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Legend

- Topographic Contours (10 Meter)
- PI-9
- Soil Depth < 6"

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Figure 2
PI-9 East Location of Limestone Encrusted Munitions
Expanded Site Inspection
Sampling and Analysis Plan Addendum, UXO 15
Former Vieques Naval Training Range
Vieques, Puerto Rico

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Legend

- Debris Pile
- Possible Detonation Point
- Low Magnetometer Response from "Mag and Flag"
- PI Site
- UXO15
- Possible location of caves
- Possible location of grenades and fuzes
- Possible location of 20 Tanks
- Possible location of bullet boxes

2007 Aerial Imagery

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Figure 3
Potential Contaminant Sources at UXO-15
Expanded Site Inspection
Sampling and Analysis Plan Addendum, UXO 15
Former Vieques Naval Training Range
Vieques, Puerto Rico

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Legend

- Non-Munitions-Related Scrap Metal
- Munitions Debris
- Material Potentially Presenting and Explosive Hazard
- Transect
- PI Site
- UXO15

2007 Aerial Imagery

Note:
Number next to item indicates the quantity of Item.

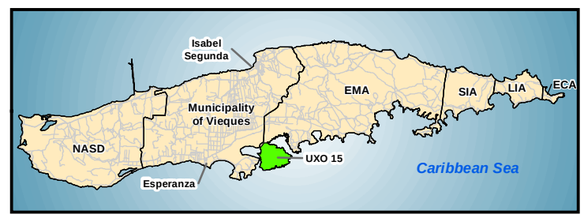

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Figure 4
Location of Transect Items
Expanded Site Inspection
Sampling and Analysis Plan Addendum, UXO 15
Former Vieques Naval Training Range
Vieques, Puerto Rico

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Figure 5 2003 Photo of rusted artillery casings near PI-9

Figure 6 2003 Photo of rusted artillery casings at boat ramp of PI-9

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Legend

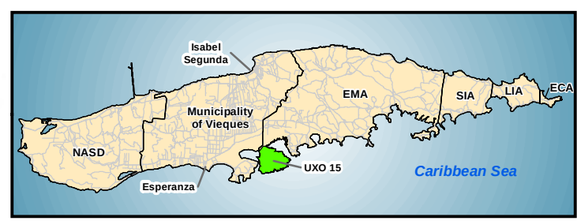
Magnetometer Response from "Mag and Fla

- Low
- Medium
- High
- Elevated Anomaly Density Area (EADA)
- PI Site
- UXO15

2007 Aerial Imagery

Aerial Magnetometer Survey Total Magnetic Field

-4.6 -2.3 0.0 1.9 3.8 5.8 7.7 9.6



N W E S

0 400 800 Feet

Figure 7

Aerial and Hand Held Magnetometer Survey Results

Expanded Site Inspection
Sampling and Analysis Plan Addendum, UXO 15
Former Vieques Naval Training Range
Vieques, Puerto Rico

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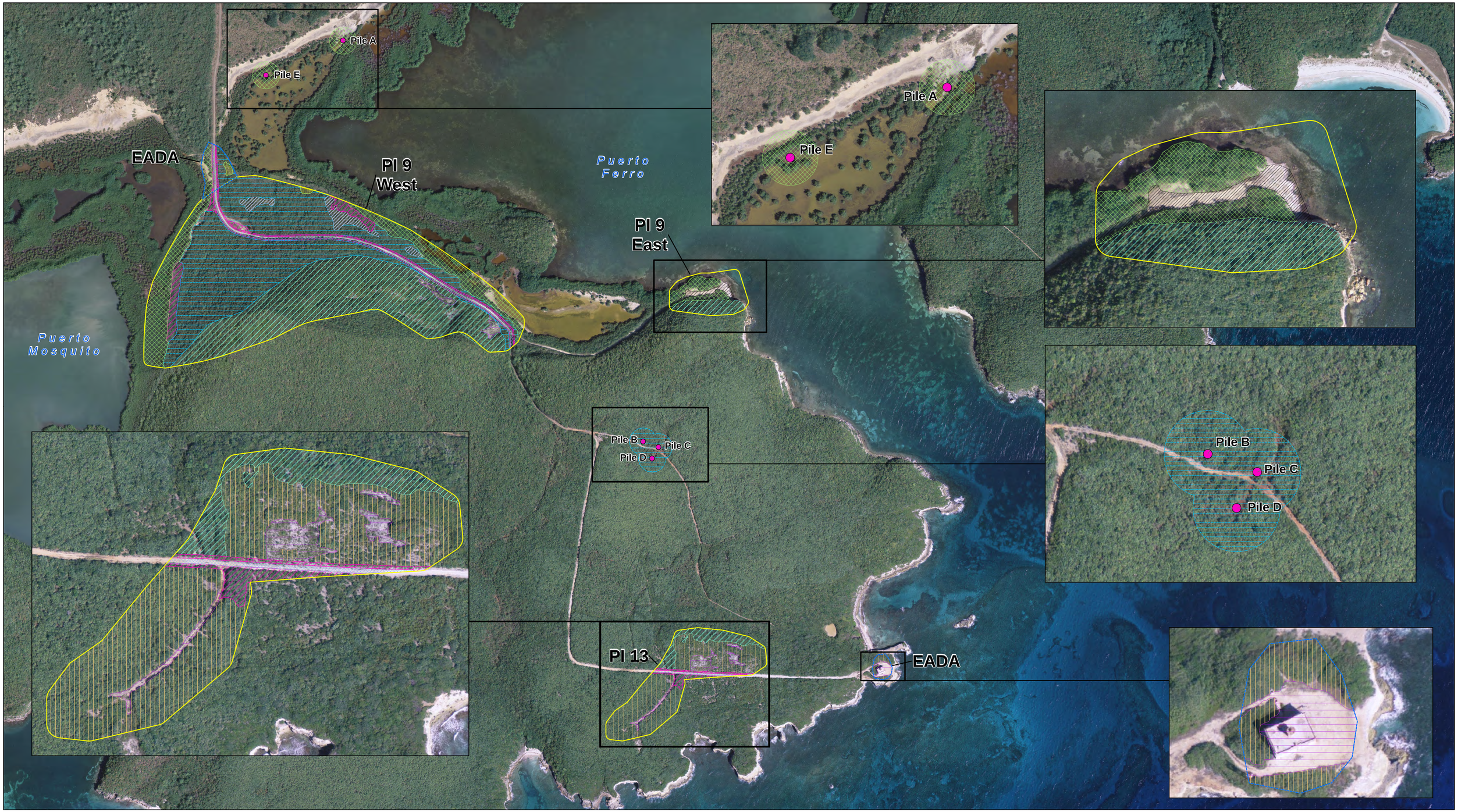

Legend

- Debris Piles
- Elevated Anomaly Density Area (EADA) from Digital Geophysical Mapping
- PI Site
- Dry Scrub Forest
- Evergreen Scrub
- Exposed Limestone
- Exposed Sand
- Giant Wild Pine (Air Plant)
- Invasive Vegetation
- Mangrove Forest
- Mixed Native and Invasive Vegetation
- Road
- Secondary Growth Forest

2007 Aerial Imagery

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W E
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0 125 250 500 750 1,000 Feet

Figure 8
Important Habitats
Expanded Site Inspection
Sampling and Analysis Plan Addendum, UXO 15
Former Vieques Naval Training Range
Vieques, Puerto Rico

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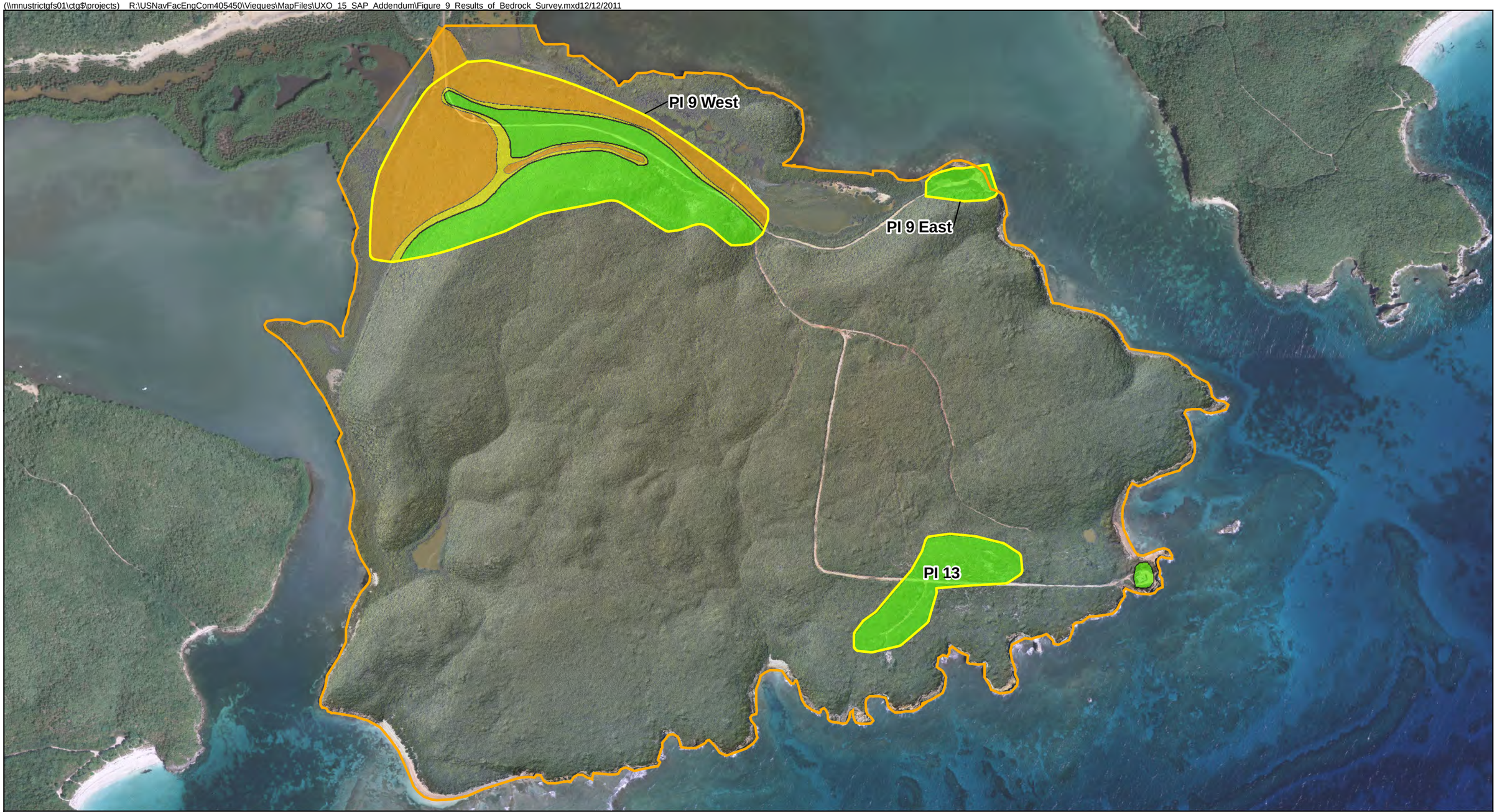

Legend

- Photo Identified Site
- UXO15
- Soil Depth < 6"
- Soil Depth 6" - 24"
- Soil Depth > 24"

2007/2005 Aerial Imagery

N
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0 300 600
Feet

Figure 9
Results of Bedrock Survey
Expanded Site Inspection
Sampling and Analysis Plan Addendum, UXO 15
Former Vieques Naval Training Range
Vieques, Puerto Rico

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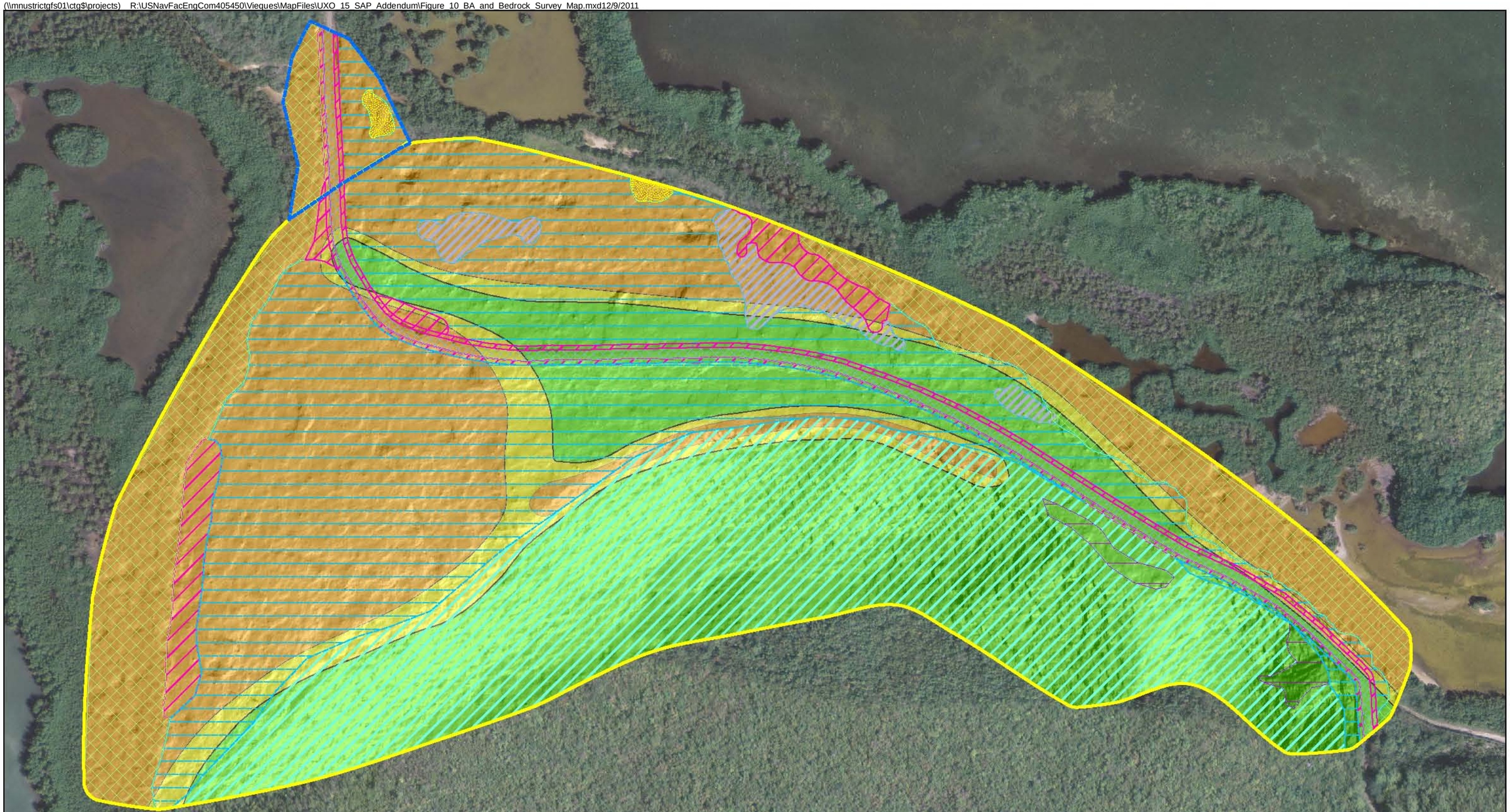

