Non-Time-Critical Removal Action
at the Municipality of Culebra, Puerto Rico

Environmental and Cultural Resources Surveys for Isla Culebrita

---

Prepared for

United States Army District, Jacksonville
United States Army Engineering and Support Center, Huntsville

Contract Number: W912DY-05-D-0007
Task Order Number: 0001
Project Number: I02PR006802

Prepared by

Ellis Environmental Group, LC
414 SW 140 Terrace, Newberry, FL 32669 • (352) 332-3888

November 2006

Introduction

In accordance with requests by the regulators involved with the Technical Planning Process and the approved Work Plan, Ellis Environmental Group, LC (EEG) is required to provide cultural resources and environmental surveys of each cay that will be investigated under this contract. The purpose of the surveys is to identify cultural resources, sensitive habitats, and endangered plants and animals that may exist in the work areas. Additionally, EEG is requested to determine the access points to the cays where the boats will anchor. This report presents the results of the surveys conducted at Isla Culebrita.

EEG employed two subcontractors with specific Caribbean experience to conduct these surveys. Southeast Archeological Research (SEARCH) performed the cultural resources survey, and ReForesta, Inc. conducted the habitat and endangered species surveys. The cultural resources survey is included in **Appendix A**. The habitat and endangered species survey is included in **Appendix B**. A wetlands jurisdictional survey is provided in **Appendix C**.

Survey Results

Cultural Resources

Based on the data in the cultural resources survey report, no significant cultural resources were found at Isla Culebrita that would limit the surface removal of munitions and explosives of concern (MEC) from this site. As SEARCH personnel observed, no limitation to EEG operations based on cultural resource issues should be necessary.

The SEARCH expert provided a cultural resources briefing to EEG personnel during the initial project mobilization. All team members will be on the lookout for any items of potential cultural significance. If, in the future, items are found, EEG will map each location with the global positioning system (GPS) and send the coordinates and pictures to the United States Army Corps of Engineers, Jacksonville District (CESAJ) project manager, to be forwarded to the cultural resources specialist.

Environmental Resources

Flora

A total of 97 plant species were recorded during the survey, none of which are state or federally threatened or endangered species. Four distinct plant communities were identified and included coastal forest, dry scrub forest, semi-open grasslands, and tidal flats. **Appendix B, Figure 1** delineates these communities. A small patch of a species described as a hybrid of sea grape plants (*Coccoloba uvifera* and *C. krugii*) was observed in the northeastern tip of the survey area growing on a rocky outcrop.

Fauna

The survey recorded 32 birds, 4 reptiles, and 2 mammals. One federally endangered species, the brown pelican, was observed resting on rocks along the coastline. The white-cheeked pintail, a species considered "threatened" by the Puerto Rico Department of Natural and Environmental Resources (DNER) was also sighted during the survey. Green turtles were also observed.

Wetlands

Wetlands were also delineated as part of the survey completed by ReForesta, Inc. Two areas were identified during the survey. The larger of the two areas is located in the northwestern portion of the survey area. The other area is located to the southeast, beginning along the eastern survey boundary and extending to the east. The wetlands are described in the jurisdictional survey included as **Appendix C**.

Recommendations

Based on the data and recommendations provided in the environmental resources survey report, EEG will implement the following actions during site preparation and MEC removal operations.

1. The small hybrid sea grape patch will not be removed. This patch is located at the northeastern tip of the study area. It measures 3 by 5 meters and is growing on a rocky coastal outcrop a few meters from the water (18.33965° N, 65.37668° W). This shrub tolerates pruning, and, if necessary, EEG will prune the bottom foliage to ensure proper detection of material potentially presenting an explosive hazard (MPPEH) in the area. EEG will not detonate an item near the sea grapes unless the item cannot be moved, in which case EEG will provide a barricade to protect the sensitive plants.

2. If MEC removal activities extend into the winter months, the crews will inform the appropriate agencies of any bird-nesting activity, especially in the tidal flat areas. All work will be coordinated with the United States Fish and Wildlife Service (FWS) and the Puerto Rico Environmental Quality Board (EQB) to ensure that EEG has current information about endangered birds that may be migrating and nesting in the area, and to ensure proper protection of the birds.

3. The appropriate agencies will be informed if any snakes are observed. As stated above, EEG will coordinate all work with the appropriate agencies.

4. Every effort will be made to avoid disturbing the brown pelicans, green turtles, and underwater habitat, especially sea grasses, when coming ashore. EEG will coordinate access to the cay with FWS to ensure protection of the brown pelicans and green turtles.

5. Clearing crews will be informed about the poisonous manchineel trees (photo at right). These trees exist in the coastal thickets. The manchineel tree is toxic and can burn the skin. The fruit of the manchineel tree resembles a small green apple and is poisonous. Contact with its leaves and fruit should be avoided and workers should not stand or sit under one when it is raining.

6. Coastal thickets and mangrove forests will be preserved. EEG will limit tree cutting and brush removal to only that necessary to effectively complete the detection and removal of surface MEC. Mangrove trees located within the coastal thickets and bordering the tidal flat will be carefully pruned to avoid damage. EEG will protect the sea grape plants located within the coastal thickets.

Vegetation Removal

Vegetation on Isla Culebrita is extremely dense, and brush removal will be required. All native trees with diameters greater than 2 inches are to be left untouched. Non-native species can be removed as necessary. Brush removal crews will remove the least amount of vegetation that will

allow EEG unexploded ordnance (UXO) personnel to properly access the site and operate the geophysical equipment required to locate surface anomalies.

EEG plans to use manual methods (chain saws, machetes, and/or other hand tools) to perform tree and brush removal in accordance with the project Environmental Protection Plan; however, EEG proposes the option to perform mechanical removal using an armored Bobcat, mounted with a specialized vegetation cutting blade developed by Timberline Environmental Services (TES). The TES cutter grinds the smaller vegetation, leaving it as fine mulch distributed over the area.

Coastal Thickets and Mangrove Forests

Vegetation removal within the coastal thickets and mangrove forests will be limited to manual methods. Two strands of coastal thickets (coastal forests) have been delineated (see **Appendix B**). One strand extends along the northwestern edge of the cay between the ocean and the inland tidal flat. This strand, ranging in width from 50 to 75 meters, is approximately 400 meters long. The other strand runs along the southern side of the cay, bordering the ocean on the south and scrub forests on the north. This strand is also approximately 400 meters long and ranges in width between 10 and 75 meters. The dominant tree species occurring in the coastal thickets include button mangrove, sea grape, water mampoo, and spoon tree. The poisonous manchineel tree is also present. A strand of white and black mangroves also exists along the northern fringe of the tidal flat (see **Appendix B**).

In accordance with the approved Work Plan, invasive trees such as mesquite may be removed from these areas. Native trees and underbrush will be pruned to a height that will allow full coverage (unobstructed access) by the geophysical equipment, which EEG believes to be 12 inches. Small native trees (less than 2 inches in diameter) may require removal in order to provide the required access. EEG will remove larger native trees only in cases where MEC is embedded in the tree or caught or suspended in the roots or branches, or to gain access to MEC, in which case the tree will be removed using a chain saw. If possible, the tree will be trimmed or pruned back instead of removed.

Dry Scrub Forest and Semi-Open Grasslands

The dry scrub forest is dominated by cat's claw, pipe-organ cactus, crabwood, black willow, and a thorny bushy-vine. EEG plans to use manual brush removal in this area along with the option to conduct mechanized vegetation removal.

The semi-open grasslands are dominated by hurricane and guinea grasses, with scattered cashia trees and bushes. Depending on the height of the grass, mowing may be required to provide adequate access to the ground surface within the open grassy areas. Mechanized removals will be conducted in the brush areas if deemed appropriate, otherwise manual removal methods will be used.

Wetlands

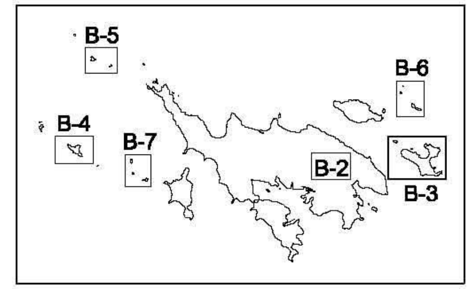
EEG will not conduct MEC removal operations in portions of the wetlands that are inundated with water at the time of the investigation. In areas not inundated, EEG will carefully hand trim vegetation to allow access to the ground. The wetlands boundaries will be marked in the field to ensure that the boundaries are clearly identified for the mechanized brush-cutting equipment.

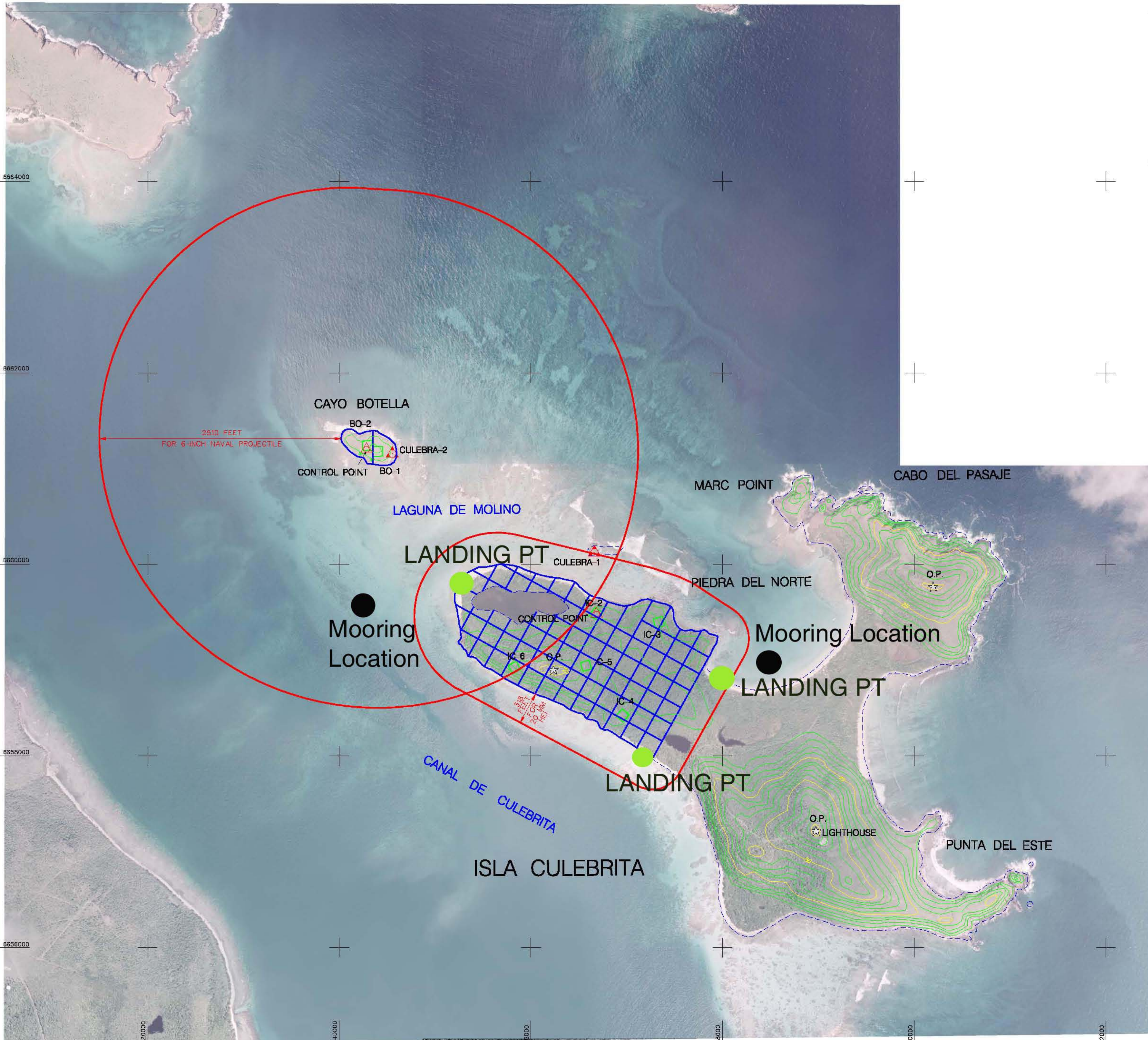
Marine Protection

EEG will use a Trident 40-foot boat with a 16-foot beam to transport personnel and equipment to the cays. The boat has a 4½-foot draft and will work well in this area.

EEG will access the cays only from the landing points shown on the map on the following page. EEG will ensure that the boat will be anchored in the mooring locations noted on the map. The bottom is sandy with only a sparse number of coral heads in the area, and care will be taken to avoid the coral heads in this area when anchoring.

EEG will use a rubber dingy or a small 14- or 21-foot skiff to land personnel and equipment on shore, which is a rocky beach presently littered with debris.





