Via Verde Natural Gas Pipeline Project

Biological Assessment

11 July 2011

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1 Introduction

This Biological Assessment (BA) for the Via Verde Natural Gas Pipeline Project (Project) was prepared by BCPeabody Construction Services, Inc. and Coll Rivera Environmental for Asesores Ambientales y Educativos, Inc. (AAE) and the Puerto Rico Electric Power Authority (PREPA, the applicant). Supplementary studies performed for PREPA/ AAE, revisions to the proposed alignment, and measures to reduce impacts have been submitted directly to the appropriate regulatory agencies during the Project development process. Where applicable, these studies and alignment changes have been noted in this updated BA. The purpose of this BA is to evaluate the effects of PREPA's proposed construction of the Project, which consists of a buried 24-inch diameter steel natural gas (NG) pipeline from the EcoEléctrica LNG Terminal in Peñuelas, north to the Cambalache Termoeléctricas Authority Central electric power plant (PES) in Arecibo, then east to the Palo Seco and San Juan power plants. The approximately 92 mile pipeline will pass through the municipalities of Peñuelas Adjuntas, Utuado, Arecibo, Barceloneta, Manati, Vega Alta, Vega Baja, Dorado, Toa Baja, Cataño, Bayamón, and Guaynabo.

Principal resources used to develop this report included:

The 2007 Puerto Rico GAP Final Report
Gould, W., et al. 2007. Puerto Rico Gap Analysis Project – Final Report. USGS, Moscow, ID and the USDA Forest Service International Institute of Tropical Forestry, Río Piedras, PR. 159pp. plus appendices.

U.S. Fish and Wildlife Service. 2000. Endangered Species List (Puerto Rico/Virgin Islands). Division of Endangered Species. U.S. Fish and Wildlife Service. 2007. Caribbean Endangered Species Map. Ecological Services in the Caribbean.

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Interactive Map Atlas and Associated Data

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Vega-Casillo, Sondra I. Search of the Puerto Rican crested toad *(Peltophyrne lemur)* and coqui llanero *(Eleutherodactylus juanariveroi*) in areas proposed for the construction of Via Verde.

Asesores Ambientales y Educativos, Inc. Via Verde Federally Listed Plant Species Report. March 2011.

BCPeabody Construction, P.A. PREPA Via Verde Pipeline, Essential Fish Habitat Evaluation. March 2011.

Coll Environmental, Wetlands and U.S. Waters Jurisdictional Determination Study – Via Verde Pipeline Project, Puerto Rico (Wetland JD report), August 2010. A copy of this report has been included in the PREPA, Via Verde Project, Declaraciòn de Impacto Ambientales. (Appendix D of the USACE Joint Permit Application)

Coll Environmental, Estudio Descriptivo de Flora Y Fauna – Via Verde Pipeline Project, Puerto Rico (Flora and Fauna report), August 2010. A copy of this report has been included in the PREPA, Via Verde Project, Declaraciòn de Impacto Ambientales. (Appendix D of the USACE Joint Permit Application)

PREPA - Via Verde Project, Declaraciòn de Impacto Ambientales *(DIA)*, August 2010. A copy of this report has been included in Appendix D of the USACE Joint Permit Application.

This BA was originally prepared as part of the Joint Permit Application (JP) evaluation process to comply with the requirements of Section 7 (a)(2) of the Endangered Species Act (ESA). This BA was designed to assist the U.S. Army Corps of Engineers (USACE) in consultations with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) with respect to Section 7 of the Endangered Species Act (ESA). This document has been prepared to:

- clarify whether and what listed, proposed, and candidate species or designated or proposed critical habitats may be in the action area;
- determine, when possible, what effect the action may have on these species or critical habitats;
- explain the ways the project has been modified to reduce or remove adverse effects to the species or critical habitats;
- determine the need to enter into consultation for listed species or designated critical habitats, or conference for proposed species or proposed critical habitats; and
- explore the design or modification of an action to benefit the species.

As cited in the ESA under provisions of Section 7(a)(2), "Each Federal agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of the habitat of such species which is determined by the Secretary, after consultation as appropriate with affected States, to be critical, unless such agency has been granted an exemption for such action by the Committee pursuant to subsection (h) of this section. In fulfilling the requirements of this paragraph each agency shall use the best scientific and commercial data available".

A total of 36 federally listed plant and animal species (25 plants and 14 animals) were originally identified as potentially occurring within the project limits. The species list initially presented included all individual species known to exist or have the potential to occur in the pipeline corridor as identified by the USFWS and NMFS. The lists of protected plants and animals for each municipality were used as a baseline. Subsequent review of the pipeline corridor route by the USFWS in June of 2010 further refined the target species for on-site field reconnaissance. Of the 36 federally listed species originally identified, only one plant species, Palo de rosa (*Ottoschulzia rhodoxylon*) and six animal species were confirmed to be present within the project right-of-way. These animal species included: two raptors (Puerto Rican sharp-shinned hawk and Puerto Rican broad winged hawk); the Puerto Rican Nightjar (Guabairo); the Puerto Rican Crested toad (Sapo Concho); the Coqui Llanero; and the Puerto Rican Boa.

2 Correspondence with Federal Agencies

The applicant has made extensive efforts to coordinate with the involved federal agencies prior to and throughout the permit process. Pre-application meetings to discuss the proposed project were held with USFWS and USACE on June 8 and June 28, 2010, respectively.

As it relates to this biological assessment, the applicant coordinated with USFWS and NMFS to ensure that all necessary surveys were performed appropriately and all data/information were properly collected. The applicant provided the USFWS with proposals for the necessary field surveys and field protocols. USFWS responded to these proposals on November 10, 2010 and December 2, 2010. A brief summary of additional correspondence is presented below. Subsequent correspondence is available in the record files of the USFWS and the USACE.

The applicant attended a meeting on December 8, 2010 with USFWS at their Boquerón offices to discuss the survey protocols for the following listed species: 1) Vegetation survey, 2) Raptor survey, 3) Nightjar (Guabairo) Presence Study, 4) Crested toad (Sapo Concho) and Coqui Llanero surveys, and the 5) Puerto Rican Boa survey. In response to this meeting, two site visits to the Peñuelas Dry Limestone area were conducted. The first site visit was conducted by USFWS biologists Omar Monsegur and Carlos Pacheco on December 13, 2010. The second site visit was attended by Biologists Monsegur, Pacheco and Rafael Gonzalez. Franklin Axelrod, Ph.D. and the applicant's consultant were present during these site visits.

On January 4, 2011 a site inspection was performed by USFWS biologists Mr. Rafael Gonzalez and Omar Monsegur with the applicant's consultant to evaluate the proposed observation points for the raptors study.

On January 6, 2011, the applicant's consultants held a meeting with NMFS at its St. Petersburg, Florida office. This meeting was held to discuss the particulars of an Essential Fish Habitat survey (EFH).

Between January 13, 2011 to January 23, 2011, two site visits were conducted by USFWS biologists to evaluate the methods and field work of the ongoing raptors surveys.

On February 7, 2011, the applicant met with USFWS personnel to discuss the protocol and the survey area to be sampled as part of the Nightjar (Guabairo) study. This meeting was held at the USACE office in San Juan. This meeting confirmed the protocol and dates to complete the survey for the nightjar study.

On February 11, 2011, a technical meeting was held between the applicant and USFWS at their Cabo Rojo facility. This meeting again involved discussion of the nightjar study. The meeting participants were Mr. Jose (Tito Chabert), Julio Cardona, the applicant's consultant, and USFWS Biologist Rafael Gonzalez. As a result of this meeting, in mid February 2011, USFWS Biologist Rafael Gonzalez and Omar Monsegur performed a site visit with Mr. Tito Chabert and Julio Cardona to evaluate the proposed study area at Peñuelas dry limestone. On February 23, 2011, USFWS biologist Rafael Gonzalez, made a site visit to review survey methods of the ongoing Guabairo field work being performed by Mr. Jose (Tito Chabert) and Julio Cardona.

On March 9, 2011 a third technical meeting was held at the USFWS Boquerón Office. The applicant provided the USFWS with an update of all the field work performed to that date and

the status of additional work required. A brief report on each of the field studies developed following the protocol approved was presented and discussed in great detail.

Again on March 17, 2011, USFWS Biologists Omar Monsegur and Carlos Pacheco performed a site visit with Frank Axelrod, Ph.D. and the applicant's consultant to the Peñuelas dry limestone study area in relation to the plant survey. A portion of the plant survey area was reviewed to verify plant survey transect locations and to demonstrate the general characteristics of the habitat.

In addition to the above mentioned meetings, supplementary formal correspondence with USFWS and NMFS further refined the protected plant and animal species reviewed in this BA. Based on the information provided by USFWS and NMFS, species specific surveys were completed and have been provided to the all of the above agencies under separate covers. In addition, the following field site visits were undertaken in collaboration with the Corps and USFWS:

May 18, 2011 – Penuelas West alternative alignment site visit; Nightjar habitat impacts

May 23, 2011 – PR 10 site visit; Puerto Rican Parrot impacts

May 25, 2011 – Penuelas East alternative alignment site visit; Nightjar habitat impacts

May 26, 2011 – Manati Karst Limestone alternative alignment site visits; plant impacts around Mogotes

June 6, 2011 – Penuelas Middle Connection site visit

June 14, 2011 – Foreman/Adjuntas site visit; historic property and habitat avoidance

3 Description of Proposed Action

Installation of the approximately 92 mile pipeline will generally require an initial construction right-of-way (ROW) approximately 100 feet wide in uplands and a maintained post-construction ROW of 50 feet. The total project area encompasses approximately 1,114 acres (92 miles X 100 foot ROW); approximately 369 acres or less of which are Waters of the United States. The actual construction corridor within the ROW will vary from 60 feet in some sensitive upland habitats to the maximum of 100 feet. In wetland areas, the construction corridor will be reduced

to limit the amount of temporary impacts (i.e. wetland habitat = max. 60 feet wide) and there will be no maintained post-construction ROW. The pipeline will traverse 235 waterbodies (rivers, wetlands, canals). The project will temporarily impact approximately 369 acres or less of jurisdictional bodies of water (Waters of the U.S.).

The project is expected to result in minimal permanent wetland impacts since all disturbed wetlands will be restored to pre-construction grades, stabilized, and revegetated. Selected sites along the alignment were visited by a joint Corps/FWS/Applicant team who assessed the current condition, condition post-construction, and condition with more intense revegetation and other efforts. Those assessments are being evaluated to prepare plans for on-site restoration and off-site compensatory mitigation. Less than 1 acre of wetland will be permanently impacted for the construction of several mainline valve stations (MLV). At these locations, only a 6-inch thick layer of gravel will be placed to support future maintenance of these valve stations.

3.1 Existing Conditions

The topography of the project corridor varies from flat to semi-level along the north segment (Mile Marker 40 to Mile Marker 92) to mostly steep in the southern segment (MM 4 to MM 40) that crosses the central range from Arecibo to Peñuelas. The project area includes four of the six life zones identified in Puerto Rico (Ewel and Whitmore, 1973). These life zones include: the Subtropical Dry Forest, Subtropical Wet Forest, Lower Montane Rain Forest, and Subtropical Moist Forest. Location data and approximate relative coverage of each zone within the project corridor are included in the table below.

Table 1: Project Life Zones

Project Life Zones				
Zone Type	Location, MM	Length, miles	Total Area, acres	% Project Area
Subtropical Dry Forest	0 – 5.25	5.25	63.5	5.8
Subtropical Wet Forest	12.25 – 13.5, 15 - 25	11.25	147.5	13.5
Lower Montane Rain Forest	13.5 – 15.0	1.5	10.6	1.0
Subtropical Moist Forest	5.25 – 12.25, 25 –	72.3	872.5	79.7

	92			

Detailed descriptions of existing conditions have been presented in the:

Coll Environmental *Wetlands and U.S. Waters Jurisdictional Determination Study – Via Verde Pipeline Project* and *Estudio Descriptivo de Flora Y Fauna – Via Verde Pipeline Project* reports and the PREPA - Via Verde Project, *Declaraciòn de Impacto Ambientales* .

Copies of these reports have previously been included in the PREPA, Via Verde Project, Declaraciòn de Impacto Ambientales (DEIS and FEIS)

The project path includes and exhibits a variety of land uses. Some of the land uses are still active, while other historic uses are recognized by their marks left on the landscape. Examples of current uses include: cattle grazing in varied intensities, sugar cane plantations, shade and sun grown coffee plantations, pineapple plantations, rice fields, and fallow agricultural lands.

While many of the species found during this survey are typical to habitats modified by anthropogenic means, there are species in some areas of the project showing ecological succession towards a more mature state. These trees are typical of secondary forest in Puerto Rico. The greatest diversity of trees was observed in the subtropical moist forest, which is present along both the north segment and part of the south section.

A composite list of protected, listed or endangered, species found within or likely to occur within the pipeline corridor route is found in Table 15. Descriptions and locations, when available, for Commonwealth parks and preserves associated with each municipality are presented and discussed below.

Table 2: Commonwealth Forests and Nature Preserves

PARKS AND RESERVES SUMMARY			
Municipality	Mile Marker	Map Number	Park/Reserve Name
Peneulas, Adjuntas	13.75 to 16.3	1	
Utuado	22.35 to 55	2	
Utuado, Arecibo	29.1 to 30.05	3	Bosque Estatal deRio Abjo
Arecibo	31.1 to 32.5	4	Bosque Estatal deRio Abjo
Arecibo	45.4 to 45.7	5	Reserva Cano Tiburones
Arecibo	47.2 to 48.7	6	Reserva Cano Tiburones
Arecibo	49.0 to 49.7	7	Reserva Cano Tiburones
Barceloneta	53.2 to 54.2	8	Reserva Natural Hacienda la Esperanza
Vega Baja, Vega Alta	70.6 to 71.5	9	Bosque Estatal de Vega
Vega Alta	72.4 to 73.6	10	
Dorado, Toa Baja	80.4 to 81.8	11	

Notes:
Mile Marker - Via Verde Pipeline, begin Penuelas MM 0.0 to end Guayanabo MM 92
Map Number - BCPeabody Critical Habitats and Wildlife Elements August 27, 2010

3.1.1 Peñuelas

Within the municipality of Peñuelas, the proposed Via Verde project corridor will run from mile 0 to approximately mile 14.5. Within this municipality, the proposed project corridor does not pass through any reserves or protected areas. The areas adjacent to the project corridor are a mix of industrial/developed areas and native shrubby vegetation commonly found along the southern coast of Puerto Rico.

Peñuelas is located within the Subtropical Dry Forest and the Subtropical Moist Forest life zones (Ewel and Whitmore, 1973). The USFWS identified the following federally threatened or endangered species as likely to occur in the Subtropical Dry Forest life zone: Palo de rosa (*Ottoschulzia rhodoxylon*), Bariaco (*Trichilia triacantha*), Diablito de tres cuernos (*Buxus vahlii*), *Eugenia woodburyana, Catesbaea melanocarpa, Cordia rupicola, Mitracarpus maxwelliae, Mitracarpus polycladus,* Guabairo (*Caprimulgus noctitherus*). Table 3 (below) lists the federally threatened or endangered species identified on USFWS Caribbean Endangered Species Map within the municipality of Peñuelas.

Table 3: Protected Species- Peñuelas

Federal Protected Species- Caribbean List

Federal Protected Species- Caribbean List			
Scientific Name	**Common Name**	**Distribution**	**Species**
Accipiter striatus venator	PR Sharp-Shinned Hawk	Monte Guilarte State Forest	Endangered
Buxus vahlii	Val's Boxwood	Tallaboa Limestone Hills	Endangered
Caprimulgus noctitherus	Puerto Rican Nightjar	Coastal Forest	Endangered
Chelonia mydas	Green Sea Turtle	Coastal Zones	Threatened
Cyathea dryopteroides	Elfin Tree Fern	Monte Guilarte State Forest	Endangered
Eretmochelys imbricata	Hawksbill Sea Turtle	Coastal Zones	Endangered
Eugenia woodburyana	No Common Name	Encarnacion West of Las Cucharas	Endangered
Pelecanus occidentalis	Brown Pelican	Coastal Zones, No Nesting	Endangered
Polystichum calderonense	No Common Name	Cerrote Peñuelas	Endangered
Stahlia monosperma	No Common Name	Tallaboa	Endangered
Sterna dougallii	Roseate Tern	Coastal Areas and Offshore Cays, Nesting	Threatened
Trichechus manatus manatus	Antillean Manatee	Coastal Zones	Endangered
Trichilia triacantha	No Common Name	Encarnacion, (Urb. El Peñon), Tallaboa Poniente	Endangered

3.1.2 Adjuntas

Within the municipality of Adjuntas, the proposed Via Verde project corridor will run from approximately mile marker 14.5 to mile marker 21.7. Within this municipality, the proposed project corridor does not pass through any reserves or protected areas.

The municipality of Adjuntas is located in three ecological life zones: Subtropical Wet Forest, Subtropical Moist Forest, and Subtropical Lower Montane Wet Forest (Ewel and Whitmore 1973). The USFWS initially identified the following federally threatened or endangered species as likely to occur in those ecological life zones: *Accipter striatus venator Amazona vittatta vittatta, Auerodendron pauciflorum, Banara vanderbilii, Buteo platypterus brunnescens, Buxus vahlii, Cordia bellonis, Daphnopsis hellerana, Juglans jamaicensis, Myrcia paganii, Ottoschulzia rhodoxylon, Pleodendron macranthum, Polystichum calderoense, Shoepfia arenaria, Tectaria, Thelypteris inabonensis, Thelypteris verecunda,* and *Zanthoxylum thomasianum.* Table 4 (below) lists the federally threatened or endangered species identified on the USFWS Caribbean Endangered Species Map within the municipality of Adjuntas.

Table 4: Protected Species- Adjuntas

Federally Protected Species- Caribbean List			
SCIENTIFIC NAME	**COMMON NAME**	**DISTRIBUTION**	**STATUS**
Accipiter striatus venator	PR Sharp-Shinned Hawk	Monte Guilarte State Forest	Endangered
Buteo platypterus brunnescens	Puerto Rican Broad-Winged Hawk	Monte Guilarte State Forest	Endangered
Cyathea dryopteroides	Elfin Tree Fern	Monte Guilarte State Forest	Endangered
Eleutherodactylus jasperi	Golden Coqui	Forested Mountains w/ elevations over 700 m.	Threatened
Epicrates inornatus	Puerto Rican Boa	Forested Volcanic and Limestone (Karst) Hills	Endangered
Juglans jamaicensis	West Indian Walnut	Monte Guilarte State Forest (La Silla de Calderón)	Endangered
Polystichum calderonense	No Common Name	Cerrote Peñuelas	Endangered

3.1.3 Utuado

In the municipality of Utuado, in the barrios of Rio Abajo, Rio Arriba, and Hato Viejo, the pipeline corridor will run 400 meters to the south and east of the Río Abajo State Forest Reserve from mile marker 28.4 to mile marker 35.

This forest and its associated wetlands have a great diversity of wildlife and varied vegetation. Within the forest, one hundred and seventy-five tree species were identified in past fauna studies; forty-seven of which are considered threatened or endangered. As a result of past deforestation that occurred in Puerto Rico during the 1930's, the Government of Puerto Rico began, and currently maintains programs for tree planting in Commonwealth forests. Some representative species of the native vegetation found in the forest are: algarrobo, almácigo, hairy camasey, canelilla, white capá, ceboruquillo, male cedar, kapok, cojoba, heart, Cork, rubial Hawthorn, guano, guara, higuerillo, jobo, magician, Palm coyor and tabaiba. Several research projects involving multiple endangered species that inhabit the forest are currently being conducted. Endemic and endangered species included are: erubia (*Solanum drymophilum)*, rosewood (*Ottoschulzia rhodoxylon)*, *Daphosis hellerana*, chigger (*Cornutia obovata)*, and *Cordia bellonis.*

In the Rio Abajo barrio, approximately 1,050 meters from the project corridor (Mile Marker 29.6), the endangered plant species, chupacallos (*Pleodendron macranthum*), was found during other flora studies. The species was not identified in the corridor during the PREPA flora study conducted by Coll Environmental or the Threatened and Endangered Plant Survey. Other

species found in the municipality of Utuado include: *Calyptronoma rivalis* and *Cornutia obovata*. Both have been identified from previous corridor studies: the locations are approximately 3,000 meters from the project.

The proposed project corridor follows, and will be co-located within, an existing transportation right-of way for about 2.3 miles (MM 30.5 - 31 and 25.2 - 27) within the municipality of Utuado.

Table 5 (below) lists the federally threatened or endangered species identified on the USFWS Caribbean Endangered Species Map within the municipality of Utuado.

Table 5: Protected Species- Utuado

Federally Protected Species- Caribbean List			
SCIENTIFIC NAME	**COMMON NAME**	**DISTRIBUTION**	**STATUS**
Accipiter striatus venator	PR Sharp-Shinned Hawk	Monte Guilarte State Forest	Endangered
Amazona vittata vittata	Puerto Rican Parrot	Rio Abajo State Forest	Endangered
Auerodendron pauciflorum	No Common Name	Rio Abajo State Forest	Endangered
Buteo platypterus brunnescens	Puerto Rican Broad-Winged Hawk	Monte Guilarte State Forest	Endangered
Calyptronoma rivalis	No Common Name	Rio Abajo State Forest	Threatened
Cordia bellonis	No Common Name	Rio Abajo State Forest	Endangered
Cornutia obovata	No Common Name	Rio Abajo State Forest	Endangered
Epicrates inornatus	Puerto Rican Boa	Forested Volcanic and Limestone (Karst) Hills	Endangered
Juglans jamaicensis	West Indian Walnut	Monte Guilarte State Forest (La Silla de Calderón)	Endangered
Pelecanus occidentalis	Brown Pelican	Lago Dos Bocas, no nesting	Endangered
Patagioenas (Columba) inornata wetmorei	Puerto Rican Plain Pigeon	Lower Montane Forest and Riparian Habitats	Endangered
Pelecanus occidentalis	Brown Pelican	Coastal Zones, Lago Dos Bocas, No Nesting	Endangered
Pleodendron macranthum	No Common Name	Rio Abajo State Forest	Endangered
Schoepfia arenaria	No Common Name	Río Abajo State Forest (Cuesta de los Perros)	Threatened
Solanum drymophilium	Erubia	Rio Abajo State Forest	Endangered
Tectaria estremerana	No Common Name	Rio Abajo State Forest	Endangered

3.1.4 Arecibo

The municipality of Arecibo has several protected areas. These include the Río Abajo Forest, Cambalache Forest and the Caño Tiburones Reserve. These protected areas have been

designated by the Puerto Rico Department of Natural and Environmental Resources (DNER), as critical habitat for several flora and fauna species.

At the border with the municipality of Utuado, the pipeline corridor will pass through the eastern boundary of the Río Abajo Forest in two locations for a total distance of approximately 3.5 miles. The project corridor will additionally pass through approximately 1.54 miles of the Caño Tiburones.

Several species of flora that are federally listed as threatened or endangered species have been identified in these two natural systems. Those species identified as potentially occurring in the path of the project are: *Auerodendron pauciflorum*, Palm of Manaca (*Calyptronoma rivalis*), *Cordia bellonis*, chigger stick (*Cornutia obovata)*, *Myrcia paganii*, matabuey (*Goetzea elegans*), rosewood (*Ottoschulzia rhodoxylon*), chupacallos (*Pleodendron macranthum*), *Schoepfia arenaria*, erubia (*Solanum drymophilum*), and *Tectaria estremerana*.

Table 6: Protected Species- Arecibo

Federal Protected Species – Caribbean List			
Scientific Name	Common Name	Location	Status
Accipiter striatus venator	Puerto Rican Sharp-shinned hawk	Rio Abajo State Forest	Endangered
Amazona vittatta vittatta	Puerto Rican Parrot	Rio Abajo State Forest	Endangered
Auerodendron pauciflorum	No Common Name	Rio Abajo State Forest	Endangered
Buteo platypterus brunnescens	Puerto Rican Broad-winged Hawk	Rio Abajo State Forest	Threatened
Calyptronoma rivalis	No Common Name	Rio Abajo State Forest	Endangered
Chelonia mydas	Green sea turtle	Coastal Zones	Threatened
Cordia bellonis	No Common Name	Rio Abajo State Forest	Endangered
Cornutia obovata	chigger stick	Rio Abajo State Forest	Endangered
Dermochelys coriacea	Leatherback sea turtle	Coastal Zones	Endangered
Epicrates inornatus	Puerto Rican boa	Forested Volcanic and Limestone (karst) hills	Endangered
Eretmochelys imbricata	Hawksbill sea turtle	Coastal Zones	Endangered
Goetzea elegans	Matabuey	Cambalachee State Forest	Endangered
Myrica paganii	No Common Name	Biafara Arrozal	Endangered
Ottoschulzia rhodoxylon	Rosewood	Cambalachee State Forest, Sabana Hoyos	Threatened
Pelicanus occidentalis	Brown Pelican	Coastal Zones, no nesting	Endangered
Peltyophryne lemur	Puerto Rico crested toad	Northern karst regions	Threatened
Pleodendron macranthum	chupacallos	Rio Abajo State Forest	Endangered
Schoepfia arenaria	No Common Name	Río Abajo State Forest	Threatened

Federal Protected Species – Caribbean List			
		(Cuesta de los Perro)	
Solanum drymophilum	Erubia	Rio Abajo State Forest	Endangered
Tectaria estremerana	No Common Name	Rio Abajo State Forest	Endangered
Trichechus manatus	Antillean Manatee	Coastal Zones	Endangered

Sections 5 and 6 include a brief description of these species.