Bedrock Survey Results
- Soil Depth < 6"
- Soil Depth 6" - 24"
- Soil Depth > 24"

Biological Assesment Habitiat Survey Results
- Dry Scrub Forest
- Evergreen Scrub
- Exposed Limestone
- Exposed Sand
- Giant Wild Pine (Air Plant)
- Invasive Vegetation
- Mangrove Forest
- Mixed Native and Invasive Vegetation
- Road
- Secondary Growth Forest

- EADA
- Photo Identified Site

2007 Aerial Imagery

N W E S

0 100 200 Feet

Figure 10
Results of Bedrock Survey and Biological Assesment PI-9 West
Expanded Site Inspection
Sampling and Analysis Plan Addendum, UXO 15
Former Vieques Naval Training Range
Vieques, Puerto Rico

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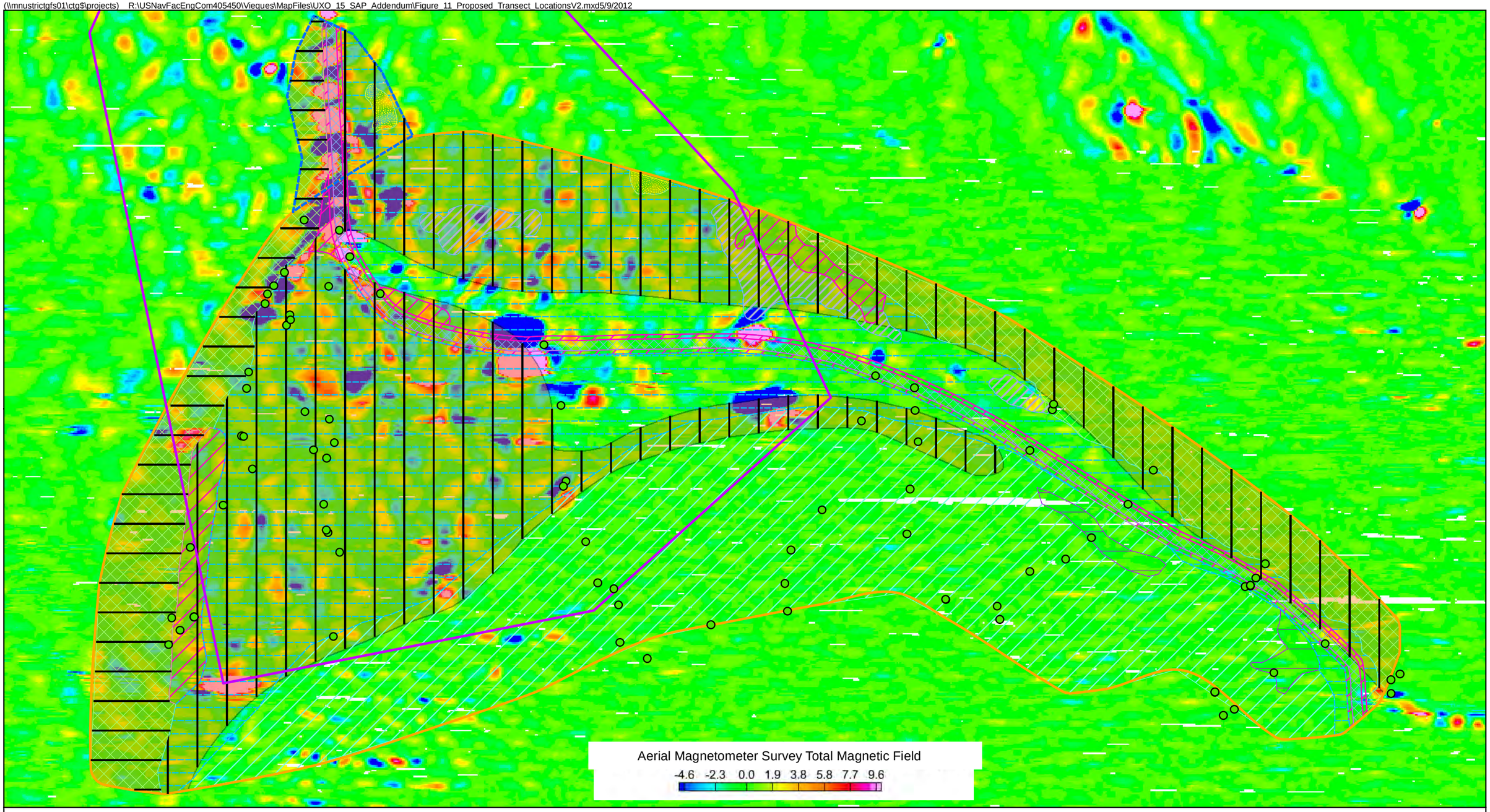

RESPONSE
- Low
- Medium
- High
- Elevated Anomaly Density Area (EADA)
- Transects - 3 ft wide, 60 ft spacing
- Proposed DGM Area (Area where Soil Depth > 6")

- EADA
- PI 9 West
- Dry Scrub Forest
- Exposed Limestone
- Giant Wild Pine (Air Plant)

- Invasive Vegetation
- Mangrove Forest
- Mixed Native and Invasive Vegetation
- Road
- Secondary Growth Forest

N
W E
S

0 100 200
Feet

Figure 11
Proposed Transect Locations
Expanded Site Inspection
Sampling and Analysis Plan Addendum, UXO 15
Former Vieques Naval Training Range
Vieques, Puerto Rico

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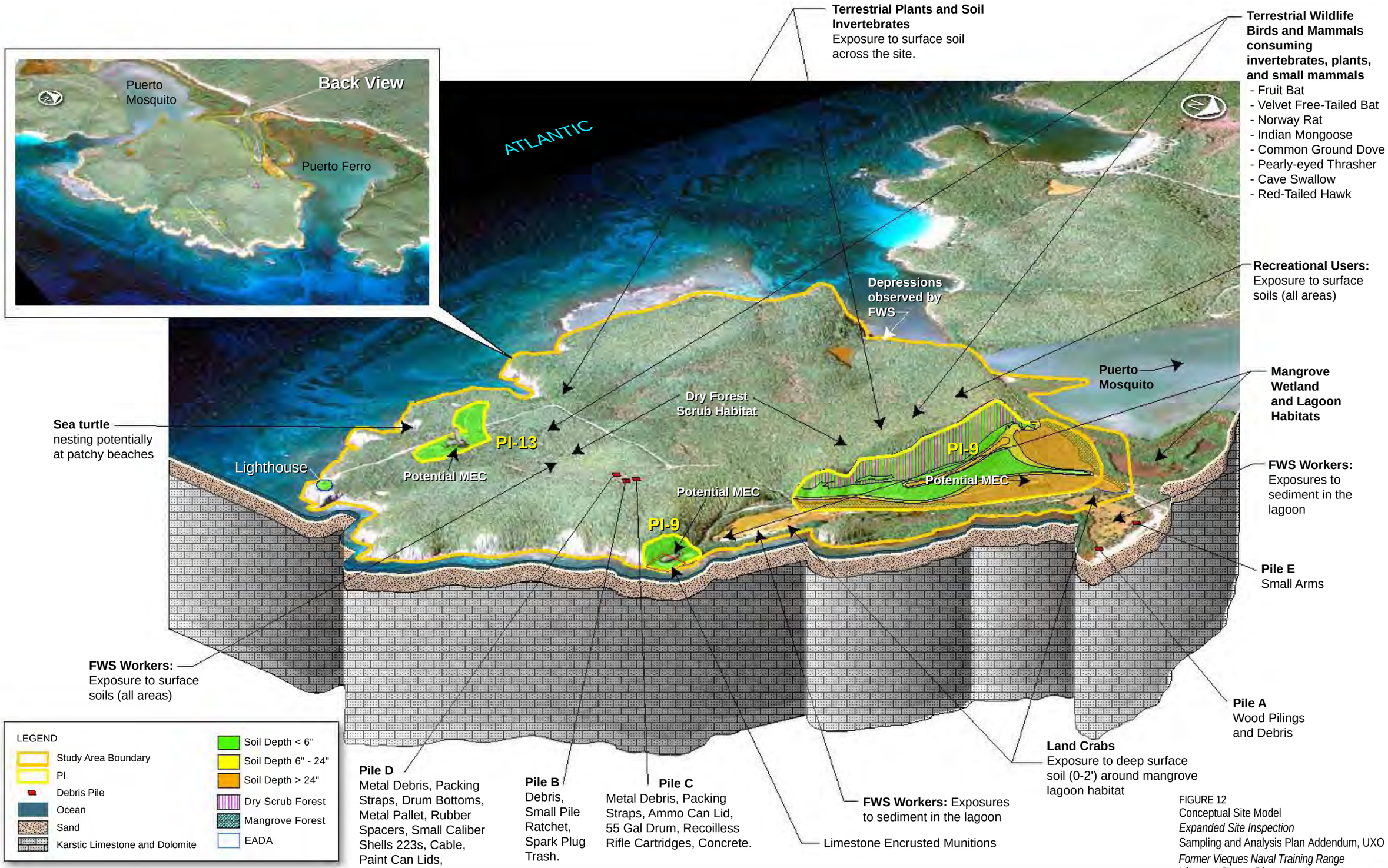

FIGURE 12
Conceptual Site Model
Expanded Site Inspection
Sampling and Analysis Plan Addendum, UXO 15
Former Vieques Naval Training Range
Vieques, Puerto Rico

CH2MHILL

ES090110063538TPA 1000-CTO-03_Fig-X_Envir_Invest_CSM.ai 09-01-2010 LED

(\\mnustrictgfs01\ctg$\projects) R:\USNavFacEngCom405450\Vieques\MapFiles\UXO_15_SAP_Addendum\Figure_13_Debris_Piles.mxd12/9/2011

Legend

- Debris Pile
- EADA
- Photo Identified Site
- UXO15

2007 Aerial Imagery

N
W E
S

0 400 800
Feet

Figure 13
Debris Piles
Expanded Site Inspection
Sampling and Analysis Plan Addendum, UXO 15
Former Vieques Naval Training Range
Vieques, Puerto Rico

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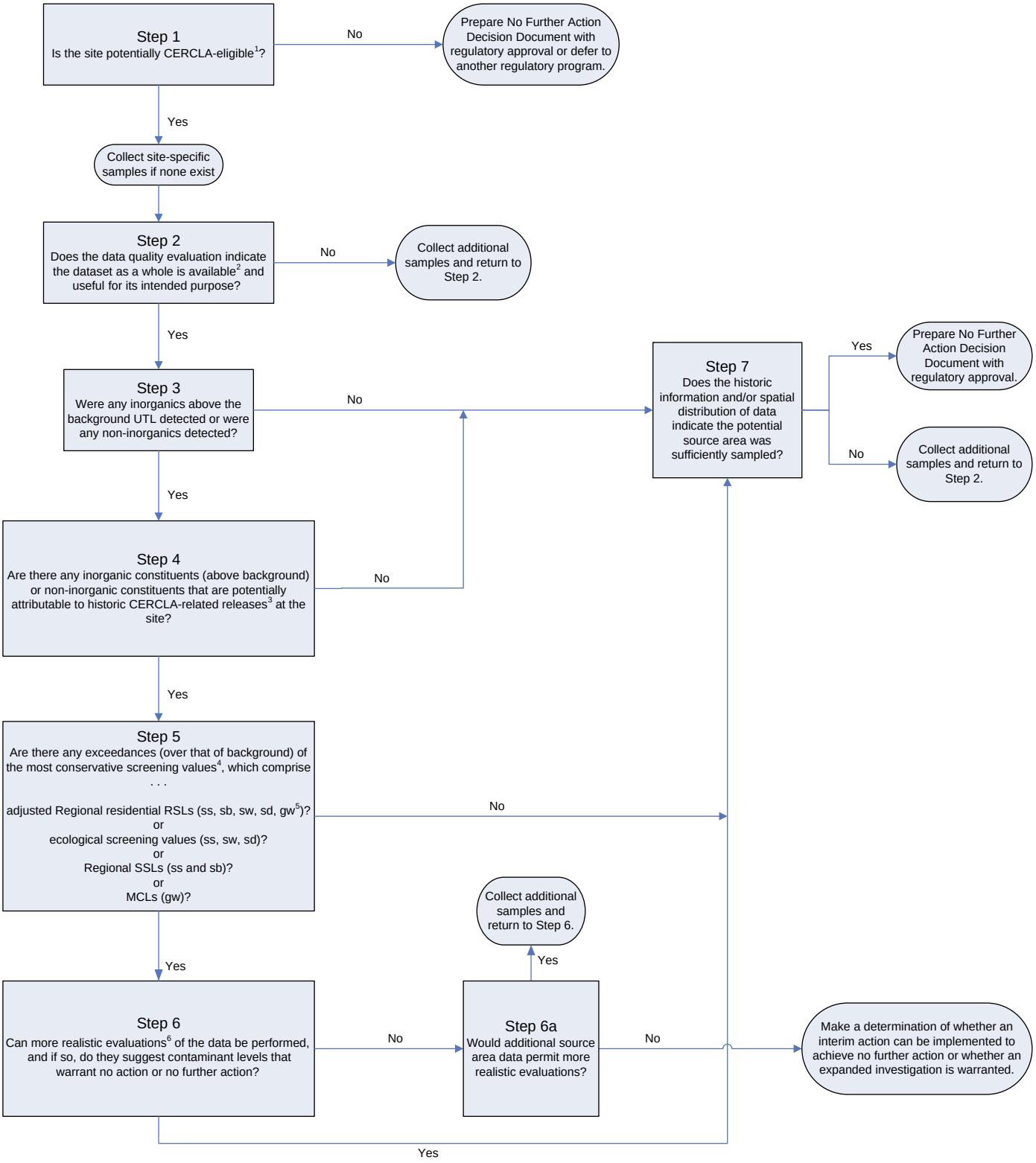

Notes:
The decision makers associated with this decision tree are the Navy, USEPA, PREQB, and USFWS.
[1] Determination of CERCLA eligibility is described in Section 1 of this SI/ESI Report (August 2010)
[2] "Available" data are described in Section 1 of this SI/ESI Report (August 2010)
[3] CERCLA-related releases are defined in Section 1 of this SI/ESI Report (August 2010)
[4] For UST sites, PREQB Land Pollution Control Corrective Action Levels
[5] ss = surface soil; sb = subsurface soil; sw = surface water; sd = sediment; gw = groundwater
[6] Examples of the types of more realistic evaluations that may be performed are described in Section 1 of this SI/ESI Report (August 2010)

FIGURE 14
Expanded SI Evaluation Decision Tree
Expanded Site Inspection
Sampling and Analysis Plan Addendum, UXO 15
Former Vieques Naval Training Range
Vieques, Puerto Rico

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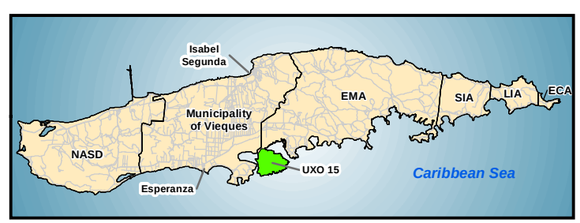
(\\mnustrictgfs01\ctg$\projects) R:\USNavFacEngCom405450\Vieques\MapFiles\UXO_15_SAP_Addendum\Figure_15_Proposed_Sample_Locations.mxd12/9/2011