500' 250' 0 500'

SCALE: 1'' = 500'-0"

LEGEND	
Symbol	Description
	GPS CONTROL MONUMENT
	CONTROL POINT
	OBSERVATION POINT
	EE/CA SAMPLING GRID LOCATION
	MEC REMOVAL GRID AREAS
	MAXIMUM FRAGMENTATION DISTANCE (Q-D ARCS)
	ISLAND DELINEATION
	MAJOR CONTOUR
	MINOR CONTOUR CONTOUR INTERVAL 5 METERS

CONTOUR SOURCE: 6' x 11' 1948 USGS QUADRANGLE.
VERTICAL DATUM: LOCAL MEAN SEAL LEVEL.
AERIAL SOURCE: (3001 INC.,2005)
MAP PROJECTION: UNIVERSAL TRASVERSE MERIATOR.
ZONE: 19
DATUM: NAD 1927 (PUERTO RICO).

US Army Corps of Engineers
District or Division

Mark	Description	Date	Appr.
1	Remove Max Frag Line & Dimen	01/06	

Designed by: MGB | Dwn by: DSS | Ckd by: | Reviewed by: | Submitted by: | Chief, Arch. Branch

Date: 01/2006 | Rev. 1 | Design file no. | Drawing code: | File name: 102PR006802SPB3C.WP | Plot date: 6/2005 | Plot scale: 1"=500'

U.S. ARMY ENGINEERING AND SUPPORT CENTER
Huntsville, Alabama

ELLIS ENVIRONMENTAL GROUP
Newberry, Florida

NON-TIME CRITICAL REMOVAL ACTION
Culebra, Puerto Rico
Project No. 102PR006802 Contract No. W912DY-05-D-0007

CULEBRITA (OOU-4) AND CAYO BOTELLA (OOU-5) GRID LAYOUT AND QUANTITY DISTANCE MAP

Sheet reference number:
B-3

APPENDIX A

Archaeological Walkover Survey

End of Fieldwork Report:
Archaeological Walkover Survey Associated with Unexploded Ordnance Removal on Isla Culebrita and Cayo Lobo, Municipality of Culebra, Puerto Rico

CONSULTANT: Southeastern Archaeological Research, Inc.
315 NW 138th Terrace, Jonesville, Florida 32669
PRINCIPAL INVESTIGATOR: William Keegan, Ph.D.
CLIENT: U.S. Army Corp of Engineers/Ellis Environmental Group
DATE: August 18, 2006

In April 2006, Southeastern Archaeological Research (SEARCH) of Jonesville, Florida was engaged by Ellis Environmental Group, LC, in conjunction with the U.S. Army Corps of Engineers (USACE), Huntsville, to conduct a cultural resource survey of the Cerro Balcón region of Culebra and several of the surrounding cays as part of the Culebra Non-Time-Critical Removal of unexploded ordnance (UXO) from the ground surface. The first phase at Cerro Balcón has been described in a separate executive summary and final report. This second phase of work consisted of a survey of two of these cays: Cayo Lobo and the northwest peninsula of Isla Culebrita (Figure 1). As noted in the Cerro Balcón report, there is no mention of previously recorded archaeological sites on the small cays surrounding Culebra, with the exception of two sites on the east side of Isla Culebrita; one of which is the National Register of Historic Places listed property the Culebrita Lighthouse ("Faro Isla de Culebritas"), built in 1874. The Isla Culebrita sites are outside the present survey project area.

Figure 1. Location of Surveyed Cays—Cayo Lobo and Isla Culebrita

This End of Fieldwork report describes walkover surveys of Cayo Lobo and the northwestern peninsula of Isla Culebrita conducted in July 2006. Dr. William F. Keegan, Curator of Caribbean Archaeology, Florida Museum of Natural History, University of Florida, Gainesville, was sub-contracted as the Principal Investigator. Dr. Keegan conducted his investigation of Cayo Lobo on July 25 and Isla Culebrita on July 26, 2006. Unfortunately, due to severe weather conditions during the time of the survey, it was impossible to return safely to either island for follow-up investigations.

Dr. Keegan's investigations were limited to a walkover survey. No subsurface testing was permitted due to the potential for buried UXO in the project area. An Explosive Ordnance Disposal (EOD) specialist, equipped with a magnetometer, preceded Dr. Keegan at all times during the surface survey. Because the current UXO removal project is limited to surface disposal with no planned subsurface impacts and the islands are protected by the Department of Fish and Wildlife, a surface survey was deemed a sufficient methodology for identifying resources within the project area. The project will have no significant subsurface impacts.

The following is a brief description of the survey completed on Isla Culebrita and Cayo Lobo. A complete report is pending, which will thoroughly present previous research, environmental conditions, archaeological site potential and findings. No sites were located during this investigation.

Cayo Lobo

Cayo Lobo is a small cay to the west of Culebra. It is composed of three high promontories connected by a low saddle (Figure 2). There are military observation bunkers on two of the promontories and a helicopter landing pad on the third. It appears that most of the bombing was restricted to the lower central part of the cay. Today, most of the cay is covered in dense grass, with woodland vegetation on the promontories and along the cliff edges. Surface visibility is only fair in most places, but toward the center of the cay there are former craters and erosion gulleys that offer complete surface exposures.

Keegan's survey covered the entire circumference of the cay, with special attention to cliff edges and other exposures. In addition, most of the low interior was walked in a series of transects that focused on the substantial exposures. The walkover survey achieved extensive coverage of the cay. The cay would certainly have provided access to a variety of resources including marine mollusks and a variety of lithics (milky quartz, diorite, and greenstone) that were used by the Taínos. However, the entire island is a high ridge with steep sides. This rocky outcrop has no beaches to easily land a canoe and no protection from the elements. Cayo Lobo has a low potential for prehistoric archaeological sites. The survey found no evidence of historic or prehistoric activities, other than 20th century military use.

Isla Culebrita

Isla Culebrita, located east of Culebra, has a similar layout to Cayo Lobo but on a much larger scale. There are again three promontories connected by a lowland. Only the northwestern peninsula of Culebrita is within the project area (Figure 3). The vegetation is extremely dense

and covered with thorns. Surface visibility on top of the peninsula is limited due to abundant leaf litter. There is a sand beach at the western tip of the peninsula that extends in front of a large pond (*Laguna del Molino*). This pond is not open to the ocean today, however it may have been a tidal creek at the time the Taínos were living in the region. The pond is described by the 1977 Soil Survey of Humacao Area of Eastern Puerto Rico (1977) as a tidal flat and shown in the aerial to have had access to the ocean on both ends of the pond. The fieldwork and photography for the 1977 soil survey was completed between 1962 and 1968. The sand beach at the tip of this peninsula appears to be a building rather than eroding shoreline and is possibly of modern origin (since A.D. 1500). The soils north of the pond are Catano loamy sand, which are nearly level, rapidly permeable sediments. Most of the remainder of Culebrita consists of Descalabrado clay loam (20-40% slopes, eroded) (USDA 1977). This soil type is well drained and moderately permeable, and occurs in areas of low rainfall. These soils are usually shallow and overlie volcanic bedrock.

The walkover survey progressed along the northwest beach and covered the entire perimeter of the project area. In addition, the margins of the pond were surveyed, and a transect was walked along a diagonal from the southern beach to the northern cliffs. With the possible exception of the pond, there is a low probability that prehistoric sites of significance ever existed here due to poor soils, a lack of freshwater resources, and little protection from the elements. The terrestrial environment offers no resources of value and is a difficult terrain to traverse as it consists of steep, heavily vegetated slopes. No evidence for historic or prehistoric activities was found.

Conclusions

Neither Cayo Lobo nor Isla Culebrita offered any signs of historic or prehistoric activities. No historic structures are located within the project areas. It is our opinion that the archaeological survey work described above and the submittal of a Final Technical report will adequately complete the cultural resource assessment of Isla Culebrita and Cayo Lobo. The walkover survey found no cultural resources and no evidence of past resource exploitation. Therefore, the project areas are not subject to any further investigations or protective or mitigative measures.