3.1.5 Barceloneta

A part of the Caño Tiburones natural reserve lies in this municipality, approximately 543 meters north of the project corridor right-of-way, at Mile Marker 51.0 to 51.30. This reserve is the longest herbaceous marsh on the Island, and the second largest in the Caribbean. This coastal wetland plays an important role in quantity and quality of storm water treatment.

The U.S. Fish and Wildlife Service's Caribbean Endangered Species List for the Municipality of Barceloneta identifies seven species, six of which are characterized as marine or coastal zone species. The only terrestrial species identified is the Puerto Rican Boa. Due to the wide range of habitats and overall distribution of the boa, this species is considered to have the potential to occur throughout the entire project construction corridor right-of-way. The project will not result in any impacts to marine or coastal zone habitats and all of these open water crossings will be directionally drilled.

Table 7: Protected Species- Barceloneta

Federal Protected Species – Caribbean List			
Scientific Name	Common Name	Location	Status
Chelonia mydas	Green Sea turtle	Marine Coastal	Threatened
Dermochelys coriacea	Leatherback Sea Turtle	Marine Coastal	Endangered
Epicrates inornatus	Puerto Rican Boa	Forested Volcanic / Limestone (Karst) Hills	Endangered
Eretmochelys imbricata	Hawksbill Sea Turtle	Marine Coastal	Endangered
Pelecanus occidentalis	Brown Pelican	Coastal Zones	Endangered
Sterna dougallii	Roseate Tern	Coastal Zones	Threatened
Trichechus manatus manatus	Antillean Manatee	Marine Coastal	Endangered

Flora found in the project corridor throughout the municipality varied. The land cover within the project right-of-way corridor ranges from farmlands (pineapple and other minor fruits) and fallow uncultivated areas to herbaceous wetlands and open freshwater wetlands with floating aquatics.

3.1.6 Manati

The project corridor will pass through approximately 1.1 miles of the Hacienda La Esperanza nature reserve in the municipality of Manatí. The importance of this reserve lies mainly in its diversity of terrestrial and marine natural resources. It is classified as an important area for wildlife that uses this area for foraging and reproduction. There is a dense, structurally complex natural forest located within the mogotes (haystacks) area in the southeast of the Municipality. This forest consists of a secondary forest composed mostly of invasive species, secondary spiny forest composed mostly of tintillo (*Randia aculeata*), a new growth area of invasive herbaceous vegetation, mostly of exotic origin, bamboo forest, tall herbaceous species (brava cane) and other exotic species that grow on the edge of the Manati River. Portions of this system are brackish water due to past flood control. These areas are populated by tidal marsh species. Salterns, mostly devoid of vegetation due to high salinity (irregularly inundated by extreme high tides) and fringed by red, white, and black mangroves, and buttonwood are also an important vegetative community in this system. The forest along the route in Manati is within the mogotes (haystacks). It is in the southeast of the municipality. The rest of the route crosses basically herbaceous areas associated with the Rio Grande de Manati floodplain.

One species listed as Endangered, the rosewood (*Ottoschulzia rhodoxylon*), is likely to be found within the limits of the construction right of way, although it is not included in the federal list for Manati nor was it identified during the flora and fauna study conducted for the Via Verde Pipeline. One specimen of this species has however been previously documented approximately 2,650 meters north of the project right-of-way.

Table 8: Protected Species- Manati

Federal Protected Species - Caribbean List			
Scientific Name	Common Name	Location	Status
Agelaius xanthomus	Yellow-Shouldered Black Bird	Coastal Forest	Endangered
Chamaecrista glandulosa var mirabilis	No Common Name	Tortuguero Lagoon Natural Reserve	Endangered
Chelonia mydas	Green Sea Turtle	Coastal Zones	Threatened
Epicrates inornatus	Puerto Rican Boa	Forested Volcanic / Limestone (Karst) Hills	Endangered

Pelecanus occidentalis	Brown Pelican	Coastal Zones, No Nesting	Endangered
Schoepfia arenaria	No Common Name	Tortuguero Lagoon Natural Reserve	Threatened
Sterna dougallii	Roseate Tern	Coastal Areas and Offshore Cays, Nesting	Threatened
Trichechus manatus manatus	Antillean Manatee	Coastal Zones	Endangered

The remainder of this segment of the project corridor (from Mile Marker 54.75 mile to Mile Marker 63.45) includes vegetation consisting of weeds and shrubs commonly found on the northern coast of Puerto Rico. None of the vegetation within the corridor was identified as threatened or endangered.

3.1.7 Vega Baja and Vega Alta

Vega State forest includes six areas that are distributed between the municipalities of Vega Alta and Vega Baja. Vega Alta and Vega Baja have been considered as one region since all parts of the corridor pass through a single preserve area, the Bosque Estatal de Vega. This preserve area is found within the construction right-of-way for both Municipalities.

These areas are classified as moist subtropical forest. Forest flora is represented by seventy-two species of trees. Four federally listed plant species have been initially identified as possibly occurring within the project right-of-way for these two municipalities. These include the Erubia (*Chamaecrista glandulosa var mirabilis*), *Daphnopsis hellerana*, rosewood (*Ottoschulzia rhodoxylon*), and *Schoepfia arenaria*.

Table 9: Protected Species- Vega Baja and Vega Alta

Federal Protected Species - Caribbean List			
Scientific Name	Common Name	Location	Status
Chamaecrista glandulosa var mirabilis	No Common Name	Tortuguero Lagoon Natural Reserve	Endangered
Chelonia mydas	Green Sea Turtle	Coastal Zones	Threatened
Daphnopsis hellerana	No Common Name	Bloques Carmelo	Endangered
Dermochelys coriacea	Leatherback sea turtle	Coastal Zones	Endangered
Epicrates inornatus	Puerto Rican boa	Forested Volcanic and Limestone hills	Endangered
Eretmochelys imbricata	Hawksbill sea turtle	Coastal Zones	Endangered
Pelecanus occidentalus	Brown Pelican	Coastal Zones	Endangered

Federal Protected Species - Caribbean List			
Ottoschulzia rhodoxylon	Stick of roses	Sabana Ward	Endangered
Schoepfia arenaria	No Common Name	Tortuguero Lagoon Natural Reserve	Threatened
Trichechus manatus manatus	Antillean manatee	Coastal Zones	Endangered

3.1.8 Dorado

The U.S. Fish and Wildlife Service's Caribbean Endangered Species List for the Municipality of Dorado identifies nine species, four of which are characterized as marine or coastal zone species. The only terrestrial faunal species identified is the Puerto Rican Boa. Due to the wide range of habitats and overall distribution of the boa, this species will be considered to have the potential to occur throughout the entire project construction corridor right-of-way. The project will not result in any impacts to marine or coastal zone habitats and all open water crossings will be directionally drilled.

The Ramon stick (*Banara vanderbilitii)*, rosewood (*Ottoschulzia rhodoxylon*), and *Daphnopsis hellerana* are listed as endangered plants. In Dorado, most of the route goes through herbaceous areas, or the PR-22 right of way. Suitable habitat for the above mentioned species (except Chamaecrista) is typically limited to haystacks. Chamaecrista was not found. It prefers silica sands, which were not found in that segment of the route.

Table 10: Protected Species- Dorado

Federal Protected Species - Caribbean List			
Scientific Name	Common Name	Location	Status
Banara vanderbiltii	Ramón stick	Near Rio Lajas Limestones	Endangered
Chamaecrista glandulosa var mirabilis	No Common Name	Sardinera	Endangered
Daphnopsis hellerana	No Common Name	Rio Lajas	Endangered
Eretmochelys imbricata	Hawksbill sea turtle	Coastal Zones	Endangered
Epicrates inornatus	Puerto Rican Boa	Forested Volcanic / Limestone (Karst) Hills	Endangered
Ottoschulzia rhodoxylon	Rosewood	Cerro Higuillar, Espinosa Ward, Maguayo Ward	Endangered
Pelecanus occidentalus	Brown Pelican	Coastal Zones	Endangered
Trichechus manatus manatus	Antillean manatee	Coastal Zones	Endangered

3.1.9 Toa Baja

None of the federally listed species known to exist within the Municipality of Toa Baja were found in the project corridor.

Table 11: Protected Species- Toa Baja

Federal Protected Species - Caribbean List			
Scientific Name	Common Name	Location	Status
Banara vanderbiltii	Ramón stick	Rio Lajas Hills	Endangered
Chelonia mydas	Green Sea Turtle	Coastal Zones	Threatened
Daphnopsis hellerana	No Common Name	Nevares Limestone Hills, Near Sabana Seca, Primate Center	Endangered
Epicrates inornatus	Puerto Rican boa	Forested Volcanic and Limestone hills	Endangered
Eretmochelys imbricata	Hawksbill sea turtle	Coastal Zones	Endangered
Ottoschulzia rhodoxylon	Stick of roses	Media Luna Ward, Candelaria Ward	Endangered
Pelecanus occidentalus	Brown Pelican	Coastal Zones	Endangered
Trichechus manatus manatus	Antillean manatee	Coastal Zones	Endangered

3.1.10 Cataño

Cataño has several environmentally sensitive areas of high natural value that must be protected. These areas include: La Esperanza Park, the Laguna Secreta, remnant wetlands from channelizing the Bayamón River, and the historic mouth of the River Bayamón. Remnants of wetlands can also be found along the project construction right-of-way at the Hondo River.

The vegetation associated with these estuarine wetlands includes black mangrove (*Avicennia germinans*) and white mangrove (*Laguncularia racemosa*). The Laguna Secreta is located 100 meters north of the project right-of-way. This area is dominated by cattail marsh with several remnants of marshy areas occupied by the black mangrove.

The U.S. Fish and Wildlife Service's Caribbean Endangered Species List for the Municipality of Catano identifies four species, all of which are characterized as marine or coastal zone species.

Table 12: Protected Species- Catano

Federal Protected Species - Caribbean List			
Scientific name	Common name	Location	Status
Chelonia mydas	Green Sea Turtle	Coastal Zones	Threatened
Eretmochelys imbricata	Hawksbill Sea Turtle	Marine Coastal	Endangered
Pelecanus occidentalis	Brown Pelican	Coastal Zones, No Nesting	Endangered
Trichechus manatus manatus	Antillean Manatee	Coastal Zones	Endangered

The project will not result in any impacts to marine or mangrove forested coastal zone habitats and open water crossings will be directionally drilled.

3.1.11 Bayamón

The U.S. Fish and Wildlife Service's Caribbean Endangered Species List for the Municipality of Bayamon identifies six species, four of which are endangered plant species. The four endangered plant species include: *Banara vanderbiltii, Buxus vahlii, Daphnopsis hellerana,* and *Ottoschulzia rhodoxylon*. The only terrestrial faunal species identified is the Puerto Rican Boa. Due to the wide range of habitats and overall distribution of the boa, this species will be considered to have the potential to occur throughout the entire project construction corridor right-of-way.

The remaining species is the Puerto Rican Plain Pigeon.

Table 13: Protected Species- Bayamon

Federal Protected Species - Caribbean List			
Scientific Name	Common Name	Location	Status
Banara vanderbiltii	Ramón stick	PR-2	Endangered
Buxus vahlii	Val's Boxwood	Hato Tejas, Parque de las Ciencias	Endangered
Daphnopsis hellerana	No Common Name	Sabana Seca, PR-2	Endangered
Epicrates inornatus	Puerto Rican Boa	Forested Volcanic / Limestone (Karst) Hills	Endangered
Ottoschulzia rhodoxylon	Stick of roses	Hata Tejas, Parque de las Ciencias	Endangered
Patagioenas (Columba) *inornata wetmorei*	Puerto Rican Plain Pigeon	Lower Montane Forests and Riparian Habitats	Endangered

Sections 5 and 6 include a brief description of the federally listed species.

3.1.12 Guaynabo

According to the U.S. Fish and Wildlife Service 2007 *Caribbean Endangered Species Map*, six federally listed species, including the Yellow Shouldered Black Bird (*Agelaius xanthomus*) and the rosewood (*Ottoschulzia rhodoxylon)* have been identified from the municipality of Guaynabo.

Table 14: Protected Species- Guaynabo

Federal Protected Species - Caribbean List			
Scientific Name	Common Name	Location	Status
Agelaius xanthomus	Yellow-Shouldered Black Bird	Coastal Forest	Endangered
Patagioenas (Columba) inornata wetmorei	Puerto Rican Plain Pigeon	Lower Montane Forest and Riparian Habitats	Endangered
Ottoschulzia rhodoxylon	Stick of roses	Hata Tejas, Parque de las Ciencias	Threatened
Epicrates inornatus	Puerto Rican Boa	Forested Volcanic / Limestone (Karst) Hills	Endangered
Pelecanus occidentalis	Brown Pelican	Coastal Zones, No Nesting	Endangered
Trichechus manatus manatus	Antillean Manatee	Coastal Zones	Endangered

4 Species Account

The following criteria were used to determine the list of sensitive species covered in this document:

- Species considered by the agencies that are federally or state listed as threatened/, endangered, candidate or proposed and occur or have the potential to occur within the project area. Non-federally listed species are examined if there is the potential for future federal listing.
- Species observed in the project area as recorded in the Flora and Fauna Study.
- Species that have the potential to occur in the project area as determined or suggested by USFWS and NMFS
- Species suggested presence as recorded in previous studies
- Species identified as occurring in or near the project area during past studies

As required, this biological assessment addresses all listed and proposed species found within the action area, not just those listed and proposed species that are likely to be affected. The

purpose of this biological assessment is to help make the determination of whether the proposed action is "likely to adversely affect" a listed or proposed species.

The status, life history, habitat requirements, current conditions, conservation measures, and conclusions are provided for each listed species in Sections 5 (USFWS species) and 6 (USFWS/NMFS species) of this BA. Table 15 presents those species considered by this Biological Assessment.

5 USFWS and DNER Listed Species

As previously mentioned, a total of 46 species are reviewed in this Biological Assessment. Of these species, USFWS has jurisdiction over 38. In a letter dated December 15, 2010, USFWS concurred with the USACE's determination that the "proposed project may affect the following listed species: Puerto Rican nightjar (*Caprimulgus nocitherus*); Puerto Rican parrot (*Amazonia vittatta vittatta*); Puerto Rican crested toad (*Peltyophryne nocitherus*); Puerto Rican boa (*Epicrates inornatus*); Puerto Rican sharp-shinned hawk (*Accipiter striatus venator*); Puerto Rican broad-winged hawk (*Buteo platypterus brunnescens*); Puerto Rican plain pigeon (*Patagioenas inornata wetmorei*); and the listed plant species *Aurodendron pauciflorum,* Palo de Ramon (*Banara vanderbilitii*), diabilto de tres cuernos (*Buxus valhi*), *Cordia bellonis*, *Daphnopsis helleriana,* palo de rosa (*Ottoshulzia rhodoxlyon*), *Myrica paganii, Tectarea estremerana, Thelypteris inabonensis, Thelypteris verecunda, Thelypteris yaucoensis, Chamaecrista glandulosa,* cobana negra (*Stahlia monosperma*), *Polystichm calderoense,* nogal (*Juglans jamaicensis*), *Mitricarpus mexwelliae, Mitricarpus polycladus, Cordia rupicola, Catesbaea melanocarpa, Eufenia woodburyana,* bariaco (*Thrichilia triacantha*), and St. Thomas prickly ash (*Zanthoxylun thomasianum*). USFWS recommended "surveys of the petitioned species coqui llanero (*Eleutherodactylus juanariveroi*). In the same letter, USFWS stated that the USACE "needs to make an effect determination with regards to the endangered Antillean manatee (*Trichechus manatus*). Subsequent to the initial USFWS determination, the USFWS has indicated that the Puerto Rican parrot (*Amazonia vittatta vittatta*) and the Puerto Rican plain pigeon (*Patagioenas inornata wetmorei*) will not be affected by the project alignment as currently proposed. All of the above mentioned species have been included in this Biological Assessment and are reviewed below. Additional plant and wildlife species have been included when past studies have shown their potential presence in the vicinity of the proposed project.

5.1 Vegetation

A total of 29 species of plants on the federal list have the potential to occur within the identified pipeline corridor. Only one species, the palo de rosa (*Ottoshulzia rhodoxlyon*) was found during the plant studies conducted by Dr. Frank Axelrod. No critical habitats have been published for this species in Puerto Rico.

The threatened and endangered vegetation survey was conducted by Franklin Axelrod, Ph.D. during the months of November 2010 through March 2011. As a result of the survey, three (3) individuals of a single species were observed in the Manati study segment. No other species were observed in the field. To avoid and/or minimize impacts to the observed species and potential habitat for listed species, the pipeline has been realigned and the construction corridor reduced in this area.

The areas included in these supplementary surveys and the associated listed vegetation were identified by USFWS and Franklin Axelrod, Ph.D. These areas were as follows:

Area 1 - Dry limestone hills in Peñuelas:

Target species identified by USFWS: 1*) Ottoschulzia rhodoxylon* (palo de rosa), *2) Trichilia triacantha* (bariaco), *3) Buxusvahlii (*diablito de trescuemos*), 4) Eugenia woodburyana, 5) Catesbaea melanocarpa, 6) Cordia rupícola, 7) Mitracarpus maxwelliae, and 8) Mitracarpus polycladus.*

Area 2 -Central Mountain Range (Volcanic):

Target species identified by USFWS:*1) Thelypteris inabonensis, 2) Thelypteris yaucoensis, 3) Thelypteris verecunda, 4) Juglan jamaicensis(nogal), and 5) Polystichum calderoense.*

Area 3 - Moist limestone (Manatí):

Target species identified by USFWS: 1*) Cordia bellonis, 2) Ottoschulzia rhodoxylon* (palo de rosa)*, 3) Daphnopsis helleriana, 4) Solanum drymophilum* (erubia), *5) Pleodendron macranthum (chupacallos), 6) Myrcia paganii, 7) Shoepfia arenaria, 8) Tectarea estremerana, and 9) Auerodendron pauciflorum.*

Coll Rivera Environmental conducted two Flora and Fauna studies for the proposed project. Results from these studies have been provided to USACE. These studies cataloged all of the species of flora within the arranged study areas.

5.1.1 Auerodendron pauciflorum – (No Common Name)

Federal Status: Endangered

5.1.1.1 General Species Biology

The *Auerodendron pauciflorum* is a shrub or small evergreen tree that can reach 5 meters (16.5 feet) high. The leaves are opposite or sub-opposite, glabrous, and elliptical, 15.6 cm (2.5 to 6 inches) long and 3.5 to 6 centimeters (1.5 to 2.5 inches) wide with tiny black glandular spots. Two or three flowers are found in the axils of the leaves. The fruit are not described and seeds have not been observed in the field.

5.1.1.2 Distribution and Abundance

The species is found in limestone elevations in northwest Puerto Rico. Only 19 individual plants are known for the four groups in the Barrio Coto de Isabela area near the intersection of Highway 113 road and Highway 2. *A. pauciflorum* was included in the Federal Endangered species list on 2 March 1994 due to habitat destruction.

5.1.1.3 Current Conditions

A. pauciflorum was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor. Additionally, this species was not observed during the threatened or endangered vegetation survey conducted by Dr. Frank Axelrod, Ph.D. Potential suitable habitat may exist on the Rio Abajo State Forest region, as well as the limestone hills of the northern section of Project route.

5.1.1.4 Summary of Impacts

No direct impacts are anticipated to this species since the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod.

5.1.1.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Since potential suitable habitat may exist in some sections of the Project route, indirect impacts to this species may occur if its habitat is significantly diminished by the construction of the Project. According to available scientific literature, no relation with other flora or faunal species is known, therefore, interdependent or interrelated effects cannot be assessed in the present. Cumulative effects may occur when the construction of the Project and other construction or development projects reduce the amount of available habitat of *A. pauciflorum*.

5.1.1.6 Conservation Measures and Recommendations

See 5.1.30.

5.1.1.7 Conclusion

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod. Therefore, the Project may affect, but is not likely to adversely affect *A. pauciflorum* species.

5.1.2 *Banara vanderbilitii* – (Palo de Ramón)

Federal Status: Endangered

5.1.2.1 General Species Biology

Palo de Ramón is an evergreen shrub or small tree that reaches 10 meters (33 feet) high and 12 cm (5 inches) in diameter. Leaves are alternate in a single plane, have a toothed margin and are densely pubescent on both sides. The older leaves become rough textured similar to the role of sandpaper on the upper surface. Flowers are bisexual and pollinate themselves. The fruit was discovered in 1985 and consists of berries with many seeds, deep red to purple, with an enlarged calyx and long tip style.

5.1.2.2 Distribution and Abundance

The species is known in the karstic northern regions of Puerto Rico and in the Central Highlands area. Specifically, the Palo de Ramón is found in semi-evergreen forests in two locations that are privately owned in northern Puerto Rico; one from Toa Baja to Bayamón and one in the municipality of Salinas (USFWS 1990). Two populations consist of six plants less than 16 meters square (52 sq ft) in the location of Toa Baja and five individuals in Salinas. It has also been found in Dorado and San Juan, according to the Map of Species Occurrence, USFWS Species Profile. The species was included in the list of federal protection on January 14, 1987.

5.1.2.3 Current Conditions

B. vanderbilitii was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor. Additionally, this species was not observed during the threatened and endangered vegetation survey conducted by Franklin Axelrod, Ph.D. Potential suitable habitat for this species may exist on the limestone hills of the northern section of the Project route.

5.1.2.4 Summary of Impacts

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod.

5.1.2.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Since potential suitable habitat may exist in some sections of the Project route, indirect impacts to this species may occur if its habitat is significantly diminished by the construction of the Project. According to available scientific literature, no relation with other flora or faunal species is known, therefore, interdependent or interrelated effects cannot be assessed in the present. Cumulative effects may occur when the construction of the Project and other construction or development projects reduce the amount of available habitat of *B. vanderbilitii*.

5.1.2.6 Conservation Measures and Recommendations

See 5.1.30.

5.1.2.7 Conclusion

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod. Therefore, the Project may affect, but is not likely to adversely affect *B. vanderbilitii* species.

5.1.3 Buxus vahlii – Diablito de tres cuernos

Federal Status: Endangered

5.1.3.1 General Species Biology

The diablito de tres Cuernos is an evergreen shrub that grows 4.5 meters (15 feet) tall with a trunk up to 13 cm (5 inches) in diameter. Branches have two channels below each pair of leaves. Oblong leaves are simple, opposite, green dark shiny, and grow to 3-4 cm (1.2 - 1.6 inches) long and about two centimeters (0.75 inch) wide. Flowers group is small, about 6-7 mm (0.25 inches) long, and is composed of a single female flower at the end of several male flowers just below it. Fruiting occurs December to early April, producing black, shiny seeds from 3-4 cm (1.2-1.6 inches) long in a capsule type horn.

5.1.3.2 Distribution and Abundance

The species is found in three locations in Puerto Rico: on the nuclear energy property of the Commonwealth of Puerto Rico at Punta Higüero, Rincón; at the plant in Hato Tejas, Bayamón, near of Highway No. 2, 650 meters (2,130 feet) west of the intersection with the road No. 167 (on land owned by Pan American Investment, Inc.) (USFWS 1990); and at Isabela. In 1984, there was an estimate of 16 plants at the Rincón site and 24 plants at Hato Tejas, Bayamón.

5.1.3.3 Current Conditions

The Diablito de tres cuernos was listed as a Federal Endangered species on August 13, 1985. Potential threats to the Diablito de tres cuernos include the destruction or modification of its habitat, the pollution of air and water, and development. The vulnerability generally increases due to the small size of the population, easy access, low rate of reproduction, and likely loss of genetic variation in species from both locations. *B. vahlii* was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor. Additionally, this species was not observed during the threatened and endangered vegetation survey conducted by Franklin Axelrod, Ph.D. The USFWS and the DNER confirmed the presence of this species between Guayanilla and Ponce. The DNER found a population of approximately 500 individuals of this species in that area. Potential suitable habitat for this species may be present on the limestone hills of Peñuelas and of the northern section of the Project route.