Legend

- Prosposed Soil Sample Location at Debris Pile
- Prosposed Sediment Sample Location at Debris Pile
- UXO15
- EADA
- Photo Identified Site

2007 Aerial Imagery



N
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Figure 15
Proposed Sample Locations
Expanded Site Inspection
Sampling and Analysis Plan Addendum, UXO 15
Former Vieques Naval Training Range
Vieques, Puerto Rico

CH2MHILL

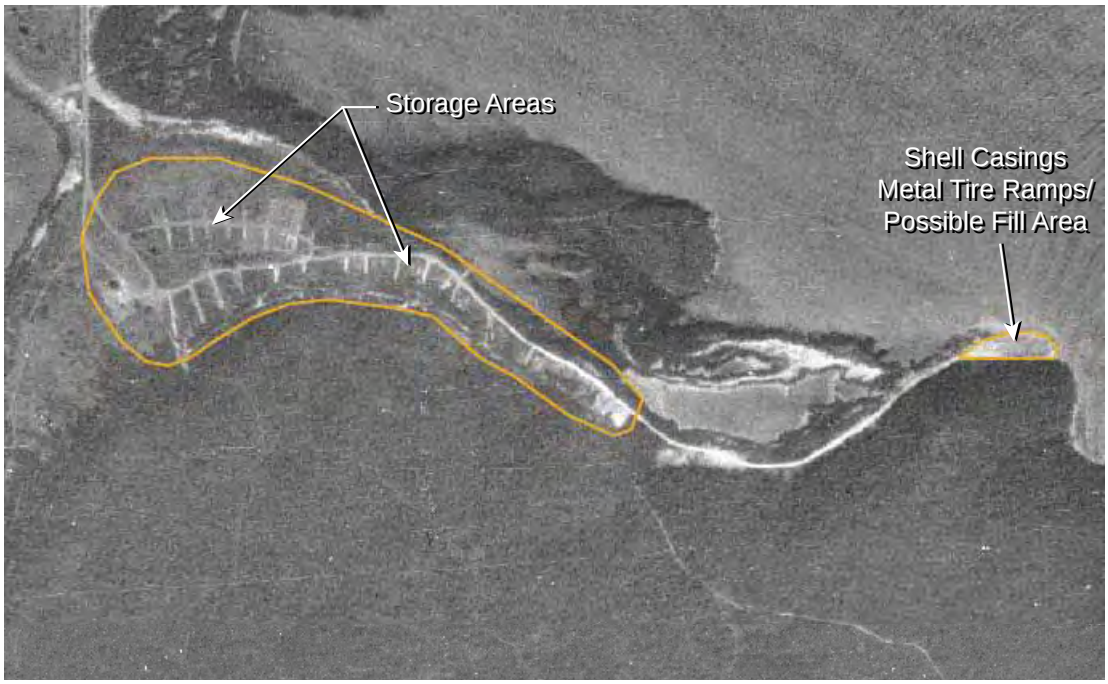

Figure 16 1959 Aerial Photo of PI-9. Orange line denotes area of activity since 1936 identified by ERI, Inc.

Figure 17 1962 Aerial Photo of PI-9. Purple line denotes area of activity since 1959 identified by ERI, Inc.

Figure 18 1964 Aerial Photo of PI-9. Green line denotes area of activity since 1962 identified by ERI, Inc.

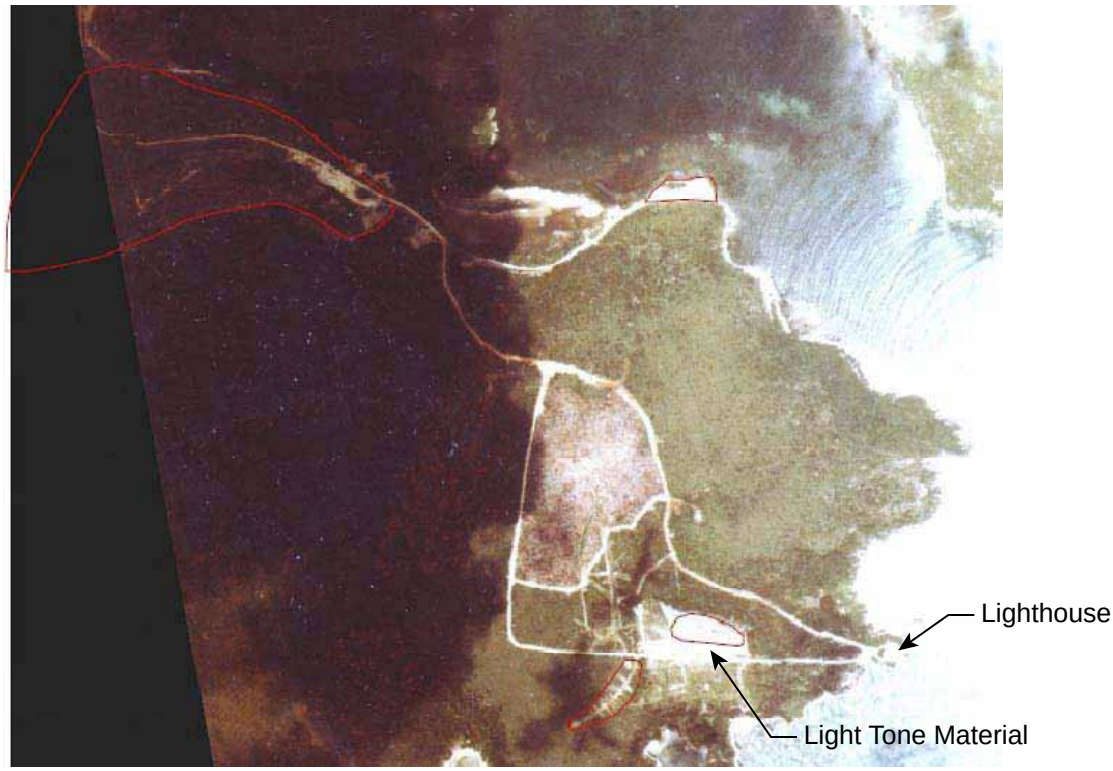

Figure 19 1970 Aerial Photo of UXO-15

Attachment A
Final Biological Assessment

Final

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

Former Vieques Naval Training Range
Vieques, Puerto Rico

Contract Task Order 0182

March 2012

Prepared for

Department of the Navy
Naval Facilities Engineering Command
Atlantic Division

Under the

NAVFAC CLEAN 1000 Program
Contract N62470-08-D-1000

Prepared by

CH2MHILL

Virginia Beach, Virginia

Contents

Section **Page**

Contents ..... **iii**

Acronyms and Abbreviations ..... **v**

1 Introduction **1-1**
1.1 Project Description 1-1

2 Biological Assessment Methods **2-1**
2.1 Species and Critical Habitat Considered 2-1
2.1.1 Listed Plants 2-2
2.1.2 Listed Birds 2-2
2.1.3 Important Refuge Habitats 2-2
2.1.4 Other Biological Resources 2-3
2.2 Survey Methodology 2-3
2.2.1 Literature Review 2-3
2.2.2 Survey Method 2-4
2.3 Agency Consultation and Coordination 2-5

3 Biological Assessment Survey Results **3-1**
3.1 Listed Plants 3-1
3.2 Listed Birds 3-1
3.3 Important Refuge Habitats 3-1
3.3.1 Dry Scrub Forest 3-2
3.3.2 Mangrove Forest 3-2
3.3.4 Evergreen Scrub 3-2
3.3.5 Exposed Limestone 3-2
3.3.6 Areas of Mixed Native/Naturalized and Invasive Species 3-0
3.3.7 Areas Composed Entirely of Invasive Species 3-0
3.3.8 Other Biological Resources 3-0

4 Effects Analysis **4-1**
4.1 Listed Plants 4-1
4.2 Listed Birds 4-2
4.3 Important Refuge Habitats 4-2
4.3.1 Dry Scrub Forest 4-2
4.3.2 Mangrove Forest 4-3
4.3.3 Secondary Growth Forest 4-3
4.3.4 Evergreen Scrub 4-4
4.3.5 Exposed Limestone 4-4
4.3.6 Areas of Mixed Native, Naturalized, and Invasive Species 4-5
4.3.7 Areas Composed Entirely of Invasive Species 4-5

4.4 Other Biological Resources 4-6
4.4.1 Giant Wild Pine 4-6
4.4.2 Land Crab 4-6
4.4.3 Birds 4-7
4.4.4 Antillean Nighthawk 4-7
4.5 Conservation Measures 4-8

5 Works Cited 5-1

Exhibits

1 Federally Endangered and Threatened Species Potentially Occurring at UXO 15 2-1

2 Habitats in PI 9, PI 13, and Debris Piles within UXO 15 3-1

3 Habitat Characteristics 3-0

Attachment

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.

B Photo Log

C Figures

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

SECTION 1

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) (Attachment 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.

Exhibit 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.

EXHIBIT 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			
Calyptranthes thomasiana	None	Endangered	Endangered
Chamaecrista glandulosa var. mirabilis	None	Endangered	Endangered
Goetzea elegans	Beautiful goetzea	Endangered	Endangered
Stahlia monosperma	Cóbana negra	Threatened	Threatened
Birds			
Agelaius xanthomus	Yellow-shouldered blackbird	Endangered	Endangered
Pelecanus occidentalis	Brown pelican	Delisted[1]	Delisted[1]
Sterna dougallii dougallii	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*), *Calyptranthes thomasiana*, *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.
- *Calyptranthes thomasiana* 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 Exhibit 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 *Calyptranthes 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 Exhibit 2 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.

EXHIBIT 2
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**

Exhibit 3 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 (Exhibit 3).

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 (Exhibit 3). 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 Exhibit 3. 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). Exhibit 3 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 Exhibit 3. 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.

EXHIBIT 3
Habitat Characteristics
Biological Assessment for PI 9 and PI 13 and Debris Piles within UXO 15

		Percent Cover				
Habitat Type	**Dominant Vegetation**	**Canopy**	**Shrub**	**Ground-cover**	**Substrate Type**	**Other Biological Resources**
Dry Scrub Forest	calambreña (*Coccoloba venosa*), corcho bobo (*Pisonia subcordata*), gumbo limbo (*Bursera simaruba*), muñeco (*Cordia collococca*), torchwood (*Amyris elemifera*), Coccothrinax sp., tamarind (*Tamarindus indica*)	100% (15-20 feet height)	5%	5%	100% Soil	grey kingbird (*Tyrannus dominicensis*), monk orchid (*Oeceoclades maculata*)
Mangrove Forest	black mangrove (*Avicennia germinans*), red mangrove (*Rhizophora mangle*), white mangrove (*Laguncularia racemosa*), buttonwood (*Conocarpus erectus*), portia tree (*Thespesia populnea*)	Variable depending on location, 5-100%	Variable, depending on location, 0-40%	Variable depending on location, 5-100%	100% Soil	land crab (*Cardisoma guanhumi*) colonies, mangrove cuckoo (*Coccyzus minor*), clapper rail (*Rallus longirostris*), white-winged dove (*Zenaida asiatica*), bananaquit (*Coereba flaveola*), pearly-eyed thrasher (*Margarops fuscatus*), black-necked stilt (*Himantopus mexicanus*), yellow warbler (*Dendroica petechia*), Antillean grackle (*Quiscalus niger*), clapper rail (*Rallus longirostris*), black-bellied plover (*Pluvialis squatarola*), Wilson's plover (*Charadrius wilsonia*), and fulvous whistling duck (*Dendrocygna bicolor*)
Secondary Growth Forest	pink trumpet tree (*Tabebuia heterophylla*), cassia (*Senna bicapsularis*), torchwood (*Amyris elemifera*), gumbo limbo (*Bursera simaruba*)	100% (30 feet height)	50-75%	25-50%	100% Soil	None observed

EXHIBIT 3
Habitat Characteristics
Biological Assessment for PI 9 and PI 13 and Debris Piles within UXO 15

		Percent Cover				
Habitat Type	**Dominant Vegetation**	**Canopy**	**Shrub**	**Ground-cover**	**Substrate Type**	**Other Biological Resources**
Evergreen Scrub	PI 13 (area south of road) - *Thrinax morrisii*, *Erithalis fruticosa*, beach creeper (*Ernodea littoralis*), and *Coccoloba krugi*. PI 13 (area north of road) - low growing shrubs, including *Erithalis fruticosa*, beach creeper (*Ernodea littoralis*), Coccothrinax sp., and buttonsage (*Lantana involucrata)*. EADA east of PI 13 - seagrape (*Coccoloba uvifera*), sea-oxeye (*Borrichia arborescens*), slender seapurslane (*Sesuvium portulacastrum*), and blacktorch (*Erithalis fruticosa*).	100%	75-100%	0-10%	100% Limestone	None observed
Exposed Limestone	Sparse and low shrub cover consisting of blacktorch (*Erithalis fruticosa*), *Thrinax morrisii*, beach creeper (*Ernodea littoralis)*, *Coccoloba krugii*, and *Lantana involucrata*.	5%	Variable, depending on location, 0- 25%	Variable, depending on location, 0- 25%	100% Limestone	Antillean nighthawk (*Chordeiles gundlachii*)
Mixed Native/Naturalized and Invasives	Mixed native and naturalized species including pink trumpet tree (*Tabebuia heterophylla*), cassia (*Senna bicapsularis*), torchwood (*Amyris elemifera*), gumbo limbo (*Bursera simaruba*), sapwood (*Comocladia dodonaea*), and silver palm (*Coccothrinax* sp.). Multiple monk orchids (*Oeceoclades maculata*) on forest floor. Invasive or introduced species including acacia (*Acacia tortuosa*), tan tan (*Leucaena leucocephala*), and mesquite (*Prosopis juliflora*).	100%	Variable, depending on location, 50-75%	25%	100% Soil	Mangrove cuckoo (*Coccyzus minor*), grey kingbird (*Tyrannus dominicensis*), giant wild pine (*Tillandsia utriculata*)
Entirely Invasive Species	Acacia (*Acacia tortuosa*), tan tan (*Leucaena leucocephala*), and mesquite (*Prosopis juliflora*).	90-100%	50%	5%	100% Soil	None observed

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 (O*eceoclades 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.

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.

SECTION 4

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 *Calyptranthes 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 affects 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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Attachment 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 (VNWRCP), 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 VNWRCP. 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*), *Calyptranthes 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.