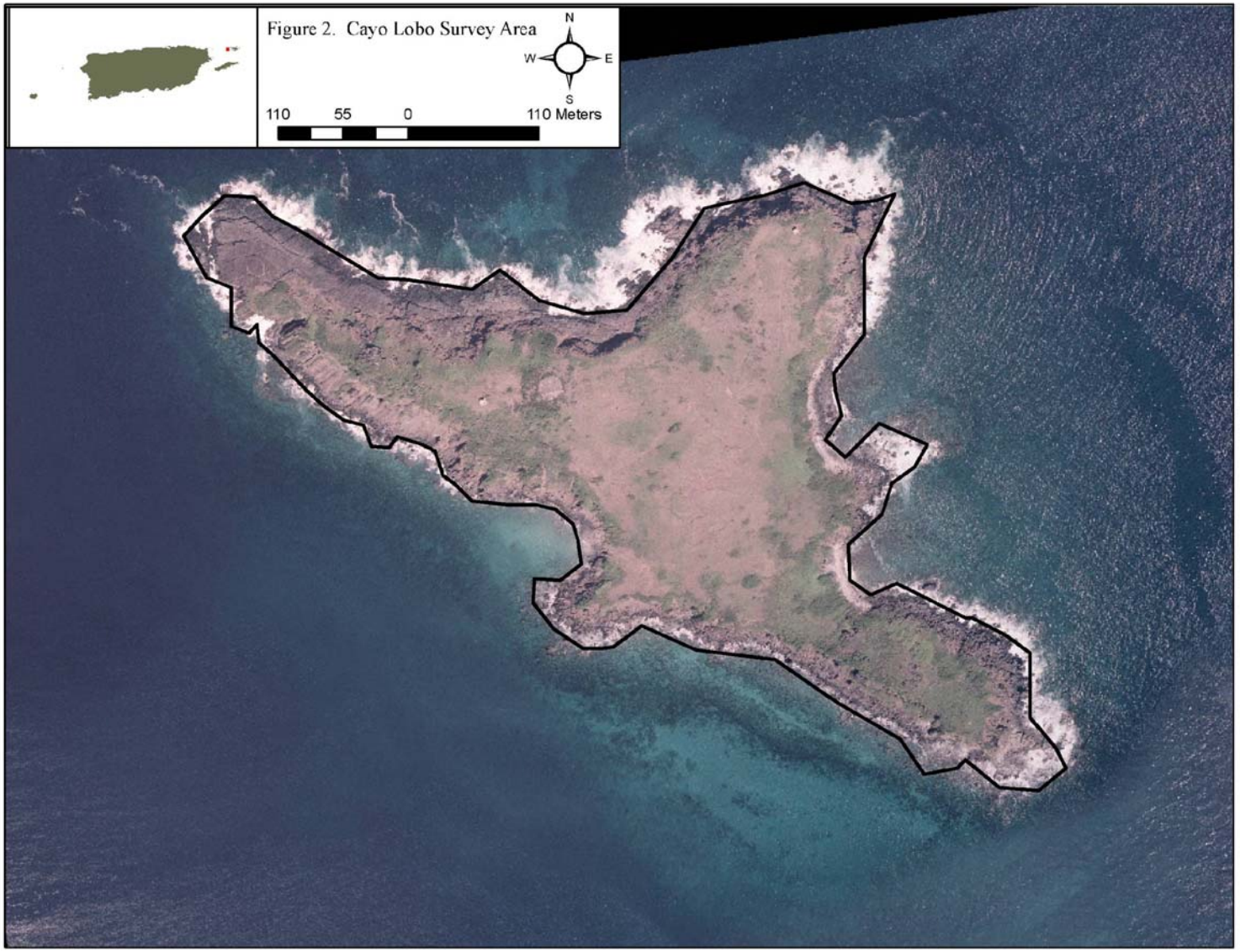


Figure 2. Cayo Lobo Survey Area
N
W
E
S
110 55 0 110 Meters

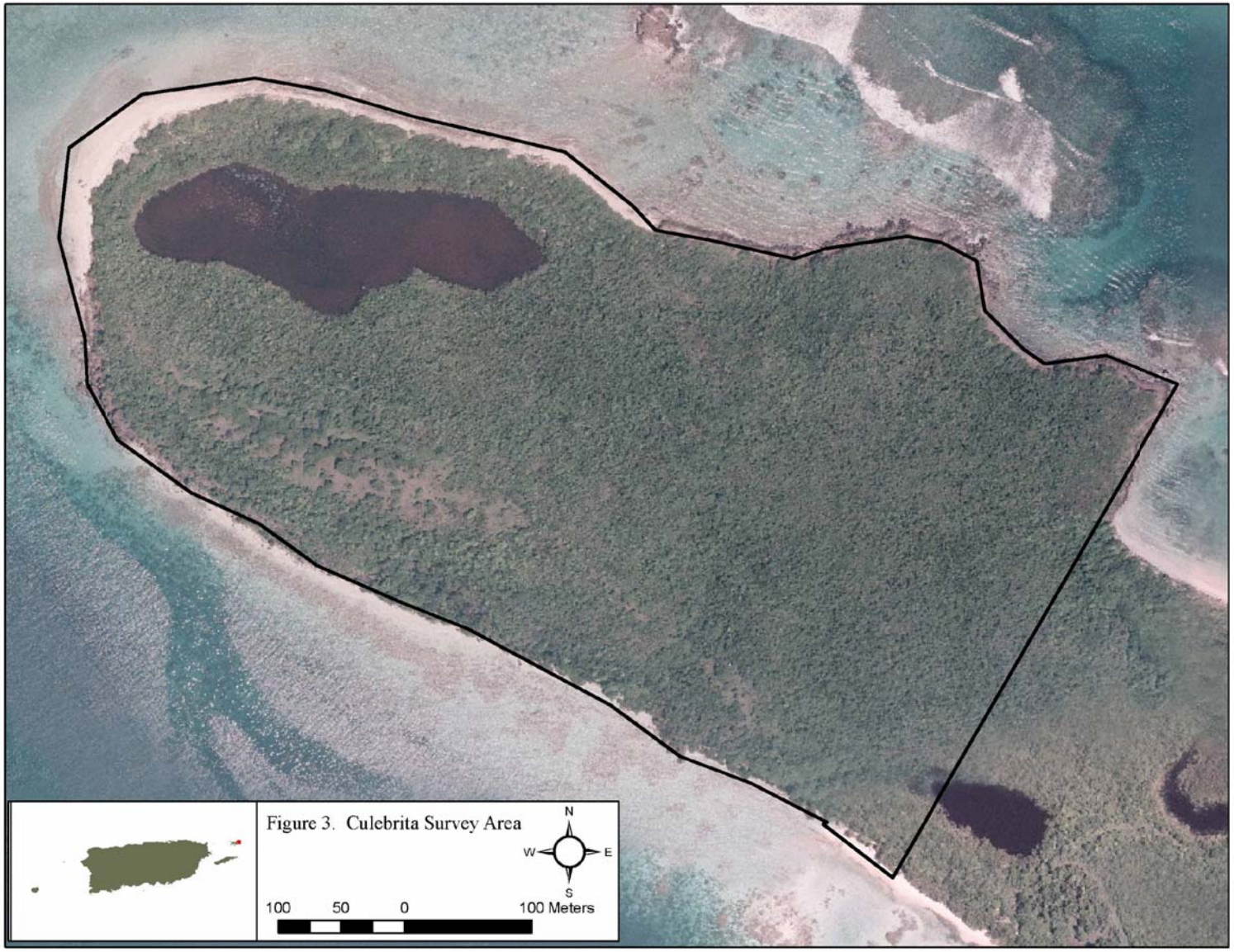


Figure 3. Culebrita Survey Area
N
W
E
S
100 50 0 100 Meters

APPENDIX B

Flora and Fauna Survey for Culebrita Island

FLORA AND FAUNA SURVEY
FOR
CULEBRITA ISLAND
DERP-FUDS CLEAN UP
CULEBRA, Puerto Rico

OCTOBER-2006

Prepared for:

Ellis Environmental Group, LC
414 SW 140th Terrace
Newberry, Fl 32669

Prepared by:

PO Box 8972
San Juan PR 00910-0972
(787) 748-5435-voice
(787) 748-5390-fax

Participants:
Roberto Bello, M.S.
Alejandro Cubiñá, M.S.
Carlos Laboy
OCTOBER 2006

Location

The island of Culebrita is located approximately 1.5 kilometers east of Playa Larga in eastern Culebra (see appendix 1 for location map). Culebrita is located within the subtropical dry forest life zone (Ewel & Whitmore 1973).

The study area, located in the northwestern portion of the island, comprises 82 acres (approximately 1/3 of the island). Culebrita is part of the Culebra Wildlife Refuge administered by the U.S. Fish and Wildlife Service.

Soils

According to the National Resource Conservation Service there are three soil types in the study area (see Appendix 1 for map):

Cf - Cataño Loamy sand (Deep soils that are excessively drained and rapidly permeable. Parent material: Beach sand deposits).

Td - Tidal flats (Low areas that are affected by seawater during high tide).

DeE2 - Descalabrado clay loam (Well-drained moderately permeable soils found on mountain side slopes and ridge tops in the semiarid volcanic uplands).

Methodology

Field work was conducted on July 26, and August 10-11, 2006. All surveys were conducted during the day from approximately 8 A.M. to 3 PM by Roberto Bello, Alejandro Cubiñá, and Carlos Laboy from Reforesta, Inc. A UXO specialist was always

present with the biological team, and Dr. William F. Keegan, an archaelogist, accompanied us on the first field work day.

Penetrating the thick spiny scrub forest was the biggest challenge in conducting the field work. To maximize our effort, we selected representative areas by analyzing a 2005 aerial photo to establish linear study transects (see Appendix 2 for transect location), since total coverage was not possible. Emphasis was given to closed canopy forests and wetland areas. Steep cliffs were out of the scope of work of this survey. Coordinates were recorded with a handheld GPS in DEG.DDDDD, NAD 27 datum.

Flora – We recorded all plant species occurring within the study site. Any plants that could not be identified in the field were taken to the University of Puerto Rico at Río Piedras herbarium for later identification. Plant nomenclature follows Liogier and Martorell (2000).

Fauna – The vertebrate fauna was determined by visual and acoustic means. Rock and fallen branches were frequently turned to detect cryptic species. Any skeletal remains were identified. Nomenclature for the herpetofauna follows Schwartz and Henderson (1991) and Raffaele *et al*. (1998) for the avifauna.

Results

Flora – We recorded 97 plant species of plants (see Table 1). No state or federally threatened and endangered species of plants were recorded. Grey nickers (*Caesalpinia bonduc*) is listed as an "elemento crítico" by the Puerto Rico Department of Natural and Environmental Resources (PR-DNER) and is found throughout the coastal thickets in the study area. This plant is not uncommon throughout Puerto Rico and

adjacent islands. It is probably included in the "elemento crítico " list because it resembles *Caesalpinia culebae* and *Caesalpinia melanosperma*.

To determine the degree of human disturbance in Culebrita before becoming a nature reserve, we obtained a 1965 aerial photo (earlier photos weren't available in the PR Highway Authority). The main difference between vegetation cover in the sixties and today is the degree of fragmentation of the dry forests in the study area. Forty years ago scrub forest wasn't as extensive as it is today. Earlier photography is needed to determine the degree of human impact in the island. It is very likely that the suitable trees found in the dry forest were exploited by the lighthouse caretakers and that fires must have been a common occurrence during military practices.

Four distinct plant communities occur in northwestern Culebrita (see Appendix 4 for map):

1 - Coastal forest – Flat coastal areas with closed tree canopy from 3.5 to 5 meters in height. The dominant tree species occurring in this community are: Button mangrove (*Conocarpus erectus*), Sea grape (*Coccoloba uvifera*), Water mampoo (*Pisonia subcordata*), and the Spoon tree (*Elaedendron xylocarpum*). The poisonous Manchineel tree (*Hippomane mancinella*) occurs in these coastal thickets.

2 – Dry scrub forest – This is the most abundant habitat-type found in the study site. It occurs along the cliffs and hills of the island. The soil is rocky and very shallow. Canopy height averages 2.6 m. The dominant shrubs and trees growing in this community are: Cat's claw (*Pithecellobium unguis-cati*), Pipe-organ cactus (*Pilosocereus royenii*), Crabwood (*Gymnanthes lucida*), and Black willow (*Capparis cynophallophora*). The thorny bushy-vine *Oplonia spinosa* is also abundant.

3 – Semi-open grasslands – Grassy patches dominated by Hurricane grass (*Bothriochloa pertusa*), and Guinea grass (*Urochloa maxima*). Scattered Cashia (*Acacia farnesiana*) trees and (*Capparis flexuosa*) bushes are common.

4 – Tidal flats – Seasonally flooded shallow lagoons. May be partially or completely surrounded by mangrove forests dominated by White (*Laguncularia racemosa*) and Black (*Avicennia germinans*) mangroves.

A species described as a hybrid between *Coccoloba uvifera* and *Coccoloba krugii* which was abundant in Cayo Lobo, was only found in the northeastern tip of the study area. The small patch measures 3 x 5 m and is growing on a rocky coastal outcrop a few meters from the water (18.33965º N, 65.37668ºW, 108 ft). Another plant of interest, the endemic herb *Justicia culebritae*, was not recorded in the study area. According to the information provided by the U.S. Fish and Wildlife this plant is found in the hills surrounding the lighthouse (T. Tallevast, pers. comm.).

Fauna – We recorded 32 birds, 4 reptiles, and 2 mammals in the study area. A few Brown pelican (*Pelecanus occidentalis*) individuals, a federally endangered species, were observed resting on rocks along the coast of Culebrita. Two dead pelicans were found along the coasts during the field effort. Green turtles (*Chelonia mydas*) were observed foraging in *Thalassia* beds found in northern Culebrita. A few individuals of the White Cheeked Pintail (*Anas bahamensis*) were sighted on the tidal flats in the northwestern tip of Culebrita. This species is considered threatened by the PR-DNER.

No amphibians were recorded during our diurnal survey, but we would expect to find *Eleutherodactylus antillensis*, *Eleutherodactylus cochranae* and *Eleutherodactylus*

coqui, three common Coquí species, if we had continued the surveys through the night. The white-lipped frog (*Leptodactylus albilabris*) and the toad (*Bufo marinus*) should also be present. In addition, other probable reptiles found in Culebrita are: *Typhlops richardi*, *Alsophis portoricensis*, *Arrhyton exiguum*, and the Puerto Rican slider (*Trachemys stejnegeri*).

The Virgin Islands tree boa (*Epicrates monensis granti*) has been observed in nearby Culebra. During our site visit we did not find any boas or shed skins. The coastal thickets and scrub forest are ideal habitat for this species. Nocturnal surveys would be necessary to determine if the species is present in this small island. Finally, we observed abundant evidence of deer presence in Culebrita. A study on the impact of this exotic species on the native vegetation would be appropriate.

Recommendations

We recommend the following:

1. As in Cayo Lobo, avoid removing the small Hybrid seagrape patch.

2. If work extends into the winter months, the cleaning crews should inform the appropriate agencies of any bird nesting activity, especially in the tidal flat areas.

3. Inform the appropriate agencies if any snakes are observed.

4. Avoid disturbing the brown pelicans, green turtles and underwater habitat, especially sea grasses, when coming ashore.

5. Inform clearing crews about the poisonous Manchineel tree.

6. Preserve the coastal thickets and mangrove forests.

Literature cited

Acevedo-Rodríguez, P. 2003. Bejucos y Plantas Trepadoras de Puerto Rico e Islas Virgenes. Washington DC: Smithsonian Institution. 491 p.

Ewel, J. S. and J. L. Whitmore. 1973 Ecological life zones of Puerto Rico and the U.S. Virging Islands. USDA – Forest Serv. Res. Paper ITF-18. 72 p.

Liogier, H.A. 1985. Descriptive Flora of Puerto Rico and Adjacent Islands, Vol 1. Río Piedras, PR : Editorial de la Universidad de Puerto Rico. 357 p.

Liogier, H.A. 1988. Descriptive Flora of Puerto Rico and Adjacent Islands, Vol 2. Río Piedras, PR : Editorial de la Universidad de Puerto Rico. 481 p.

Liogier, H.A. 1991. Descriptive Flora of Puerto Rico and Adjacent Islands, Vol 3. Río Piedras, PR : Editorial de la Universidad de Puerto Rico. 461 p.

Liogier, H.A. 1995. Descriptive Flora of Puerto Rico and Adjacent Islands, Vol 4. Río Piedras, PR : Editorial de la Universidad de Puerto Rico. 617 p.

Liogier, H.A. 1997. Descriptive Flora of Puerto Rico and Adjacent Islands, Vol 5. Río Piedras, PR : Editorial de la Universidad de Puerto Rico. 436 p.

Liogier, H.A., and L.F. Martorell. 2000. Flora of Puerto Rico and Adjacent Islands: A Systematic Synopsis. San Juan, PR: Editorial de la Universidad de Puerto Rico. 382 p.

Lugo et. al. 2001. Puerto Rican Karst-A Vital Resource. Gen. Tech. Report WO-65: USDA Forest Service. 101 p.

Raffaele, H.A. 1989. Una Guía a las Aves de Puerto Rico y las Islas Virgenes. Princeton NJ: Princeton University Press. 274 p.

Raffaele, H., Wiley, J., Garrido, O., Keith, A., Raffaele, J. 1998. A Guide to the Birds of the West Indies. Princeton, NJ: Princeton University Press. 511 p.

Rivero, J. A. 1998. Los anfibios y reptiles de Puerto Rico. San Juan, P R: Editorial Universitaria. 510 p.