5.1.3.4 Summary of Impacts

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod.

5.1.3.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Since potential suitable habitat may exist in some sections of the Project route, indirect impacts to this species may occur if its habitat is significantly diminished by the construction of the Project. According to available scientific literature, no relation with other flora or faunal species is known, therefore, interdependent or interrelated effects cannot be assessed in the present. Cumulative effects may occur when the construction of the Project and other construction or development projects reduce the amount of available habitat of *B. vahlii*.

5.1.3.6 Conservation Measures and Recommendations

See 5.1.30.

5.1.3.7 Conclusion

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod. Therefore, the Project may affect, but is not likely to adversely affect *B. vahlii* species.

5.1.4 *Calyptronoma rivalis* – (Palma de manaca)

Federal Status: Threatened

5.1.4.1 General Species Biology

The Palma de manaca is a palm tree that reaches approximately 8-10 m (26-33 ft) tall. Its trunk is soft and can grow up to 13-25 centimeters (5-10 inches) in diameter. The species has pen-shaped leaves that can reach up to 3-4 meters (10-13 feet) long. The base of the petiole can be measured approximately 61 cm (two feet) long. Its large flowers are stacked, branched and downward. The flowers are arranged into triads of two males and one female. Fruits, less than 6 mm (0.25 inch) wide, are imperfect and reddish, rounded when ripe and are born in summer.

5.1.4.2 Distribution and Abundance

This species was designated as threatened on February 6, 1990. *Calyptronoma rivalis* was previously known only from three wild populations in Puerto Rico: (1) adjacent to the Quebrada Collazo, a small Creek near San Sebastián; (2) for the Camuy River, and; (3) in the Rio Guajataca (USFWS 1990). The combined total population identified at these three locations is about 265 individuals. Three natural populations are located in the semi-evergreen limestone forests of northwestern Puerto Rico at elevations between 100 to 150 meters (490 to 325 feet). In the southern portion of the Camuy River, some individuals are located at the bottom of deep canyons. Its distribution has been revised to include Arecibo and Utuado (Map of Species Occurrence, Species Profile, USFWS). Deforestation caused by development, flash floods (compounded by the effect of deforestation) and forest fires are the most serious threats to these plants.

5.1.4.3 Current Conditions

C. rivalis was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor.; Potential suitable habitat may exist in the Arecibo/Utuado section of Project route.

5.1.4.4 Summary of Impacts

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod.

5.1.4.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Since potential suitable habitat may exist in some sections of the Project route, indirect impacts to this species may occur if its habitat is significantly diminished by the construction of the Project. According to available scientific literature, no relation with other flora or faunal species is known, therefore, interdependent or interrelated effects cannot be assessed in the present. Cumulative effects may occur when the construction of the Project and other construction or development projects reduce the amount of available habitat of *C. rivalis*.

5.1.4.6 Conservation Measures and Recommendations

See 5.1.30.

5.1.4.7 Conclusion

No direct impacts are anticipated to this species as the species was not found during the plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod. Therefore, the Project may affect, but is not likely to adversely affect *C. rivalis* species.

5.1.5 *Catesbaea melanocarpa*- (No Common Name)

Federal Status: Endangered

5.1.5.1 General Species Biology

Catesbaea melanocarpa is a branching shrub that may reach approximately 9.8 feet in height. Spines are borne at every internode and are from 0.39 to 0.78 inches. Leaves are small (0.19 to 1.0 inches long and 0.07 to 0.58 inches wide), often opposite. The flowers are white, solitary or paired, and almost lacking a stalk in the axils. The petals are united in the form of a funnel and measure from 0.31 to 0.39 inches long. The fruit is black, spherical, and 0.19 to 0.23 inches in diameter. This species resembles *Randia aculeata* (Tintillo).

5.1.5.2 Distribution and Abundance

Catesbaea melanocarpa is extremely rare; and was previously known from only one individual location in Cabo Rojo. The one location is on privately-owned land, which is subject to

development pressure for residential and tourism projects. The risk of extinction is high because so few individuals of *Catesbaea melanocarpa* are known to occur in limited areas. Additionally, the species is threatened by catastrophic natural events, such as hurricanes, as well as human induced fires. *Catesbaea melanocarpa* was listed as endangered under the Endangered Species Act of 1973 on March 17, 1999. Its present distribution includes: Sabana Grande, Yauco, Guanica, Guayanilla, Peñuelas, and Ponce (Map of Species Occurrence, Species Profile, USFWS).

5.1.5.3 Current Conditions

C. melanocarpa was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor. Additionally, this species was not observed during the threatened and endangered vegetation survey conducted by Franklin Axelrod, Ph.D. Potential suitable habitat for this species may exist within the Peñuelas section of the Project route.

5.1.5.4 Summary of Impacts

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod.

5.1.5.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Given that potential suitable habitat may exist in some sections of the Project route (as mentioned above), indirect impacts to this species may occur if its habitat is significantly diminished by the construction of the Project. According to available scientific literature, no relation with other flora or faunal species is known, therefore, interdependent or interrelated effects cannot be assessed in the present. Cumulative effects may occur when the construction of the Project and other construction or development projects reduce the amount of available habitat of *C. melanocarpa*.

5.1.5.6 Conservation Measures and Recommendations

See 5.1.30.

5.1.5.7 Conclusion

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod. Therefore, the Project may affect, but is not likely to adversely affect *C. melanocarpa* species.

5.1.6 *Chamaecrista glandulosa var mirabilis* – (No Common Name)

Federal Status: Endangered

5.1.6.1 General Species Biology

Chamaecrista glandulosa var. mirabilis is a small shrub endemic to the white silica sands of the northern coast of Puerto Rico at elevations near sea level. *C. glandulosa var. mirabilis* is a prostrate, ascending, or erect shrub which may reach up to 1 meter in height. The branches are slender, straight, and wire-like. Leaves are alternate, evenly one-pinnate, 1 to 3 centimeters long, 0.5 to 1 centimeter wide, with some scattered whitish hairs. The stipules are persistent, striate, and about 2 millimeters long. The leaflets are usually in 18 pairs, 3 to 6 millimeters long and 0.5 to 1.5 millimeters wide. The petioles have one to two stipitate glands. The flowers are solitary, with a pedicel about as long as the leaves. The corolla is yellow, about 2 centimeters in diameter, with one petal much larger than the others. Mature fruits (legumes) are glabrous, linear, 2.5 to 4 centimeters long, 3 to 4 millimeters wide, flat, elastically dehiscent, and 12 to 15 seeded (Vivaldi and Woodbury 1980).

5.1.6.2 Distribution and Abundance

This species is scattered along the southern shore of the Tortuguero Lagoon and is also found at one location in Dorado and one in Vega Alta. Although the Tortuguero Lagoon area has been designated by the Puerto Rico Planning Board as a Natural Reserve, the majority remains in private ownership or in public ownership by agencies such as the Puerto Rico Land Administration, not an agency that is responsible for the protection of natural resources. These populations have been estimated at 100 individual plants. The Dorado population is located just to the east of the Dorado airport, where 20 to 50 individual plants have been observed on this privately owned land. Its distribution also includes Manati and Vieques (Map of Species Occurrence, Species Profile, USFWS). Urban, industrial, and agricultural expansion, as well as sand extraction, may have eliminated other known populations. Although few areas of silica sands have not been explored, it is possible that other small populations may remain.

5.1.6.3 Current Conditions

C. glandulosa var. mirabilis was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor. Additionally, this species was not observed during the threatened and endangered vegetation survey conducted by Franklin Axelrod, Ph.D.; however, potential suitable habitat may exist in the silica sands area of the northern section of Project

route. Silica sands were only found in Arecibo (near the sanitary landfill area) and the species was not found.

5.1.6.4 Summary of Impacts

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod.

5.1.6.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Given that potential suitable habitat may exist in some sections of the Project route (as mentioned above), indirect impacts to this species may occur if its habitat is significantly diminished by the construction of the Project. According to available scientific literature, no relation with other flora or faunal species is known, therefore, interdependent or interrelated effects cannot be assessed in the present. Cumulative effects may occur when the construction of the Project and other construction or development projects reduce the amount of available habitat of *C. glandulosa var. mirabilis*.

5.1.6.6 Conservation Measures and Recommendations

See 5.1.30.

5.1.6.7 Conclusion

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod. Therefore, the Project may affect, but is not likely to adversely affect *C. glandulosa var. mirabilis* species.

5.1.7 *Cordia bellonis* – (No Common Name)

Federal Status: Endangered

5.1.7.1 General Species Biology

It is an arched to erect shrub 1-2 meters (3-6.5 feet) in height, with light branches with short hairs. The leaves are alternate, oblong to oblong-lanceolate, 2 to 6 cm (0.75-2.5 inches) long and usually 2.5-3 times longer that wide. The corolla is white with four subcylindrical lobes. Fruit, appearing from October to January, is a dotted, drupe 5 mm (0.25 inches) long. This dioecious species produces white, axillary, unisexual flowers which have a thin and reduced Corolla. Plants are dense and shrubby, with shade branches that become divergent at obtuse

angles. These branches ensnare the plant to adjacent trees. The species entered federal lists on January 10, 1997.

5.1.7.2 Distribution and Abundance

Historically found in the western part of the Cordillera Central of Puerto Rico in open areas exposed to the sun. Today, *Cordia bellonis* is a shrub known only in three public forest in Puerto Rico: Maricao, Susúa, and Río Abajo.

Found in Maricao and Susúa, along roadsides, on the banks of rivers and on slopes, steep elevation between 230-250 m (750-820 feet) in Susúa, and 441-820 m (1, 450-2, 700 ft, Maricao (USFWS 1990). In the Río Abajo forest area, the species is found in open areas in the understory, growing in the forest litter and also among the open, sun exposed portions of the limestone hills. This species was not discovered at Rio Abajo until 1994, when approximately 118 individuals were found in 12 locations (USFWS 1990). *C. bellonis* is threatened by habitat destruction and habitat modification, certain practices in forest management and restricted distribution.

5.1.7.3 Current Conditions

C. bellonis was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor. Additionally, this species was not observed during the threatened and endangered vegetation survey conducted by Franklin Axelrod, Ph.D. Potential suitable habitat for this species may exist on the limestone hills of the northern section of the Project route.

5.1.7.4 Summary of Impacts

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod.

5.1.7.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Since potential suitable habitat may exist in some sections of the Project route, indirect impacts to this species may occur if its habitat is significantly diminished by the construction of the Project. According to available scientific literature, no relation with other flora or faunal species is known, therefore, interdependent or interrelated effects cannot be assessed in the present. However, given that this species is dioecious, impacting female or male individuals may affect the reproductive cycle of the species. Cumulative effects may occur when the construction of the Project and other construction or development projects reduce the amount of available habitat of *C. bellonis*.

5.1.7.6 Conservation Measures and Recommendations

See 5.1.30.

5.1.7.7 Conclusion

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod. Therefore, the Project may affect, but is not likely to adversely affect *C. bellonis* species.

5.1.8 *Cordia rupicola* – (Puerto Rico Manjack)

Federal Status: Candidate for listing as Endangered Species

5.1.8.1 General Species Biology

Cordia rupicola is a large shrub reaching up to 5 meters (m) (4.9 to 16.4 feet (ft)) in height. Leaves are ovate to elliptic, two to nine centimeters (cm) (0.8 to 3.5 inches (in)) long, and chartaceous. The upper surface of the leaf is rigidly scabrous, puberulous underneath, and the strigose petioles are from 2 to 10 millimeters (mm) (0.1 to 0.4 in) long. Flowers are in solitary globular heads of 20, and about 1 cm (0.4 in) in diameter. The corolla is white, 7 mm (0.3 in) long, and the fruit is a one-seeded red drupe about 4-5 mm (0.2 in) long (Proctor 1991, p 65, Lioger 1995, p.313).

5.1.8.2 Distribution and Abundance

C. rupicola was believed to be endemic only to Puerto Rico until it was described from the island of Anegada in 1987. The species was discovered in Los Indios, between Guayanilla and barrio Barinas in Yauco in 1986. A year later it was found in Guánica. Two reports of a single specimen exist from the island of Vieques but no population has been confirmed. In 1995 fifteen plants were found east of the historical locations at El Peñón in Peñuelas. El Peñón is a privately-owned subtropical dry forest site located in a limestone substrate. The area has a sparse, low brush (2 to 3 m/6.6 to 9.8 ft) with a few taller trees reaching 4 to 5 m (13 to 16 ft). These trees include *Bourreria succulenta* var. *succulenta*, *Bucida buceras*, and *Bursera simaruba*. Two Anegada sites, each with a few dozen individuals, have also been confirmed. Both sites are located in the western part of the island and cover an area of less than 5 km^2 (1,200 acres). In Anegada the species is locally abundant in limestone and sand dunes, showing a slight preference for limestone.

5.1.8.3 Current Conditions

C. rupicola was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor. Additionally, this species was not observed during the threatened and endangered vegetation survey conducted by Franklin Axelrod, Ph.D. Potential suitable habitat for this species may exist within the Peñuelas section of the Project route.

5.1.8.4 Summary of Impacts

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod.

5.1.8.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Since potential suitable habitat may exist in some sections of the Project route, indirect impacts to this species may occur if its habitat is significantly diminished by the construction of the Project. According to available scientific literature, no relation with other flora or faunal species is known, therefore, interdependent or interrelated effects cannot be assessed in the present. Cumulative effects may occur when the construction of the Project and other construction or development projects reduce the amount of available habitat of *C. rupicola*.

5.1.8.6 Conservation Measures and Recommendations

See 5.1.30.

5.1.8.7 Conclusion

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod. Therefore, the Project may affect, but is not likely to adversely affect *C. rupicola* species.

5.1.9 Cornutia obovata – (Palo de Nigua)

Federal Status: Endangered

5.1.9.1 General Species Biology

The *Cortuntia obovata* is an evergreen tree growing to 10-15 m (33-50 ft) high and 25 cm (10 inches) in diameter. The leaves are opposite, simple, obovate, blunt or rounded in the apex and can measure 5-14 cm (2-5.5 inches) long and 4-8 cm (1.5-3.2 inches) wide. Branches have four sides, fine hair and are brown when young. The flower is terminal, 8-30 centimeters (3-12

inches) long, perfect and zygomorphic. The corolla is bluish or purple with fine outside and inside long hairs. The fruit is a purple drupe containing 3 to 4 seeds. Flowering occurs between the months of May and July, the fruits are present in September and October.

5.1.9.2 Distribution and Abundance

The species is found in forests semi-evergreen or evergreen covering hills limestone elevations of 150-350 m (490-1150 ft) and higher. Only Palo de Nigua are known from three areas: five individuals have been identified at five different locations in limestone hillsides of the Río Abajo forest; one on a limestone slope near the Arecibo Observatory; and one in the Monte Torrecilla of Barranquitas (USFWS 1990). However, the map of species occurrence also includes it in Camuy, Hatillo, Florida, Ciales, Utuado, Jayuya, Orocovis, Ponce, Yauco and Sabana Grande as potential habitat areas (Species Profile, USFWS). The species was placed on the Federal Endangered species list on April 7, 1988. The listing was prompted by deforestation, selective cuts for agriculture, production of coffee, grazing, charcoal, and the timber industry.

5.1.9.3 Current Conditions

Cortuntia obovata was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor. Additionally, this species was not observed during the threatened and endangered vegetation survey conducted by Franklin Axelrod, Ph.D. Potential suitable habitat may exist on the Rio Abajo State Forest region, as well as the limestone hills of the northern section of Project route.

5.1.9.4 Summary of Impacts

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod.

5.1.9.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Since potential suitable habitat may exist in some sections of the Project route, indirect impacts to this species may occur if its habitat is significantly diminished by the construction of the Project. According to available scientific literature, no relation with other flora or faunal species is known, therefore, interdependent or interrelated effects cannot be assessed in the present. Cumulative effects may occur when the construction of the Project and other construction or development projects reduce the amount of available habitat of *C. obovata*.

5.1.9.6 Conservation Measures and Recommendations

See 5.1.30.

5.1.9.7 Conclusion

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod. Therefore, the Project may affect, but is not likely to adversely affect *C. obovata* species.

5.1.10 Cyathea dryopteroides – (Elfin Tree Fern)

Federal Status: Endangered

5.1.10.1 General Species Biology

Cyathea dryopteroides is a tree fern of the order *Cyatheales*. The genus name *Cyathea* is derived from the Greek kyatheion, meaning "little cup", and refers to the cup-shaped sori on the underside of the fronds. Several botanists have previously classified this species in the Alsophila genus. They are mostly terrestrial ferns, usually with a single tall stem. *Cyathea dryopteroides* is a small tree fern about 2 feet tall with a trunk of an inch in diameter. Fronds are 3 feet long. Like all ferns, this species reproduces by spores. Plants in state of reproduction as well as individuals of different sizes and in different stages of development have been observed. These two observations suggest that the species is reproducing and is incorporating more individuals to the population.

5.1.10.2 Distribution and Abundance

This species is unique to Puerto Rico and grows at elevations over 2,700 feet. The species was discovered in Peñuelas in 1915. Later it was discovered in Monte Jayuya, Cerro Rosa in Ciales, and Monte Guilarte. It has not been seen recently in the town of Peñuelas and it is believed the species disappeared there. This fern grows only in the type of forest known as Delfin Forest, in the peaks of the highest mountains of the Cordillera Central Mountain Range in Puerto Rico. In this type of forest, trees are short in height, grow slowly, and have twisted branches and thick leaves. Many of these characteristics are related to environmental factors, such as wind exposure, precipitation and soil characteristics, among others. Some areas in this type of forest are made up almost exclusively of Sierra Palm, *Prestoea montana*. *Cyathea* grows in regions of Sierra Palms in the lower part of the forest, in the understory, which is less exposed to sun and wind.

5.1.10.3 Current Conditions

Cyathea dryopteroides is seriously threatened by the destruction of its habitat. Part of its habitat has been modified by the construction of antennas and other communication installations in the highest peaks of our island. In previous years, several of the public forests have also been used as military training areas, human activity that seriously disturbs vegetation. This plant was included in the federal list of endangered species in 1987. The Map of Species Occurrence also includes this species in Adjuntas, Orocovis, Ponce and Juana Diaz (Species Profile, USFWS). The species was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor. Potential suitable habitat may exist on the Peñuelas and Adjuntas section of Project route.

5.1.10.4 Summary of Impacts

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod.

5.1.10.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Since potential suitable habitat may exist in some sections of the Project route, indirect impacts to this species may occur if its habitat is significantly diminished by the construction of the Project.According to available scientific literature, no relation with other flora or faunal species is known, therefore, interdependent or interrelated effects cannot be assessed in the present. Cumulative effects may occur when the construction of the Project and other construction or development projects reduce the amount of available habitat of *Cyathea dryopteroides*.

5.1.10.6 Conservation Measures and Recommendations

See 5.1.30.

5.1.10.7 Conclusion

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod. Therefore, the Project may affect, but is not likely to adversely affect *C. dryopteroides* species.

5.1.11 *Daphnopsis hellerana* – (No Common Name)

Federal Status: Endangered

5.1.11.1 General Species Biology

The *Daphnopsis hellerana* is a small tree or shrub that grows six meters in height and five centimeters (2 inches) in diameter. Leaves (3.13 cm long and 1.5-6 cm of width) (1.2-5 inches long and 0.5-2.4 inches wide) are simple, alternate, elliptic obovate and without edge or rounded. Lateral veins are prominent and curved. The leaves and branches have golden hairs when the plant is young. The species is dioecious (male and female flowers are located on different individuals) and groups of flowers are found between February and April. While both flowers are small, male flowers are tubular with fine hairs outside and female flowers are bell-shaped and also have hairs inside and outside. The fruit is an elliptical, white berry, which is less than 2 centimeters (0.75 inch) long. The species is found in semi-evergreen or evergreen forests of the subtropical rainforest in limestone slopes at elevations from 150 to 350 meters (490 to 1,150 feet). It is restricted to the slopes of limestone on the northwest coast of the island.

5.1.11.2 Distribution and Abundance

Only four populations are in existence consisting of approximately 61 individuals in the area of Isabela / Quebradilla; seven individuals in the Lajas River, Dorado; about 50 in the bottom of the limestone hills in Nevárez; and seven trees on grounds of the National Health Institute near Sabana Seca, Toa Baja (USFWS 1990). Three of the seven locations are located on private land. The species was included in the Federal lists on June 23, 1988. It has possibly always been a rare species, since it is dioecious, thereby reducing the likelihood of successful reproduction. Individuals in well-known places at present are threatened by urban, tourist and industrial expansion (limestone and fill dirt) and clearing of forests for agriculture. The cutting of trees for charcoal and raw materials for construction were the historical threat to this species. The limestone area in the north of the island is under particular threat since the entire areas are destroyed for construction material. These activities can eliminate an entire population of this and other species of plants by destroying the geological formations that define the physical characteristics of this species habitat.

5.1.11.3 Current Conditions

D. hellerana was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor. Additionally, this species was not observed during the threatened and endangered vegetation survey conducted by Franklin Axelrod, Ph.D. Potential suitable habitat for this species may exist on the limestone hills of the northern section of the Project route.

5.1.11.4 Summary of Impacts

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod.

5.1.11.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Since potential suitable habitat may exist in some sections of the Project route, indirect impacts to this species may occur if its habitat is significantly diminished by the construction of the Project. According to available scientific literature, no relation with other flora or faunal species is known, therefore, interdependent or interrelated effects cannot be assessed in the present. However, given that this species is dioecious, impacting female or male individuals may affect the reproductive cycle of the species. Cumulative effects may occur when the construction of the Project and other construction or development projects reduce the amount of available habitat of *D. hellerana*.

5.1.11.6 Conservation Measures and Recommendations

See 5.1.30.

5.1.11.7 Conclusion

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod. Therefore, the Project may affect, but is not likely to adversely affect *D. hellerana* species.

5.1.12 *Eugenia woodburyana* – (No Common Name)

Federal Status: Endangered

5.1.12.1 General Species Biology

Eugenia woodburyana is an evergreen tree than can reach a height of about 18 feet. Its leaves are opposite, obovate, pilose on both sides, 1.5 to 2.0 centimeters long and 1.0 to 1.5 wide, with almost no petiole. The inflorescence is axillary. The berries are globose, 5-6 mm (0.2 inch) in diameter, and turn from green to red.

5.1.12.2 Distribution and Abundance

Eugenia woodburyana is endemic to subtropical dry forest in the southwest of Puerto Rico. Currently, *Eugenia* is found only in the State forest of Guánica, Cabo Rojo Wildlife Refuge and

the Laguna Cartagena Wildlife Refuge. The total population consists of approximately about 150 individuals in various locations in the Sierra Bermeja in Cabo Rojo and Lajas municipalities. The most recent map for species occurrence also includes this species as potentially occurring in Sabana Grande, Yauco and Peñuelas (Species Profile, USFWS). Destruction of habitat for urban development and livestock, and fires are the principal factors that threaten *Eugenia woodburyana. Eugenia* was included in the federal list of endangered species on September 9, 1994.

5.1.12.3 Current Conditions

E. woodburyana was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor. Additionally, this species was not observed during the threatened and endangered vegetation survey conducted by Franklin Axelrod, Ph.D Potential suitable habitat for this species may exist within the Peñuelas section of the Project route.

5.1.12.4 Summary of Impacts

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod.

5.1.12.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Since potential suitable habitat may exist in some sections of the Project route, indirect impacts to this species may occur if its habitat is significantly diminished by the construction of the Project. According to available scientific literature, no relation with other flora or faunal species is known, therefore, interdependent or interrelated effects cannot be assessed in the present. Cumulative effects may occur when the construction of the Project and other construction or development projects reduce the amount of available habitat of *E. woodburyana*.

5.1.12.6 Conservation Measures and Recommendations

See 5.1.30.

5.1.12.7 Conclusion

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod. Therefore, the Project may affect, but is not likely to adversely affect *E. woodburyana* species.

5.1.13 *Goetzea elegans* – (Mata buey)

Federal Status: Endangered

5.1.13.1 General Species Biology

Goetzea elegans is a shrub or small evergreen tree that measures approximately 9 meters (30 feet) in height, and 13 cm (5 inches) thick trunk. Leaves are simple, alternate, and can grow to 10 centimeters (4 inches) long and 5 centimeters (2 inches) wide. The upper surface of leaves is dark green bright and the bottom is pale green. The flowers are small, orange, funnel-shaped and are in the axils of the leaves, usually alone. The orange fruit is about 2 cm round (0.75 inch) and occurs usually between May and August, during the same period in which the plant flowers. The species was listed as endangered son April 19, 1985.