- *Calyptranthes 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, *Calyptranthes 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			
Calyptranthes thomasiana	none	Endangered	Endangered
Chamaecrista glandulosa var. mirabilis	none	Endangered	Endangered
Goetzea elegans	Beautiful goetzea	Endangered	Endangered
Stahlia monosperma	Cóbana negra	Threatened	Threatened
Birds			
Agelaius xanthomus	Yellow-shouldered blackbird	Endangered	Endangered
Pelecanus occidentalis	Brown pelican	Delisted[1]	Delisted[1]
Sterna dougallii dougallii	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 [>5m] 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

References

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\\NORTHEND\PROJ\USNAVFACENGCOM\386637VIEQUES\GIS\MAPFILES\ARCH_SURVEY\FIGURE_1_PI-9_BIOLOGICAL ASSESSMENT.MXD FCAIN 4/13/2011 15:38:50

Legend

Transect (30 meter spacing)

PI-9

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Feet

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

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Legend

Transect (30 meter spacing)

PI-13

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Feet

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

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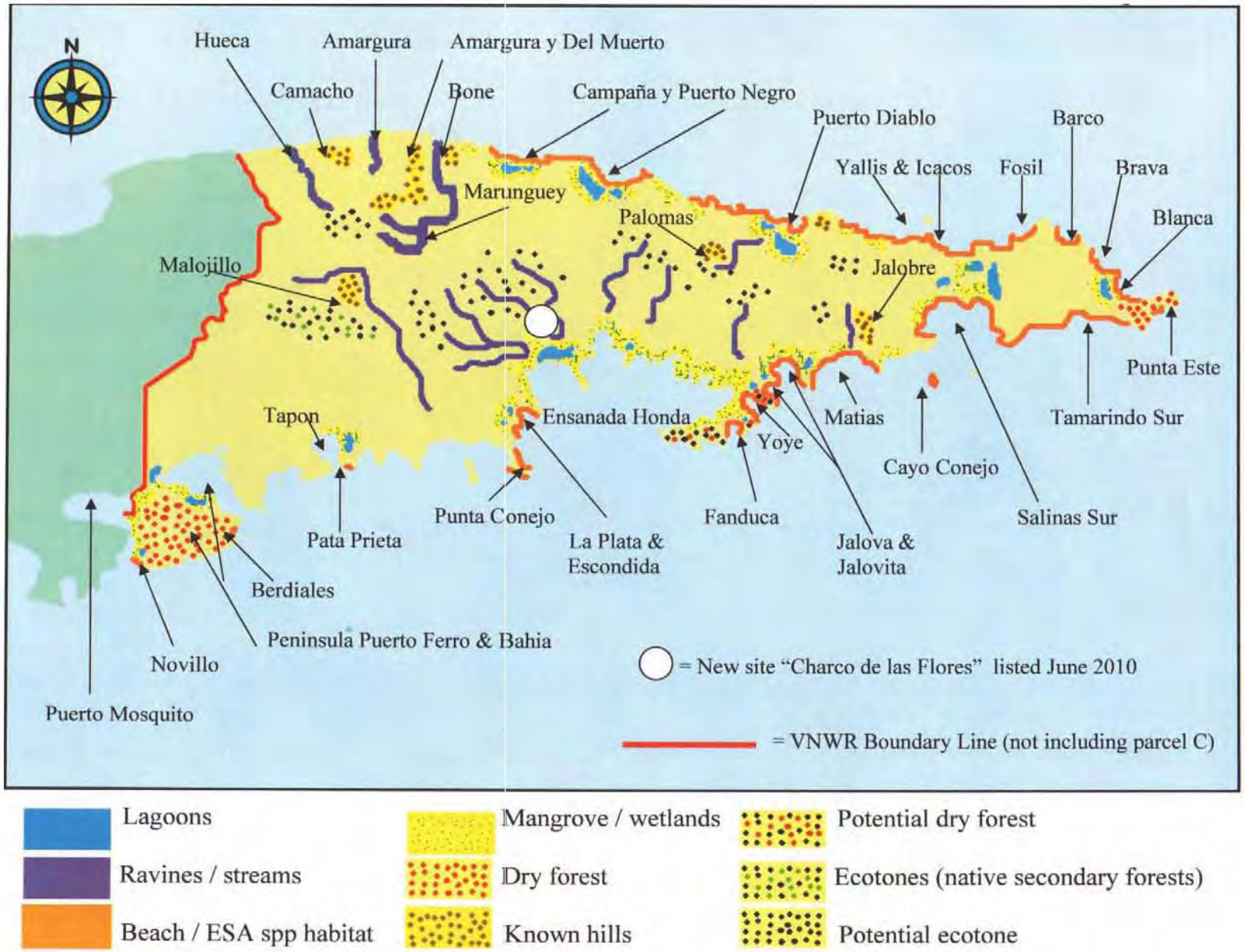

FIGURE 3
Significant and Sensitive Habitats
Former Vieques Naval Training Range
Vieques, Puerto Rico

Source: FWS, 2010 (Draft)

CH2MHILL

Attachment B
Photo 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 gundlachii*)

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

Attachment C
Figures

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Legend

- Debris Pile

Topographic Contour (USGS)

- 1 Meter Interval
- 10 Meter Interval

- Elevated Anomaly Density Area (EADA) from Digital Geophysical Mapping
- PI Site
- UXO15

2007 Aerial Imagery

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

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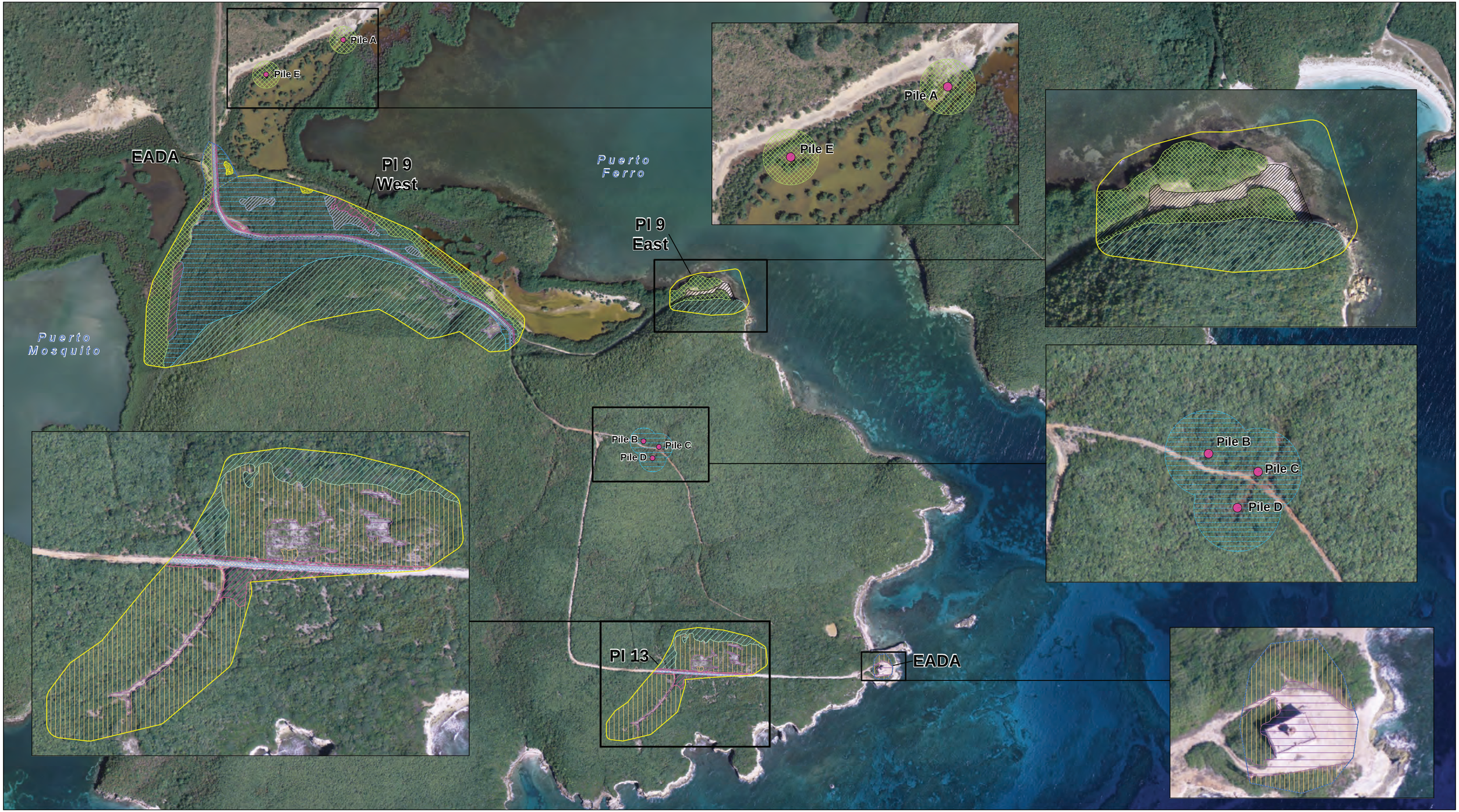

Legend

- Debris Piles
- Elevated Anomaly Density Area (EADA) from Digital Geophysical Mapping
- PI Site
- Dry Scrub Forest
- Evergreen Scrub
- Exposed Limestone
- Exposed Sand
- Giant Wild Pine (Air Plant)
- Invasive Vegetation
- Mangrove Forest
- Mixed Native and Invasive Vegetation
- Road
- Secondary Growth Forest

2007 Aerial Imagery

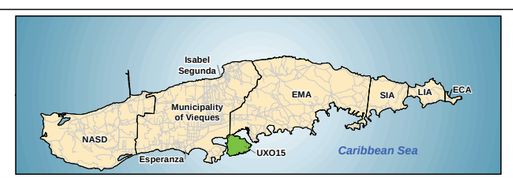

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Figure 2
UXO 15 Biological Assessment
Overall Map for PI 9, PI 13, and Debris Piles within UXO 15
Former VNTR
Vieques, Puerto Rico

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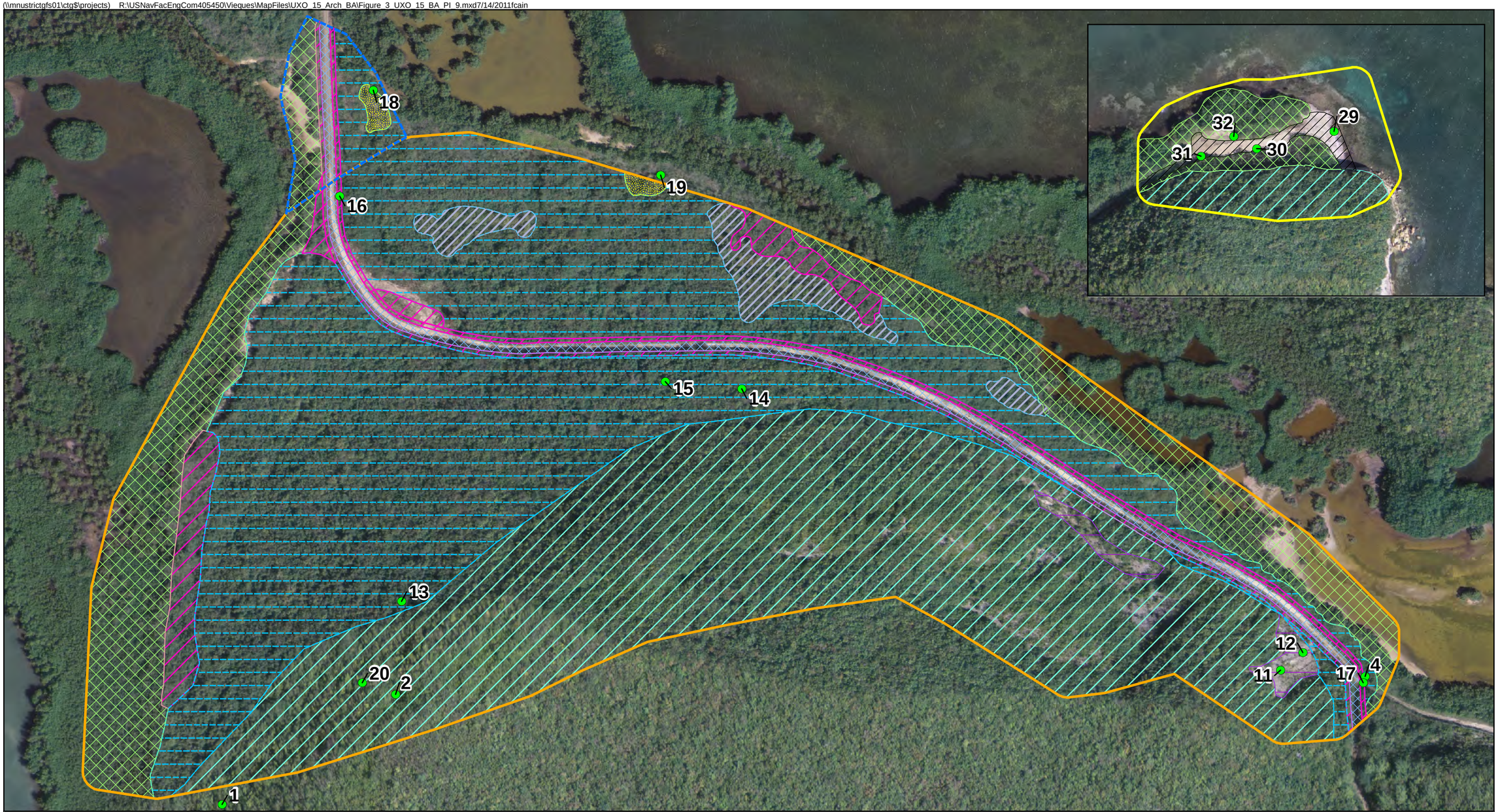

Legend

- 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

N W E S

0 100 200 400 Feet

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

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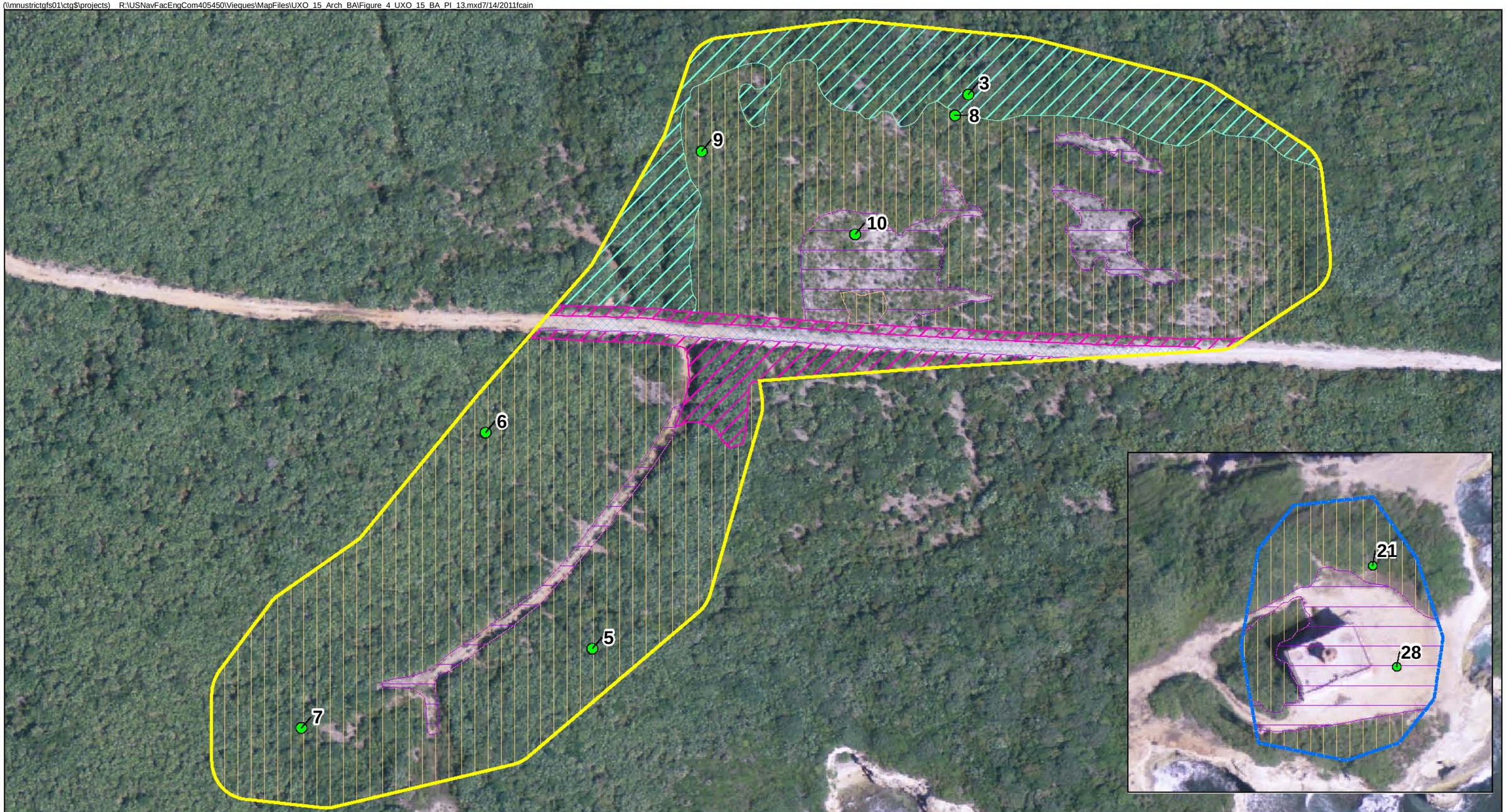