Schwartz, A., and R.W. Henderson. 1991. Amphibians and Reptiles of the West Indies: Descriptions, Distributions, and Natural History, Gainesville, Fl: University Florida Press. 720 p.

Literature cited (Continued)

United States Department of Agriculture Soil Conservation Service. 1977. Soil Survey of Humacao Area of Eastern Pureto Rico, 103 p.

http://plants.usda.gov/

http://www.itis.usa.gov/

http://www.soils.usda.gov/

Table 1. Flora

Scientific name	Common name (E)	Common name (Sp.)	Family
Herbaceous Plants			
Argusia gnaphalodes (L.) Heine	Sea lavender	Temporana	BORAGINACEAE
Batis maritima L.	Saltwort	Barilla	BATACEAE
Bothriochloa pertusa (L.) A. Camus	Hurricane grass	Hierba amarga	POACEAE
Cakile lanceolata (Willd.) O. E. Schulz	Sea-rocket	Mostacilla del mar	BRASSICACEAE
Chamaecrista sp.			LEGCAESALPINIOIDEAE
Chamaesyce messembrianthemifolia (Jacq.) Dugand			EUPHORBIACEAE
Commelina sp.			COMMELINACEAE
Crotolaria lotifolia L.		Cascabelillo axilar	LEG.-PAPILIONOIDEAE
Cyperus planifolius Rich.			CYPERACEAE
Desmanthus virgatus (L.) Willd.		Desmanto	LEG.-MIMOSOIDEAE
Hymenocallis caribae (L.) Herb.	White lily, spider lily	Lirio blanco	AMARYLLICACEAE
Mammilaria nivosa Link in Pfeiff.	Snow cactus	Erizo blanco	CACTACEAE
Melocactus intortus (Miller) Urban	Turk's cap	Melón de costa	CACTACEAE
Opuntia repens Bello	Suckers	Gatos	CACTACEAE
Portulaca oleracea L.	Purslane	Verdolaga	PORTULACACEAE
Psychilis macconnielliae Sauleda			ORCHIDACEAE
Rivina humilis L.	Cat's blood	Carmín	PHYTOLACCACEAE
Ruellia tuberosa L**.**	Many-roots		ACANTHACEAE
Sesuvium portulacastrum (L.) L.	Sea purslane	Verdolaga rosada	AIZOACEAE
Setaria rariflora Mikan			POACEAE
Sida ciliaris L.		Escoba peluda	MALVACEAE
Spartina patens (Ait.) Muhl.	Salt grass	Hierba de sal	POACEAE
Sporobolus virginicus (L.) Kunth	Seashore dropseed	Matojo de burro	POACEAE
Tephrosia cinerea (L.) Pers.		Añil cenizo	LEG.-PAPILIONOIDEAE
Tillandsia utriculata L.	Florida giant air plant		BROMELIACEAE
Tolumnia prionochila (Kranzlin) Braem	Dancing lady		ORCHIDACEAE
Urochloa maxima (Jacq.) R. D. Webster	Guinea grass	Hierba de guinea	POACEAE

Table 1. Flora (continued)

Scientific name	Common name (E)	Common name (Sp.)	Family
Herbaceous Plants (continued)			
Waltheria indica L.		Malvavisco	STERCULIACEAE
Wedelia fruticosa Jacq.	Margarita de las rocas		COMPOSITAE
Shrubs and Trees			
Acacia farnesiana (L.) Willd.	Cashia	Aroma	LEG.-MIMOSOIDEAE
Amyris elemifera L.	Torchwood	Tea	RUTACEAE
Avicennia germinans (L.) L.	Black mangrove	Mangle negro	AVICENNIACEAE
Bourreria succulenta Jacq.	Pigeon berry	Palo de vaca	BORAGINACEAE
Bucida buceras L.	Oxhorn bucida	Ucar	COMBRETACEAE
Bursera simaruba (L.) Sarg.	Gumbo limbo	Almácigo	BURSERACEAE
Capparis cynophallophora L.	Black willow	Burro prieto	CAPPARACEAE
Capparis hastata Jacq.	Broad-leaved caper	Burro	CAPPARACEAE
Capparis flexuosa (L.) L.	Dog caper	Palinguán	CAPPARACEAE
Citharexylum fruticosum L.	Florida fiddlewood	Péndula	VERBENACEAE
Coccoloba krugii x *C. uvifera* Howard	Hybrid Seagrape	Uva de playa híbrida	POLYGONACEAE
Coccoloba krugii Lindau			POLYGONACEAE
Coccoloba uvifera (L.) L.	Seagrape	Uva de playa	POLYGONACEAE
Coccothrinax alta (OF. Cook) Becc.	Teyer palm		PALMAE
Cocos nucifera L.	Palma de coco	Coconut palm	PALMAE
Conocarpus erectus L.	Button mangrove	Mangle botón	COMBRETACEAE
Cordia rickseckeri Millsp.	Manjack	San Bartolomé	BORAGINACEAE
Crossopetalum rhacoma Crantz	Poison cherry		CELASTRACEAE
Croton astroites Dryand *in* Ait.		Maná	EUPHORBIACEAE
Croton flavens L. var. *rigidus* Muell. Arg.	Yellow balsam	Adormidera	EUPHORBIACEAE
Ficus citrifolia P. Mill.	White fig	Jagüey	MORACEAE
Elaeodendron xylocarpum (Vent.) DC.	Spoon tree	Guayarote	CELASTRACEAE
Erithalis fruticosa L.	Black torch	Jayajabico	RUBIACEAE

Table 1. Flora (continued)

Scientific name	Common name (E)	Common name (Sp.)	Family
Shrubs and Trees (continued)			
Ernodea littoralis Sw.	Golden creeper		RUBIACEAE
Erythroxylum brevipes DC.	Brisselet	Rocío	ERYTHROXYLACEAE
Eugenia biflora (L.) DC.	Black rod-wood	Hoja menuda	MYRTACEAE
Eugenia foetida Pers.	Spanish stopper	Hoja menuda	MYRTACEAE
Euphorbia petiolaris Sims	Manchineel berry	Indio desnudo	EUPHORBIACEAE
Exostema caribaeum (Jacq.) R. & S.	Yellow torch	Palo de quina	RUBIACEAE
Guapira fragans (Dum.-Cours.) Little	Black mampoo	Corcho	NYCTAGINACEAE
Gymnanthes lucida Sw.	Crabwood	Yaití	EUPHORBIACEAE
Hippomane mancinella L.	Manchineel	Manzanillo	EUPHORBIACEAE
Krugiodendron ferreum (Vahl) Urban	Black ironwood	Palo de hierro	NYCTAGINACEAE
Laguncularia racemosa (L.) Gaertn.	White mangrove	Mangle blanco	COMBRETACEAE
Lantana involucrata L.	Santa María	Wild sage	VERBENACEAE
Jacquinia arborea Vahl	Torchwood	Azúcares	THEOPHRASTACEAE
Jacquinia berteroi Sprengel		Mercocha	THEOPHRASTACEAE
Melochia tomentosa L.	Broom wood	Bretónica afelpada	STERCULIACEAE
Morinda citrifolia L.	Noni	Gardenia hedionda	RUBIACEAE
Neea buxifolia (Hook. F.) Heimerl		Nía	NYCTAGINACEAE
Opuntia dilenii (Ker-Gawl) Haw.	Prickly pear	Tuna brava	CACTACEAE
Opuntia rubescens Salm-Dick *ex* DC.	Prickly pear	Tuna de petate	CACTACEAE
Piscidia carthagenensis Jacq.	Fish poison	Ventura	LEG.-PAPILIONOIDEAE
Pisonia subcordata Sw.	Water mampoo	Corcho blanco	NYCTAGINACEAE
Pilosocereus royenii (L.) Byles & Rowley	Pipe-organ cactus	Sebucán	CACTACEAE
Pithecellobium unguis-cati (L.) Mart.	Cat's claw	Rolón	LEG.-MIMOSOIDEAE
Plumeria alba L.	Milk tree	Alhelí blanco	APOCYNACEAE
Randia aculeata L.	Christmas tree	Tintillo	RUBIACEAE

Table 1. Flora (continued)

Scientific name	Common name (E)	Common name (Sp.)	Family
Shrubs and Trees (continued)			
Rauvolfia viridis Willd. *ex* Roem. & Schultes	Bitter bush		APOCYNACEAE
Rhizophora mangle L.	Red mangrove	Mangle colorado	RHIZOPHORACEAE
Schaefferia frutescens Jacquin	Florida boxwood	Jibá	CELASTRACEAE
Suriana maritima L.	Bay cedar	Guitarán	SIMAROUBACEAE
Tabebuia heterophylla (DC.) Britt.	White cedar	Roble blanco	BIGNONIACEAE
Vines			
Caesalpinia bonduc (L.) Roxb.	Gray nickers	Mato de playa	LEG.-CAESALPINIOIDEAE
Canavalia rosea (Sw.) DC.	Bay bean	Haba de playa	LEG.-PAPILIONOIDEAE
Centrosema virginianum (L.) Bentham	Wist vine	Flor de conchitas	LEG.-PAPILIONOIDEAE
Dalbergia monetaria L. f.	Money bush	Palo de brasilete	LEG.-PAPILIONOIDEAE
Galactia dubia DC.	Iron weed		LEG.-PAPILIONOIDEAE
Jacquemontia pentanthos (Jacq.) G. Don	Wild daisy	Aguinaldo azul	CONVOLVULACEAE
Hylocereus trigonus (Haw.) Safford	Strawberry pear	Pitahaya	CACTACEAE
Ipomoea pes-caprae (L.) R. Br.	Bay hops	Bejuco de playa	CONVOLVULACEAE
Ipomoea steudelii Millsp.			CONVOLVULACEAE
Macfadyenia unguis-cati (L.) A. H. Gentry	Cat claw	Uña de gato	BIGNONIACEAE
Metastelma decipiens Schltr.			ASCLEPIADACEAE
Oplonia spinosa (Jacq.) Raf.	Prickly bush	Espinosa	ACHANTHACEAE
Passiflora suberosa L.	Passion flower	Flor de pasión	PASSIFLORACEAE
Serjania polyphylla (L.) Radlkofer	Black withe	Bejuco de canastas	SAPINDACEAE
Tournefortia volubilis L.		Nigua enredadera	BORAGINACEAE

Table 2. Fauna

Scientific name	Common name (Eng.)	Common name (Sp.)	Family
Birds			
Anas bahamensis	White-cheeked Pintail	Pato quijada colorada	ANATIDAE
Buteo jamaicensis	Red-tailed Hawk	Guaraguao	ACCIPITIDAE
Butorides virescens	Green Heron	Martinete	ARDEIDAE
Calidris himantopus	Stilt Sandpiper	Playero patilargo	SCOLOPACIDAE
Calidris minutilla	Least Sandpiper	Playerito menudo	SCOLOPACIDAE
Calidris pusilla	Semipalmated Sandpiper	Playerito gracioso	SCOLOPACIDAE
Charidrius wilsonia	Wilson's Plover	Playero maritimo	CHARADRIIDAE
Coccyzus minor	Mangrove Cuckoo	Pajaro bobo menor	CUCULIDAE
Coereba flaveola	Bananaquit	Reinita	EMBERIZIDAE
Columba squamosa	Scaly-naped Pigeon	Paloma turca	COLUMBIDAE
Columbina passerina	Common ground-Dove	Rolita	COLUMBIDAE
Crotophaga ani	Smooth-billed Ani	Judío	CUCULIDAE
Dendroica petechia	Yellow Warbler	Canario de mangle	EMBERIZIDAE
Elaenia griseus	Caribbean Elaenia	Juí blanco	TYRANNIDAE
Gallinula chloropus	Common Gallinule	Gallareta común	RALLIDAE
Haematopus palliatus	Oystercatcher	Ostrero	HAEMATOPODIDAE
Larus atricilla	Laughing Gull	Gaviota gallega	LARIDAE
Margarops fuscatus	Pearly-eyed Thrasher	Zorzal pardo	MIMIDAE
Falco sparverius	American Kestrel	Falcón común	FALCONIDAE
Fregata magnificens	Magnificent Frigatebird	Tijereta	FREGATIDAE
Orthorhyncus cristatus	Antillean crested Hummingbird		TROCHILIDAE
*Pelecanus occidentalis**	Brown Pelican	Pelícano pardo	PELECANIDAE
Rallus longirostris	Clapper Rail	Pollo de mangle	RALLIDAE
Saurtothera vielloti	Puerto Rican Lizard-Cuckoo	Pajaro bobo mayor	CUCULIDAE
Sterna hirundo	Common tern	Gaviota común	LARIDAE
Sula leucogaster	Brown Boobie	Boba prieta	SULIDAE
Tiaris bicolor	Black-faced Grassquit	Gorrión negro	EMBERIZIDAE

Table 2. Fauna (continued)

Scientific name	Common name (Eng.)	Common name (Sp.)	Family
Tringa flaviceps	Lesser Yellowlegs	Chorlo	SCOLOPACIDAE
Tringa solitaria	Solitary Sandpiper	Playero solitario	SCOLOPACIDAE
Tyrannus dominicensis	Gray Kingbird	Pitirre	TYRANNIDAE
Zenaida asiatica	White-winged Dove	Tortola aliblanca	COLUMBIDAE
Zenaida aurita	Zenaida Dove	Tortola cardosantera	COLUMBIDAE
Mammals			
Odocoileus virginianus	White-tailed deer	Venado	CERVIDAE
Rattus rattus	Black rat	Rata	MURIDAE
Reptiles			
Ameiva exsul	Common P.R. Ameiva	Siguana común	TEIIDAE
Anolis cristatellus	Common Anole	Lagartijo común	IGUANIDAE
Anolis pulchellus	Common Grass Anole	Lagartijo jardinero	IGUANIDAE
Anolis stratulus	Tree Anole	Lagartijo manchado	IGUANIDAE
Chelonia mydas+	Green turtle	Pejeblanco	CHELONIIDAE
Hemidactylus mabouia	House Gecko	Salamanquesa	GEKKONIDAE
Sphaerodactylus macrolepis	Ground Gecko	Salamanquita común	GEKKONIDAE
Sphaerodactylus nicholsi	Dwarf Ground Gecko	Salamanquita pigmea	GEKKONIDAE

+Threatened species
*Endangered species

Appendix 1 – Location and Soil Maps.