5.1.13.2 Distribution and Abundance

The species habitat is on the edge of the forested semi-evergreen limestone hills below 200 meters (656 feet) and is present in multiple locations crammed in the northwest part of Puerto Rico in the area of Quebradillas and Isabela (USFWS 1990). Approximately 40 to 50 individual plants are known in these places. All locations except one are found on private land. The publicly owned lands belong to the Department of Transportation and Public Works of the Commonwealth. Private locations can be impacted by mining, grazing, looting of plants for landscape uses, and the proposed construction of a hotel development.

5.1.13.3 Current Conditions

Goetzea elegans was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor. Additionally, this species was not observed during the threatened and endangered vegetation survey conducted by Franklin Axelrod, Ph.D Potential suitable habitat may exist on the limestone hills of the northern section of Project route.

5.1.13.4 Summary of Impacts

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod.

5.1.13.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Since potential suitable habitat may exist in some sections of the Project route, indirect impacts to this species may occur if its habitat is significantly diminished by the construction of the Project. According to available scientific literature, no relation with other flora or faunal species

is known, therefore, interdependent or interrelated effects cannot be assessed in the present. Cumulative effects may occur when the construction of the Project and other construction or development projects reduce the amount of available habitat of *G. elegans*.

5.1.13.6 Conservation Measures and Recommendations

See 5.1.30.

5.1.13.7 Conclusion

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod**.** Therefore, the Project may affect, but is not likely to adversely affect *G. elegans* species.

5.1.14 *Juglans jamaicensis* – (Nogal or West Indian Walnut)

Federal Status: Endangered

5.1.14.1 General Species Biology

Juglans jamaicensis is a large distinctive tree with fissured bark that can reach heights of up to 25 meters (USFWS 1999). Twigs, buds, and leaf axes have minute rusty hairs. The leaves are alternate and compound, and consist of from 16 to 20 mostly paired, nearly stalkless leaflets. Leaflets are from 2.2 to 3.5 inches long and 0.9 to 1.6 inches wide, thin and hairless, except on the veins beneath. Leaflets are lanceolate, finely toothed, long-pointed and rounded, and unequal at the base.

Staminate or male flowers are numerous and in drooping catkins, 3.5 to 4.3 inches long, that are born on the twigs of the previous year. Individual male flowers are composed of a 6-lobed calyx and many stamens. Pistillate or female flowers are several along an axis, 1.7 to 3.5 inches long, borne at the end of the shoots of the season. Female flowers are about 0.2 inches long, composed of a 4-toothed scale opening at one side and 4 sepals. The fruit, a drupe, is a walnut which is composed of a blackish husk, a brown rough-ridged hard shell from 0.6 to 1.1 inches wide and one large, oily, edible seed (Little et al. 1974, Proctor 1992 (in USFWS 1999)).

5.1.14.2 Distribution and Abundance

This species is found in Puerto Rico as well as Cuba and Hispaniola. In Puerto Rico, this species was known only from 14 individuals at one locality in the municipality of Adjuntas. The recovery plan includes past specimens in Peñuelas and Yauco that probably do not exist in the

present. However, the map for species occurrence includes this species in Utuado and Guayanilla. The habitat for this species is found in the subtropical lower montane wet forest life zone (Ewel and Whitmore 1973).

The existing known population of *Juglans jamaicensis* is near the Monte Guilarte Commonwealth Forest, located west of the pipeline corridor.

5.1.14.3 Current Conditions

J. jamaicensis was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor. Additionally, this species was not observed during the threatened and endangered vegetation survey conducted by Franklin Axelrod, Ph.D. Potential suitable habitat for this species may exist where a segment of the route crosses the subtropical lower montane wet forest. Associated forest community species (*Prestoea montana*, among others) were found close to that segment during the Coll Rivera Environmental flora study.

5.1.14.4 Summary of Impacts

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod**.**

5.1.14.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Since potential suitable habitat may exist in some sections of the Project route, indirect impacts to this species may occur if its habitat is significantly diminished by the construction of the Project. According to available scientific literature, no relation with other flora or faunal species is known, therefore, interdependent or interrelated effects cannot be assessed in the present. Cumulative effects may occur when the construction of the Project and other construction or development projects reduce the amount of available habitat of *J. jamaicensis*.

5.1.14.6 Conservation Measures and Recommendations

See 5.1.30.

5.1.14.7 Conclusion

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod. Therefore, the Project may affect, but is not likely to adversely affect *J. jamaicensis* species.

5.1.15 *Mitracarpus maxwelliae*

5.1.15.1 General Species Biology

Mitracarpus maxweliiae is a low, densely-branching, mound-like shrub which may reach approximately 20 centimeters in height. The somewhat woody branches are striate and sharply 4-angled. The leaves are opposite, sessile, linear or linear-lanceolate, densely scabrous, and from 1 to 3 centimeters long and 2 to 5 millimeters wide. The flower heads are terminal, dense, sub-glubose, and from 0.8 to 1.3 centimeters in diameter. The corolla is white, narrowly funnelform, minutely glandular-papillose, and 5 to 6 millimeters long. The capsule is about 1.5 millimeters in diameter, opening by a transverse circular split at about the middle. The seeds are ellipsoid, brownish-black, and 1.2 millimeters long and 0.8 millimeter wide (Proctor 1991a).

5.1.15.2 Distribution and Abundance

M. maxweliiae is known from only one locality in the Guánica Commonwealth Forest in the Municipality of Guayanilla, and it is found along an unpaved road, growing on dry exposed gravel. Approximately 1,443 individuals, including mature flowering plants and seedlings, were count.

5.1.15.3 Current Conditions

M. maxweliiae was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor. Additionally, this species was not observed during the threatened and endangered vegetation survey conducted by Franklin Axelrod, Ph.D. No potential suitable habitat for this species is expected to be found along Project route.

5.1.15.4 Summary of Impacts

No impacts are expected to this species.

5.1.15.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Given that that the Project route does not include this species habitat, no direct, indirect, interdependent, or cumulative impacts are expected.

5.1.15.6 Conservation Measures and Recommendations

No conservation measures or recommendations are necessary for the species.

5.1.15.7 Conclusion

No impacts are expected to this species. Therefore, the Project has no affect on *M. maxweliiae*.

5.1.16 *Mitracarpus polycladus* - (Cana Gorda Girdlepod)

Federal Status: Endangered

5.1.16.1 General Species Biology

Mitracarpus polycladus is a small shrub that is endemic to a sub-tropical dry forest in southwestern Puerto Rico (USFWS 1994, USFWS 1998), but is also known from the island of Saba of the Lesser Antilles.

5.1.16.2 Distribution and Abundance

In Puerto Rico, *M. maxwelliae* and *M. polycladus* are known from only one locality each, both in the Guanica Commonwealth Forest. All areas where this species are located are found within the subtropical dry forest life zone (Ewel and Whitmore 1973), the driest life zone in Puerto Rico.

Existing populations of *Mitracarpus spp*. exist 11.25 miles west-southwest of the pipeline corridor in the Guanica Commonwealth Forest. Both populations are known from only one locality each.

5.1.16.3 Current Conditions

M. polycladus was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor. Additionally, this species was not observed during the threatened and endangered vegetation survey conducted by Franklin Axelrod, Ph.D. No potential suitable habitat for this species is expected to be found along Project route.

5.1.16.4 Summary of Impacts

No impacts are expected to this species.

5.1.16.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Given that that the Project route does not include this species habitat, no direct, indirect, interdependent, or cumulative impacts are expected.

5.1.16.6 Conservation Measures and Recommendations

No conservation measures or recommendations are necessary for the species.

5.1.16.7 Conclusion

No impacts are expected to this species. Therefore, the Project has no effect on *M. maxweliiae*.

5.1.17 *Myrcia paganii* – (No Common Name)

Federal Status: Endangered

5.1.17.1 General Species Biology

The *Myrcia paganii* is an evergreen tree that can grow up to 9 meters (30 feet) high and 13 cm (5 inches) in diameter. The bark is iridescent and flaky with an orange-brown inner bark. Young branches are flat and have numerous soft, brown hairs. The leaves are opposite, simple, leathery, aromatic and glandular below. The leaf is elliptical-oblong reaching 10-16 cm (4-6.5 inches) long and 4-9 cm (1.5-3.5 inches) wide. The fruit and flowers are not described. *M. paganii* was added to the Federal Endangered Species lists as "endangered" on 18 February 1994. It is found in semi-evergreen and evergreen forests in limestone slopes at elevations of 150-350 meters (490-1,150 feet).

5.1.17.2 Distribution and Abundance

All known locations of the species are in private ownership in the limestone hills of northwest of Puerto Rico. Eight individuals of *M. paganii* were reported in three locations in the area south of Arecibo Biáfra-Vietnam and Quebradillas (USFWS 1990).

5.1.17.3 Current Conditions

M. paganii was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor. Additionally, this species was not observed during the threatened and endangered vegetation survey conducted by Franklin Axelrod, Ph.D. Potential suitable habitat for this species may exist on the limestone hills of the northern section of the Project route.

5.1.17.4 Summary of Impacts

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod.

5.1.17.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Since potential suitable habitat may exist in some sections of the Project route, indirect impacts to this species may occur if its habitat is significantly diminished by the construction of the Project. According to available scientific literature, no relation with other flora or faunal species is known, therefore, interdependent or interrelated effects cannot be assessed in the present. Cumulative effects may occur when the construction of the Project and other construction or development projects reduce the amount of available habitat of *M. paganii*.

5.1.17.6 Conservation Measures and Recommendations

See 5.1.30.

5.1.17.7 Conclusion

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod. Therefore, the Project may affect, but is not likely to adversely affect *M. paganii* species.

5.1.18 *Ottoschulzia rhodoxylon* – (Palo de rosa)

Federal Status: Endangered

5.1.18.1 General Species Biology

Ottoschulzia rhodoxylon is an evergreen tree growing to 4-5 meters (13-16.5 feet). Its smooth, alternate leaves are elliptical to ovate with rounded apex and thick and leathery bases. The species flowers are bisexual and can be found at the base in single layers or in groups. The fruit is a drupe with a thin shell and that occurs irregularly throughout the year, as well as flowers. The species was placed on the Federal Endangered Species List species April 10, 1990.

5.1.18.2 Distribution and Abundance

Presently, approximately 200 individuals are known from 17 populations in the following areas of Puerto Rico: Guaynabo; Quebradillas / Isabela; Cambalache forest; Guánica forest; Cabo Rojo; and close to the Río Abajo forest. The map for species occurrence also includes this species as potentially present in the Municipalities of Barceloneta, Vega Baja, Vega Alta, Toa Baja, and Dorado (Species Profile, USFWS), all of which fall within the project corridor route. Types of habitats are semi-evergreen forest about 100 meters (328 ft) in Bayamón, located at low elevations, dry forests in limestone, semi - deciduous, on the southwest coast in Guánica forest. A tree in the Maricao forest only survives in a montane, semi-evergreen green forest in outcrops 600 meters (1970 ft) elevation (USFWS 1990).

5.1.18.3 Current Conditions

O. rhodoxylon is limited to well-drained, alkaline, rocky soils derived from limestone or serpentine. It has been reported to occur in the municipalities of Aguadilla, Bayamón, Guaynabo, Arecibo, Camuy, Hatillo, Barceloneta, Vega Baja, Vega Alta, Fajardo, Toa Baja, Ciales, Quebradillas, Isabela, Dorado, Mayaguez, Maricao, Cabo Rojo, San Germán,

Guayanilla, Yauco, Sabana Grande, Guánica, and Ponce, therefore it exists in the Subtropical Dry Forest and the Subtropical Moist Forest. Three individuals of this species were found during threatened and endangered vegetation survey conducted by Franklin Axelrod, Ph.D. in the Municipality of Manatí. After the three individuals of *O. rhodoxylon* were found in the Municipality of Manatí, the Project route was changed in that area to avoid impacts on those individuals. A Flora and Fauna survey (Supplement to the Flora and Fauna Study, Coll Rivera Environmental, 2011) was carried out for the new segment. No individuals of this species were observed during the new survey. Potential suitable habitat for this species may be present on the limestone hills of Peñuelas, and northern limestone hills along Project route.

5.1.18.4 Summary of Impacts

Due to the realignment of the proposed pipeline, no direct impacts are anticipated to this species as the species was not found during the supplemental plant studies performed by Dr. Axelrod on the alternative route.

5.1.18.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Given that potential suitable habitat may exist in some sections of the Project route (as mentioned above), indirect impacts to this species may occur if its habitat is significantly diminished by the construction of the Project. According to available scientific literature, no relation with other flora or faunal species is known, therefore, interdependent or interrelated effects cannot be assessed in the present. Cumulative effects may occur when the construction of the Project and other construction or development projects reduce the amount of available habitat of *O. rhodoxylon*.

5.1.18.6 Conservation Measures and Recommendations

See 5.1.30.

5.1.18.7 Conclusion

No direct impacts are anticipated to this species as the species was not found during the supplementary plant studies performed on the alternative alignment by Dr. Axelrod. Therefore, the Project may affect, but is not likely to adversely affect *O. rhodoxylon* species.

5.1.19 *Pleodendron macranthum* – (Chupacallos)

Federal Status: Endangered

5.1.19.1 General Species Biology

The chupacallos is an evergreen tree growing to 10 meters (33 feet) in height. The leaves are alternate, simple, leathery about 8.5-12.5 cm (3-5 inches) long and 4.5-5 cm (1.5-2 inches) wide. The leaves are elliptical with a dark glossy green upper surface and sunken central veins. The underside is pale green with fine, and prominent central veins with parallel lateral veins. The leaf stalks are approximately 7 mm (0.25 inch) long. Bisexual whitish flowers are solitary, 2 cm (0.75 inch) wide with stem flower 2.5 cm (1 inch). The black-purple aromatic fruit is 2 cm (0.75 inch) in diameter and contains many seeds.

5.1.19.2 Distribution and Abundance

The chupacallos was placed on the Federal Endangered species lists as "Endangered" on September 9, 1994. There are less than 50 individuals of the species currently at seven locations in the wet tropical montane forests to the North and East of Puerto Rico (USFWS 1990). These locations are within the Caribbean National Forest and four are within the Río Abajo forest. This evergreen species is found in semi-open areas of the subtropical rainforest in the limestone slopes at elevations of 150-350 meters (490-1,150 feet).

5.1.19.3 Current Conditions

P. macranthum was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor. Additionally, this species was not observed during the threatened and endangered vegetation survey conducted by Franklin Axelrod, Ph.D. Potential suitable habitat for this species may exist along the Arecibo/Utuado section of the Project route.

5.1.19.4 Summary of Impacts

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod.

5.1.19.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Since potential suitable habitat may exist in some sections of the Project route, indirect impacts to this species may occur if its habitat is significantly diminished by the construction of the Project. According to available scientific literature, no relation with other flora or faunal species is known, therefore, interdependent or interrelated effects cannot be assessed in the present. Cumulative effects may occur when the construction of the Project and other construction or development projects reduce the amount of available habitat of *P. macranthum*.

5.1.19.6 Conservation Measures and Recommendations

See 5.1.30.

5.1.19.7 Conclusion

The proposed corridor route may contain limited habitat suitable for the species, but none were identified during the Coll Rivera Environmental flora studies for the pipeline alignment. Potential suitable habitat may exist along the Utuado/Arecibo section of the Project route. The species is considered to have low potential occurrence within the pipeline corridors. No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod. Therefore, the Project may affect, but is not likely to adversely affect *P. macranthum* species.

5.1.20 *Polystichum calderoense* (Monte Guilarte hollyfern)

Federal Status: Endangered

5.1.20.1 General Species Biology

Polystichum species are terrestrial or rock-dwelling ferns of warm-temperate and montane-tropical regions. Adult specimens are medium in size and reach 1 to 2 meters high. Ferns of this genus have stout, slowly-creeping rootstocks that form a crown, with a vase-like ring of evergreen fronds 30-200 cm long. The sori are round, with a circular indusium. The stipes have prominent scales. The genus differs from *Dryopteris* in the indusium being circular, not reniform, and in having stronger, more persistent fronds with a harder, somewhat rough, texture. Hybridization is frequent in the genus.

5.1.20.2 Distribution and Abundance

The species was identified by USFWS (June 30, 2010 Technical Assistance Letter) as having the potential to occur in the Central Mountain Range (Volcanic) of the project corridor route and the species was Listed as Federally Endangered on June 9, 1993. *P. calderonense* is only known from two localities. Forty-five individual plants (including juveniles) are known from the summit of “La Silla de Calderón” in the Monte Guilarte Commonwealth Forest (Proctor 1989). Additionally, 12 individuals found by Proctor (1991) in Cerrote Peñuelas in the municipality of Peñuelas. The species present in the Guilarte Commonwealth Forest may be affected by forested management practices.

5.1.20.3 Current Conditions

P. calderonense was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor. Additionally, this species was not observed during the threatened and endangered vegetation survey conducted by Franklin Axelrod, Ph.D. Potential suitable habitat for this species may exist on the volcanic hills of north Peñuelas and Adjuntas sections of the Project route.

5.1.20.4 Summary of Impacts

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod.

5.1.20.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Since potential suitable habitat may exist in some sections of the Project route, indirect impacts to this species may occur if its habitat is significantly diminished by the construction of the Project. According to available scientific literature, no relation with other flora or faunal species is known, therefore, interdependent or interrelated effects cannot be assessed in the present. Cumulative effects may occur when the construction of the Project and other construction or development projects reduce the amount of available habitat of *P. calderonense*.

5.1.20.6 Conservation Measures and Recommendations

See 5.1.30.

5.1.20.7 Conclusion

Potential habitat may exist for the species along the mountainous segments of the pipeline corridor but none were observed during Coll Environmental field reviews for this BA. No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod. Therefore, the Project may affect, but is not likely to adversely affect *P. calderonense* species.

5.1.21 Schoepfia arenaria – (No Common Name)

Federal Status: Threatened

5.1.21.1 General Species Biology

The Schoepfia arenaria is an evergreen small tree or a shrub growing to 6 meters (19.7 ft) high. The species often has several trunks arising from the base, reaching 10 centimeters (4 inches) in diameter. Leaves are simple, alternate, and green on the upper surface and slightly green on the underside. The bark is grey, or thick, deeply furrowed, dead external crust color chocolate inside. The inner bark is dark pink. It has two or three tubular flowers at the base of the leaf. The species mainly flowers in spring and autumn, usually with two or three slightly yellow flowers and tubular at the end of the stems. The fruit, which appears during the summer and winter, is elliptical, one-seeded, shiny red and 12 mm (0.5 inch) in diameter.

5.1.21.2 Distribution and Abundance

The species was listed as “Threatened” on on April 19, 1991. S. arenaria is known to exist in four locations: Isabela, pine nuts, Fajardo and the Río Abajo Forest (USFWS 1990), however, the map for species occurrences also includes it in Quebradillas, San Juan, Loiza and Vega Baja (Species Profile, USFWS).

In the Isabela area about 100 individuals of all sizes are known, from woody upper slopes of the mountains to the West of the mouth of the River Guajataca (USFWS 1990). The species is found in evergreen or semi-evergreen forests in the lower elevations in densely wooded portions of the limestone hills in northern Puerto Rico; typically occurring at elevations of 150 to 350 meters (490 to 1,150 feet). Items that have historically restricted dissemination of this plant species are deforestation and the destruction of the limestone hills for materials, construction, agriculture, grazing and development such as urban, industrial or tourist development.

5.1.21.3 Current Conditions.

S. arenaria was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor Additionally, this species was not observed during the threatened and endangered vegetation survey conducted by Franklin Axelrod, Ph.D.; however, potential suitable habitat for this species may exist on the limestone hills of the northern section of the Project route.

5.1.21.4 Summary of Impacts

No direct impacts are expected to this species. However, there is a possibility of indirect impacts if its habitat is affected.

5.1.21.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Given that potential suitable habitat may exist in some sections of the Project route (as mentioned above), indirect impacts to this species may occur if its habitat is significantly diminished by the construction of the Project. According to available scientific literature, no relation with other flora or faunal species is known, therefore, interdependent or interrelated effects cannot be assessed in the present. Cumulative effects may occur when the construction of the Project and other construction or development projects reduce the amount of available habitat of S. arenaria.

5.1.21.6 Conservation Measures and Recommendations

See 5.1.30.

5.1.21.7 Conclusion

No direct impacts are expected to this species. However, there is a possibility of indirect impacts if its habitat is affected. Therefore, the Project may affect, but not likely to adversely affect S. arenaria species.

5.1.21.8 General Species Biology

5.1.22 *Solanum drymophilum* – (Erubia)

Federal Status: Endangered

5.1.22.1 General Species Biology

The Erubia is an evergreen shrub that can grow up to 5.5 m (18 ft) tall, branching from the base, although it may grow from a single stem. The leaves and petioles of this species have sharp yellow spines, mainly on the midrib of the leaves. The spines are almost 13 mm (0.5 inch) long and are located in the middle of leaf vein. The mature shrubs have tiny whitish star-shaped hairs on leaves and petioles. These hairs are longer and appear in the branches and flowers of the younger bush. The lanceolate to oblongate leaves are alternate, and the bisexual, white flower has five lobes and fan. The Erubia appears to flower and produce round, bright black berries, throughout the year.

5.1.22.2 Distribution and Abundance

The Erubia was placed on the federal lists as "Endangered" on August 26, 1988. Historically, the erubia could be found in the Sierra de Cayey, Sierra de Naguabo and the town of Lares. The single location where the Erubia still is known is in the town Sierra of Cayey in the center of

Puerto Rico. Approximately 100 to 150 plants exist in this private field, 840 meters (2,760 feet) in elevation and marked with volcanic outcroppings.

5.1.22.3 Current Conditions

S. drymophillum was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor Additionally, this species was not observed during the threatened and endangered vegetation survey conducted by Franklin Axelrod, Ph.D. Potential suitable habitat for this species may exist on the volcanic hills along the northern Peñuelas, Adjuntas, and Utuado section of the Project route.

5.1.22.4 Summary of Impacts

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod.

5.1.22.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Since potential suitable habitat may exist in some sections of the Project route, indirect impacts to this species may occur if its habitat is significantly diminished by the construction of the Project. According to available scientific literature, no relation with other flora or faunal species is known, therefore, interdependent or interrelated effects cannot be assessed in the present. Cumulative effects may occur when the construction of the Project and other construction or development projects reduce the amount of available habitat of *S. drymophillum*.

5.1.22.6 Conservation Measures and Recommendations

See 5.1.30.

5.1.22.7 Conclusion

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod**.** Therefore, the Project may affect, but is not likely to adversely affect *S. drymophillum* species.

5.1.23 *Stahlia monosperma* – (Cobana negra)

Federal Status: Threatened

5.1.23.1 General Species Biology

Stahlia monosperma is a medium-sized evergreen tree endemic to Puerto Rico and Hispaniola (USFWS 1996). This tree can grow up to 50 feet in height and can be found in seasonally flooded wetlands in association with mangrove communities (USFWS 1996). Cobana negra produces an abundance of clustered-yellow flowers that give way to fleshy red fruits that smell like ripe apples (USFWS 1996). Possible native seed dispersers include fruit-eating bats and land crabs that may take fruit into their burrows (USFWS 1996).

5.1.23.2 Distribution and Abundance

S. monosperma grows in brackish, seasonally flooded wetlands in association with mangrove communities (USFWS 1996). They are usually found close to black mangrove but are restricted to drier, elevated microclimates that are absent of mangrove species (USFWS 1996). Scattered populations can be found in Puerto Rico, Vieques and the eastern portion of the Dominican Republic (USFWS 1996). The largest population is known from southwestern Puerto Rico. The current status of these populations is unknown.

5.1.23.3 Current Conditions

S. monosperma was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor Additionally, this species was not observed during the threatened and endangered vegetation survey conducted by Franklin Axelrod, Ph.D. Potential suitable habitat for this species may exist on northern and southern wetland areas along the Project route.

5.1.23.4 Summary of Impacts

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod.

5.1.23.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Since potential suitable habitat may exist in some sections of the Project route, indirect impacts to this species may occur if its habitat is significantly diminished by the construction of the Project. According to available scientific literature, no relation with other flora or faunal species is known, therefore, interdependent or interrelated effects cannot be assessed in the present. Cumulative effects may occur when the construction of the Project and other construction or development projects reduce the amount of available habitat of *S. monosperma*.

5.1.23.6 Conservation Measures and Recommendations

See 5.1.30.

5.1.23.7 Conclusion

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod. Therefore, the Project may affect, but is not likely to adversely affect *S. monosperma* species.

5.1.24 *Tectaria estremerana* – (Helecho alabarda de Puerto Rico)

Federal Status: Endangered

5.1.24.1 General Species Biology

The Helecho alabarda de Puerto Rico is a terrestrial fern with woody rhizomes averaging 10 - 15 mm (0.5-0.7 inch) in length. It has several loosely cluttered fronds 65-80 cm (25-32 inches) long. Significant items that affect this rare and restricted fern are destruction of habitat, and illegal specimen harvesting by collectors.