Legend

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

2007 Aerial Imagery

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

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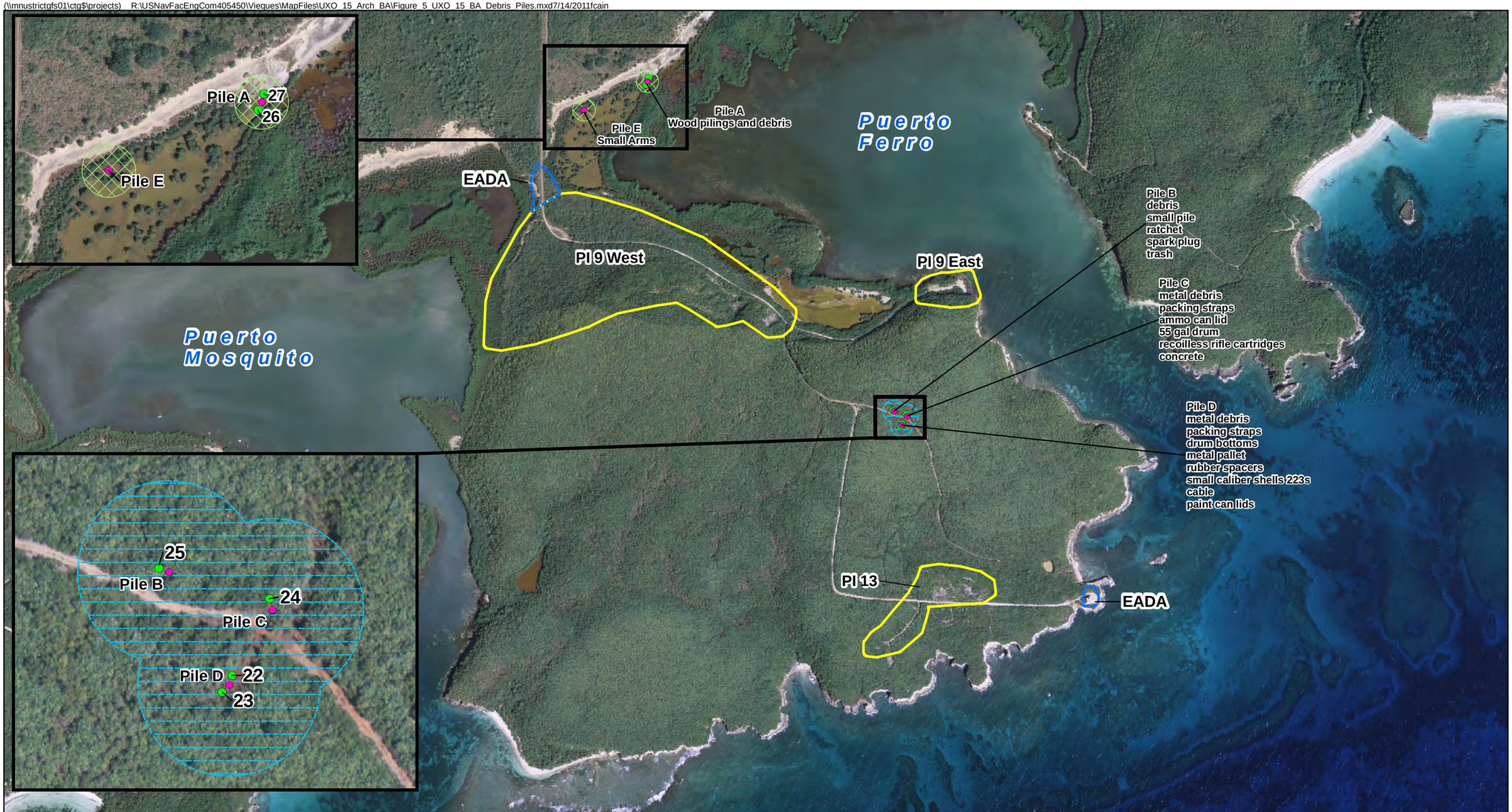

Legend

- Debris Pile
- Photo Point
- Mangrove Forest
- Mixed Native and Invasive Vegetation
- Elevated Anomaly Density Area (EADA) from Digital Geophysical Mapping
- PI Site

2007 Aerial Imagery

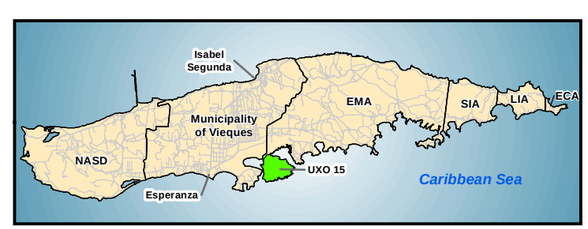

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Figure 5
UXO 15 Biological Assessment
Debris Piles within UXO 15
Former VNTR
Vieques, Puerto Rico

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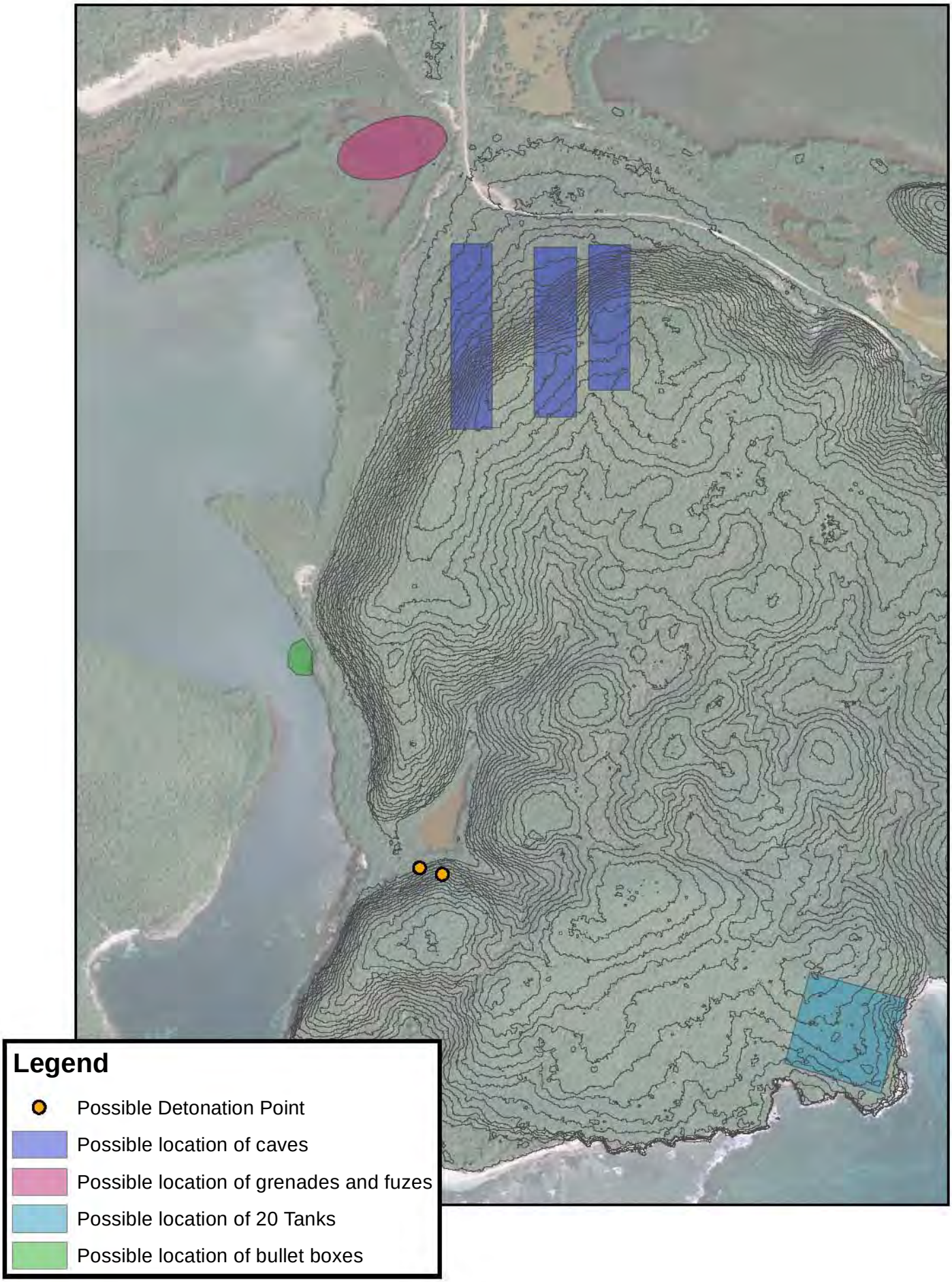
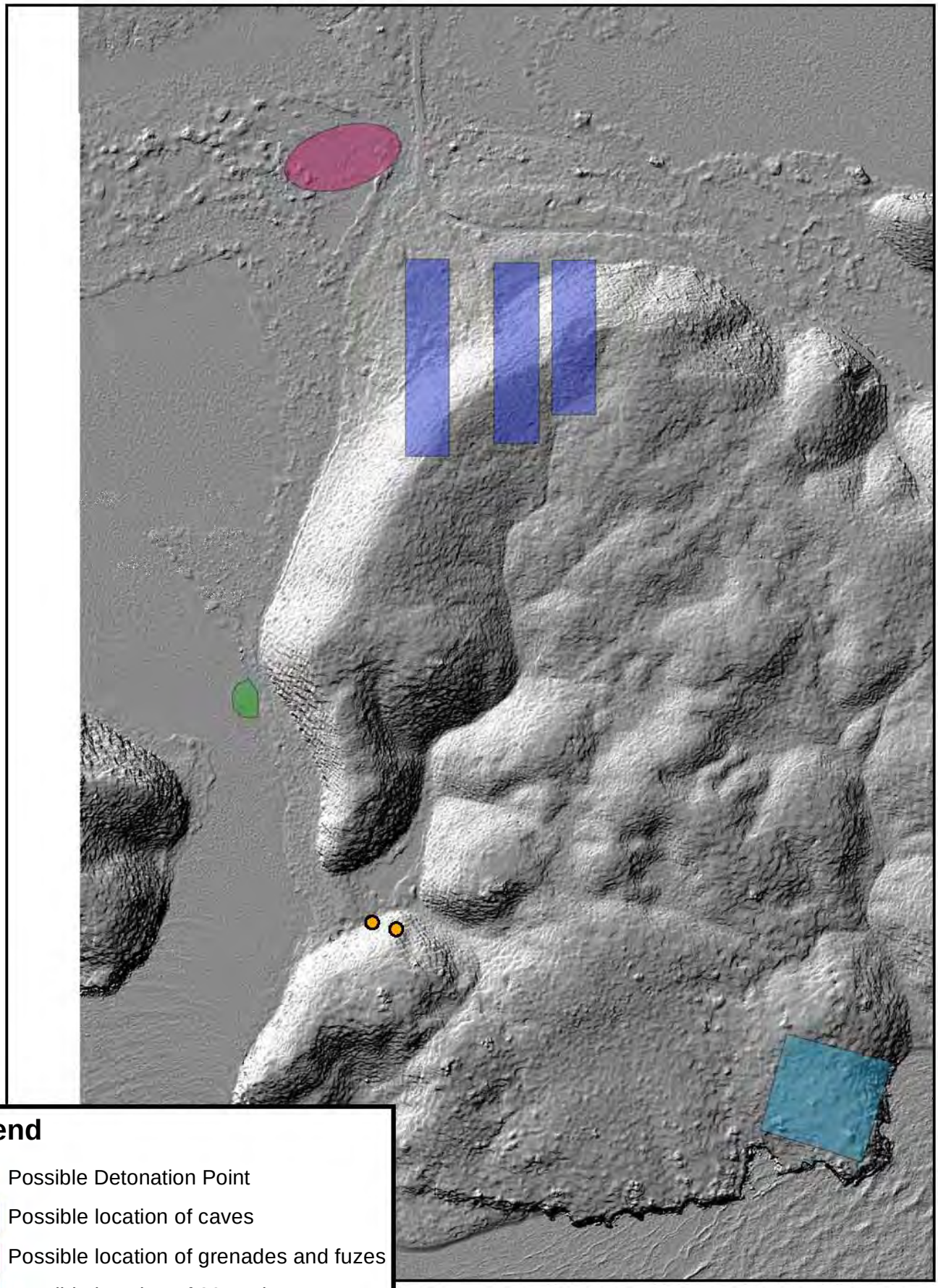
Attachment B
LIDAR Figures


Legend
Possible Detonation Point
Possible location of caves
Possible location of grenades and fuzes
Possible location of 20 Tanks
Possible location of bullet boxes



Legend

- Possible Detonation Point
- Possible location of caves
- Possible location of grenades and fuzes
- Possible location of 20 Tanks
- Possible location of bullet boxes

Attachment C
Final Responses to USEPA, PREQB, and USFWS Comments

Final Responses to

EPA Comments on the Draft Expanded Site Inspection Sampling and Analysis Plan Addendum, UXO 15 Former Vieques Naval Training Range Vieques, Puerto Rico December 2011

Presented below are review comments on the *Draft Expanded Site Inspection Sampling and Analysis Plan Addendum, UXO 15, Former Vieques Naval Training Range, Vieques, Puerto Rico*, dated December 2011 (hereinafter referred to as the SAP Addendum).

General Comments

1. During the October 25-27, 2011 Vieques Technical Subcommittee meeting the Navy expressed their intent to the agencies to move the UXO 15 Expanded Site Investigation (ESI) into a Remedial Investigation (RI) since a RI report will have to be prepare for this site because a No Action decision most likely will not be achieved. Please modify the title of the report to reflect the phase of the investigation at the site, Remedial Investigation, and submit the entire RI SAP as draft final for final review and approval while document is being reviewed by community members of the RAB. EPA tracks the RI start milestone in our database.