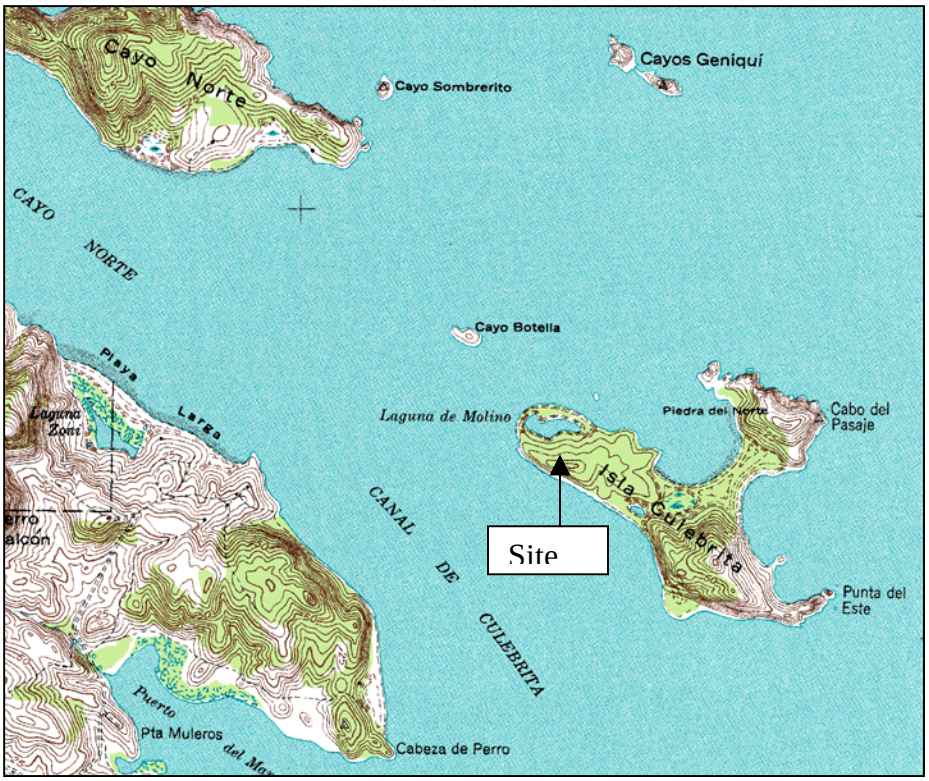


Figure 1. Location of Culebrita Island.

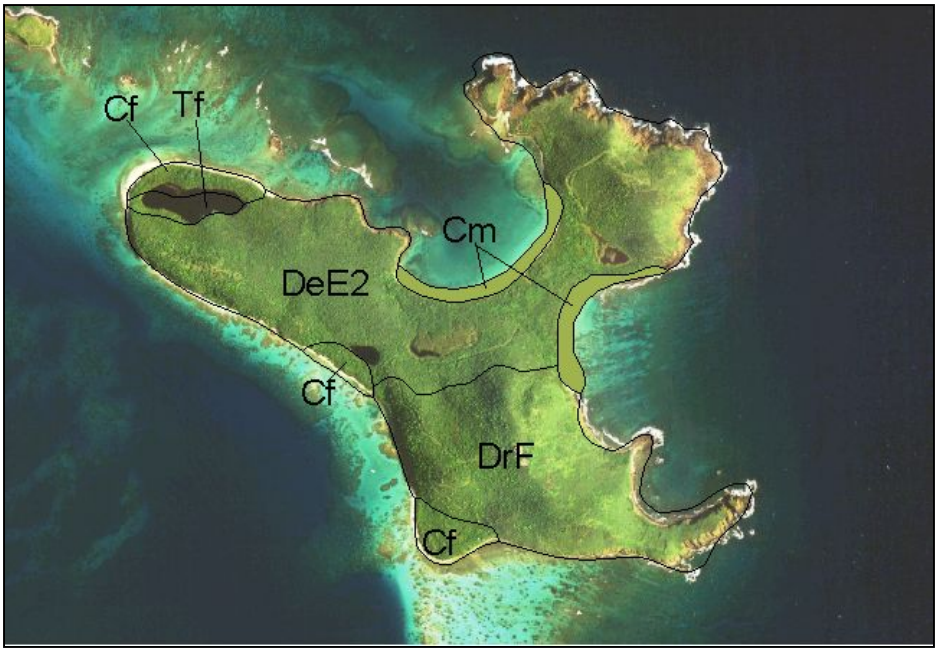


Figure 2. Soil map.

Appendix 2 – Surveyed areas (2005 aerial photo).

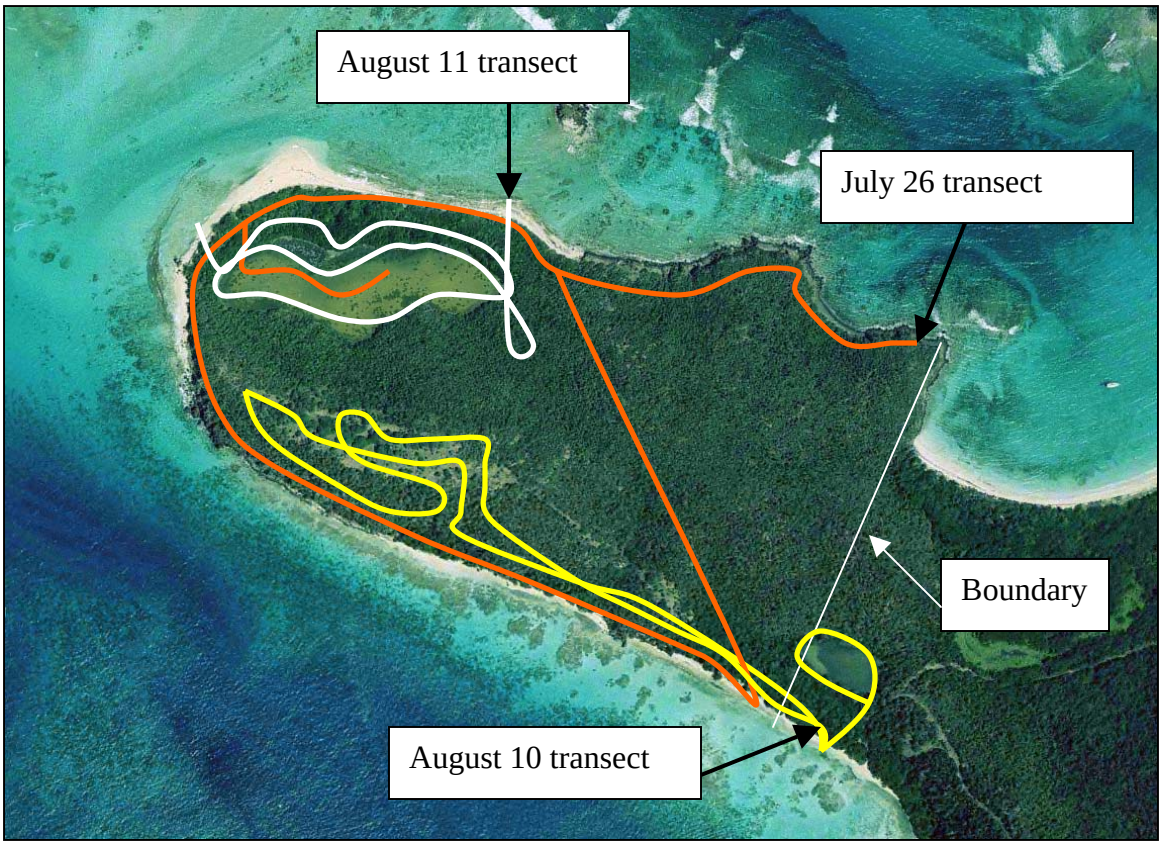


Figure 3. Colored transects depicting sampled areas.

Appendix 3 – 1965 Aerial photo.

Figure 4. Vegetation cover in 1965.

Appendix 4 – Plant communities and field photographs.

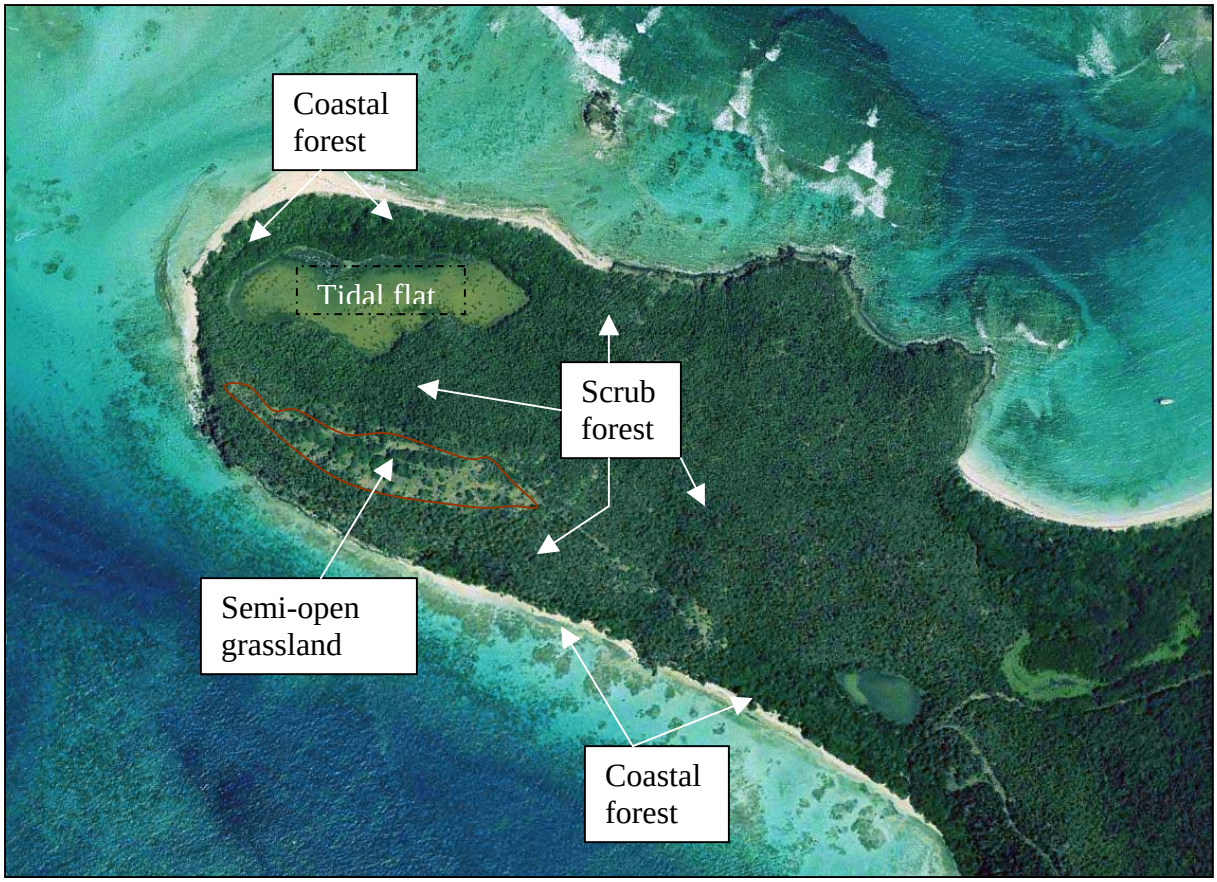


Figure 5. Approximate location of plant communities in study site.