5.1.24.2 Distribution and Abundance

The Helecho alabarda was listed as an "Endangered species" on June 9, 1993. The species is found in the karstic northwest region of Puerto Rico region and portions of the United States Virgin Islands. In Puerto Rico, this species has been found in two locations: the first is wet, shaded regions in or around limestone in wooded rocky slopes at elevations of 250-300 meters (820-985 ft) in the municipality of Arecibo. This location is inside the property of the Arecibo Radio telescope and had 23 individual plants when the registration was made. The second location is in the down river area in the municipality of Florida, where it was observed in 1994 (USFWS 1990). The species and the maiden hair of Puerto Rico (Adiantum vivesii) share local habitats and characteristics.

5.1.24.3 Current Conditions

T. estremerana was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor Additionally, this species was not observed during the threatened and endangered vegetation survey conducted by Franklin Axelrod, Ph.D. Potential suitable habitat for this species may exist on the limestone hills of the northern section of the Project route.

5.1.24.4 Summary of Impacts

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod.

5.1.24.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Since potential suitable habitat may exist in some sections of the Project route, indirect impacts to this species may occur if its habitat is significantly diminished by the construction of the Project. According to available scientific literature, no relation with other flora or faunal species is known, therefore, interdependent or interrelated effects cannot be assessed in the present. Cumulative effects may occur when the construction of the Project and other construction or development projects reduce the amount of available habitat of *T. estremerana*.

5.1.24.6 Conservation Measures and Recommendations

See 5.1.30.

5.1.24.7 Conclusion

The Via Verde project corridor includes suitable habitat for the species, but the species was not found in the field studies of the proposed construction corridor. Potential suitable habitat may exist on the limestone hills of the northern section of Project route. The species is considered to have a low potential of occurrence in the project ROW and a determination of may affect but not likely to adversely affect (MANLAA) is recommended for this species or its critical habitat. No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod**.**

5.1.25 *Thelypteris inabonensis* (Cordillera Maiden Fern)

Federal Status: Endangered

5.1.25.1 General Species Biology

Thelypteris inabonensis is terrestrial fern with an erect and slender (0.5 cm in diameter) rhizome which is clothed at the apex with numerous dark lustrous brown, and densely setulose scales. The fronds are erect-arching, up to cm long. The stipes are 5 to 10 cm long and clothed with grayish, acicular hairs, and have numerous spreading scales similar to those of the rhizome.

The blades are narrowly elliptical, up to 55 cm long. The small sori, which has a densely long-ciliate indusium, are located dorsal on veins (Proctor, 1989).

5.1.25.2 Distribution and Abundance

Thelypteris inabonensis is currently known from only two localities, one protected population in the municipality of Ponce and the other in the municipality of Quberadillas. The Ponce population is made up of 34 individuals, whereas that in Quebradillas is composed of only 12 individuals. These low numbers combined with such a small number of populations spells trouble for this rare fern which favors high elevations (3,680-4,100 feet) in wet montane forests. The fern may also be found on high limerock outcrops in the understory of sub-tropical moist forests. This species was placed on the Federal Endangered Species List on January 17, 1995.

5.1.25.3 Current Conditions

T. inabonensis was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor Additionally, this species was not observed during the threatened and endangered vegetation survey conducted by Franklin Axelrod, Ph.D. Potential suitable habitat for this species may exist on the Utuado/Adjuntas section, specifically where *P. montana* dominates along the Project route.

5.1.25.4 Summary of Impacts

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod.

5.1.25.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Since potential suitable habitat may exist in some sections of the Project route, indirect impacts to this species may occur if its habitat is significantly diminished by the construction of the Project. According to available scientific literature, no relation with other flora or faunal species is known, therefore, interdependent or interrelated effects cannot be assessed in the present. Cumulative effects may occur when the construction of the Project and other construction or development projects reduce the amount of available habitat of *T. inabonensis*.

5.1.25.6 Conservation Measures and Recommendations

See 5.1.30.

5.1.25.7 Conclusion

Potential habitat may exist for the species along the mountainous segments of the pipeline corridor but none were observed during Coll Rivera Environmental field reviews for this BA. No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod. Therefore, the Project may affect, but is not likely to adversely affect *T. inabonensis* species.

5.1.26 *Thelypteris verecunda* – (Helecho doncella del Barrio Charcas)

Federal Status: Endangered

5.1.26.1 General Species Biology

The Helecho doncella del Barrio Charcas is a terrestrial fern with 2-3 mm (0.75-1.2 inch) thick climbing rhizomes. Its dimorphic frond is covered with star-shaped hairs and many simple and long hairs. Sterile sheets are oblong, 2.5-4 centimeters (1-1.6 inches) long and 1.5-2 centimeters (0.6-0.8 inch) wide, truncated at the base, and round in the widely lobed apex, which also has brown scales. The fertile leaves are linear to attenuated, 13-15 cm (5-6 inches) long, 1.2-1.8 cm (0.5-0.7 inch) in width, truncated at the base and the spine has a tiny and mainly button below the apex. The small and erect sori has a tuft of hair which is long, white, and simple.

5.1.26.2 Distribution and Abundance

This species was placed on the Federal Endangered Species List on July 2, 1993. Due to its rarity, the species is extremely vulnerable to the loss of any individual. Elements that have negatively affected the species survival are land clearing and the subsequent development of its habitat. The species has been found from the Charcas Barrio in the Municipality of Quebradillas (USFWS 1990). Other locations with known specimens include: Barrio Bayaney, Hatillo and Barrio Cidral in the Municipality of San Sebastian (USFWS 1990). Each of the three known locations for this fern are in private ownership. In Quebradillas and San Sebastian, only an individual has been collected from every location (USFWS 1990). At Barrio Bayaney, around 20 plants are known (USFWS 1990). Specimens are found in wet, shaded limestone areas at elevations of approximately 200 meters (656 ft).

5.1.26.3 Current Conditions

T. verecunda was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor. Additionally, this species was not observed during the threatened and endangered vegetation survey conducted by Franklin Axelrod, Ph.D. Potential suitable habitat for this species may exist on the limestone hills of the Arecibo section of the Project route.

5.1.26.4 Summary of Impacts

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod.

5.1.26.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Since potential suitable habitat may exist in some sections of the Project route, indirect impacts to this species may occur if its habitat is significantly diminished by the construction of the Project. According to available scientific literature, no relation with other flora or faunal species is known, therefore, interdependent or interrelated effects cannot be assessed in the present. Cumulative effects may occur when the construction of the Project and other construction or development projects reduce the amount of available habitat of *T. verecunda*.

5.1.26.6 Conservation Measures and Recommendations

See 5.1.30.

5.1.26.7 Conclusion

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod. Therefore, the Project may affect, but is not likely to adversely affect *T. verecunda* species.

5.1.27 Thelypteris yaucoensis

Federal Status: Endangered

5.1.27.1 General Species Biology

T. yaucoensis is a terrestrial fern with an erect, 0.5 mm-thick rhizome, which is bearded at the apex with a tuft of brown, narrowly to broadly lance-attenuate, 5 to 8 mm long scales. The few

fronds are 44 to 52 cm long and have lustrous light brown, glabrous, 18 to 22 cm long stipes. The blades are narrowly deltate to oblong, 25 to 31 cm long, 10 to 14 cm broad, acuminate at the apex and truncate at the base. The rachis, costae and costules are more or less stelate-puberolous on both sides. This fern has inframedial to medial sori, which are ciliated with minute forked and 3-branchd hair, and have small indusium often hidden by the sporangia (Proctor, 1989).

5.1.27.2 Distribution and Abundance

Thelypteris yauconensis is perhaps one of Puerto Rico's least known ferns. Very little information is currently available on any aspect of its biology. The species is known only from three populations in the Municipalities of Yauco and Ciales. The total number of plants from all populations is estimated to be fewer than 65 individuals, and all occur on privately owned land, where no protection laws are in place. This fern prefers steep, shady, rocky banks at high elevations of 2780-3940 feet. Given the small population sizes of all three *Thelypteris* ferns, removal of even a single individual could be harmful. This species was placed on the Federal Endangered Species List on January 17, 1995.

5.1.27.3 Current Conditions

T. yaucoensis was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor. Additionally, this species was not observed during the threatened and endangered vegetation survey conducted by Franklin Axelrod, Ph.D. Potential suitable habitat for this species may exist on the volcanic hills of north Peñuelas and Utuado sections of the Project route.

5.1.27.4 Summary of Impacts

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod.

5.1.27.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Since potential suitable habitat may exist in some sections of the Project route, indirect impacts to this species may occur if its habitat is significantly diminished by the construction of the Project. According to available scientific literature, no relation with other flora or faunal species is known, therefore, interdependent or interrelated effects cannot be assessed in the present. Cumulative effects may occur when the construction of the Project and other construction or development projects reduce the amount of available habitat of *T. yaucoensis*.

5.1.27.6 Conservation Measures and Recommendations

See 5.1.30.

5.1.27.7 Conclusion

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod. Therefore, the Project may affect, but is not likely to adversely affect *T. yaucoensis* species.

5.1.28 *Trichilia triacantha*- (Bariaco)

Federal Status: Endangered

5.1.28.1 General Species Biology

Trichilia triacantha is a small evergreen endemic tree. Easily recognized by its three to seven small wedge shaped palmate leaves (i.e. in the form of the Palm of the hand); each with three sharp spiny tooth lobes. This species can reach about 30 feet tall with a trunk diameter of 3 inches. Floral clusters are short and are located out on the ends of the twig. The flowers are white and about 1/8 inch in size. The fruits are in the form of capsules. The Bariaco produces flowers between January and March, their fruits ripen in the summer months. Preliminary studies indicate that this species produces very little fruit and that there have been very few seedlings or young trees.

5.1.28.2 Distribution and Abundance

Trichilia triacantha tree is currently known only in Guánica, Yauco and Guaniquilla in the Cabo Rojo area. It is estimated there are approximately seventy individuals. The map for species occurrence also includes the tree in Peñuelas, Sabana Grande, and Guanica (Species Profile, USFWS). The species is found in the deciduous forests and semi-evergreen forests on soils comprised of limestone in the driest area of Puerto Rico. *Trichilia triacantha* was included in the list of endangered species in 1988.

The most important factors affecting the continued survival of this tree include deforestation for urban and industrial development, agriculture, and its use for entresaque wooden poles and charcoal. In Guánica some individuals are located in the State forest. Expanding and/or improving this habitat area will allow for expansion of existing populations. Key factors to

preserving this species should include: protection of known individuals, studying the biology of the species, recognition that this attractive tree has an ornamental potential, and development of a method to production of new plants for planting in protected areas; attempts to propagate *Trichilia triacantha* have not been successful so far.

5.1.28.3 Current Conditions

The species was not found during the Coll Environmental field reviews of the project's proposed corridor. Potential suitable habitat may exist within the Subtropical Dry Forest in the Peñuelas section of Project route.

5.1.28.4 Summary of Impacts

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental.

5.1.28.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Since potential suitable habitat may exist in some sections of the Project route, indirect impacts to this species may occur if its habitat is significantly diminished by the construction of the Project. According to available scientific literature, no relation with other flora or faunal species is known, therefore, interdependent or interrelated effects cannot be assessed in the present. Cumulative effects may occur when the construction of the Project and other construction or development projects reduce the amount of available habitat of *Trichilia triacantha*.

5.1.28.6 Conservation Measures and Recommendations

See 5.1.30.

5.1.28.7 Conclusion

Potential habitat may exist for the species but none were observed during Coll Rivera Environmental field reviews for this BA. Therefore, the Project may affect, but is not likely to adversely affect *Trichilia triacantha*.

5.1.29 Zanthoxylum thomasianum (St.Thomas Prickly Ash)

Federal Status: Endangered

5.1.29.1 General Species Biology

Zanthoxylum thomasianum is a small evergreen tree/shrub up to 6 meters in height, growing as a component of dry forest. Male and female flowers are borne on different plants and this may be an important detrimental factor for its survival given its low population size and the

fragmented nature of its distribution. No seedlings have been reported from the PR or USVI populations and only a single seedling has been observed in Virgin Gorda.

5.1.29.2 Distribution and Abundance

A total population was estimated to be around 300–350 mature individuals in 1985 when it was listed as an Endangered Species under the US Federal Endangered Species Act. The US Fish and Wildlife Service drew up a recovery plan for this species in 1988. It was also listed as Endangered in the 1997 IUCN Red List of Threatened Plants (Walter and Gillett 1998). All these listings were based on the known scattered subpopulations on Puerto Rico, St Thomas and St John (US Virgin islands). Since 1988 the habitat for this species in St Thomas, St John and Puerto Rico has come under increasing pressure from residential development, habitat has been lost and we can infer that mature individuals have been lost. Some of the known Puerto Rico individuals are on private land that is undergoing changing land use. Mining for limestone is also a threat in part of its range.

5.1.29.3 Current Conditions

Z. thomasianum was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor. Additionally, this species was not observed during the threatened and endangered vegetation survey conducted by Franklin Axelrod, Ph.D. Potential suitable habitat for this species may exist on the limestone hills of southern and northern sections of the Project route.

5.1.29.4 Summary of Impacts

No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod.

5.1.29.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Since potential suitable habitat may exist in some sections of the Project route, indirect impacts to this species may occur if its habitat is significantly diminished by the construction of the Project. According to available scientific literature, no relation with other flora or faunal species is known, therefore, interdependent or interrelated effects cannot be assessed in the present. Cumulative effects may occur when the construction of the Project and other construction or development projects reduce the amount of available habitat of *Z. thomasianum*.

5.1.29.6 Conservation Measures and Recommendations

See 5.1.30.

5.1.29.7 Conclusion

The proposed corridor route may contain limited habitat suitable for the species, but none were identified during the Coll Rivera Environmental flora studies for the pipeline alignment. No direct impacts are anticipated to this species as the species was not found during the preliminary plant studies performed by Coll Environmental and subsequent detailed studies of the project right-of-way performed by Dr. Axelrod**.** Therefore, the Project may affect, but is not likely to adversely affect *Z. thomasianum* species.

5.1.30 Construction Measures

5.1.30.1 Construction ROW

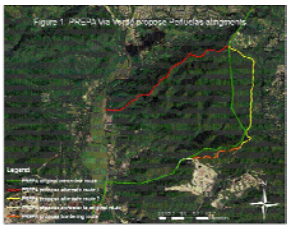
The construction ROW is typically 100 feet wide within which the construction contractor will be permitted to stage materials or drive vehicles and in non-wetland areas allowed to clear the land.

- Reduction of the construction ROW width from 100 feet to a total of 60 feet will be shown on the final project drawings on steep slopes and narrow ridges.
- The accompanying GIS shape file "Listed Plants Reduced Footprint" show additional areas where the ROW width will be to 60 feet.

5.1.30.2 Advance Construction Survey

Relatively undisturbed areas will be surveyed prior to starting vegetation removal.

- In the Peñuelas region, the "relatively undisturbed area" is the eastern extent of the east-west alignment (Orange line in the figure). In other regions will be extent of alignment excluding that in active agriculture, alongside highways, or wetlands. Exact definition of these can be refined during consultation.



- The boundary of the construction ROW shall be clearly flagged in advance of the survey;
- The appropriate methodology will be used (not transects) to encompass the entire ROW;
- A qualified botanist with expertise and experience identifying the species expected in the area will perform the survey. A single individual may or may not be able to perform the survey for all species and/or for all areas.
- At least 60 days before the first survey, the applicant/permittee will provide the name of candidate botanists, their credentials and academic records to demonstrate their expertise to recognize the species.
- At least 30 days before the first survey (and updates thereafter), the applicant/permittee will provide a detailed schedule of the surveys to the Corps/FWS and a point of contact

from whom they can obtain the “meet me” location to provide opportunity to accompany any of the surveys;

- After the survey, if no individuals of the species are found, the applicant/permittee shall submit the survey results to the Corps/FWS not less than 30 days before the scheduled start of land-clearing activities to provide opportunity for Corps/FWS to review and visit the area;
- If individuals are found, procedures at 5.1.30.4 will be implemented.

5.1.30.3 Concurrent Construction Survey

The entire alignment ROW will be surveyed prior to and during land-clearing activities.

- The boundary of the construction ROW shall be clearly flagged in advance of the survey;
- The appropriate methodology will be used survey the construction ROW prior to landclearing;
- During landclearing activities, a botanist will be on site to ensure that adjacent areas with suitable habitat are not affected and conservation measures are appropriately implemented.
- A qualified botanist with expertise and experience identifying the species expected in the area. A single individual may or may not be able to perform the survey for all species and/or for all areas.
- At least 60 days before the botanist begins work on-site, the applicant/permittee will provide the name of candidate botanists, their credentials and academic records to demonstrate their expertise to recognize the species.
- At least 30 days before the first survey, the applicant/permittee will provide a projected schedule of the surveys to the Corps/FWS and updates thereafter adjusting for the pace of construction and a point of contact from whom they can obtain the “meet me” location to provide opportunity to accompany any of the surveys;
- After the survey, if no individuals of the species are found, the applicant/permittee shall submit a monthly summary of the surveys to the Corps/FWS;
- If individuals are found, procedures at 5.1.30.4 will be implemented.

5.1.30.4 If Species Identified

If an individual of the species is identified from surveys of 5.1.30.2 or 5.1.30.3, the botanist shall contact the Service to confirm the identity of the species.

- If identified concurrent during construction, ongoing activity within 50 meters will cease and no new activity will commence until after (1) the FWS confirms the species was mis-identified or (2) Corps/FWS approves resumption of work after revisions of the project to avoid and protect the species;
- After FWS confirms the species identification, a comprehensive species survey of the habitat will be carried within the area "including outside the ROW" to determine if the detected individuals are part of a bigger viable population.
    - No impacts to the habitat will occur until the applicant conducts the survey and Corps/FWS approves resumption of work after revisions of the project to avoid and protect the species.
    - The appropriate survey data (site map, transect waypoints, etc) shall be submitted to the Corps/FWS to be evaluated;
- The presence of the species should be documented thru digital photos and if possible by a herbarium specimen to be deposited at the herbariums of the University of Puerto Rico (MAPR or UPRRP). The botanist should be trained in collecting herbarium specimens and should collect the minimum field data "number of adults, number of seedlings, evidence of flowers or fruits, GPS readings, etc". The collection of herbarium samples should not compromise an individual or a population.
- The applicant/permittee will submit a proposal to modify the project to re-align the construction ROW to avoid the individual(s);
    - Upon preliminary approval by Corps/FWS, the applicant will survey the re-alignment for listed species as well as other issues relevant to the permit (e.g., historic or cultural resources);
    - The area where the population is present shall be acquired and protected in perpetuity;
    - Due to possible direct / indirect impacts (changes in microhabitat conditions, sedimentation of drainage areas, loss of seed bank, intrusion of exotics, ect.) that may result in the net loss of the habitat necessary for the natural recruitment of the species, the applicant/permittee will implement a propagation program as described 5.1.30.5.

- The permittee/applicant can propose for Corps/FWS review justifications why the project cannot be re-aligned completely to avoid direct impact to one or more individual(s) of the species. If the Corps/FWS accepts such justifications, the applicant will either:
  - Submit for consideration a plan for transplanting of affected individuals if the plan meets the restrictions listed at 5.1.30.6; or,
  - Submit a Biological Assessment for the Corps/FWS to initiate formal consultation under Section 7 of the Endangered Species Act for the proposed impact.

- No work on original nor proposed alignment will occur until Corps/FWS approves resumption of work after revisions of the project to avoid and protect the species

5.1.30.5 Propogation Program

The following are measures that will be included in the development and implementation of an appropriate propagation program for the species when required by 5.1.29.4.

- Propagation should be conducted by qualified personnel with expertise in the propagation of rare plants (e.g., UPR Río Piedras, UPR Mayaguez, Fideicomiso de Conservación) and utilizing information where propogation was successful (e.g., by Mr. Eugenio Santiago from the UPRRP for Trichilia triacantha and Ottoschulzia rhodoxylon, Mr. José "Rene" Roman of Guajataca Forest for Buxus vahlii, Mr. Eugenio Santiago from the UPRRP for Eugenia woodburyana, and KEW Botanical Garden at England for Cordia rupicola).
- At the time of this writing propagation techniques have not been developed for fern species such as *Polystichum calderonense*, *Tectaria estremerana* and *Cyathea dryoteroides*, however the applicant/permittee will investigate and consult with FWS on any new developments.
- Collection of seed material should follow the appropriate standards to avoid impacts to the natural recruitment of a natural viable population. The collection of seed and seedling from wild population should not compromise the natural recruitment. The Service recommends that no more than 20% of the available seed material is collected.
- Propagation should consider the genetic diversity of the species. The source of the plant material should be tracked to avoid outbreeding depression. Seed material can be collected from the populations within Puerto Rico.

- The minimum number of individuals to be established per populations will be based on that observed to be the minimum as a self sustainable population or based on FWS's current efforts to establish self-sutaining populations.
- The minimum number of populations to be established will be in accordance with the Recovery Plan of the species.
- All planted individuals should be market with an aluminum numbered tag and properly georeferenced to track their status in the long term basis. Monthly reports should be handled to the Service during the first year of the establishment and subsequently on a year basis for the first five years.
- The area selected for the establishment of the populations must be in accordance with the recovery plan of the species.
- Planted individuals should be watered and monitored as needed to guaranty the survival of the individuals in the field. Maintenance should include the control of exotic plants species and if necessary the enhancement of the area with the adequate native vegetation.
- After the first year of establishment all populations should be monitored and reports submitted to the Service peri0dically until individuals established as part of a viable population.

5.1.30.6 Transplanting Program

The applicant/permittee can propose a transplanting plan if ALL the below are satisfied:

- The Corps/FWS accepts submission of a transplanting plan (5.1.29.4);
- The species is one of the following: *Ottoschulzia rhodoxylon; Trichilia triacantha; Buxus valhii; Eugenia woodburyana; Cordia rupicola; Cordia bellonis; Daphnopsis helleriana; Solanum drymophilum; Pleodendron macranthum; Banara vanderbiltii; Myrcia paganii;* Auerodendron pauciflorum; Zanthoxylun thomasianum;
- Species that not eligible (transplanting not appropriate) are: *Catesbaea melanocarpa*, *Junglans jamaicecensis*, *Polystichum calderoense*, and *Cyathea dryopteroids.* These are excluded because of very low number of total known population and/or have very restricted distribution and/or have low or no potential for success.
- The number of individuals to be transplanted comprises 10% or less of the population "including seedling" found in and adjacent to the construction ROW
- Transplanted individuals will be transferred to the botanical Garden at Río Piedras and latter planted within a protected area within the range of the species.
- The receiving area will be enhanced to ensure that it constitutes a viable population.

- Since discovery/presence of the species in ROW indicates the project may impact areas essential for recovery of the species, the applicant/permittee will protect suitable habitat. The total amount of habitat to be protected will be determined in accordance to the amount of prime (undisturbed) suitable habitat to be affected, plus the amount suitable but degraded habitat that harbors the conditions necessary for the establishment of the species to be affected. The first priority is adding protection of the transplant receiving area if is not already protected. Second priority is protection of known populations not currently protected, e.g., placing a conservation easement the *Buxus vahlii* population at Rincón and transfer to the DNER. The third is protecting further suitable habitat in the region of the discovered individual(s).

5.1.30.7 Earthwork on steep topography

Due to the steep topography of some areas, cut and fill activities are anticipated. This construction method will be limited to the minimum necessary and fill material will not be deposited down slope on undisturbed forest habitat. Fill material will be removed from the areas and not deposited down slope. If fill material is deposited down slope, it may affect further habitat outside the ROW. The purpose of this action is to minimize the possibility that fill material reach areas that were not appropriately surveyed and to minimize the possibility of affecting listed plants populations "seedlings and seed bank". The areas identified to deposit fill material will be appropriately surveyed to ensure that additional impacts to listed species are avoided.

5.1.30.8 Restoration of cleared area

Cleared areas that are not part of permanent ROW will be restored to the previous conditions of the area.

- Prior to initiation of landclearing operations, the applicant/permittee will submit to the Corps/FWS a detailed plan for the restoration for each of the major regions. The outline for the detailed plan for the Peñuelas region follows.
- Restoration in Peñuelas.
    - Habitat quality on Guánica Forest could be used as a standard to reforest the affected areas within Peñuelas.
    - Restoration can be based on species and tree density from Murphy and Lugo (1986): Structure and Biomass of a subtropical dry forest in Puerto Rico.
    - Plant at least a minimum 2,000 trees per acre.