   Navy Response:

   The document will still be submitted as an addendum since the content of the original SAP is still viable. However, the title of the addendum will be amended to indicate it is for an RI and text will be added to the Executive Summary and Introduction explaining the work will be conducted as an RI since it is presumed MEC will potentially be left at the site

2. Worksheet #9, Project Scoping Session Sheet, indicates that the potential for caves and additional locations for munitions related items identified by a Vieques community member would be evaluated. It is stated that this evaluation would use information such as Light Detection and Ranging (LIDAR) data, and that this evaluation would be included in the SAP Addendum. However, from the information presented it is unclear how LIDAR data will be used. For example, Worksheet #14 only states that historical information such as LIDAR data will be used to assist the visual inspection of these areas. Revise the SAP Addendum to clarify how the LIDAR data will guide the visual inspection.

   Navy Response:

   Lidar data for the area identified as having possible caves was evaluated and no indication of caves was identified. A statement has been added to Worksheet 10 under Investigation History, at the end of the third paragraph which states: "Lidar data for the area identified as having possible caves was evaluated and no indication of caves was identified." Worksheet 14, Visual Survey of Potential Debris Areas, Potential Caves, and Debris Pile Removal, second sentence has been edited to: "Historical information such as LIDAR has been evaluated and no evidence of caves was identified; however, a visual inspection will still be done in the general area."

   EPA Evaluation of Response:

   The response partially addresses the comment. The response indicates that light detection and ranging (LIDAR) data was reviewed and determined caves were not likely present, but a reference to

where this LIDAR data can be found is not provided. Revise the SAP Addendum to indicate where the LIDAR data can be found.

In addition the Navy is not being consistent when LIDAR data is used for determining the presence of features (caves) in UXO 15, meanwhile it cannot be used for supporting sampling areas by identifying similar features (craters) in the LIA.

Navy Follow Up Response:

LIDAR was not performed to look for caves; it was used to help identify where craters potentially associated with bombing activities may have occurred to help focus the munitions removal activities. When a comment was received from EPA that a member of the public suggested caves may have been used to store munitions, the LIDAR images were evaluated to see if features possibly representing caves were observable, which they were not. The LIDAR image of UXO 15 has been added to the SAP Addendum.

3. The SAP Addendum identifies additional documents that provide data considered for this investigation (e.g., the Biological Assessment and the bedrock survey). However, a revised Worksheet #13, Secondary Data and Limitations Table, has not been included to discuss these documents. It is unclear when (SAP Worksheet # 10 indicates the work was conducted during the week of October 10, 2011 using a steel rod probe, further detail not provided) and how the bedrock survey investigation was conducted (e.g., how many measurements of the depth to bedrock were collected to produce the results in Figure 9, Results of Bedrock Survey). Revise the SAP Addendum to include a revised Worksheet #13 that identifies these documents with additional information that is used for this investigation. If a reference to a separate document cannot be provided, revise the SAP Addendum to include the information.

Navy Response:

Worksheet #13 was updated as shown below. In addition, Worksheet #10 was edited to describe in more detail how the bedrock survey was completed. A separate written report was not generated to document the results of the bedrock survey. Instead, the results were presented to the Vieques Technical Subcommittee during the October 26, 2011 meeting.

SAP Worksheet #13 — Secondary Data Criteria and Limitations Table

The table below provides general information on how secondary data will be used in meeting the current project objectives and the limitations on their use in developing the SAP. Secondary data criteria and limitations tables are presented for each site where historical analytical data exist (applicable to the scope of work covered by this SAP), specifically to address the use and limitations of the historical analytical data.

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Elevated anomaly density areas (EADA)	Expanded Range Assessment/Site Inspection (ERA/SI)	EADAs identified during the ERA/SI using aerial magnetometer survey	Identification of sampling locations	Limited to the accuracy of the device performing the survey. The aerial magnetometer is accurate up to 2 centimeters. Refer to Attachment A Field SOPs (Aerial Magnetometry SOP)

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
MD, MPPEH, scrap metal item locations	Expanded Range Assessment/Site Inspection (ERA/SI)	MD, MPPEH, scrap metal identified during SIs and associated geophysical surveys	Locations, varieties and concentrations of MD, MPPEH, scrap metal items have been used to locate systematic sampling	Locations of items limited to the accuracy of the PDA used to collect the data. The PDA is accurate up to submeter distances. Refer to PDA GeoExplorer User Guide in Attachment A.
Federal-and State-listed species, habitat types and biological resources	Biological Assessment (BA)	Federal-and State-listed species, habitat types and biological resources will be documented	Assess what potential effects the proposed investigation activities, including vegetation removal and debris removal will have on listed plant and bird species, refuge habitats, and other wildlife	Location of species, habitat types and biological resources dependant on visual observations.

EPA Evaluation of Response:

The response partially addresses the comment. The response indicates that a separate report was not prepared to document the bedrock survey results, but information on how the survey was conducted has been added to Worksheet #10. However, the revisions were not provided in the response, and could not be evaluated to determine if the survey data (e.g., depth to bedrock measurements) have been included. Ensure that the survey data are provided in the revised SAP Addendum.

Navy Follow Up Response:

The following text was added to Worksheet 10, Investigation History, 6th Paragraph, after 3rd sentence: "The bedrock survey was completed by following the GPS along transects and previously cleared areas. A 3/8-inch diameter piece of steel, approximately 3.5 feet long, was pounded into the ground at periodic intervals and the depth of penetration recorded. If downward penetration was prevented before reaching 2 feet bgs, the test was repeated within 5 feet of the previous test to ensure bedrock was encountered and not a just a subsurface obstruction. These results were documented along with other observations including rock outcrops and anthropogenic debris."

4. The term "UXO (unexploded ordnance) avoidance" has been replaced by the term "anomaly avoidance" in the Department of Defense Ammunition and Explosives Safety Standards (DoDM 6055.09-M). Although NAVSEA OP 5, Volume 1 (Naval Sea Systems Command Ammunition and Explosives Safety Ashore, Volume 1) states in the definition of Anomaly Avoidance that, "Anomaly avoidance is sometimes referred to as UXO avoidance," the former is the currently accepted term per the DoD standard. In addition, since the goal of the process is to avoid all potential munitions related material that may pose an explosive threat, UXO is not the only category

that is to be avoided by the actions involved. Replace all occurrences of the term "UXO avoidance" with "anomaly avoidance."

Navy Response:

All occurrences of the term ”UXO avoidance” were replaced with “anomaly avoidance.”

Specific Comments

1. **SAP Worksheet #9, Project Scoping Session Participants Sheet, Page 3:** Diana Cutt's email is incorrect. Please use cutt.diana@epa.gov.

   Navy Response:

   Diana Cutt’s e-mail address has been changed.

2. **SAP Worksheet #10, Problem Definition, Receptors, Page 10**: In the discussion of the Human Health, there is no mention of any personnel to maintain the lighthouse, which is shown in Figure 12. There is also no mention recreational use of the beach and USFWS workers at the beach to conduct surveys or other activities. Are these populations that should be considered?

   Navy Response:

   The SAP and SAP addendum reflect the receptors jointly developed and concurred upon in the scoping session by EPA, PREQB, FWS, and the Navy. Recreational users of the site will be evaluated and FWS workers will also be evaluated.

3. **SAP Worksheet #11, Project Quality Objectives/Systematic Planning Process Statements, What are the Project Action Limits (PALs)?, Page 13:** As the sample collected beneath pile E is assumed to be sediment, the PALs should include ecological sediment screening values in addition to ecological soil screening values. The sediment screening values are correctly provided on SAP Worksheet # 15-1a.

   Navy Response:

   The requested change has been made. The third tick mark has been updated to “Vieques ecological screening values for soil and for marine sediment, which are listed in the Vieques Master Ecological Risk Assessment Protocol (CH2M HILL, 2010a) and associated Master ERA Protocol Update 1 (CH2M HILL, 2010b).“

4. **SAP Worksheet #11 — Project Quality Objectives/Systematic Planning Process Statements, Page 16:** The Further Investigation or Action Determination (Steps 5 and 6 of Figure 1) subsection of the worksheet states that, "One soil sample will be collected beneath each large debris pile, at a minimum from beneath the five aforementioned piles. If other piles of comparable size are found during the investigation, an additional soil sample will be collected beneath each. With respect to the interval from which the soil samples will be collected, if the debris or item at a particular location is solely MEC, the soil sample will be collected from the 2-inch interval beneath the debris/item following its (and any suspected contaminated soil) removal. If the debris or item at a particular location is not or does not contain MEC, the soil sample will be collected from the 6-inch interval beneath the debris/item following its (and any suspected contaminated soil) removal. If the debris at a particular location is a mixture of MEC and non-MEC items, the soil sample will be collected from the 6-inch interval beneath the debris/item following its (and any suspected contaminated soil) removal."

While the stated process is acceptable, it appears that the term "MEC" (munitions and explosives of concern) should be replaced by the term "MPPEH" (material potentially presenting an explosive hazard). The former term refers only to items that present an explosive hazard, and it does not include MD (munitions debris) that may be contaminated with non-explosive quantities of energetic materials. The MD also may present non-explosives related contaminant concerns (e.g., metals and organic contaminants). The term "MPPEH" includes all of these potential items and should be used to describe munitions related debris piles that may contain both MEC and MD that has not been inspected and further classified. Review the cited subsection and correct it as necessary.

Navy Response:

MPPEH has replaced MEC in this subsection.

5. **SAP Worksheet #14, Summary of Project Tasks for UXO 15, Page 19:** The discussion of the debris pile removal indicates that debris will be stockpiled at consolidation point(s), but it is unclear where these points are located. Page 44 of the Final Expanded Site Inspection Sampling and Analysis Plan UXO 15, dated May 2011 (Final ESI SAP — UXO 15), indicates that the debris will be taken to the Central Processing Center (CPC) within the Live Impact Area (LIA) for proper disposal and recycling. Revise the SAP Addendum to clarify where these consolidation points are located. EPA's understanding is that the CPC in the LIA is no longer in operation, and an alternate location is in discussion with FWS. Please provide clarification and, if necessary, revise SAP Addendum.

Navy Response:

Although the CPC is no longer used for the processing of munitions related scrap metal, it is still maintained as a consolidation point for scrap metal that has been inspected and determined to be free of explosives material. Any munitions related scrap metal will be inspected to ensure it is free of explosives then stockpiled at the former CPC for future disposition. Any non-hazardous solid waste will be disposed of at the Municipal landfill or off-island.

EPA Evaluation of Response:

The response addresses the comment. The response clarifies that the former Central Processing Center (CPC) will be used as the consolidation point for stockpiling scrap metal, but it does not appear that Worksheet #14 has been revised to reflect this information. Revise Worksheet #14 to include this information.

Navy Follow Up Response:

Worksheet # 14 has been revised to state that:

"Although the CPC is no longer used for the processing of munitions related scrap metal, it is still maintained as a consolidation point for scrap metal that has been inspected and determined to be free of explosives material. Any munitions related scrap metal collected from UXO-15 will be inspected to ensure it is free of explosives, and then stockpiled at the former CPC for future disposition. Any non-hazardous solid waste will be disposed of at the Municipal landfill or off-island."

6. **SAP Worksheet #14, Summary of Project Tasks for UXO 15, Page 19:** It is unclear why the section discussing debris pile removal does not discuss the removal of the 32 MD identified on Figure 4. These 32 MD locations are discussed in the Debris Pile Removal section (page 44) of the Final ESI SAP — UXO 15, Worksheet #14. Revise the SAP Addendum to clarify why this section was altered and the removal and sampling of these 32 MD items is not discussed.

Navy Response:

This paragraph was inadvertently omitted as the Addendum was prepared. The following text was added, "In addition, the 31 MD and scrap items and 1 MPPEH previously identified during the ERA/SI will be removed during this investigation. The locations of these items are shown in Figure 2."

EPA Evaluation of Response:

The response addresses the comment; however, the reference to Figure 2 for the location of munitions debris (MD) and material potentially presenting an explosive hazard (MPPEH) is incorrect. Figure 4 of the SAP Addendum depicts the MD and MPPEH items. Revise the new text to reference the correct figure.

Navy Follow Up Response:

The figure call-out has been corrected in the Draft Final SAP Addendum.

7. **SAP Worksheet #15-1, Reference Limits and Evaluation Table, Pages 21-23:** Please note that the EPA RSL Table is scheduled to be updated in April 2012. Any changes to that table should be reflected in this worksheet.

Navy Response:

Worksheet #15 will be updated to the most-current RSLs if they are released at a time when it is feasible to update Worksheet #15. The most up-to-date RSLs will be used for data evaluation.

EPA Evaluation of Response:

The response addresses the comment; however, this information should be added to Worksheet #15. Revise Worksheet #15 to note that the most up-to-date Regional Screening Levels (RSLs) will be used for data evaluation.

Navy Follow Up Response:

The footnotes (referencing the RSLs version) have been updated to indicate May, 2012. In addition, those footnotes have been appended to indicate that "The most up-to-date Regional Screening Levels will be used for data evaluation."

8. **SAP Worksheets #15-2, Reference Limits and Evaluation Table, Pages 24-26:** Please note that RSL values are not available for 3,5-Dinitroaniline. The footnote should clarify that toxicity values are not available from any of the sources identified in EPA's toxicity hierarchy memo.

Navy Response:

The requested change has been made. Also, please note the response to comment for PREQB comment #5 which affects this response. Footnote #1 on Worksheet #15-2 has been updated to "The Project Action Limit for SS is "RSLs Residential Soil Adjusted" (November, 2011), "SSLs", and "Soil TRVs." Toxicity values for 3,5-Dinitroaniline are not available from any of the sources identified in EPA's toxicity hierarchy memo." Footnote 1 on Worksheet #15-2A has been updated to "The Project Action Limit for SD is "RSLs Residential Soil Adjusted" (November, 2011) and "Marine Sediment TRVs." Toxicity values for 3,5-Dinitroaniline are not available from any of the sources identified in EPA's toxicity hierarchy memo."

9. **SAP Worksheet #15-2 — Reference Limits and Evaluation Table, Page 24:** The Analytical Group displayed on the worksheet is explosives. Explosive D (ammonium picrate) was the energetic filler of the Navy projectiles 5-inch and over, and the Army/Marine Corps APC (armor piercing-capped) projectiles (sometimes incorrectly referred to as APHE [armor piercing high explosive]) that were in use during a significant portion of the active

period of the ranges at Vieques. The list of analytes in Worksheet #15-2 does not include Explosive D. Provide the reason for this omission. If none exists, include Explosive D in the listing.

Navy Response:

The SAP addendum reflects the analytical protocol jointly developed and concurred upon in the scoping session by EPA, PREQB, FWS, and the Navy and documented in the Final SAP. Additionally, there are no widely-accepted human health or ecological screening values for Explosive D for the media to be sampled at UXO 15. This information has been added to Worksheet 17 (Sampling Design and Rationale) of the SAP Addendum.

EPA Evaluation of Response:

The response is partially acceptable. The analysis presented is technically correct. However, it should be provided in the revised document as a basis for not sampling for Explosive D.

Navy Follow Up Response:

Please see revised response above.