Figure 6. Tidal flat in northwestern tip of Culebrita.

Appendix 4 – (Continued).

Figure 7. Pipe-organ cactus and surrounding scrub forest vegetation.

Figure 8. Flowering Gray nickers (*Caesalpinia bonduc*).

APPENDIX C

Jurisdictional Determination for Culebrita Island

JURISDICTIONAL DETERMINATION
FOR
CULEBRITA ISLAND
DERP-FUDS CLEAN UP
CULEBRA, Puerto Rico

OCTOBER-2006

Prepared for:

Ellis Environmental Group, LC
414 SW 140th Terrace
Newberry, Fl 32669

Prepared by:

PO Box 8972
San Juan PR 00910-0972
(787) 748-5435-voice
(787) 748-5390-fax

Participants:
Roberto Bello, M.S.
Alejandro Cubiñá, M.S.
Carlos Laboy

INTRODUCTION

Ellis Environmental Group, LC (EEG) is conducting a clean-up and removal action of munitions of environmental concern (MEC) under the Defense Environmental Restoration Program-Formerly Utilized Defense Sites (DERP-FUNDS) Military Munitions Response Program (MMRP) in the island of Culebrita. Wetlands, primarily lagoons, salt flats, and associated transitional zones are considered part of essential fish habitat and provide foraging areas for migratory and resident bird species. To aid in protecting these resources, jurisdictional wetlands have been delineated.

LOCATION

The island of Culebrita is located approximately 1.5 kilometers east of Playa Larga in eastern Culebra (see appendix 1 for location map). Culebrita is located within the subtropical dry forest life zone (Ewel & Whitmore 1973).

The study area, located in the northwestern portion of the island, comprises 82 acres (approximately 1/3 of the island). The proposed areas of clean-up and removal activities are part of the Culebra Wildlife Refuge administered by the U.S. Fish and Wildlife Service.

METHODS

The determination of jurisdiction was conducted following the routine on site method as described in the Wetland Determination Manual, 1987. It involved an evaluation of the Soil Survey, Wetland Inventory Maps and aerial photos. An intensive field inspection for the presence of wetland plants, hydric soils and wetland hydrology was conducted. Once

a wetland was identified, sampling transects were established perpendicular to the wetland baseline. Each transect consisted of three sampling points (within the wetland, bordering the wetland, and approximately 3-4 m from the wetland border. Field work was conducted on July 26, and August 10-11, 2006. A UXO specialist was always present with the delineation team, and Dr. William F. Keegan, an archaelogist, accompanied us on the first day. Coordinates were recorded with a handheld Magellan Platinum GPS in DEG.DDDDD, NAD 27 datum.

SOILS

According to the National Resource Conservation Service there are three soil types in the study area (see Appendix 1 for soil map):

Cf - Cataño Loamy sand (Deep soils that are excessively drained and rapidly permeable. Parent material: Beach sand deposits).

Td - Tidal flats (Low areas that are affected by seawater during high tide). A hydric soil.

DeE2 - Descalabrado clay loam (Well-drained moderately permeable soils found on mountain side slopes and ridge tops in the semiarid volcanic uplands).

RESULTS

Hydrology

The two wetland areas identified in the study are enclosed by land. The two shallow lagoons or tidal flats flood during rain events and may receive sea water from storm surges. During our first visit to Laguna de Molino (western tidal flat) on July 26, 2006

about 95 % of the sandy bottom of the lagoon was exposed. Two weeks after, the area was completely flooded following several rainy days.

Vegetation

The field investigation of the site revealed that both lagoons are bordered on the seaward side by a small mangrove fringe. The mangrove fringe on the eastern lagoon is dominated by Bottom mangrove (*Conocarpus erectus*), while Black (*Avicennia germinans*) and White (*Laguncularia racemosa*) mangroves are more abundant in Laguna de Molino. Both mangrove areas are narrow and are less than 10 m wide. Further seaward, both wetlands are bounded by coastal forests. The upland species that dominate this community are the Spoon tree (*Elaeodendron xylocarpum*) and Water mampoo (*Pisonia subcordata*).

The hydric vegetation on the landward side is limited to the shrubby *Batis maritima*. The wetland limit is well defined due to an abrupt change in topography which in turn allows for the development of upland plant species. The landward side of both lagoons consists of xeric scrub forest.

CONCLUSION

The USACE jurisdictional areas are limited to two shallow lagoons (see Appendix 6). Laguna de Molino occurs on the western tip of the study site and covers approximately 5.5 acres. The other lagoon occurs on the boundary of the study site. This wetland is smaller, covering only 0.9 acres. The U.S. Fish and Wildlife Wetland Inventory Map has no data on Culebrita (see Appendix 2).

The Laguna de Molino boundaries were flagged and GPS coordinates were recorded for each point. Below are the recorded coordinates:

Pt. 1 - 18.32005º N, 65.23826º W
Pt. 2 - 18.32021º N, 65.23804º W
Pt. 3 - 18.32031º N, 65.23781º W
Pt. 4 - 18.32035º N, 65.23761º W
Pt. 5 - 18.32021º N, 65.23683º W
Pt. 6 - 18.32017º N, 65.23645º W
Pt. 7 - 18.32018º N, 65.23606º W
Pt. 8 - 18.32008º N, 65.23570º W
Pt. 9 - 18.31379º N, 65.23538º W
Pt.10 - 18.31962º N, 65.23530º W
Pt.11 - 18.31947º N, 65.23559º W
Pt.12 - 18.31940º N, 65.23576º W
Pt.13 - 18.31944º N, 65.23592º W
Pt.14 - 18.31950º N, 65.23606º W
Pt.15 - 18.31959º N, 65.23629º W
Pt.16 - 18.31945º N, 65.23647º W
Pt.17 - 18.31944º N, 65.23661º W
Pt.18 - 18.31925º N, 65.23676º W
Pt.19 - 18.31926º N, 65.23676º W
Pt.20 - 18.31937º N, 65.23715º W
Pt.21 - 18.31948º N, 65.23729º W
Pt.22 - 18.31958º N, 65.23751º W
Pt.23 - 18.31963º N, 65.23772º W
Pt.24 - 18.31963º N, 65.23796º W
Pt.25 - 18.31966º N, 65.23808º W
Pt.26 - 18.31967º N, 65.23587º W

The western end of the small lagoon was also flagged. The rest of the lagoon is outside the clean-up and removal area. Below are the recorded coordinates:

Pt. 1 - 18.31573º N, 65.23255º W
Pt. 2 - 18.31582º N, 65.23266º W
Pt. 3 - 18.31597º N, 65.23274º W
Pt. 4 - 18.31600º N, 65.23260º W
Pt. 5 - 18.31601º N, 65.23253º W
Pt. 6 - 18.31602º N, 65.23242º W
Pt. 7 - 18.31600º N, 65.23228º W

References

Ewel, J. S. and J. L. Whitmore. 1973. Ecological life zones of Puerto Rico and the U.S. Virgin Islands. USDA – Forest Serv. Res. Paper ITF-18. 72 pp.

Liogier, H.A., and L.F. Martorell. 2000. Flora of Puerto Rico and Adjacent Islands: A Systematic Synopsis. Editorial de la Universidad de Puerto Rico, Río Piedras, Puerto Rico. 382 pp.

Soil Conservation Service. 1977. Soil Survey of the Humacao Area of Eastern Puerto Rico.

United States Army Corps of Engineers. 1987. Corps of Engineers Wetland Delineation Manual. Department of the Army, Waterways Experimental Station, Washington D.C.

United States Fish and Wildlife Service. 1988. National List of Plant Species that Occur in Wetlands: Caribbean Area. U.S. Department of the Interior, Fish and Wildlife Service Biological Report 88 (26.2).

United States Department of Agriculture – Natural Resources Conservation Service. 2005. Hydric Soils of the Caribbean Area. Internet: http://www.pr.nrcs.usda.gov/technical/soil_survey/cbhydricsoil.pdf

Appendix 1 – Location and Soil Maps.

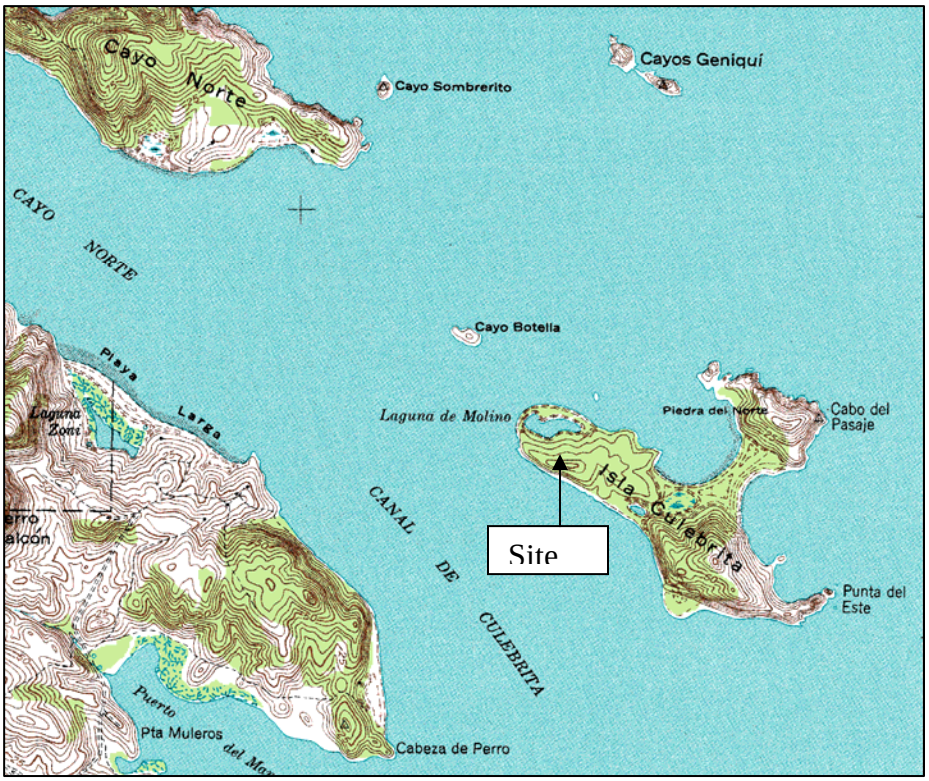


Figure 1. Location of Culebrita Island.

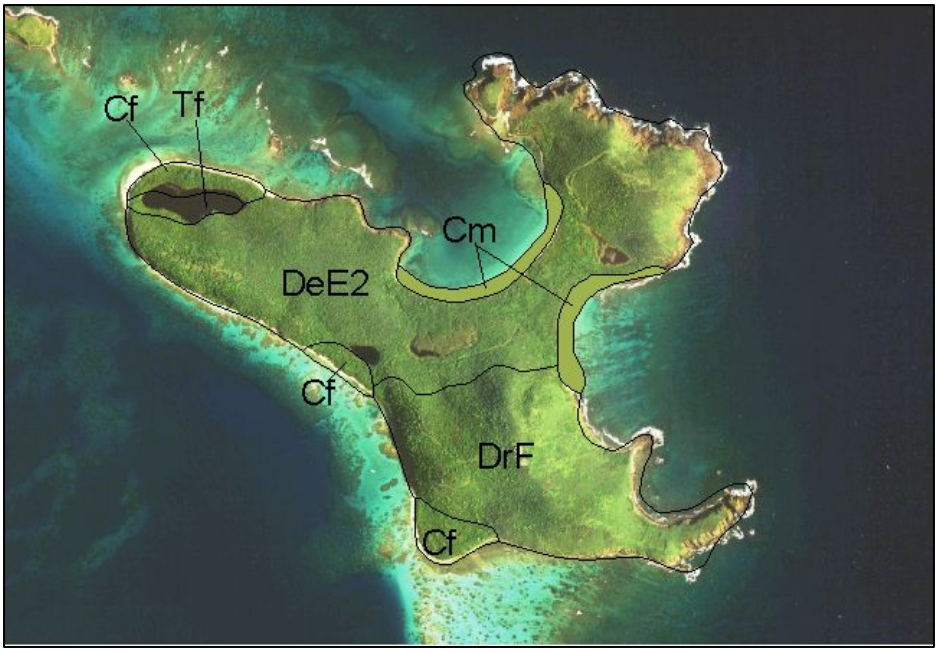


Figure 2. Soil map.

Appendix 2 – Wetland Inventory Map.