- Include the more common species for the Guánica Forest as reported in Murphy and Lugo (1986).
- No exotic tree species be used.
- The survival of each planted tree guaranteed for a period of at least five years.
- Watering should be provided as necessary to guarantee the survival of the planted trees.
- In the case of the alignment that harbors habitat but shows evidence recent disturbance but still harbors habitat (north-south yellow line in the figure), use Cobana negra (Stahlia monosperma), for reforestation purposes.

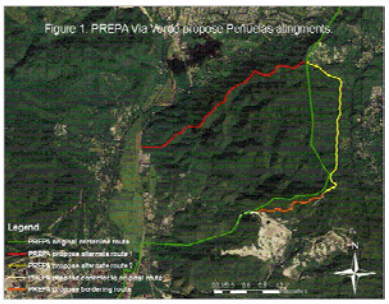


Figure 1. PREPA Via Verde proposed Peñuelas alignments.

5.1.30.9 Reporting

The applicant/permittee will submit montly report on implementation of the implementation of 5.1.30, including summarizing the information gathered during surveys and construction phases of the project. The content of the reports and the format of the data should be coordinated with the Corps/FWS prior the project starts.

5.2 Wildlife

The following species of animals, nine federally listed under USFWS jurisdiction and ten state listed (Commonwealth of Puerto Rico) have the potential to be found within the pipeline corridor route.

5.2.1 *Trichechus manatus manatus*- (Antillean manatee)

Status: Endangered

5.2.1.1 General Species Biology

The West Indian manatee is the largest surviving member of the order Sirenia. The Antillean manatee or Caribbean manatee is a sub-species based on genetic and morphological studies. The average West Indian manatee is approximately 3 meters long and weighs between 400 and 600 kilograms. The manatee is generally gray to brown in color. These marine mammals are uniformly dark gray to brown in color, wrinkled, sparsely haired and rubber like. Manatees have

paddle like forelimbs, no hind limbs, and a spatulate, horizontally flattened tail (USFWS 2001 Florida Manatee).

Manatees are herbivorous, feeding opportunistically on marine, estuarine, and freshwater plants. Manatees can tolerate a range of salinities and can travel between marine and freshwater habitats but do require a source of freshwater that can be obtained from both natural and anthropogenic sources. Manatees are cold sensitive and require water temperatures above 68 degrees Fahrenheit to prevent thermal shock.

Reproduction generally successfully occurs between the ages of seven and nine and gestation lasts from twelve to fourteen months. Mating activity can occur throughout the year. A single calf is normally born; however, two calves have been recorded on rare occasions. Calving intervals range from two to three years.

5.2.1.2 Distribution and Abundance

The Antillean manatee is sparsely distributed throughout the Caribbean. This species can be found from Mexico, east to the Greater Antilles, and south to Brazil. They are found in the following countries: French Guiana, Suriname, Guyana, Trinidad, Venezuela, Columbia, Panama, Costa Rica, Nicaragua, Honduras, Guatemala, Belize, Mexico, Cuba, Haiti, Dominican Republic, Jamaica, and in the U.S. (Puerto Rico).

The USFWS 2007 Manatee 5-Year Review indicates that "...spatial distribution of manatees in Puerto Rico was described by several researchers and is based primarily on manatee sighting locations during aerial distribution surveys". The studies referenced in the review all indicate that manatees in Puerto Rico are more commonly observed in coastal areas of San Juan, eastward to the east coast, and then south and west to the west coast to Rincon. Manatees are not as common along the north coast. This is thought to be the case because of a lack of secluded embayments, freshwater sources, and shallow seagrass beds.

USFWS reports that in a 2009 survey, the Antillean manatees in Puerto Rico were thought to include about 350 animals. In this survey, stock was deemed to be stable and potentially increasing in certain areas.

Manatees are under threat from increasing human-related threats that include watercraft, habitat loss, and other activities. Historically, Antillean manatees were hunted by local natives

and sold to European explorers for food. Poaching and entanglement in fishing gear still remain a threat.

5.2.1.3 Current Conditions

Manatees are known to heavily utilize areas along the southwestern coast of Puerto Rico. Coastal waters from Ponce to Guayanilla have been identified as areas of distribution and movement for the Antillean manatee.

5.2.1.4 Summary of Impacts

No direct impacts to the Antillean manatee or its habitat are expected to occur as a result of the proposed action. The proposed pipeline will be installed landward of the coastal waters in this region and canals in this area will be crossed using Horizontal Directional Drilling; therefore no impacts will occur to manatees or their habitat.

5.2.1.5 Indirect, Interdependent, Interrelated and Cumulative Effects

The natural gas to be transmitted through the pipeline after the pipeline is constructed will be provided via the import terminal operated by EcoEléctrica. The Federal Energy Regulatory Commission (FERC) in May 1996 authorized EcoEléctrica to construct and operate a marine terminal for unloading LNG tankers, two 1-million-barrel LNG storage tanks, six vaporizers, and associated equipment. The Biological Opinion dated March 29, 1996, evaluated the effects of the associated increase in marine traffic by "10 to 25 movements per year if a 125,000 cubic meter LNG ship". EcoEléctrica constructed the terminal, one of the tanks, two of the vaporizers, an electric generation plant using vaporized LNG for fuel, a desalination plant, and a pipeline to serve applicant's Costa Sur plant, which resulted in approximately 12 movements per year. FERC in April 2009 authorized EcoEléctrica to add two vaporizers and associated equipment to supply re-gasified LNG to PREPA's Aquirre power plant, increasing EcoElectrica's peak send-out of regasified LNG by 93 million standard cubic feet per day (MMscf/day) and increases the number of LNG vessels by 12 per year for a total of 24 per year (compared to 25 in the Biological Opinion). For the modification, FERC consulted with FWS who replied on March 6, 2009 concurring with FERC's determination the modification would not likely to adversely affect the Antillean manatee. The pipeline to the Aquirre power plant was not completed and the applicant advised the Corps, by letter of March 7, 2011, that "the natural gas supply for the Project [Via Verde] (approximately 93MM scf/day) will be purchased by PREPA in accordance with the Order and Authorization granted by FERC in 2009. This amount of gas will be utilized by PREPA in fueling the power plants that are part of its generating system", that is, 93MM scf/day delivered by the approximately 12 LNG vessels per year will be selectively distributed

among the three power plants at the terminus of the pipeline and the Costa de Sur plant, the selection could occur on a daily basis. PREPA may in the future purchase additional gas for transmission through the pipeline but that would require a modification of the import terminal which would require authorization from FERC, who would, based on past practice, assess and consult with FWS on the effect on the Antillean Manatee.

5.2.1.6 Conservation Measures and Recommendations

No specific conservation measures are proposed for this species.

5.2.1.7 Conclusion

Based on current research and known distribution of the Antillean manatee, and the information contained herein, PREPA has determined the proposed action would not affect the Antillean Manatee.

5.2.2 Eleutherodactylus jaunariveroi- (Coqui llanero or Plains Coqui)

Status: Under Review

5.2.2.1 General Species Biology

Eleutherodactylus jaunariveroi can be distinguished from similar species by a combination of morphometrics, body coloration, call features and habitat association. This species is the smallest of the genus Eleutherodactylus on the island. Adults are 15 mm in body length on average and their color ranges from yellow to yellowish brown with a light longitudinal, reversed comma mark on each side. Its mid-dorsal zone is broadly bifurcated and has two conspicuous post-tympanic glands. The calls consist of a series of short high pitched notes with call duration varying from 4 to 21 seconds. The calling activity starts at sunset and decreases before midnight.

5.2.2.2 Distribution and Abundance

The *Eleutherodactylus juanariveroi* is only known from the Sabana Seca, Toa Baja Municipality, in seasonally flooded herbaceous wetlands that are located in the vicinity of the U.S. Naval Security Group Activity Sabana Seca (USNSGASS) and the Caribbean Primate Research Center.

The species inhabits the subtropical moist forest life zone. This species is considered a habitat specialist, limited to a 180 hectares of seasonally flooded palustrine wetlands on a limestone formation.

5.2.2.3 Current Conditions

A habitat assessment and search for the species was conducted along the proposed pipeline route of the project in the municipality of Toa Baja. Field visits were conducted during daylight in December 2010 and during the day and night during the month of January and February 2011. Playback calls were used during the night to encourage males to vocalize.

The study area extends from PR 165 to the south of road PR-867, and comprises a mosaic of herbaceous wetlands and uplands. This area is comprised mostly of areas of improved pastures, interrupted by canals and lagoons. In this area, the cocqui llanero was not observed or heard during the study.

An area closer to the coast was also surveyed. This palustrine area was interrupted by groups of trees and shrubs including almond, coconut palms, and mangroves. During this portion of the site survey, the presence of six (6) individuals of the coqui llanero were detected. This site represents the first location for the coqui llanero outside of the habitat originally described for the species. Coqui llanero habitat is located between Mile Markers 78 - 79**.**

5.2.2.4 Summary of Impacts

The six (6) individuals of the coqui llanero were detected within the proposed project corridor. During the construction of the pipeline, the known habitat will be temporarily impacted. Immediately upon completion of construction within the coqui llanero habitat, the disturbed area will be restored to preconstruction conditions, which includes reconstructing the coqui llanero habitat. The proposed project will result in the temporary impacts of approximately 0.0025 acre of coqui llanero habitat.

No individuals of this species are expected to be directly impacted, as they will be captured and released in a nearby undisturbed suitable habitat.

5.2.2.5 Indirect, Interdependent, Interrelated and Cumulative Effects

The construction of the proposed project is not expected to have any indirect, interdependent or interrelated effects on the coqui llanero. Cumulative effects are not expected due to the restoration of all potential coqui llanero habitat.

5.2.2.6 Conservation Measures and Recommendations

Conservation measures for the coqui llanero will involve conducting surveys for the species prior to any construction activities in each area considered potential habitat. A local qualified biologist will be on staff to conduct these surveys. During these surveys, if individuals of the species are detected, the biologist will relocate the individuals to a nearby undisturbed suitable habitat.

The coqui llanero is a State listed species and coordination of conservation measures has been in process with the DNER. A draft letter summarizing the avoidance protocol was delivered in April 2011. A final letter will be submitted to DNER upon approval of the proposed methods.

(1) During the initial establishment and clearing of the construction right-of-way, two biologists will conduct daily sampling for detecting the concho toad in every area of construction before work begins.

(2) These monitoring activities will be carried out daily, concurrent with the monitoring required for the Puerto Rican boa and will be focused on cover areas (cracks in rocks and trees species) that are regularly used by these species.

(3) All monitoring events will be incorporated into and will be carried out in coordination with the work plan of the contractor; daily changes to these work plans shall be considered in planning the work.

(4) Monitoring events will be carried out between 5:00 a.m. and 7:30 a.m. on days when major equipment will be operated within the construction right-of way.

(5) When a species is detected, established capture and relocation protocols (similar to those identified for the boa) will be implemented. Data regarding all species identified within the ROW, captured and/or relocated, will be incorporated into the daily environmental monitoring logs.

(6) All collections, relocations and data transmissions will be coordinated with the appropriate local, state, and federal regulatory agencies.

5.2.2.7 Conclusion

In light of the proposed conservation measures, it is recommended that the proposed action would affect, but is not likely to adversely affect the coqui llanero and its habitat within the project area.

5.2.3 *Peltophryne lemur* – Puerto Rican Crested Toad

Federal Status: Threatened

5.2.3.1 General Species Biology

The Puerto Rican crested toad, or Sapo concho, is a mid-size toad, 64-120 mm (2.5-5 inches), with olive-yellow to blackish brown supraorbital ridges and a distinctive turned up snout. Males are considerably smaller than females and have a prominent crest. In spite of not being documented, it is believed these toads are opportunists who primarily consume insects and other invertebrates. Mating appears to be sporadic and highly dependent on occasional heavy rain. When rain and surface waters are suitable, a mating season may occur. The mating period is short and after a few weeks the metamorphosis is complete and their young disperse rapidly. The adult toads are semi-fossorial and widely dispersed when not mating. The crested toad has the ability to travel approximately two miles from cavities and crevices used as retreat sites in the wood hills.

5.2.3.2 Distribution and Abundance

Due to this species' cryptic behavior, location or even the presence of adults when they are not mating is difficult to detect. At present, crested toads are known to exist only on the island of Puerto Rico at low elevations, below 200 meters (656 feet). This habitat is associated with lowland limestone forest in both the north and south parts of the island. A single large population, located on the southwest coast in Guánica forest has been documented, and a small population is believed to exist on the North Coast. This species has also been infrequently collected in the plains of the South coast, near Coamo (USFWS 1990). While the population of the Guánica forest is relatively stable and consists of approximately 1,500 to 2,000 individuals, the Northern population is only 25 individuals.

The Puerto Rican crested toad was added to the Federal lists as "threatened" on August 4, 1987. The main factors contributing listing includes loss of habitat due to fill and drain for construction, farming, and control of mosquito breeding sites.

The Department of Natural and Environmental Resources reported a significant increase in the Concho toad population in the Bosque Seco de Guánica (Guánica Dry Woodlands) during the first half of this year. The current estimate for the toad population in Puerto Rico is 3,000. Three significant reproductive events have already taken place in Guánica and there is still the possibility that the population will keep on growing because of the above normal rainy season. DNER biologists have monitored and counted 1339 males, 389 females, 201 amplexus, and 39 rows of hatched eggs.

Funding for recent studies has been provided by USFWS along with the consulting and labor from the Texas Fort Worth Zoo. DNER's efforts to construct artificial ponds for toad reproduction in Manglillo Pequeño continue to provide positive results. Initial monitoring of the artificial pond site indicated that the pond was used by two pairs of Concho toads for reproduction. Additional efforts in the Finca Gabia in Coamo and El Tallonal, have demonstrated that observed adult toads who grew up in other artificial ponds have also demonstrated reproductive success.

The Puerto Rican crested toad is the only toad endemic to the island. In the past, populations could be found along the northern coast from Arecibo to Isabela and the southern coast between Coamo and Guánica. The northern population was observed for the last time in 1992. The only known reproductive populations are currently found in the Guánica State Forest. Appropriate collaborative management between state, federal and private agencies have resulted in positive population increases of this endangered species.

5.2.3.3 Current Conditions

The habitat of *P. lemur* is associated with humid, arid or semiarid limestone forests, characterized by a high content of cavities and cracks in soil with good drainage and diverse vegetation. Areas of runoff accumulation or permanent ponds that serve for breeding are essential habitat components for the species.

A survey was conducted for the crested toad within three focus sections within the project corridor that are considered part of the historical range of the species. The three focus areas were located in the municipality of Penuelas, Manati, and Vega Baja. The results of a flow accumulation model were used to identify areas where accumulation of water would occur within the project corridor. Those areas identified were visited and the search was narrowed to 100 feet to each site of the propose project corridor. All areas were visited during the day, allowing for identification of landscape and potential habitat. Visits were also carried out at night

to detect the species. During these visits, substrates such as small caves and rock shelters were searched. Additionally, tadpoles were searched and identified in all areas where pools were identified. All site visits occurred between November and December 2010. The survey was not only conducted to determine presence or absence of the crested toad, but the proposed project corridor was reviewed for potential habitat as well. All potential habitat was documented.

No crested toads or tadpoles were observed or heard during any of the site visits. However, eight (8) potential areas of habitat for the species were identified during the survey. Potential habitat was identified in all three focus areas:

South Section

Three areas were identified as potential habitat for the crested toad. Two areas hold water intermittently and are both surrounded by dry forest. The third area consists of two permanent ponds surrounded by dry forest.

Vega Baja Section

Two areas were identified as potential habitat for the crested toad in the Vega Baja section. The first area is a permanent artificial pond that is located in a flat area approximately 75 meters away from the nearest haystack hill and is surrounded by pastures. The second area has the greatest potential for occurrence of the species. This area consists of a sinkhole that flows into an intermittent streambed that forms small temporary ponds during rain periods. This area is located within a part of a limestone forest that is in good condition and is characterized by a large number of cavities and leaf litter. Additionally, this forested area is part of the limestone are where individuals of crested toad have been observed in the past.

Manati Section

In this focus section, three areas were identified to have potential habitat for the crested toad. The first area consists of a sinkhole that collects runoff water that is surrounded by limestone forest, which contains cavities that can serve as a retreat for the species. The second area is a small permanent pond surrounded by both limestone forest and open area. The third area is another sinkhole that collects runoff water forming intermittent ponds. This area is adjacent on one side to a haystack hill and on the other, an abandoned agricultural field.

5.2.3.4 Summary of Impacts

Adjustments and realignments of the proposed pipeline corridor reduced the potential direct impacts of potential reproductive habitat for the Puerto Rican crested toad. The most recent change shown in the figure and will be reflected in revised project drawings, and in addition at this location additional care will be taken to protect and restore the waterway that passes by these ponds. As a result of these actions, all potential reproductive site impacts have been eliminated.

5.2.3.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Removal of habitat could result in an Indirect affect. A 50-foot ROW will be permanently maintained. In the Karst area the construction ROW will be limited to 60-feet as shown in the GIS shape file "Listed Plants Reduced Footprint". Cumulative effects could potentially occur if additional linear construction activities occur in the same vicinity, reducing habitat.

5.2.3.6 Conservation Measures and Recommendations

The Puerto Rican crested or Concho toad is very difficult to detect due to their small size and secretive habits. However, due to the potential for occurrence of this species in the project corridor right-of-way, the following conservation measures will be implemented:

(1) During the initial establishment and clearing of the construction right-of-way, two biologists will conduct daily sampling for detecting the concho toad in every area of construction before work begins.

(2) These monitoring activities will be carried out daily, concurrent with the monitoring required for the Puerto Rican boa and will be focused on cover areas (cracks in rocks and trees species) that are regularly used by these species.

(3) All monitoring events will be incorporated into and will be carried out in coordination with the work plan of the contractor; daily changes to these work plans shall be considered in planning the work.

(4) Monitoring events will be carried out between 5:00 a.m. and 7:30 a.m. on days when major equipment will be operated within the construction right-of way.

(5) When a species is detected, established capture and relocation protocols (similar to those identified for the boa) will be implemented. Data regarding all species identified

within the ROW, captured and/or relocated, will be incorporated into the daily environmental monitoring logs.

(6) All collections, relocations and data transmissions will be coordinated with the appropriate local, state, and federal regulatory agencies.

Additionally, the applicant has recommended that the construction ROW corridor be reduced to 70 feet from 100 feet in this species' potential habitat.

5.2.3.7 Conclusion

Conservation measures for the Puerto Rican crested toad have been adopted to reduce any potential impacts associated with clearing and construction of the proposed pipeline. With these conservation measures in place, a "May Affect, but Not Likely to Adversely Affect" (MANLAA) determination is recommended.

5.2.4 *Epicrates inornatus* – (Puerto Rican Boa)

Federal Status: Endangered

5.2.4.1 General Species Biology

The color of the Puerto Rican boa is variable, but generally is colored from pale to dark brown, sometimes white, with 70 to 80 more dark spots on the back from the neck to the anal opening. These dorsal spots usually have dark edges with centers of a lighter hue. The maximum size of this snake is about 2 meters (6.5 feet). In captivity, the boa diet consists of birds, small mammals and lizards, and their diet in the wild is estimated to be similar. The boa feeds by swallowing its prey head first, taking the prey in its jaws, then coiling and squeezing to suffocate the victim.

5.2.4.2 Distribution and Abundance

This species exists only in Puerto Rico; however, there are no estimates as to the population numbers. During radio telemetry studies in the Reserva de Mata de Plátano, the average area covered by females during the breeding season was 7,800 square meters, and 5,000 square meters for males (USFWS 1990). The average area covered by females during the non-breeding season was 22,119 square meters and 1,326 square meters for males. During the breeding season, all females under study covered an average area of 16,940 square meters and all males covered 18,500 square meters.

The Puerto Rican boa was listed as "endangered" on October 13, 1970. The decline in the snake's population resulted from the popularity of the oil produced from the snake's fat and impacts to the snake's preferred habitat. Deforestation and poaching continue to affect the population. Predation by the mongooses, introduced in Puerto Rico in the 1900s, is thought to be another possible element contributing to the decrease in the boas' numbers, although this has not yet been substantiated.

5.2.4.3 Current Conditions

During field reviews of the pipeline corridor conducted by Coll Rivera Environmental (Flora and Fauna Study, 2010), two individuals were encountered. The species is considered to have a high potential of occurrence in the proposed pipeline corridor.

Coll Rivera Environmental conducted a GIS analysis of the Puerto Rican boat habitat along the length of the pipeline corridor (Action Area). This method was used to estimate the areas of Puerto Rican boa habitat that could be affected by the construction and operation of the Via Verde Pipeline project. A screening using GIS technology was used to identify the areas where *E. inornatus* are potentially present. Forested areas were identified as potential PR boa habitat.

The routes of the Vía Verde Pipeline project will temporarily (100-feet Right–of-Way) affect approximately 307 acres of potential *Epicrates inornatus* habitat during the construction phase of the project. Permanent (50-feet Right–of-Way) impact was estimated at approximately 154 acres. To further mitigate potential impact, the applicant agrees to reduce the construction ROW to 60-feet in the more valuable boa habitat in the Karst areas (Manati).

However, impacts to *E. inornatus* habitat areas are likely to be reduced due to the fact that forested areas in the Municipality of Peñuelas show other conditions that are not part of the typical habitat of this species. In fact, the Caribbean Endangered Species Map, published by the U.S. Fish and Wildlife Service, does not include this species for the Municipality of Peñuelas. If the Peñuelas area is not taken into account, the temporary impacts to the boa's habitat will be approximately 199 acres or less. The permanent impact to this species' habitat will be approximately 99 acres.

5.2.4.4 Summary of Impacts

As previously mentioned, it is expected that approximately 199 acres (or less) of temporary impacts and 99 acres of permanent impact will occur within Puerto Rican boa habitat. The permanent impacts will result in the reduced capacity of lands potentially suited for Puerto Rican

boa habitat. The temporary impacts are expected to have no long term impacts to Puerto Rican boas.

5.2.4.5 Indirect, Interdependent, Interrelated and Cumulative Effects

The loss of habitat associated with the proposed project will be negligible in relation to the amount of available habitat for the Puerto Rican boa. As such, the proposed project is not expected to have any indirect, interdependent, interrelated or cumulative effects on the species.

5.2.4.6 Conservation Measures and Recommendations

Conservation measures proposed for the Puerto Rican boa include educating project staff, pre-construction studies, and relocation of individuals to protected areas. Conservation measures are as follows:

(1) All construction personnel will be required to attend instructive meetings related to the Puerto Rican boa. Information to be presented at these meetings will include a description of the snake, protection measures which must be undertaken to insure their survival, penalties for harassing boas, and the relocation and capture procedures described below.

(2) During the clearing and construction of the right-of-way, two field biologists will carry out daily surveys to detect for presence of the Puerto Rican boa in each construction area before starting work. Heavy equipment will be checked to see if any boa entered it overnight. Observations are to be carried out daily and any changes to the work plan shall be considered when planning for examinations. A search will take place from 5: 00 a.m. to 7: 30 a.m., any day that major equipment is used.

(3) In the event the presence of any individual is noticed, the protocol below will be followed to capture the individual for relocation. If construction staff discover a snake in the workspace, all machinery 50 feet around the snake shall cease and the resident engineer shall be notified. An authorized project biologist will capture the snake for relocation in accordance with the Protocol that follows. Construction activities can continue once the snake has been removed.

(4) Any captured snake will be relocated to the Guajataca or Río Abajo forest, or other public land in an area with habitat similar to the capture area.

(5) Boa monitoring reports will be prepared monthly, summarizing the results of surveys, the capture of any boas, and relocation activities. Reports are to be forwarded to the USFWS and the DNER as per permit conditions.

Capture and Relocation Protocol for the Puerto Rico Boa

Resident project biologists are responsible for implementing these procedures in the event a snake is found within the limits of the established ROW during construction. At least one resident biologist project will be present during all working hours. The following steps will be taken in the event a snake is found:

(a) workers up to 50 feet away will stop all work.

(b) a person will keep watch on the snake while another alerts the project engineer or biologist.

(c) the project biologist will capture the snake with a snake rod or other appropriate instrument, not inflicting any damage to the snake. The snake will be placed in a bag or box in a cool, dark place to wait for transport to the relocation site.

(d) if a Puerto Rican Boa is positively identified, the snake is to be released in the forests of Guajataca or Rio Abajo, or any other public land with habitat similar to the area where the snake was captured. All other species of snake will be released within the established construction ROW at the end of the work day: outside the limits of the existing or future construction site.

(e) the project biologist releasing the snake will be responsible for ensuring an incident report is completed and properly filed. This report shall contain the following information:

(1) Exact location of the snake when observed and the circumstances of the observation.

(2) The order and the procedures followed after the observation time.

(3) Personnel involved in every step of the procedure.

(4) The perceived condition of the snake at the time of observation and the snake's condition when removed.