Final Responses to PREQB

Technical Review of the Draft Expanded Site Inspection Sampling and Analysis Plan Addendum, UXO 15 Former Vieques Naval Training Range Vieques, Puerto Rico December 2011

General Comments

1. Worksheet 10 introduces the concept of using VSP-based random transects across the search area to determine if military burial sites are located in the area. This approach is discussed further in Worksheets 14, and is explained in detail in Attachment A. Please clarify the underlying assumptions used. For example, Attachment A says, "The Transect verification sampling module in VSP was used to assist in developing a sampling strategy to achieve high confidence that there is no MEC at the UXO-15 site. Although the module was designed for post remedial action verification, the basic assumption for the UXO-15 site is that there is no MEC to begin with, which provides a comparable situation to a site that has been cleared of all MEC." However, the site has not received remediation or "been cleared of all MEC". This project is looking for locations where MEC and other potential hazards were discarded, not verifying that a remedial action was previously done adequately. Please clarify. Also, VSP must be used on a homogeneous site and, if the overall site is not homogeneous, the site should be broken into individual homogeneous areas where VSP is applied. In this case there are specific individual locations that have already been identified as not homogeneous (EADAs, small surface dumps near roads, potential detonation locations, etc.). These areas need to be analyzed separately rather than include these non-homogeneous areas into the overall VSP analysis.

   Navy Response:

   Based on discussions with the VSP developers, the post remedial action verification module is applicable for use at UXO-15 because it presumes that there is no MEC present at the site. However, based on PREQB's concern for the inherent assumptions that are used in a random sampling approach (uniform site conditions), the Navy proposes to revise the investigation approach to uniformly space the geophysical transects (which are 3 ft. wide) at a 60 ft. spacing across the PI-9 West site and EADA 45 where the depth to bedrock was found to be greater than six inches in depth. All geophysical anomalies identified in the transects will be excavated and inspected for MPPEH, the proposed TOI. Based on our previous experience during the ERA/SI and the VSP modeling, this level of site inspection coverage (5%) provides a high confidence level in the data for determining whether or not MPPEH is present at the site. In addition to the geophysical anomaly investigation, the previous depth to bedrock survey will be extended to include the entire EADA 44. This approach provides a high confidence level in the data as well as investigating those areas where munitions would most likely be present at UXO-15.

   Evaluation of Response:

   This comment was discussed at the May technical meeting and the Navy has decided to dispense with the VSP-established transects and to implement evenly distributed 60-ft. spaced transects. After the discussions and explanations of this approach at the May technical meeting EQB was in agreement with this revised approach. As the new approach hasn't been presented in a revised document, EQB prefers to review the revised document prior to providing final concurrence with this approach. However, EQB reiterates its basic agreement with the evenly spaced 60-ft. transects as described at the May technical meeting.

Navy Follow Up Response:

The Draft Final ESI SAP Addendum has been revised to incorporate an evenly spaced 60-ft transect approach.

The following are additional comments on the VSP analysis in this work plan:

- Figure 4 in Attachment A shows that the EADA are almost completely uninvestigated. Please revise the investigation approach to ensure that these areas are addressed.

Navy Response:

Most of EADA 45 is located within PI-9 West where subsurface metallic anomalies have been previously identified. Part of this area has been previously investigated and show where both the depth to bedrock is less than six inches deep and there are no metallic subsurface anomalies detected. MEC would not likely be present at these areas. The remainder of the area will be investigated with transects and the removal of any metallic debris associated with the subsurface metallic anomalies. These investigations should verify whether or not the high magnetic density associated with EADA 45 is associated with either bedrock or buried metallic debris. A portion EADA 44 is located within site PI-13 where the bedrock investigation determined that the bedrock was less than six inches in depth and no metallic subsurface anomalies were identified. The bedrock depth survey will be extended to include the remaining area of EADA 44.

- The analysis of the "transect swath" refers to the "target of interest" (TOI). But the TOI is not specifically defined. What minimum sized subsurface burial is the subject of the TOI?

Navy Response:

As previously discussed, the Target of Interest is assumed to be any munitions related items that are MPPEH items that are identified to pose an explosive safety hazard. Munitions debris (MD) that do not contain explosives, such as empty expended artillery casings, have been transported through the area. However, these materials do not present an explosive or environmental hazard, and therefore they are not considered Targets of Interest. This definition of Target of Interest has been added to the SAP. The proposed transect investigations can detect MPPEH items as small as 20 mm projectiles.

Evaluation of Response:

EQB disagreed with this comment and this was discussed during the May technical meeting. The resolution of this discussion was that the “target of interest” is the large subsurface anomalies as identified by the aerial magnetometer survey, not individual 20-mm projectiles as stated in the response. EQB concurs with the resolution at the May technical meeting that the transects spaced 60-ft. apart will adequately intersect enough to the “targets of interest” (the large anomalies identified in the aerial magnetometer data) to reliably characterize these anomalies.

Navy follow up Response:

The Draft Final ESI SAP Addendum has been revised to state that the “targets of interest” are the anomalies within the Elevated Anomaly Density Area (EADA) identified by the aerial magnetometer survey. In addition, it is stated that proposed transect locations, spaced 60 ft apart, will adequately intersect enough of the anomalies within the “targets of interest” to reliably characterize these anomalies.

- The transects shown in the unnamed figure above the table "Summary of Transect Survey design for Area: Area 1" are different than the transects shown in Figure 4. Please clarify.

Navy Response:

The transects shown on Figure 4 are the transect locations that were traversed during the Expanded Range Assessment/Site Inspection of the entire UXO 15. The transects survey design are the transects proposed for the subsurface anomaly investigation.

- Assumption #4 in the section on "Assumptions Underlying Attribute Compliance Sampling (ACS)" on an unnumbered page in Attachment A says that transects with a greater likelihood for containing a TOI should be evaluated in a separate VSP study. At a minimum, this applies to at least the EADA, the locations near roads where previous surface dumps have been observed and the possible detonation sites.

Navy Response:

Please see the response to Comment 1.

Evaluation of Response:

This comment is resolved by the decision to implement 60-ft. transects in #1 above.

- Attachment A: The table under "Sensitivity Analysis" on an unnumbered page is difficult to use as the headings start on one page and the remainder of the table is on the next.

Navy Response:

The table has been deleted based on the revised approach (see following comment response).

PREQB recommends that an alternate approach be used to position the geophysical transects that is based on analysis of the site characteristics, including determination of a minimum TOI and the results of previous investigations.

Navy Response:

The Navy proposes to revise the investigation approach to uniformly space the geophysical transects. Please see the response to Comment 1.

Page-Specific Comments

1. Worksheet 9:

Please correct Wilmarie Rivera's extension in this document to X 6129.

Navy Response:

Wilmarie's extension has been changed to x 6129

2. Worksheet 10:

a. Page 8: The first paragraph makes several mentions of "tanks". Please indicate whether these are storage tanks or military vehicle tanks. If storage tanks, please specify ASTs or USTs. Note that the term "tanks" is used and undefined elsewhere in the document (for example, Page 9, Worksheet 10).

Navy Response:

The term "tanks" was changed to "military artillery tanks." This edit was made in five locations in Worksheet 10 and one location in Worksheet 14. The edit was not made in Worksheet 9 because the text was taken directly from Finalized Subcommittee Meeting Minutes.

Evaluation of Response:

This was discussed at the May technical meeting and it was decided the clearly refer to these "tanks" as "military tracked vehicles" or other similar term to differentiate them from storage tanks.

b. Page 10, Problem Formulation: Minor typographical error – the first sentence is referring to the ERI. Please verify if it should be ESI.

Navy Response:

The text listed as "ERI" was changed to "ESI" on Worksheet 10, first sentence of the Problem Statement.

3. Worksheet 11:

a. The Project Quality Objectives/Systematic Planning Process Statements on Worksheet 11 cover only environmental contamination. This worksheet does not cover the potential presence of munitions burial sites. As inspection to detect munitions burial sites is part of the ESI project, this worksheet should be modified to describe the potential expected burials, including their size, to describe the requirements, goals and objectives of the MEC inspection process. Adding this information to this worksheet is recommended to help EQB assess the adequacy of the MEC inspection plan.

Navy Response:

Worksheet 11 has been modified to state that the areas where munitions are most likely to be buried are those areas shown on historical aerial photos that were identified as "storage areas" and where the depth to bedrock is greater than six inches. The goal of "determining, with a high level of confidence, whether or not MPPEH is present in the subsurface, while preserving to the extent possible, the ecological habitat" has been added to the Worksheet.

b. Project Quality Objectives: Please include RDX (SSL), PETN (SSL) and NG (SSL) in the list of analytes with DLs greater than the PAL.

Navy Response:

The suggested change has been made, including for 2,6-dinitrotoluene. The statement has been revised to: "For the following constituents, the DL is still greater than the PAL: hexavalent chromium Soil Screening Level (SSL), RDX (SSL), 1,3-dinitrobenzene (SSL), nitrobenzene (SSL and marine sediment Toxicity Reference Value (TRV)), 2,4-dinitrotoluene (SSL), 2,6-dinitrotoluene (SSL), 2-nitrotoluene (SSL), 3-nitrotoluene (SSL), 4-nitrotoluene (SSL), PETN (SSL), and Nitroglycerin (SSL)."

4. SAP Worksheet #14:

a. Vegetation clearance will consist of selective removal of all shrubs and small trees less than one meter in height and four centimeters (1.6 inches) dbh. Cutting trees larger than three inches dbh will be avoided (unless they are invasive species). It is unclear if trees greater than 1.6 inches dbh but less than 3 inches dbh will be removed or retained. These smaller trees should be retained if possible, particularly if located within areas identified as important habitat.

Navy Response:

Trees greater than 1.6 inches dbh but less than 3 inches dbh will be retained if the project objectives can still be met.

Evaluation of Response:

As discussed in the May 2012 ERP Meeting, the response was revised to include that trees greater than 1.6 inches dbh but less than 3 inches dbh will be retained if the project objectives can still be met.

b. Page 18: The section on "Excavation of Subsurface Anomalies" indicates that the previously identified EADA will not be investigated. Please clarify why these two EADA are not included in this investigation, as

it appears that a targeted geophysical investigation and some intrusive investigation are appropriate at the two EADA.

Navy Response:

See the revised investigation approach outlined in the Response to PREQB's last General Comment.

Evaluation of Response:

This comment is resolved by the decision to implement 60-ft. transects in General Comment #1 above.

5. Worksheet 15: Please clarify why SSLs are listed as PALs for sediments but not for soil. Note, for sediments saturated with water, SSLs do not apply (i.e., SSLs assume contaminants partition into the gas phase as well as liquid and solid phases using Henry's Law, and saturated sediment systems are only a two-phase system – liquid and solid).

Navy Response:

SSLs were inadvertently applied to sediment samples rather than soil samples. Worksheet #15 has been updated to reflect that soil samples are compared to RSLs, SSLs, and TRVs and sediment samples are compared to RSLs and TRVs.

6. Figure 5: This photo shows MEC or MD in the water. Earlier the work plan established that UXO 15 doesn't include water areas and that these areas were part of UXO 16. Please define boundaries between UXO 15 and UXO 16.

Navy Response:

The following sentence has been added to the end of the 4th paragraph under Investigation History, Worksheet 10:

"The boundary between UXO 15 and UXO 16 is the low-tide water line."

Evaluation of Response:

The response is acceptable. However, EQB notes that the shallow water with the dense surface munitions debris contamination could be investigated and removed as a land project since the water is so shallow and traditional underwater methods (divers, towed sensors, etc.) cannot be used.

7. The locations of the EADA appear to be shown differently on Figures 7, 8, 10, 13 and 15. Please review the EADA locations and ensure they are shown consistently on all figures.

Navy Response:

Figure 7 identifies the polygons drawn by Sky Research Inc., who conducted the Aerial Magnetometer Survey. These polygons were evaluated by the Navy and it was determined there were two areas that appeared to have high concentrations of anomalies outside the PI 9 and PI 13 sites: one just north of the PI 9 site and one at the lighthouse area east of the PI 13 site. These two areas were added to the study area. Figures listed in the comment are correct as portrayed. To help clarify this, the following text has been added to Worksheet 10, Investigation History, end of 3rd paragraph: "Figure 7 identifies the polygons drawn by Sky Research, Inc. during an Aerial Magnetometer Survey (Sky Research, 2009). These data were evaluated by the Navy and two areas were added to the PI 9 and PI 13 study areas that included elevated anomalies. The two additional areas are shown in Figures 8, 10, 11, 12, 13, and 15." A reference to Sky Research has also been added to the Reference Section.

8. Figure 9 indicates that only small portions of UXO 15 received soil depth analysis and are being considered for investigation. Please explain why this decision was made. Surface ordnance-related debris was found outside of these areas indicating military ordnance activities took place. Please clarify why only the northern portion of UXO 15, corresponding to PI 9 West, is the subject of the MEC investigation.

   Navy Response:

   The soil depth analysis corresponded to the two PI sites identified within UXO 15, which are the primary subjects of the ESI and where historical aerial photographs indicate the military activities were concentrated. All of PI 13 and all eastern part of PI 9 were found to have 6 inches of soil or less, so no DGM is necessary in those areas.

9. Appendix B, Section 4.4.4, Page 4-7: Option 1 is projected to have a moderate effect on the local Antillean nighthawk population if vegetation clearing is conducted within the nesting season while Option 2 is considered to likely have minimal effect on the local nighthawk population even if vegetation removal is conducted during the nesting season. However, as noted in Option 1, any vegetation clearing conducted during the nighthawk nesting season could disrupt nesting and result in nest abandonment. As discussed earlier (Section 4.3.5) Options 1 and 2 within the exposed limestone habitat where the nighthawks nest were projected to be similar. It would appear that impacts to the nighthawk would be similar under both options. Please clarify.

   Navy Response:

   The Navy agrees that the potential impact to nesting Antillean nighthawks would be similar under vegetation removal Option 1 and Option 2. Therefore, the word “minimal” in Option 2 will be changed to “moderate” to be consistent with Option 1.

Final Responses to

US Fish and Wildlife Service Comments Regarding the Draft Expanded Site Inspection Sampling and Analysis Plan Addendum, UXO 15 Former Vieques Naval Training Range Vieques, Puerto Rico December 2011

Presented below are the US Fish and Wildlife Service (FWS) thoughts and comments on the subject document.

General Comments

1. The Puerto Ferro peninsula is the closest natural area to the entrance of the Vieques National Wildlife Refuge (NWR). Its unique dry forest habitat and historic light house have significant ecological value and public use potential. It is a priority for the FWS to preserve and enhance these natural and cultural resources and allow the public to enter and visit this area.

   The document mentions munitions items, munitions debris and other metallic debris that have become encrusted in limestone in the eastern portion of Photo Identified (PI) area 9. This area has been known for the last ten years and is identified as a boat ramp in Figure 6. It consists of limestone fill, metal debris and expended artillery shell casings that have been deposited along the shoreline. This activity and the expansion of the shoreline can be clearly seen in historical aerial photos. The area is adjacent to PI-9 east and is locally known as munitions reef (Figure 5). Worksheet 10, page 8 states that these items are not part of Unexploded Ordinance (UXO) area 15 and they will likely not be removed because they are empty and have been incorporated into a reef. The FWS recommends that these items be removed prior to any final action regarding UXO-15. While the empty shell casings shown in Figure 5 may not pose a munitions risk as stated in the document, they are an attractive nuisance which draw the public into the area. The area is a known tourist attraction and is commonly accessed by local fishermen and trespassers. Because the ecological value of these shell casings is minimal, the FWS recommends that they be removed to lessen the attraction of the area. If there is some doubt as to the ecological value of the shell casings, the FWS suggests that the Navy contact the National Oceanic and Atmospheric Administration (NOAA) and Puerto Rico (PR) Department of Natural and Environmental Resources (DNER) regarding this issue.