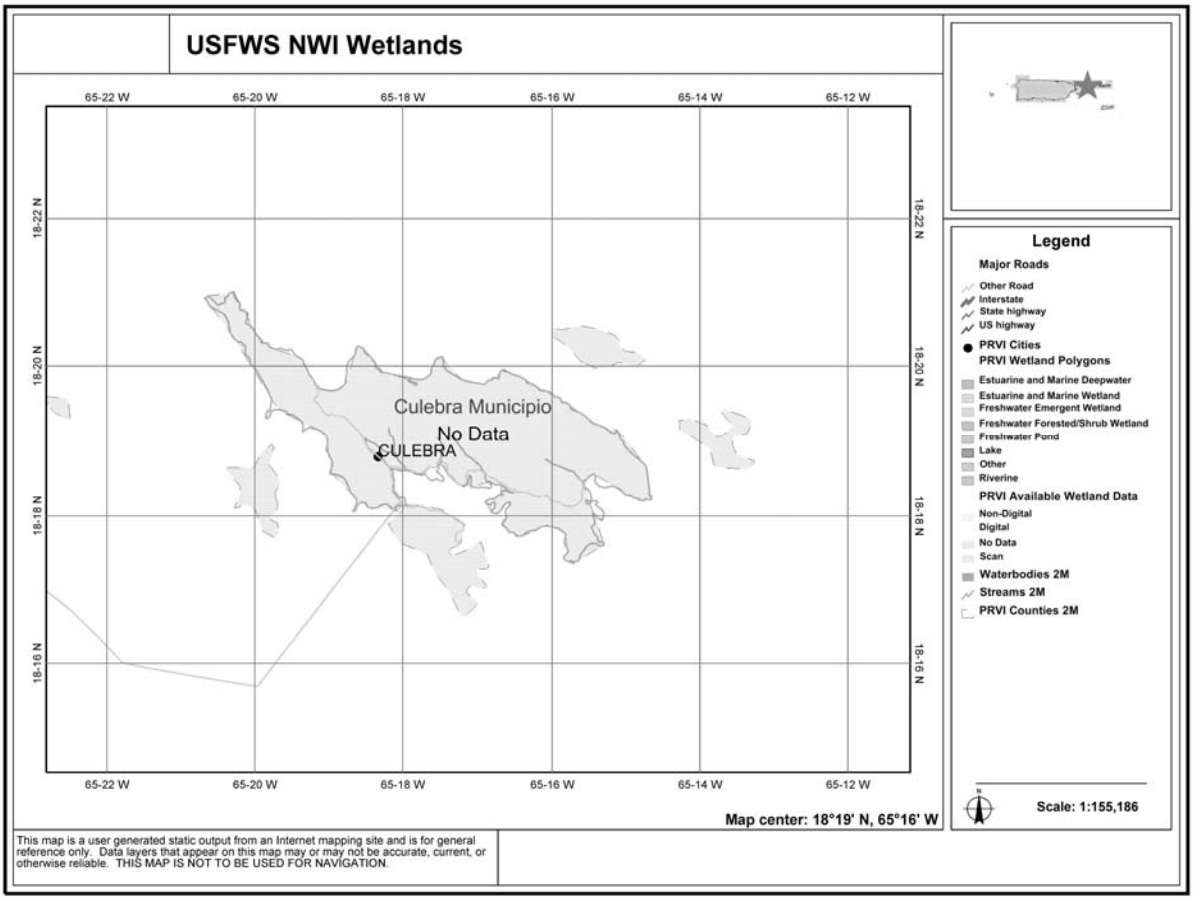


Figure 3. No data are provided for the area of Culebra.

Appendix 3 – Field Photographs.

Figure 4. Laguna de Molino (western tidal flat) on July 26, 2006.

Figure 5. Laguna de Molino on August 11, 2006.

Figure 6. Northern limit of wetland at Laguna de Molino.

Figure 7. Eastern tidal flat on August 10, 2006.

Appendix 4 – Field Data Sheets.

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site:	Culebrita	Date:	August 11,2006
Applicant/Owner:	Ellis Environmental	County:	Culebra
Investigator:	Alejandro Cubiñá	State:	Puerto Rico
Do Normal Circumstances exist on the site?	☒Yes ☐No	Community ID:	Laguna de Molino (Western Tidal Flat)
Is the site significantly disturbed (Atypical Situation)?	☐Yes ☒No	Transect ID:	2
Is the area a potential Problem Area? (If needed, explain on reverse.)	☐Yes ☒No	Plot ID:	A

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. No Vegetation			9.		
2.			10.		
3.			11.		
4.			12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-).

Remarks: Edge of lagoon, sandy soil with no vegetation.

HYDROLOGY

☐ Recorded Data (Describe in Remarks):
- ☐ Stream, Lake, or Tide Gauge
- ☒ Aerial Photographs
- ☐ Other

☒ No Recorded Data Available

Field Observations:

Depth of Surface Water: _____ (in.)

Depth to Free Water in Pit: 8 (in.)

Depth to Saturated Soil: 0 (in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ☐ Inundated
- ☒ Saturated in Upper 12 Inches
- ☒ Water Marks
- ☐ Drift Lines
- ☐ Sediment Deposits
- ☒ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ☐ Oxidized Root Channels in Upper 12 Inches
- ☐ Water-Stained Leaves
- ☒ Local Soil Survey Data
- ☐ FAC-Neutral Test
- ☐ Other (Explain in Remarks)

Remarks:

Appendix 4 – Field Data Sheets (continued).

SOILS

Map Unit Name (Series and Phase): Tydal Flats (Td)

Drainage Class:

Field Observations

Taxonomy (Subgroup):

Confirm Mapped Type? ☒Yes ☐ No

Profile Descriptions:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/ Size/Contrast	Texture, Concretions, Structure, etc,
0-2	A	10 YR 3/1			Rusty Orange Concretion / Loamy Sand
2-16	B	10 YR 5/2			Loamy Sand

Hydric Soil Indicators:

- ☐ Histosol
- ☐ Histic Epipedon
- ☐ Sulfidic Odor
- ☐ Aquic Moisture Regime
- ☐ Reducing Conditions
- ☒ Gleyed or Low-Chroma Colors
- ☒ Concretions
- ☐ High Organic Content in Surface Layer in Sandy Soils
- ☐ Organic Streaking in Sandy Soils
- ☒ Listed on Local Hydric Soils List
- ☐ Listed on National Hydric Soils List
- ☐ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? ☐Yes ☐No (Check)

Wetland Hydrology Present? ☒Yes ☐No

Hydric Soils Present? ☒Yes ☐No

(Check)

Is this Sampling Point Within a Wetland? ☒Yes ☐No

Remarks GPS coordinates: 18.31964° N, 65.23537° W. First parameter doesn't apply, no vegetation present.

Approved by HQUSACE 3/92

Forms version 1/02

Appendix 4 – Field Data Sheets (continued).

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site:	Culebrita	Date:	August 11,2006
Applicant/Owner:	Ellis Environmental	County:	Culebra
Investigator:	Alejandro Cubiñá	State:	Puerto Rico
Do Normal Circumstances exist on the site?	☒Yes ☐No	Community ID:	Laguna de Molino (Western Tidal Flat)
Is the site significantly disturbed (Atypical Situation)?	☐Yes ☒No	Transect ID:	2
Is the area a potential Problem Area? (If needed, explain on reverse.)	☐Yes ☒No	Plot ID:	B

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Capparis cynophallophora	S	NL	9.		
2. Laguncularia racemosa	T	OBL	10.		
3. Acacia farnesiana	T	NL	11.		
4. Pithecelobium unguis-catis	T	FAC-	12.		
5. Avicennia germinans	T	OBL	13.		
6. Sporobolus virginicus	H	FACW	14.		
7. Batis maritima	H	FACW	15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 4 out of 7 = 57 %

Remarks:

HYDROLOGY

☐ Recorded Data (Describe in Remarks):
- ☐ Stream, Lake, or Tide Gauge
- ☐ Aerial Photographs
- ☐ Other

☒ No Recorded Data Available

Field Observations:

Depth of Surface Water: _____ (in.)

Depth to Free Water in Pit: _____ (in.)

Depth to Saturated Soil: _____ (in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ☐ Inundated
- ☐ Saturated in Upper 12 Inches
- ☐ Water Marks
- ☐ Drift Lines
- ☐ Sediment Deposits
- ☐ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ☐ Oxidized Root Channels in Upper 12 Inches
- ☐ Water-Stained Leaves
- ☐ Local Soil Survey Data
- ☒ FAC-Neutral Test
- ☐ Other (Explain in Remarks)

Remarks:

Appendix 4 – Field Data Sheets (continued).

SOILS

Map Unit Name (Series and Phase): Cataño Loamy Sand (Cf)

Drainage Class: _____

Field Observations

Taxonomy (Subgroup): Typic Tropopsamments

Confirm Mapped Type? ☒Yes ☐ No

Profile Descriptions:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/ Size/Contrast	Texture, Concretions, Structure, etc,
0-16	A	2.5 Y 3/2			Loamy Sand

Hydric Soil Indicators:

- ☐ Histosol
- ☐ Histic Epipedon
- ☐ Sulfidic Odor
- ☐ Aquic Moisture Regime
- ☐ Reducing Conditions
- ☐ Gleyed or Low-Chroma Colors
- ☐ Concretions
- ☐ High Organic Content in Surface Layer in Sandy Soils
- ☐ Organic Streaking in Sandy Soils
- ☐ Listed on Local Hydric Soils List
- ☐ Listed on National Hydric Soils List
- ☐ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	☒Yes ☐No (Check)	(Check)
Wetland Hydrology Present?	☐Yes ☒No	
Hydric Soils Present?	☐Yes ☒No	Is this Sampling Point Within a Wetland? ☐Yes ☒No

Remarks GPS coordinates: 18.31962° N, 65.23531° W.

Approved by HQUSACE 3/92

Forms version 1/02

Appendix 4 – Field Data Sheets (continued).

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site:	Culebrita	Date:	August 11,2006
Applicant/Owner:	Ellis Environmental	County:	Culebra
Investigator:	Alejandro Cubiñá	State:	Puerto Rico
Do Normal Circumstances exist on the site?	☒Yes ☐No	Community ID:	Laguna de Molino (Western Tidal Flat)
Is the site significantly disturbed (Atypical Situation)?	☐Yes ☒No	Transect ID:	2
Is the area a potential Problem Area? (If needed, explain on reverse.)	☐Yes ☒No	Plot ID:	C

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Elaeodendron xyloocarpum	T	NL	9.		
2. Randia aculeata	T	NL	10.		
3. Acacia farnesiana	T	NL	11.		
4. Pithecelobium unguis-catis	T	FAC-	12.		
5. Melochia tomentosa	S	NL	13.		
6. Jacquemontia pentanthos	V	NL	14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 0 out of 6 = 0 %

Remarks:

HYDROLOGY

☐ Recorded Data (Describe in Remarks):
- ☐ Stream, Lake, or Tide Gauge
- ☐ Aerial Photographs
- ☐ Other

☒ No Recorded Data Available

Field Observations:

Depth of Surface Water: _____ (in.)

Depth to Free Water in Pit: _____ (in.)

Depth to Saturated Soil: _____ (in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ☐ Inundated
- ☐ Saturated in Upper 12 Inches
- ☐ Water Marks
- ☐ Drift Lines
- ☐ Sediment Deposits
- ☐ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ☐ Oxidized Root Channels in Upper 12 Inches
- ☐ Water-Stained Leaves
- ☐ Local Soil Survey Data
- ☐ FAC-Neutral Test
- ☐ Other (Explain in Remarks)

Remarks:

Appendix 4 – Field Data Sheets (continued).

SOILS

Map Unit Name (Series and Phase): Cataño Loamy Sand (Cf)

Drainage Class: _____

Field Observations

Taxonomy (Subgroup): Typic Tropopsamments

Confirm Mapped Type? ☒Yes ☐ No

Profile Descriptions:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/ Size/Contrast	Texture, Concretions, Structure, etc,
0-12	A	10 YR 3/3			Loamy Sand
12-16	B	10 YR 4/6			Sandy Clay Loam

Hydric Soil Indicators:

- ☐ Histosol
- ☐ Histic Epipedon
- ☐ Sulfidic Odor
- ☐ Aquic Moisture Regime
- ☐ Reducing Conditions
- ☐ Gleyed or Low-Chroma Colors
- ☐ Concretions
- ☐ High Organic Content in Surface Layer in Sandy Soils
- ☐ Organic Streaking in Sandy Soils
- ☐ Listed on Local Hydric Soils List
- ☐ Listed on National Hydric Soils List
- ☐ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? ☐Yes ☒No (Check)

Wetland Hydrology Present? ☐Yes ☒No

Hydric Soils Present? ☐Yes ☒No

(Check)

Is this Sampling Point Within a Wetland? ☐Yes ☒No

Remarks GPS coordinates: 18.31961° N, 65.23530° W.

Approved by HQUSACE 3/92

Forms version 1/02

Appendix 4 – Field Data Sheets (continued).