(5) Species of snake, if known.

(6) The time and location where the Snake is released.

(7) Any photographs taken of the snake.

(8) In the event a dead snake is discovered inside the construction right-of-way, the carcass will be placed in a sealed plastic bag with ice or frozen until a positive identification can be made. If the snake is identified as a Puerto Rican boa, the body must remain frozen and the USFWS and the DNER will be notified for additional instructions.

(9) The report shall be signed by the project biologist and included in the monthly report submitted to the USFWS and the DNER.

5.2.4.7 Conclusion

A conservation measures/plan has been prepared for protection of the Puerto Rican boa during the clearing and construction of the pipeline. With adoption of the Puerto Rican boa Conservation plan, it is PREPA's recommendationd the proposed Via Verde pipeline project have a "May Affect but not likely to Adversely Affect" determination, however the Corps has determined "May Affect".

5.2.5 *Accipiter striatus venator* – (Puerto Rican sharp-shinned hawk)

Federal Status: Endangered

5.2.5.1 General Species Biology

This small hawk is approximately 28-33 cm (11-13 inches) long. The upperparts are gray and the sub-adult is distinctive. Sub-adults are brown with stripes on their undersides. While in flight, the noticeable characteristics are the short, round wings, and long, narrow tail. Nesting hawks may prefer modified habitats and may select plantations and natural forest with similar plant structures and topography (closed and dense coverings). The breeding populations have been located in the mountain forests in Maricao, Toro Negro, Guilarte, Carite and the Caribbean national forest.

5.2.5.2 Distribution and Abundance

In 1992, a census of 285.6 miles square (178 square miles) found 82 Puerto Rican sharp-shinned hawks; 40 in the Maricao forest, 30 in Toro Negro forest, 10 in Carite forest, and 2 in the Caribbean National Forest. Courtship and territorial activities in the Maricao forest for this species has been located in the north-central, in the lower moist subtropical forest and wet

subtropical forest. In the Carite Forest, courtship and territorial activities occurred in the northeastern and north central regions. In the Caribbean National Forest, only two individuals were detected in the Palo Colorado forest and the lower-montane forest (USFWS 1990).

The species was listed as "Endangered" on September 9, 1994. Threats to this hawk include logging, construction of roads, the increase in the number of recreational facilities, the effects of hurricanes, and issues of genetic variation. Additionally, high attrition rates of eggs and high mortality of chicks due to the parasitic botfly larvae (*Philornis* spp.) have affected the numbers of this species.

5.2.5.3 Current Conditions

The project corridor traverses habitat that has been determined to be appropriate for the species, however the species was not observed during field reviews for this BA. The species is considered to occur within the pipeline corridor as proposed. To assist in compliance with the federal Endangered Species Act (ESA) of 1973, the project owner (PREPA) contracted Tetra Tech, Inc. (Tetra Tech) to complete a study to evaluate the effects of the proposed project on the Puerto Rican Broad-winged Hawk (Buteo platypterus brunnescens) and Puerto Rican Sharp-shinned Hawk (Accipiter striatus venator). Mr. Derek Hengstenberg, a recognized expert on these raptor species and current avian biologist with Tetra Tech, conducted the evaluation. The following results and recommendations pertaining to the sharp-shinned hawk have been excerpted from Mr. Hengstenberg's study:

> Extant population of Sharp-shinned Hawks have been mostly found from the upland forests (elevation of 200 meters or greater) of Puerto Rico including Maricao, Toro Negro, Carite, and Luquillo. Sharp-shinned Hawks are noticeably absent from karst forests and coastal plains. Sharp-shinned Hawk habitat appears restricted to upper elevation habitat. Sharp-shinned Hawks showed high site fidelity within subtropical wet forest and subtropical lower montane wet forest life zone. It appears that Sharp-shinned Hawks are selecting certain habitat over others (Delannoy 1997). High stem density, closed-canopy, and tall-large diameter trees are important habitat features for Sharp-shinned Hawks.
>
> Of the approximately 92 miles of pipeline proposed, approximately 20 miles is within potential Sharp-shinned Hawk habitat in parts of Focal Area 1 (Figure 1). A no impact area was calculated from mileage marker 30 to mileage marker 91 along the central and northern part of the pipeline and then again from mileage marker 0 to 10 along the

southern section. Sharp-shinned hawks are not known from the karst region and are typically found at elevations greater than 900 feet.

Northern Coast: There should be no impact to Sharp-shinned Hawks from mileage marker 38 to mileage marker 91 along Via Verde Pipeline.

Central Karst Region: There should be no impact to Sharp-shinned Hawks in these sections of the Via Verde Pipeline from mileage marker 30 to mileage marker 37.

Central Mountain Volcanic Region: The proposed Via Verde pipeline does not pass through any commonwealth forests that support known Sharp-shinned Hawks. However, the pipeline crosses stretches of continuous forest tracts in the Cordillera Central that may provide habitat for the Sharp-shinned Hawk (mileage marker 10 to 30). According to the Puerto Rico Breeding Bird Atlas, the Adjuntas Pueblo survey route (# 0910) confirmed the presences of Sharp-shinned hawks. This survey route is in close proximity to the proposed path of the pipeline.

The moist/wet subtropical forested tracts of land that occur north of the subtropical dry forest life zone and extend until the karst region near Lago Dos Bocas is the area that should be further evaluated (Figure 2). In this section, the pipeline follows some mountainous roads but the majority of the pipeline will be overland (through intact forests) and will require a temporary 100-foot corridor (in places of forested habitat) to be cleared during the construction process and then a 50-foot corridor maintained for the life of the project. In these interior forest sections, very little data exists on Sharp-shinned Hawks. Although sporadic, the data suggest the occurrence of Sharp-shinned hawks in these mountainous montane sections. Sections of pipeline that are proposed for overland development and contain intact forest structure in the moist/wet lifezone should be evaluated.

Based on the results of the Biological Evaluation and by request of the USFWS in their letter dated December 15, 2010, PREPA again contracted with Tetra Tech to conduct raptor surveys for the broad-winged hawk and the sharp-shinned hawk. The surveys were conducted in forested areas that were selected during the initial BA. After consultation with USFWS on survey design, raptor surveys were conducted from 12 observation points located within forested sections of the Project area (Action Area) during the month of January 2011. Each

observation point was surveyed twice during the survey period of January 12- January 28, 2011 for a total of 24 surveys.

The surveys were designed to cover areas identified to have potential habitat in both the karst and central mountain regions. Tetra Tech determined the potential habitat of concern through a desktop biological evaluation and confirmed through USFWS consultation, as well as site-reconnaissance survey of the Project area (Action Area) during December 2010.

Twenty-four (24) raptor surveys from 12 observation points resulted in 144 hours of direct, visual observation. A total of four (4) sharp-shinned hawks were observed in four different locations along the corridor route. All sightings were of adult birds. All four sharp-shinned hawks were sighted flying in close proximity to or within the Project Area (Action Area). No territorial or epigamic displays were observed. All sharp-shinned hawks were observed flying alone.

Two of the four sharp-shinned hawks were observed in the Karst Region, while the remaining two were observed in higher altitudes in the central mountain region.

5.2.5.4 Summary of Impacts

During the 24 surveys conducted in January 2011, Tetra Tech did not observe any evidence of nesting activity within the Project Area (Action Area). Due to this fact, Tetra Tech was not able to calculate an area of impact to nesting territories. No nests were observed during the surveys.

Direct temporary and permanent impacts to potential Puerto Rican sharp-shinned hawk were calculated for the proposed project. Areas within Focal Areas 1 and 2 that contain forested habitat and are at elevations known to be preferred by this species were included in this calculation. Based on the extent of available data, it has been determined that there are approximately 15 miles of potential Puerto Rican sharp-shinned hawk habitat along the proposed project corridor. Temporary and permanent impacts are as follows:

- Temporary impacts 50 feet (100 feet construction corridor - 50 foot permanent maintenance easement) X 15 miles of impacts = 91 acres

- Permanent impacts 50 feet X 15 miles of impacts = 91acres

Sharp-shinned hawks are dependent on closed canopy forest and clearing any forest may have an impact on the species. The impacts to this species would be limited to Focal Areas 1 and 2. Forest clearing would create openings in the forest, which could potentially directly impact foraging areas. However, based on the extent of the existing available habitat it can be assumed that these changes would not have a significant impact on the local population and subpopulation.

5.2.5.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Sharp shinned hawks appear to select certain habitat over others (Delannoy 1997). The habitat features important to sharp-shinned hawks are high stem density, closed-canopy, and tall-large diameter trees (Biological Evaluation completed by Derek Hengstenberg for Sharp-shinned hawks, 2010). Due to these factors, indirect or secondary impacts may occur to potential breeding or nesting territories in this area; however, no nests were identified during the surveys. Cumulative effects may potentially occur if future linear projects (such as road building) or large scale developments occur in the vicinity of the proposed project. These cumulative and indirect effects will be mitigated by replanting a portion of the construction ROW corridor with fast growing trees species.

5.2.5.6 Conservation Measures and Recommendations

Several options exist for minimization of impacts, which include rerouting certain pipeline segments to avoid direct impacts or other techniques to reduce impacts to this species. Mitigation shall consist of planting three (3) trees for every tree removed within the construction corridor. Trees will be planted in the cleared ROW, except in the 50-foot maintenance area.

Construction activity will be restricted to the non-breeding season (July to December) in Focal Areas 1 and 2. This will minimize impacts to nesting birds and to their courtship aerial flights. During construction, specialized biologists familiar with the sharp-shinned hawk and broad-winged hawk will conduct surveys ahead of the construction crews to identify the presence/absence of species and any nesting trees (Identification of a nesting site will necessitate the coordination with USFWS). If nesting trees are identified, the pipeline alignment and associated clearing activities will be adjusted to avoid impacts to those trees.

Reasonable and Prudent Measures

The Applicant proposes that the following reasonable and prudent measures are necessary and appropriate to minimize take of Puerto Rican sharp-shinned hawks:

l. Identify and monitor sharp-shinned hawk nesting sites during the 2011 and 2012 breeding seasons (and subsequent if construction continues) which may be adversely affected by construction activities.

2. Reduce, through terms and conditions specified below, disturbance to Puerto Rican sharp-shinned hawk nesting activities caused by construction activities including overflights, bulldozing, clearing of forested rights-of-way, etc.

3. Monitor sharp-shinned hawk nesting areas for up to 2 years following the construction completion.

4. Reduce the impacts caused by the required routine maintenance of the project right of way.

Terms and conditions

To be exempt from the prohibitions of Section 9 of the Act , PREPA would agree to comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions may be determined to be non - discretionary.

Puerto Rican sharp-shinned hawk

1. Surveys shall be conducted during the 2012 and 2013 breeding seasons (and subsequent ones if construction continues) to locate possible nesting sites within the two Focal areas identified in the Hengstenberg surveys. Emphasis should be given to those occupied territories identified during the 2012 breeding season surveys. Continuous monitoring of these areas should be conducted to determine the reuse of these areas and to document the potential for nesting. Nesting sites should be determined using the four criteria mentioned by Delannoy (1995). Breeding season begins in January-February with the courtship display flights.

The monitoring of breeding activity will be conducted with an intensity of no less than three times a week. Intensive monitoring during the first three stages of the breeding season (courtship, selection of nest tree and nest building) are essential to avoid impacts to nests. Lookouts appropriately located, trained personnel and intensive monitoring are needed.

Once the nest is constructed by the hawks, when egg deposition begins will be determined. Monitoring of activity patterns will be conducted to determine natural abandonment or predation.

After the incubation period (no less than 28 days for the species), the date when the eggs hatch will be recorded to estimate when chicks are ready to fledge. It is known that when the chicks are approximately 29-30 days old, they begin venturing out of the nest. If the lookout is appropriately located, these chicks can be observed from the lookout.

The monitoring of hawk activity patterns will be conducted to determine possible impacts related to the construction activities. For this monitoring, spot mapping for data collection and an intensity of no less than three times a week (from dawn to 2 p.m., the time when the hawks are more active) will be used.

Schedules (time and location) of construction activities (initial land clearing, pipeline machinery, helicopters overflights, bulldozing/grading, trench backfills, among others) along the route shall be prepared before the beginning of the breeding seasons. Estimates of noise and vibration levels expected at different distances along the route will be calculated.

Once the nesting sites are found, the distance between the nest trees and the construction activities will be determined. Noise and vibration levels expected at the nest tree will be corroborated with monitoring of noise and vibration levels at the nest tree (using meters).

Changes in hawk activity patterns will be recorded. If the noise and vibration levels recorded at the nest tree result in a significant change in hawk activity patterns, measures shall be taken to avoid harassment. Once the nest is active (at least one egg is deposited) more restrictive measures shall be taken to avoid mortality. Such measures will include changes in the extent and timing of forested clearing, changes in location of construction activity to areas farther from the nest, and control of access, among others. If significant changes in behavior patterns occur, the Service shall be notified immediately (same day) and necessary measures discussed.

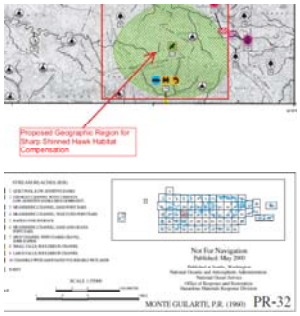
Monthly reports shall be prepared and submitted to the Service summarizing breeding activities, noise and vibration levels at nesting areas, and measures taken to minimize harassment. A final report should be submitted at the end of the construction activity.

3. Nesting sites located adjacent to the right-of-way area, once the pipeline is operational, shall be monitored for two breeding seasons to evaluate impacts of operation. Two annual reports will be submitted summarizing nesting activities during these two breeding seasons.

4. To reduce the possibility of shooting and nesting habitat vandalism, and to minimize indirect and cumulative impacts in the area adjacent to the road, actions shall be taken to increase the surveillance and enforcement in the area. These actions will include patrolling by rangers, the creation of a facility for distribution of educational materials to increase public awareness on protection of endangered wildlife species in the area and placement of signs.

5. Disturbed areas adjacent to the pipeline shall be re vegetated with native vegetation to create a buffer zone between the permanent right-of way and the sharp-shinned habitat.
6. A management and protection plan for the sharp-shinned hawk and its habitat adjacent to the pipeline ROW summarizing the actions to be taken by PREPA to prevent and/ or minimize direct, indirect and cumulative impacts of the operation of the pipeline shall be prepared and submitted to the Service.

In addition to the terms and conditions (above), PREPA agrees to mitigate unavoidable impacts to hawk habitat by acquiring up to 50-acres of suitable hawk habitat presently held in private ownership. This land will be turned over to DNER in perpetuity for management. The figure illustrating the preliminary target geographic area



5.2.5.7 Conclusion

No nests were identified, construction can be scheduled to occur outside of breeding season, and biologist will conduct surveys ahead of construction. These factors in conjunction with the incorporation of the above referenced reasonable and prudent measures should be incorporated into any permits issued. Based on these, while it is PREPA's recommendation that the project "May Affect, but is Not Likely to Adversely Affect" the Puerto Rican sharp-shinned hawk, the Corps has determined “May Affect”.

5.2.6 *Angelaius xanthomus* (Yellow-Shouldered Black Bird)

Federal Status: Endangered

The Yellow-Shouldered Black Bird is a brilliant black with yellow spots on the shoulder of each wing. Adults reached a size of 8 inches, the female being slightly smaller than the male. Young of both sexes resemble the adults. This species is one of nine species of the genus *Angelaius*. There are two subspecies: *Angelaius xanthomus xanthomus*, known only in Puerto Rico and Vieques, and *Angelaius xanthomus m. monensis*, found only in the island of Mona and Monito island.

The breeding season for this species extends from May to August. The nest is a structure of grass and dried herbs faced and lined in soft materials. These nests are built in trees and usually in aggregate. The entire process of incubation is done by the female, however, the

couple also shares the feeding of nestlings. The yellow-shouldered black bird has been known to feed on animal material or vegetable matter, but can best be classified as an arboreal insectivore.

The Yellow-Shouldered Black Bird is an endemic species, or that exists only in Puerto Rico. In the past, this species was considered abundant and was distributed throughout the island. After 1976, the population suffered a dramatic decline. Three major populations exist for this species: South West coast of Puerto Rico (State Boquerón forest), South-East Coast (Roosevelt Roads Naval Station), and Mona and Monito Islands. Current estimates of the population in the South-West of Puerto Rico range from approximately 300 to 500 individuals, approximately 400 individuals in Mona and a few individuals in the southeast of the island. Limited sightings of the Yellow-Shouldered Black Birds have been found in San Germán, Salinas, Laguna, Cartagena, Lajas, Cabo Rojo and Naguabo municipalities.

Among the main reasons for the population decline of this species are: the destruction or modification of nesting habitat, nest predation by rats and mice in mangrove areas, and in coastal areas of the southwest of Puerto Rico, competition for nest and breeding areas with the Shiny Cowbird (*Molothrus bonariensis*). Coastal forests of southwestern Puerto Rico have additionally been severely affected by agricultural use, and accelerated and unplanned residential/tourist development. The La Parguera mangrove system in Lajas, including cays close to the coast, were a very important breeding area for Yellow-Shouldered Black Bird several decades ago. At present, these areas continue to be used by the Yellow-Shouldered Black Bird as critical habitat. Although the Parguera mangrove system is part of the Boquerón State Forest and it is designated as a nature reserve by the Planning Board, the importance for the survival and recovery of this species has been limited due to unrestricted use of the area by houseboats and stilts houses and their along with their debris, continually modify and impact their habitat.

The Yellow-Shouldered Black Bird was placed on the federal list of endangered species in the 1976 and designated areas in the southwest of Puerto Rico including the village of San Germán, Roosevelt Roads Naval Station and the island of Mona were identified as critical habitat for the species. The DNER, and the United States Fish and Wildlife Service share a cooperative yellow-shouldered black bird recovery program in the southwest of Puerto Rico (Boquerón State Forest). This program is mainly to provide artificial nest structures and the control of the population of Shiny Cowbirds. Improved reproductive success of this kind is

important to increase of the population of Yellow-Shouldered Black Bird, incorporating increasingly more youth to the existing population. However, the protection of critical habitat required by the species to survive is essential for the recovery of the same.

The proposed Via Verde pipeline route has been designed to avoid impacts to coastal forested habitats. The Yellow-Shouldered Blackbird will not be affected by this project (Recommended: No Affect).

5.2.7 *Amazona vittata* – (Cotorra Puertorriqueña)

Federal Status: Endangered

5.2.7.1 General Species Biology

The Puerto Rican Parrot is bright green with red front and blue primary feathers in the wings, with flesh-colored beak and legs and is approximately 30.5 cm (1 foot) long. This bird feeds mainly on wild fruits with the Sierra palm (*Prestoea montana*), being a preferred food source. The species also eats flowers and tender shoots. During October, when other fruits are scarce, Tabonuco (*Dacryoides excelsa*) fruit becomes an important food. Observations in the 1990s indicated that nesting was limited almost exclusively to natural cavities in Palo Colorado trees (*Cyrilla racemiflora*). The parrots cleaned a cavity inside the tree but did not add materials. Nest height varies between 7 - 15 meters (23-49 feet) above the forest floor. The breeding begins in January and females generally lay two to four eggs. The incubation period is about 13 weeks. An intense management program began in 1973, greatly increasing the success rate of the Puerto Rican Parrot chicks.

5.2.7.2 Distribution and Abundance

The preferred Puerto Rican parrot habitat consists of mature rainforest between 396-929 meters (1,300 - 2,700 ft) in elevation. The species does not use dwarf forests at higher elevations or second succession lowland forests. The parrots are limited to the areas that have the largest number of old Palo Colorado trees, which supply the cavities for nests. Historically the parrots have also nested in the hollow crags of cliffs, being less specialized in habitat preferences, and also have been reported to use more diversified habitat in lower elevations.

5.2.7.3 Current Conditions

The captive breeding program for the Puerto Rican Parrot program began in 1968, mating some wild and some parrots already in captivity. A captive flock is used to increase the amount of parrots; to maintain a second group of birds, in particular if a natural disaster occurs; to provide

and manipulate different strains of genetic material for its exchange with the wild flock and eventually back into the wild. While the Caribbean National Forest contains approximately 26,000 acres, the parrots are concentrated in a small area of 3,000 acres in central west and western regions of the forest. The karst region in the north has been identified as the site for the release of the Puerto Rican parrot. The species was listed as "endangered" on March 11, 1967. The initial decline of the species is attributed to extensive deforestation. Additional factors contributing to their decline are hunting, devastating hurricanes, natural predation and illegal pet trade. The small size of the current population makes any adverse pressure very serious.

5.2.7.4 Summary of Impacts

At the municipal border of Utuado and Arecibo, the proposed project corridor crosses the northern karst belt region. In this location, the proposed project corridor follows the PR-10 right-of-way through the Rio Abajo forest. Due to the fact that the proposed project follows an existing ROW, the project is not expected to have any direct impacts.

The Puerto Rican parrot habitat range within the Rio Abajo forest does not coincide with the proposed project. The estimated distance between the project and the introduced Puerto Rican parrot population is approximately 2.4 kilometers and the proposed project is not expected to have any direct impacts on this species.

5.2.7.5 Indirect, Interdependent, Interrelated and Cumulative Effects

There are no expected indirect, interdependent, interrelated or cumulative effects associated with the proposed project.

5.2.7.6 Conservation Measures and Recommendations

No conservation measures and/or recommendations are made since the project is unlikely to have an affect on the species.

5.2.7.7 Conclusion

Puerto Rican parrots have not been documented in the proposed project area. The current boundaries of the Puerto Rican parrot have been well documented and studies on this species home range and habitat use are on-going. It is recommended that a determination be made that the Project will have no affect on the Puerto Rican parrot.

5.2.8 *Buteo platypterus brunnescens* – (Puerto Rico Broad-winged Hawk)

Federal Status: Endangered

5.2.8.1 General Species Biology

The Puerto Rican Broad-winged Hawk is a small falcon, dark brown in color, with a total length of approximately 39 cm (15 inches). Adult characteristics are broad bands of black and white on the tail and a russet chest. Unlike the adults, juveniles have dark bars on the chest and lack distinctive bands on the tail. Its wings are broader than the similar but larger Red-tailed hawks. This species normally preys on centipedes, frogs, lizards, mice, rats and other birds. The species is rare and localized.

5.2.8.2 Distribution and Abundance

Existing populations are restricted to mountain habitats in three forests: Caribbean National Forest, Carite Forest, and Río Abajo Forest. The total area currently identified as Puerto Rican broad-winged hawk habitat is approximately 338 square kilometers (132 sq mi). In the north-central area of the Caribbean National Forest, the species is found in subtropical wet forest where the Tabonuco is the dominant forest type. In the Carite National forest, this species has been reported in limestone slopes occupied by Caimitillo (*Chrysophyllum mexicanum*), Tabonuco (*Dacryodes excelsa*), Granadillo (*Buchenavia tetraphylla*), and elfin forests. Additional observations of this species have been reported in other areas including Cayey (near of forest Carite), Utuado, Jayuya, Adjuntas and Villalba.

The species was listed as endangered on September 9, 1994. Timber harvest, poor forest management practices, road construction, an increased number of recreational facilities, demands for public use, destruction of habitats, hurricanes, and the potential loss of genetic variation due to low levels of population are all potential threats to the species.

5.2.8.3 Current Conditions

To assist in compliance with the federal Endangered Species Act (ESA) of 1973, the project owner (PREPA) contracted Tetra Tech, Inc. (Tetra Tech) to complete a study to evaluate the effects of the proposed project on the Puerto Rican Broad-winged Hawk (Buteo platypterus brunnescens) and Puerto Rican Sharpshinned Hawk (Accipiter striatus venator). Mr. Derek Hengstenberg, a recognized expert on these raptor species and current avian biologist with Tetra Tech, conducted the evaluation. The following results and recommendations pertaining to the broad-winged hawk have been excerpted from Mr. Hengstenberg's study:

Northern Coast: A smaller area of evaluation is between the towns of Manati and Vega Baja where the proposed pipeline intersects karst topography of mogotes and sinkholes for a 9 mile stretch of pipeline. The section from mile marker 59 to mile marker 68 is an overland pipeline section through karst topography. There is potential Broad-winged Hawk habitat and a survey is recommended for this area. The remaining coastal area from mileage marker 38 to 58 and 69 to 91 do not contain Broad-winged Hawk habitat. No surveys are recommended in these sections.