   Navy Response:

   The area where expended shell casings have been identified in the shallow waters adjacent to PI-9 will be addressed as part of the investigations associated with UXO-16, the Underwater MEC site. Prior to conducting any intrusive activities underwater, a Biological Assessment (BA) will be required. This BA is currently being discussed with NMFS and FWS. Investigation of this area, as well as the UXO-15, will help determine acceptable future land uses.

Specific Comments

1. SAP Worksheet 9, Project Scoping Session Participant Work Sheet, page 3: The term "No project-specific role" is used throughout the table and, based on its association with different participants, it is not entirely clear what this term means. Please clarify.

Navy Response:

There are stakeholder agency and contractor personnel that may be kept apprised of the investigation activities, but have no specific role in executing the project. The phrase is used for personnel that fall into that general category. The term "No project-specific role" has been removed from Richard Henry's row.

2. SAP Worksheet 10, Site Background, page 7, paragraph 4: The location of the small arms debris piles and possible Open Burn / Open Detonation (OB/OD) pits depicted on Figure 3 may not be entirely correct and may be a miscommunication or a mapping artifact. The location of these sites should be verified during the March site visit.

Navy Response:

The locations of the aforementioned features will be verified upon mobilization.

3. Figure 3 depicts potential contaminant source areas at UXO-15: The term "low magnetometer response from mag and flag" is used to describe subsurface magnetic anomalies identified in the Final Expanded Range Assessment/Site Inspection Report. It is not clear what this term means. Please clarify.

Navy Response:

The term "low magnetometer response from mag and flag" is meant to describe a relative qualitative response from a hand-held magnetometer survey at the site. In the locations where a subsurface metallic/ferrous item was located, the location of the item was recorded but there was no intrusive investigation as to the nature of that item. This survey was conducted to get a relative sense of the number and distribution of subsurface metallic/ferrous items with respect to other sites and locations within the former VNTR. This information has been added to the end of the last paragraph under "Site Background" in Worksheet 10.

4. SAP Worksheet 10, Site Background, page 8, paragraph 1: The term "tank" used by community members probably refers to mechanized artillery or self propelled guns. Self propelled guns are usually mounted on tracks hence the community term "tank." PI-13 was identified as an artillery site in one of the historical documents however, there is no evidence in the area to indicate that it was ever used for that purpose.

Navy Response:

The term "tanks" was changed to "marine artillery tanks." This edit was made in five locations in Worksheet 10 and one location in Worksheet 14. The edit was not made in Worksheet 9 because the text was taken directly from Finalized Subcommittee Meeting Minutes.

5. SAP Worksheet 10, Physical Characteristics, page 9, paragraph 1: The terms used to describe ecological characteristics of the site should be used consistently throughout the document. For example, tidal flats and tidal swamps are used interchangeable with the terms lagoons and mangrove forests. As they are used primarily throughout the document, the FWS suggests that the latter terms be used.

Navy Response:

The terms for tidal flats and tidal swamps have been changed to lagoons and mangrove forests. The last three sentences of the first paragraph under "Physical Characteristics" in Worksheet 10 have been revised as follows: "PI 9 additionally contains lagoons and mangrove forests. The lagoons are estuaries with varied tidal influence including subtidal, irregularly exposed, regularly flooded, and irregularly flooded. The extent of the tidal connection dictates the lagoon's salinity. The mangrove forest is covered with thick mangroves and immersed in salt water the majority of the year."

6. SAP Worksheet 10, Receptors, Human Health, page 10, paragraph 1: Please note that maintenance workers and restoration workers will likely be performing tasks in the vicinity of the lighthouse and FWS workers will likely be performing general refuge activities in the general area of UXO-15.

Navy Response:

The text in the section entitled "Human Health" has been replaced with the following text:

Potentially complete exposure pathways exist for human receptor groups exposed to surface soil and surface sediment. The receptors include:

- USFWS workers exposed to surface soil while conducting restoration, surveillance, and monitoring of the dry forest scrub, and while conducting law enforcement activities and maintenance activities of proposed roads and trails.
- Recreational users exposed to surface soil during recreational activities at the site.

7. SAP Worksheet 10, Receptors, Environmental Questions to be Answered by the ESI Sampling, Question 1, page 11: Various places in the document (e.g., Figure 9) indicate that the soil depth in PI-13 is less that 6-inches and that this area was unlikely used to intentionally bury munitions. However, this section does not mention transects but simply states "following vegetation clearance, a visual survey across PI-9 and PI-13 will be conducted for any debris on the surface to facilitate the Digital Geophysical Mapping (DGM) survey." This suggests the removal of all vegetation, which is inconsistent with the overall approach described in other sections of the document. Specifically, it is not clear if vegetation will not be removed, be removed along the lines of transects, or be removed from the entire area; the FWS would prefer the former. Please clarify.

Navy Response:

Vegetation removal will only occur to facilitate the DGM survey and no clear cutting will be performed. As such, the vegetation removal will be limited to the maximum extent possible in transects throughout the site; however, the amount of vegetation removed will depend on the area and to an extent that will adequately provide for the workers to safely access the cleared areas to perform the surface debris removal and DGM survey.

8. SAP Worksheet 11, Project Quality Objectives/Systematic Planning Statements, page 14, Statement 5: Note that only sediment samples will be collected and analyzed for acid volatile sulfides and simultaneously extracted metals.

Navy Response:

SAP Worksheet 11, Project Quality Objectives/Systematic Planning Statements, page 14, Statement 5, bullet two has been changed to: "Four soil samples… metals, pH, and grain size. In addition, the sediment sample will be analyzed for acid volatile sulfide/simultaneously extracted metals (AVS/SEM)."

9. SAP Worksheet 11, Project Quality Objectives/Systematic Planning Statements, page 14, Statement 9: Note that the decision analysis process is depicted in Figure 14, not Figure 5 or 1.

Navy Response:

References to Figures 1 and 5 in the decision analysis process have been revised to Figure 14.

10. SAP Worksheet 14, Summary of Project Tasks for UXO-15, page 17: Digital Geophysical Mapping, Biological Assessment Prior to Vegetation Clearance Please change the sentence reading "The results of the BA and the DGM were…" to read "The results of the BA and the bedrock study were…"

Navy Response:

Comment incorporated.

11. Figure 11 depicts the approximate location of the proposed transects. While this may be a matter of scale, the FWS is concerned that many transects seem to be in close proximity to each other. At the proposed transect width of 3-feet, several transects side by side can cause cumulative impacts to vegetation and the FWS suggests that all transects be spaced at a minimum interval of 5- to10-meters.

Navy Response:

The Navy has revised the approach to uniformly space the transects 60 feet apart to minimize impacts to the vegetation while maintaining a high confidence level in the data.

12. SAP Worksheet 14, Summary of Project Tasks for UXO-15, page 17: Digital Geophysical Mapping, Vegetation Clearance With UXO Avoidance Figure 11 shows various DGM transects extending into mangrove forests and lagoons. The FWS suggests that DGM not be used in these habitats as the vegetation clearance protocols would result in an adverse impact. The mangrove forests and lagoons should be visually inspected for any surface debris and munitions items or characterized with the use of a hand held metal detector. If necessary, minimal de-branching can be performed. The 2003 Navy INRMP and the Biological Assessment for UXO-15 identified sensitive habitats (Figure 10), and the FWS suggests that this data be overlaid with the proposed transect locations to avoid impacts to mangrove forests and other sensitive habitats.

Navy Response:

Figure 11 (Proposed Transect Locations) of the SAP Addendum has been updated to include the sensitive habitat layers as shown in Figure 8 (Important Habitats) so that any overlaps will be identified. A uniform transect spacing of 60 ft., that disturbs only 5% of the site, has been selected to minimize impacts to the sensitive vegetation habitats while still meeting investigation objectives. Sensitive habitats can include mangrove forests, dry scrub forest, secondary growth forest, evergreen scrub, exposed limestone [Antillean nighthawk nesting area], giant wild pine colonies, and land crab colonies. Vegetation removal activities will not need to occur in exposed limestone areas because no DGM work will be necessary there. Please note that while vegetation clearance will be minimized to the extent possible, it will be necessary to clear vegetation, including mangroves, along the DGM transects in order to meet the project objectives. Hand held magnetometers are not sufficiently reliable to achieve the project objectives.

13. On February 1, 2012 the FWS conducted a visual site inspection of PI-9 west. The inspection focused on the western edge of the existing mangrove area, along the current NWR fenceline. The visual inspection found evidence that fill material had been placed in the mangrove forest. Unlike the gradual transition from uplands to wetlands typically observed, a distinct break was noted. Additionally, the leading edge of fill contained partially buried debris and there are large mounds at various locations along the fill edge. Two ammo cans were observed at the base of fill and in contact with the existing mangroves and in areas, the fill had eroded, exposing debris buried at least 5-inches below the surface. The mounds were approximately 3-feet in height and consisted of earth and stone. Although not precisely mapped, this fill and mound area seems to correspond to areas mapped as invasive vegetation on Figure 10 and may be the area referred to by the public as a dumping site. Rather than attempt to cut DGM transects in the mangrove forest, which will cause adverse impacts to this habitat type, the FWS suggests that a visual examination, aided by hand held magnetometers be conducted in the fill and mound area. Due to the relative inaccessibility of the fill and mound area, it is unlikely that munitions debris buried or disposed of would pose an undue risk to the public.

Navy Response:

The uniform 60 ft spacing of the transects will provide a high confidence level in the data; however, it will result in some minimal disturbance of the mangrove habits. As previously discussed with FWS, hand held magnetometer data are qualitative and less reliable than the DGM data and therefore the hand held magnetometer is not proposed for the transect investigations.

14. The DGM transects in the western portion of PI-9 extend into a mangrove forest that may actually belong to PR DNER and form part of the Bioluminescent Bay Natural Reserve. It is suggested that this be confirmed prior to mobilization.

Navy Response:

It is the Navy's understanding that DOI's property line extends along the land /water contact in the Puerto Mosquito bay area. If FWS has a map or other documentation to the contrary, please provide it to the Navy.

15. The text indicates that all cut vegetation will be accumulated onsite and mulched for future revegetation efforts. The FWS recommends that all cut vegetation be chipped and spread over the site once this work is finished. This would provide a suitable substrate for new vegetation and provide some erosion control.

Navy Response:

This has not been standard practice in other areas where vegetation clearance has been conducted and will not necessarily be done at UXO 15.

16. SAP Worksheet 14, Summary of Project Tasks for UXO-15, page 17: Digital Geophysical Mapping, DGM Operations Figures 10 depicts the habitats present and Figure 11 depicts the proposed transect locations. The images should be overlain to better assess impacts to habitat. At the scale presented, it is not possible to accurately determine exactly what the field teams will encounter on the ground. The FWS suggests that the field teams have the authority and ability to move transects or alter their position and length on the basis of the habitats present. The document should discuss this flexibility in light of the Data Quality Objectives and the Visual Sampling Plan protocol.

Navy Response:

The Visual Sampling Plan protocol has been replaced by evenly spaced transects covering 5 percent of the area of the vegetated portion of UXO-15. The new series of transects are shown on the attached revised Figure 11, which contains the habitat present as well. In order to maintain a high confidence and reliability in the site investigation data, there will be a limit to the level in which the transects can be relocated. As a result there will likely be some minimal impacts to the habitats present. The proposed investigation has reduced the area of vegetation removal by over 97% from the original approach. It is unlikely that any further reduction of the vegetation clearance can be achieved while maintaining the ability to meet the investigation objectives.

17. Several transects will traverse a number of habitat types (see Figure 10) including dry shrub forest, secondary forests, mangrove forests, lagoons, and areas of mixed native and invasive vegetation. The subject document provides general vegetation removal guidance that should provide sufficient protection of the habitats encountered by the field teams. However, given the variable characteristics of the different vegetative communities present and the potential for harm, the field teams need to have a very clear understanding of the methodology and approach to vegetation clearance. The FWS suggests the following specific habitat specific vegetation removal guidance:

Trees 3-inches in diameter or greater: The FWS recommends that all vegetation over 3-inches Diameter at Breast Height (DBH) be preserved. Vegetation of this size represents mature trees that can easily be avoided with geophysical equipment.

Dry Scrub Forest: Due to the rarity and sensitivity as well as the inability of this forest type to regenerate itself, the FWS suggests the following methods be used:

- No palms or palmettos are to be cut at the base (cutting at the base kills the plant); excess fronds can be trimmed back.
- Because dry forest plants are slow growing, all plants greater than 2-inches DBH are to be left in place.
- Removal of invasive plants should follow the 3-inch rule.
- Plants with orchids or bromeliads (wild pines) growing on them are to be left in place.
- Cacti are not to be cut at the base; branches can be trimmed if needed.
- Transects should attempt to work around the vegetation features

Secondary Growth Forest: The height of the trees (30-foot plus) indicates a mature forest type. Selective cutting of small trees, vines, and shrubs less than 2-inches DBH should open the understory sufficiently to allow transect to be established. The removal of invasive species should follow the 3-inch DBH rule.

Mixed Native, Naturalized and Invasive Species: This habitat type is the largest in the study area and it contains a diverse mix of species. Selective cutting of trees and shrubs 2-inches DBH or less should thin out the understory and allow transects to be established. The removal of invasive species should follow the 3-inch DBH rule.

Areas Composed Entirely of Invasive Species: This habitat type forms patches which may represent previous disturbance and is also found along the road and the road right of way. Areas along the road and road right of way composed entirely of invasive species can be cut. Other areas composed entirely of invasive species should follow the 3-inch DBH rule.

Land Crab Colonies: While not a vegetation habitat type, land crab colonies are found between the mangrove forest and the dryer uplands. These colonies consist of land crab burrows, and the shading and leaf litter provided by the trees and other vegetation is critical to the survival of the colony. Selective cutting of vines, shrubs and trees 2-inches DBH or less should provide sufficient space to allow transects to be established.

Mangrove Forests: Due to the rarity and sensitivity of this habitat, the FWS requests that standard DGM methods not be used. Several transects are being proposed in the mangrove areas, these mangroves are tidally influenced and connected to either Puerto Ferro or Bahia Mosquito. The FWS suggests that DGM not be used in mangrove forests as the vegetation clearance protocols would result in a substantial and adverse impact. The mangrove forests should be visually inspected for any surface debris and munitions items or characterized with the use of a hand held metal detector. If necessary, minimal de-branching can be performed to access anomalies or observed munitions or munitions debris.

The FWS would offer assistance in the field regarding the field effort.

Navy Response:

As previously stated, hand held magnetometer is not as reliable and does not provide the quantitative geophysical data needed to completed the geophysical investigation. Although there may be some impact to the mangrove forests, the impacts will be minimal in that the DGM transects only cover 5% of the site. In addition, mangrove restoration can be implemented for those areas where the mangrove vegetation is removed. The above FWS guidance for vegetation clearance methods within UXO 15 will be implemented where the vegetation does not impede the use of the DGM equipment.

18. SAP Worksheet 14, Summary of Project Tasks for UXO-15, page 19: Visual Survey of Potential Debris Areas, Potential Caves, and Debris Pile Removal The text indicates that as a general housekeeping measure, debris piles, metal items, and munitions-related items will be removed. The FWS suggests that all removal be done by hand (if possible), as it would avoid unnecessary impacts to vegetation.

Navy Response:

If debris is large and isolated enough to be easily removed by hand then it will be. However, it is likely that, given the condition of the debris depicted in the photographs, mechanized means of debris removal will be utilized.