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site:	Culebrita		Date:	August 10,2006
Applicant/Owner:	Ellis Environmental		County:	Culebra
Investigator:	Alejandro Cubiñá		State:	Puerto Rico
Do Normal Circumstances exist on the site?	☒Yes	☐No	Community ID:	Eastern Tidal Flat
Is the site significantly disturbed (Atypical Situation)?	☐Yes	☒No	Transect ID:	1
Is the area a potential Problem Area? (If needed, explain on reverse.)	☐Yes	☒No	Plot ID:	A

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Batis maritima	H	FACW	9.		
2. Conocarpus erectus	T	FACW	10.		
3.			11.		
4.			12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 2 out of 2 = 100 %

Remarks:

HYDROLOGY

☐ Recorded Data (Describe in Remarks):
- ☐ Stream, Lake, or Tide Gauge
- ☒ Aerial Photographs
- ☐ Other

☒ No Recorded Data Available

Field Observations:

Depth of Surface Water: _____ (in.)

Depth to Free Water in Pit: 6 (in.)

Depth to Saturated Soil: 0 (in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ☐ Inundated
- ☒ Saturated in Upper 12 Inches
- ☐ Water Marks
- ☐ Drift Lines
- ☐ Sediment Deposits
- ☐ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ☐ Oxidized Root Channels in Upper 12 Inches
- ☐ Water-Stained Leaves
- ☒ Local Soil Survey Data
- ☒ FAC-Neutral Test
- ☐ Other (Explain in Remarks)

Remarks:

Appendix 4 – Field Data Sheets (continued).

SOILS

Map Unit Name (Series and Phase): Tydal Flats (Td)

Drainage Class:

Field Observations

Taxonomy (Subgroup):

Confirm Mapped Type? ☒Yes ☐No

Profile Descriptions:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/ Size/Contrast	Texture, Concretions, Structure, etc,
0-15	A	Gley 1 2.5/10Y			Loamy Sand

Hydric Soil Indicators:

- ☐ Histosol
- ☐ Histic Epipedon
- ☐ Sulfidic Odor
- ☐ Aquic Moisture Regime
- ☐ Reducing Conditions
- ☒ Gleyed or Low-Chroma Colors
- ☐ Concretions
- ☐ High Organic Content in Surface Layer in Sandy Soils
- ☐ Organic Streaking in Sandy Soils
- ☒ Listed on Local Hydric Soils List
- ☐ Listed on National Hydric Soils List
- ☐ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? ☒Yes ☐No (Check)

Wetland Hydrology Present? ☒Yes ☐No

Hydric Soils Present? ☒Yes ☐No

(Check)

Is this Sampling Point Within a Wetland? ☒Yes ☐No

Remarks GPS coordinates: 18.31567° N, 65.23244 ° W

Approved by HQUSACE 3/92

Forms version 1/02

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site:	Culebrita			Date:	August 10,2006
Applicant/Owner:	Ellis Environmental			County:	Culebra
Investigator:	Alejandro Cubiñá			State:	Puerto Rico
Do Normal Circumstances exist on the site?		☒Yes	☐No	Community ID:	Eastern Tidal Flat
Is the site significantly disturbed (Atypical Situation)?		☐Yes	☒No	Transect ID:	1
Is the area a potential Problem Area? (If needed, explain on reverse.)		☐Yes	☒No	Plot ID:	B

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Tabebuia heterophylla	T	FAC	9.		
2. Conocarpus erectus	T	FACW	10.		
3. Elaeodendron xylocarpum	T	NL	11.		
4. Hippomane mancinella	T	NL	12.		
5. Randia aculeata	T	FAC	13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 3 out of 5 = 60%

Remarks:

HYDROLOGY

☐ Recorded Data (Describe in Remarks):
- ☐ Stream, Lake, or Tide Gauge
- ☐ Aerial Photographs
- ☐ Other

☒ No Recorded Data Available

Field Observations:

Depth of Surface Water: _____ (in.)

Depth to Free Water in Pit: _____ (in.)

Depth to Saturated Soil: _____ (in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ☐ Inundated
- ☐ Saturated in Upper 12 Inches
- ☐ Water Marks
- ☐ Drift Lines
- ☐ Sediment Deposits
- ☐ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ☐ Oxidized Root Channels in Upper 12 Inches
- ☐ Water-Stained Leaves
- ☐ Local Soil Survey Data
- ☐ FAC-Neutral Test
- ☐ Other (Explain in Remarks)

Remarks:

Appendix 4 – Field Data Sheets (continued).

SOILS

Map Unit Name (Series and Phase): Cataño Loamy Sand (Cf)

Drainage Class: _____

Field Observations

Taxonomy (Subgroup): Typic Tropopsamments

Confirm Mapped Type? ☒Yes ☐No

Profile Descriptions:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/ Size/Contrast	Texture, Concretions, Structure, etc,
0-7	A	10 YR 3/2			Loamy Sand

Hydric Soil Indicators:

- ☐ Histosol
- ☐ Histic Epipedon
- ☐ Sulfidic Odor
- ☐ Aquic Moisture Regime
- ☐ Reducing Conditions
- ☐ Gleyed or Low-Chroma Colors
- ☐ Concretions
- ☐ High Organic Content in Surface Layer in Sandy Soils
- ☐ Organic Streaking in Sandy Soils
- ☐ Listed on Local Hydric Soils List
- ☐ Listed on National Hydric Soils List
- ☐ Other (Explain in Remarks)

Remarks: Soil mixed with crushed coral. Below 7" limestone layer.

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	☒Yes ☐No (Check)	(Check)
Wetland Hydrology Present?	☐Yes ☒No	
Hydric Soils Present?	☐Yes ☒No	Is this Sampling Point Within a Wetland? ☐Yes ☒No

RemarksGPS coordinates: 18.31564° N, 65.23247°W

Approved by HQUSACE 3/92

Forms version 1/02

Appendix 4 – Field Data Sheets (continued).

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site:	Culebrita			Date:	August 10,2006
Applicant/Owner:	Ellis Environmental			County:	Culebra
Investigator:	Alejandro Cubiñá			State:	Puerto Rico
Do Normal Circumstances exist on the site?		☒Yes	☐No	Community ID:	Eastern Tidal Flat
Is the site significantly disturbed (Atypical Situation)?		☐Yes	☒No	Transect ID:	1
Is the area a potential Problem Area? (If needed, explain on reverse.)		☐Yes	☒No	Plot ID:	C

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Elaeodendron xylocarpus	T	NL	9.		
2. Conocarpus erectus	T	FACW	10.		
3. Crossopetalum rhacoma	T	NL	11.		
4. Bursera simaruba	T	NL	12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 1 out of 4 = 25%

Remarks:

HYDROLOGY

☐ Recorded Data (Describe in Remarks):
- ☐ Stream, Lake, or Tide Gauge
- ☐ Aerial Photographs
- ☐ Other

☒ No Recorded Data Available

Field Observations:

Depth of Surface Water: _____ (in.)

Depth to Free Water in Pit: _____ (in.)

Depth to Saturated Soil: _____ (in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ☐ Inundated
- ☐ Saturated in Upper 12 Inches
- ☐ Water Marks
- ☐ Drift Lines
- ☐ Sediment Deposits
- ☐ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ☐ Oxidized Root Channels in Upper 12 Inches
- ☐ Water-Stained Leaves
- ☐ Local Soil Survey Data
- ☐ FAC-Neutral Test
- ☐ Other (Explain in Remarks)

Remarks:

Appendix 4 – Field Data Sheets (continued).

SOILS

Map Unit Name (Series and Phase): Cataño Loamy Sand (Cf)

Drainage Class: _____

Field Observations

Taxonomy (Subgroup): Typic Tropopsamments

Confirm Mapped Type? ☒Yes ☐ No

Profile Descriptions:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/ Size/Contrast	Texture, Concretions, Structure, etc,
0-16	A	7.5YR 3/2			

Hydric Soil Indicators:

- ☐ Histosol
- ☐ Histic Epipedon
- ☐ Sulfidic Odor
- ☐ Aquic Moisture Regime
- ☐ Reducing Conditions
- ☐ Gleyed or Low-Chroma Colors
- ☐ Concretions
- ☐ High Organic Content in Surface Layer in Sandy Soils
- ☐ Organic Streaking in Sandy Soils
- ☐ Listed on Local Hydric Soils List
- ☐ Listed on National Hydric Soils List
- ☐ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? ☐Yes ☒No (Check)

Wetland Hydrology Present? ☐Yes ☒No

Hydric Soils Present? ☐Yes ☒No

(Check)

Is this Sampling Point Within a Wetland? ☐Yes ☒No

Remarks GPS coordinates: 18.31563° N, 65.23252°W

Approved by HQUSACE 3/92

Forms version 1/02

Appendix 5 – Data Point Photos.

Figure 8. Sampling point 2A.

Figure 9. Sampling point 2B.

Appendix 5 – Data Point Photos (continued).

Figure 10. Sampling point 2C.

Figure 11. Sampling point 1A.

Appendix 5 – Data Point Photos (continued).

Figure 11. Sampling point 1B.

Appendix 6 – Location of Wetlands and Sampling Transects.

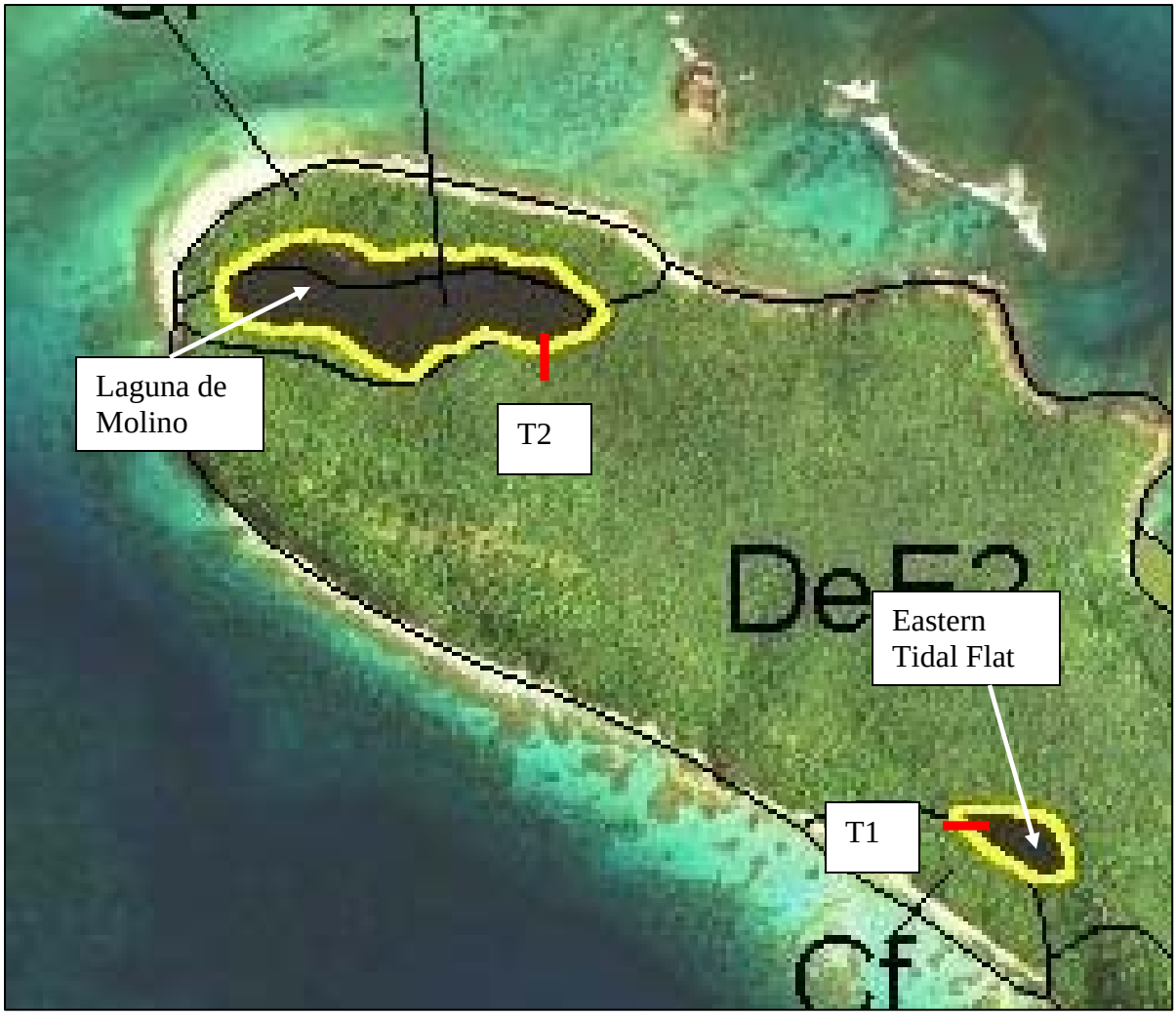


Figure 11. Location of both tidal wetlands and sampling transects. Yellow lines represent wetland boundaries.