Central Karst Region: The proposed Via Verde pipeline will pass through the Rio Abajo Forest (karst region) where there is the highest abundance of Broad-winged Hawks nesting on the island (Delannoy 1997; Hengstenberg and Vilella 2004, 2005). This forest is also home to a recently re-introduced population of endangered Puerto Rican Parrots (Amazona vittata). In 2000 and 2001, one Broad-winged Hawk had a home range (Hengstenberg and Vilella 2004, 2005; Vilella and Hengstenberg 2006) that encompassed area on both sides of Highway Route 10 in the northern section of Rio Abajo. In addition, the Puerto Rico Breeding Bird Atlas recorded Broad-winged Hawks on a couple of their survey routes in this region: # 0608, # 0610, # 0613, #0537, and #0687. Broad-winged Hawks in this stretch of pipeline, from mile marker 30 to 37.5 have been studied in the early 1990s and early 2000's. In this particular section, the pipeline is to be co-located in the same right-of-way as the Highway Route 10. Due to the co-location of the Via Verde pipeline, there should not be any greater disturbance to Broad-winged Hawks than the already existing highway. For this reason, the pipeline in this section may affect but is not likely to adversely affect the Broad-winged Hawk. We still recommend conducting a Broad-winged Hawk survey along the pipeline corridor in this section to document presence/absence along the proposed route. Three survey points should be established, one at the northern, one in the central portion, and one at the southern extreme of the forest boundary to cover the Rio Abajo Forest section of pipeline.

Central Mountain Volcanic Region: The section of pipeline running just south of Rio Abajo through the volcanic region to just north of Ponce in subtropical dry forest zone is a section that needs to be evaluated for the Broad-winged Hawk. The evaluation area is a stretch of pipeline of approximately 20 miles. This section contains a combination of upper elevation forests with forested habitat and there have been historical,, as well as recent, records of Broad-winged Hawks. The Puerto Rico Breeding Bird Atlas recorded

birds from the Guaraguao, Ponce survey route (# 0987). In this section, the pipeline follows some roads but the majority of the pipeline will be overland (through intact forests) and will require a temporary 100-foot corridor (in places of forested habitat) during the construction process and then maintaining a 50-foot corridor. Due to the limited data from this area, the occurrence during a breeding bird survey, historic incidental observations, and potential habitat in this region, a Broad-winged Hawk survey is recommended.

Based on the results of the Biological Evaluation and by request of the USFWS in their letter dated December 15, 2010, PREPA again contracted with Tetra Tech to conduct raptor surveys for the broad-winged hawk and the sharp-shinned hawk. The surveys were conducted in forested areas that were selected during the initial biological evaluation. After consultation with USFWS on survey design, raptor surveys were conducted from 12 observation points located within forested sections of the Project area (Action Area) during the month of January 2011. Each observation point was surveyed twice during the survey period of January 12- January 28, 2011 for a total of 24 surveys.

The surveys were designed to cover areas identified to have potential habitat in both the karst and central mountain regions. Tetra Tech determined the potential habitat of concern through a desktop biological evaluation and confirmed through USFWS consultation, as well as site-reconnaissance survey of the Project area (Action Area) during December 2010.

Twenty-four (24) raptor surveys from 12 observation points resulted in 144 hours of direct, visual observation. A total of one broad-winged hawk was observed in Planta, south of PR-10 just west of the project area. All sightings were of adult birds. The broad-winged hawk was sighted flying in close proximity to or within the Project Area (Action Area). No territorial or epigamic displays were observed. The broad-winged hawk was observed flying alone.

The broad-winged hawk was observed flying in the transition zone between the karst forests of the Rio Abajo Forest and the central mountains of Utuado. It was observed along a slope north of the Rio Grande of Arecibo River and south of the Rio Abajo Forest.

5.2.8.4 Summary of Impacts

During the 24 surveys conducted in January 2011, Tetra Tech did not observe any evidence of nesting activity within the Project Area (Action Area). Due to this fact, Tetra Tech was not able to calculate an area of impact to nesting territories. No nests were observed during the surveys.

Direct temporary and permanent impacts to potential Puerto Rican broad-winged hawk were calculated for the proposed project. Areas within Focal Areas 1 and 2 that contain karst forested areas known to be preferred by this species were included in this calculation. Based on the extent of available data, it has been determined that there are approximately 15 miles of potential Puerto Rican broad-winged hawk habitat along the proposed project corridor. Temporary and permanent impacts are as follows:

- Temporary impacts 50 feet (100 feet construction corridor - 50 foot permanent maintenance easement) X 15 miles of impacts = 115 acres
- Permanent impacts 50 feet X 15 miles of impacts = 115 acres

Broad-winged hawks prefer continuous closed canopy forests. The impacts to this species would be limited to Focal Areas 1 and 2. Forest clearing would create openings in the forest, which would potentially directly impact foraging areas. However, based on the extent of the existing available habitat it can be assumed that these changes would not have a significant impact on the local population and subpopulation.

5.2.8.5 Indirect, Interdependent, Interrelated and Cumulative Effects

The Puerto Rican broad-winged hawk nesting site habitat is of two types: plantation and second growth forest. For nesting the habitat has relatively high density, mostly small trees, closed, canopy, well developed understory, and moderate to average slopes (Recovery Plan). Due to these factors, the indirect or secondary impacts may occur to potential breeding or nesting territories in this area; however, no nests were identified during the surveys. Cumulative effects may potentially occur if future linear projects (such as road building) or large scale developments occur in the vicinity of the proposed project. These cumulative and indirect effects will be mitigated by replanting a portion of the construction ROW corridor with fast growing trees species.

5.2.8.6 Conservation Measures and Recommendations

Several options exist for mitigation, which include rerouting certain pipeline segments to avoid direct impacts or other techniques to reduce impacts to this species. The Broad-winged Hawk is primarily a perch hunter, therefore the use of fragmented areas may be limited by perch availability (Bloom et al. 1993). Nevertheless, available information on spot mapping and raptor

surveys (Hengsten- berg & Vilella 2004) indicated Broad-winged Hawks were frequently observed outside the forest boundaries. Three areas of particular importance to Broad-winged Hawks on the periphery of Rio Abajo Forest in the north-east, north-west, and south-central portions of the reserve have been documented by Vilella and Hengstenberg, 2006. Broad-winged Hawk pairs were observed engaged in courtship and territory display behaviors in privately owned lands during studies in 2001 and 2002. These private lands comprised 693 hectares of mostly closed-canopy forest and should be considered high priority areas for protection or acquisition. Protection of Broad- winged Hawk habitat within private lands surrounding Rio Abajo Forest could entail cooperation between government agencies, public utilities, and landowners. PREPA agrees to mitigate unavoidable impacts to broad-winged hawk habitat by acquiring up to 100-acres of suitable hawk habitat presently held in private ownership. An area immediately west of the Rio Abajo Forest has been recommended by DNER. After acquisition, this land would be turned over to DNER in perpetuity for management. The figure illustrates the this preliminary proposed location.

Additional mitigation could involve the planting 3 trees for every tree removed. Trees could be planted within the cleared ROW, except in the 50-foot no root zone maintenance area.

Construction activity will be restricted to the non-breeding season (July to December) in Focal Areas 1 and 2. This will minimize impacts to nesting birds and to their courtship aerial flights. During construction, specialized biologists familiar with the sharp-shinned hawk and broad-winged hawk will conduct surveys ahead of the construction crews will identify the presence/absence of species and any nesting trees (Identification of a nesting site will necessitate the coordination with USFWS). If nesting trees are identified, the pipeline alignment and associated clearing activities can be adjusted to avoid impacts to those trees.

5.2.8.7 Conclusion

No nests were identified. Construction could be scheduled to occur outside of breeding season and additional areas for habitat conservation exist. Biologist would conduct surveys ahead of construction. Based on these, it is PREPA's recommendation that the project "May Affect, but is Not Likely to Adversely Affect" the Puerto Rican broad-winged hawk, however, the Corps has determined “May Affect”..

5.2.9 *Caprimulgus noctitherus* – (Puerto Rican Nightjar)

Federal Status: Endangered

5.2.9.1 General Species Biology

The Puerto Rican Nightjar, *Caprimulgus noctitherus*, is a rare bird found in the coastal dry scrub forests in localized areas of southwestern. The Spanish common name "Guabairo de Puerto Rico" is derived from the Taino Indian name. Active only after dark, the Puerto Rican Nightjar is rarely detected during daylight hours. Its excellent camouflage of mottled black, brown and gray, broken by a white band across the throat and white spots at the ends of the tail feathers, makes this robin-sized bird scarcely distinguishable from the leaf-litter on the forest floor where it rests motionless all day. Shortly after twilight, and again before dawn, the male may call from a tree branch, giving a rapid series of whistled "whip" notes. It is heard far more often than seen. Most sightings are mere glimpses of the bird in flight at dusk after it has betrayed its presence by vocalizing, but individuals may also make repeated foraging flights from favorite perches. The loud, distinctive territorial calling makes this species especially easy to census.

The Puerto Rican Nightjar was federally listed as Endangered in 1973. The U.S. Fish and Wildlife Service approved a Puerto Rican Whip-poor-will (nightjar) Recovery Plan in 1984. The plan recommends research to gain knowledge of the population, range and natural history of the imperiled species, the cause of its decline, and potential threats to its survival. It also calls for protection of existing populations on both public and private lands, and education of the public against adverse habitat modification.

Puerto Rican Nightjars make short foraging flights from perches to capture night-flying insects (beetles, moths). They feed almost entirely below the forest canopy. As in all caprimulgids, the wide gape is edged with stiff bristles to aid the bird in localizing its prey. Foraging activity may increase on bright moonlit nights, as calling has been observed to diminish at those times.

Breeding occurs from late February to early July, but mainly in April-June. The territorial male is vocal throughout the year, but calling peaks at the height of the breeding season during April and May. The female lays 1 or 2 eggs directly on leaf litter under low bushes, constructing no nest. Evidence of nesting is common at elevations above 100 m; usually being characterized by a deep layer of leaf litter and an open mid-story beneath a closed canopy. The light brown eggs are ringed and splotched with purple. Incubation is by both sexes and takes about 19 days. In Guánica forest area, approximately 87% of nests in one year produced at least one fledgling.

After hatching, the young chicks are moved away from the incubation site by the attending parents. Adults use distraction displays to lure predators away from their eggs or chicks. The young begin to fly in the third week after hatching, and become independent shortly thereafter.

The mongoose (*Herpestes jarvanicus*) may have played an important role in eliminating nightjars from the moist forests of the north coast after its introduction to Puerto Rico in 1877. Any changes that make the dry forests in the southwest of the island more hospitable to mongooses or more accessible to dogs, cats, and rats could adversely impact the nightjar.

5.2.9.2 Distribution and Abundance

The historical range probably comprised moist limestone and coastal forest in northern Puerto Rico, as well as currently occupied dry limestone forest, drier sections of the lower cordillera forest and perhaps dry coastal forest. It is presently more abundant in closed canopy dry forest on limestone soils, composed mainly of semi-deciduous hardwood trees with abundant leaf litter and an open understory (little or no ground vegetation) at elevations up to 230 m, but more commonly above 75 m. It occurs in lower densities in dry, open, scrubby secondary growth, xeric or dry scrubland, open scrub-forest and thorny forest undergrowth, with a few birds in *Eucalyptus robusta* plantations. Birds are perhaps permanently territorial, exhibiting strong inter-annual site fidelity.

The Puerto Rican nightjar once inhabited coastal lowlands all around western Puerto Rico, but habitat loss and introduced predators have now restricted it to a very small fraction of its former breeding range. The species is now found only in dry limestone forest along the southwest coast of the island on public lands designated as state forests and biosphere reserves, the most notable of which is the Bosque Estatal de Guanica (Commonwealth Forest of Guanica), where it is most numerous, but also in the Bosque Estatal de Susua, the Sierra Bermeja, and in hills near Guayanilla and Parguera. The Conservation Trust of Puerto Rico has also acquired lands in the Guayanilla-Peñuelas region, this area includes mature dry forest where nightjars are abundant. The present distribution represents only a small fraction (estimated at 3%) of the nightjar's former range, which is known to have included moist limestone forests along the north coast as far eastward as Bayamon, and may have extended inland to the lower cordillera.

The current population is estimated to be between 1,400 and 2,000 mature birds and expected to be stable as long as the habitat is not altered and introduced predators such as and cats, are controlled. The current classification is mainly due to the special habitat on which it depends being heavily fragmented and degraded. As a result of this habitat fragmentation, the

population is very patchily distributed. Disturbances that could significantly threaten nightjars in their remaining forest refuges include tree cutting, road and utility line construction and maintenance, extensive recreational use of the forests, wild fires, and grazing by domestic stock. About half of the current nightjar habitat is in protected public forests, but the remainder, including lands adjacent to the public forests, is privately held forestland susceptible to conversion to other uses.

The Puerto Rican nightjar is legally protected throughout much of its current range. Guánica, Susúa and Maricao are public lands designated as state forests, and Guánica is a biosphere reserve. The Conservation Trust of Puerto Rico lands in the Guayanilla-Peñuelas region includes mature dry forest where nightjars are abundant, constituting the only protected nightjar habitat in this portion of their range. The population is surveyed regularly and spatial analysis is being used to identify areas of potentially suitable habitat for protection and examine changes in habitat cover over time.

5.2.9.3 Current Conditions

The Puerto Rican nightjar and its habitat were known to occur within the originally proposed Project ROW. The habitat in question is located between Mile Marker 3 and 7 of the pipeline corridor within the municipality of Peñuelas. Based on the recommendation from USFWS in their letter dated December 15, 2010, a population assessment for the Puerto Rican nightjar was conducted.

The methodology for conducting the population assessment was established in coordination with the USFWS. Seven point count stations (PCS) were established along three transect routes located within potential nightjar habitat within the ROW of the originally proposed pipeline. As agreed upon with USFWS, the PCS locations were distributed as follows: one in the North, four in the Center, and two in the South.

Field surveys began on February 21 and ended on March 2, 2011. Each PCS was surveyed a total of three dawns and three dusk sessions. Nightjars were heard calling at each PCS location, except during the morning sessions at PCS C3 (Center transect). Overall, a total of 66 nightjars were detected in all seven PCS for the duration of the study. This number does not represent the total number of nightjars; rather, it represents the total number of events of male nightjars heard over the course of three morning and three evening sessions. The same individual bird may have been detected more than once in different survey sessions. The

minimum number of male nightjars per transect route is as follows: North transect route= 2; Center transect route= 5; and South transect route= 4.

In further meetings with USFWS it was agreed additional route alternatives would be considered. In May, 2011, field inspections of these route alignments were undertaken in collaboration with USFWS staff in an effort to select one that reduced, even further, impact to undisturbed Nightjar habitat. As a result of these meetings and field inspections, a Puerto Rican Nightjar (Guabairo) Habitat Quantitative Analysis and Mitigation plan document prepared by Asesores Ambientales y Educativos, Inc. (AAE) has been included with this report (Appendix 1). This document summarized impact to Nightjar habitat that would occur under the three alignment alternatives (the original and two new options requested by USFWS). The applicant agreed to revise the project and utilize an alignment alternative that would have the smallest impact on prime Nightjar habitat while, at the same time, utilize existing dirt roads that ran through the area. This alignment would have a total project construction footprint of 41.4 acres (60-foot construction ROW X 6,494 meters) of which only 1.9 acres was identified as prime nightjar habitat while the remaining 38 acres was considered to be low quality habitat supporting an extensive populations of invasive species (such as *Leucaena leucocephala*) or no habitat (such as the open dirt roads).

5.2.9.4 Summary of Impacts

It is expected that an area of approximately 1.9 acres of prime habitat will be directly impacted by the construction of the proposed pipeline, which includes both permanent and temporary impacts. An additional 38 acres of low quality (or no quality) habitat would also be affected. Due to the permanent ROW, the proposed project may result in habitat fragmentation. However, it has been shown the nightjars can exist in some disturbed habitat and the habitat to be impacted is not considered to be high quality.

Direct impacts to Puerto Rican nightjar habitat have been significantly minimized through realignment of the pipeline.

5.2.9.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Secondary impacts may occur due to the habitat loss and fragmentation. Additionally, cumulative effects may occur if future linear projects or large development affect the Puerto Rican nightjar habitat.

5.2.9.6 Conservation Measures and Recommendations

To avoid impacts to nightjars during construction, commencement of any clearing of vegetation required for construction within or adjacent to mature dry forest where nightjars are abundant, will occur outside of the nightjar nesting season (late February to early July). However, in emergency situations, if vegetation needs to be cleared during the nesting season, experienced and qualified biologists will survey the area proposed for clearing for Nightjar nests prior to any clearing activity being undertaken. In the event that nests are found, the nests will be avoided by reducing or relocating the right-of way, or by delaying the activity until the nightjars fledge their young.

Additionally, construction protocol and educational program will be implemented to ensure that all construction activities minimize any potential and avoidable impacts during the construction phase. An on-site biologist will be available during construction activities to ensure that all proper protocol is adhered to.

Specific construction techniques may be utilized that could reduce the temporal loss of habitat for the nightjar. In areas used for temporary construction access, the vegetation would be "run over" by equipment rather than clearing the vegetation. This technique has been shown to reduce the amount of time required for vegetation to recruit in the construction footprint; therefore, the temporal loss of habitat would be reduced.

Habitat restoration, conservation, etc will be proposed to compensate for habitat loss. One of the most crucial issues facing Puerto Rico today is the chronic need for setting aside presently owned lands and the continued need to purchase additional lands deemed critical habitats for the large number of endangered, threatened, and rare species on both federal and commonwealth lists. Therefore, a preliminary proposal is for land acquisition of approximately 290 acres (based on calculation of 1.9 acres multiplied by 48:1 plus 38 acres multiplied by 7:1) of such habitat areas to further mitigate unavoidable impact to nightjar habitat from the project.

5.2.9.7 Conclusion

A determination of May Affect but Not Likely to Adversely Affect (MANLAA) is made based on the minimization if impact and mitigatative measures.

5.2.10 *Columba inornata wetmorei* – (Puerto Rican Plain Pigeon)

Federal Status: Endangered

5.2.10.1 General Species Biology

The Puerto Rican Plain Pigeon is similar to the dove in size and shape. At a distance, the species seems to be pale blue-grey. Head, back of neck, chest, and the top center of the collected wing are wine colored. The edge of the wing is marginalized with white, while the legs are dark red.

Mating occurs throughout the year, but reaches its peak in late winter and spring. Some nests are weak twigs, occasionally placed on an accumulation of garbage in reeds or nests of rats without using platforms. More typically, nests are built in the crook of tree branches or near the top of a stalk of bamboo. The Plain Pigeon produces only one egg per brood, but females have been observed to have three broods per year. The formation of flocks may occur at any time when food is abundant. Adult pigeons congregate in small packs for feeding during the breeding season.

A variety of fruits, seeds and livestock feed make up the diet of this species. Approximately 7O percent of the foods come from tree branches, and 3O percent from the ground. Principal foods are royal palm (*Roystonea borinquena*); mountain immortelle (*Erythrina poeppigiana*); West Indies trema (*Trema lamarckiana*); and white prickle (*Zanthoxylum martinicense*). Water is usually taken from the axils of bromeliads or from water-retaining blossoms of the African tulip-tree (*Spathodea campanulata*) (Wiley et al., 1982).

5.2.10.2 Distribution and Abundance

In 1990, this species had a minimum of 204 individuals in the wild and 116 in captivity (USFWS 1990). Observations carried out since 1973 indicate that the only existing population is found in the mountainous forest and in Cidra and surrounding municipalities, particularly Cayey. Also a few birds were reported in Gurabo and Utuado (USFWS 1990). Historical habitats used by this bird includes the low swamps and timber lands, open land and land in the mountains, the limestone karst area and coffee plantations in the high hills.

The Puerto Rican Plain Pigeon was listed as "Endangered" on October 13, 1970. Extensive deforestation and over hunting have contributed to the reduction of the population. Loss of habitat due to the rapid development of the Cidra area is the most serious threat to the existence of the species. Most of the observed failed nests were a direct result of human

disturbance. The species' reluctance to colonize new areas has hindered the establishment of new populations.

5.2.10.3 Current Conditions

No known habitat occurs along the 92 miles of the project area (Action Area).

5.2.10.4 Summary of Impacts

The project will not impact the Puerto Rican Plain Pigeon. There is no suitable or known nesting or roosting areas within the project area. This species is known to occur in Cidra and the Aguirre Forest in Guayama.

5.2.10.5 Indirect, Interdependent, Interrelated and Cumulative Effects

There are no expected indirect, interdependent, interrelated or cumulative effects to the Puerto Rican Plain Pigeon.

5.2.10.6 Conservation Measures and Recommendations

No specific conservation measures are proposed for the Puerto Rican Plain Pigeon.

5.2.10.7 Conclusion

Based on available information and due to the fact that the Puerto Rican Plain Pigeon is not known to occur within the project area, PREPA has determined that the proposed action will not affect this species.

6 NMFS/USFWS Listed Species

The most abundant sea turtles found either nesting or in feeding areas of Puerto Rico and its adjacent islands are the leatherback (*Dermochelys coriacea)*, the hawksbill (*Eretmochelys imbricata*) and the green turtle (*Chelonia mydas*) (Status of Marine Turtles at Puerto Rico, Diez et al, Oral presentation). The leatherback and the hawksbill have been known to use shoreline areas above the mean higher high water line for nesting purposes and as such also fall under the jurisdiction of the USFWS. In addition to these species, this section also covers the Kemp's ridleys turtle (*Lepidochelys kempii*).

6.1 *Carretta carretta*- Loggerhead sea turtle

Status: Threatened

6.1.1 General Species Biology

The English common name for this species, Loggerhead, was termed because of their relatively large head. An adult loggerhead sea turtle weighs approximately 300 pounds and approximately 84 inches long. Its skin color ranges from yellow to brown and carapace is typically reddish-brown.

Adult loggerheads are omnivorous, feeding mainly on bottom dwelling invertebrates such as gastropods, bivalves and decapods. It's large and powerful jaws are used to crush hard-shelled prey, such as whelks or conch. Other food items include, sponges, corals, sea pens, polychaete worms, sea anemones, cephalopods, barnacles, brachiopods, isopods, insects, bryozoans, sea urchins, sand dollars, sea cucumbers, starfish, hatchling turtles, algae, and vascular plants (Wiki). During migrations through the open ocean, this species is also known to consume jellyfish, floating mollusks, floating egg clusters, squid, and flying fish.

6.1.2 Distribution and Abundance

Loggerhead recovery plan - The loggerhead occurs throughout temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans. The Atlantic subpopulation is commonly found in the North Atlantic including the Gulf of Mexico, the northern Caribbean, and the Bahamas archipelago (Dow et al 2007). It is also found in West Africa, the western Mediterranean, and the west coast of Europe.

Nesting in the U.S. occurs from Texas to Virginia. Loggerheads are not known to nest in Puerto Rico. During non-nesting years, adult female loggerheads from U.S. beaches are found in waters off the eastern U.S., The Bahamas, Greater Antilles, and Yucatan, and throughout the Gulf of Mexico.

6.1.3 Current Conditions

In Puerto Rico, all sandy beaches are considered suitable sea turtle nesting habitat according to NOAA's Environmental Sensitivity Index. The marine beaches associated with the Via Verde Pipeline which border PR-165 (Levittown beachfront) are moderately eroded and have been armored with stone rip-rap. These areas were not considered to be suitable habitat for sea turtle nesting. The central and western ends of this shoreline (Station 4336+06 to Station 4385+00) do include some sandy expanses with natural vegetation above the mean high water line.

The Puerto Rico Department of Natural Resources (DNER) currently monitors and maintains a comprehensive data base for sea turtle nesting sites in Puerto Rico. The DNER maps and data base for the Levittown shoreline area were reviewed on February 21, 2011. No nest sites, false crawls or habitat utilization of this beach front area, Station 4336+06 to Station 4435+10, have been documented. Subsequent to the initial file/map review at DNER, all pipeline laydown and extra work areas in this segment of the Via Verde pipeline project are located landward of the mean higher high water mark and the pipeline will be embedded at a depth of 55 feet below ground surface in this area. The eastern most HDD workpad station will incorporate the use of sheet-pile walls along three sides of the construction area to ensure no direct or secondary impact to the beach or open water.

6.1.4 Summary of Impacts

Due to the methods and location of construction activities on or near beaches, impacts to potential sea turtle nesting areas are not expected.

6.1.5 Indirect, Interdependent, Interrelated and Cumulative Effects

No indirect, interdependent, interrelated or cumulative effects are expected.

6.1.6 Conservation Measures and Recommendations

1) A turtle monitoring program should be implemented 70 days prior to the commencement of construction activities and will cease once all equipment and personnel have vacated the premises. Monitoring shall be performed daily between hours of dawn and 8:00. The surveys shall be conducted by personnel with appropriate DNER Endangered Species Permit.
2) A schedule for the monitoring program shall be submitted to the US Fish & Wildlife Service (USFWS), Boquerón Field Office, at least 15 days prior to commencement of the activities.
3) The area to be surveyed shall be clearly marked with flagging and shall encompass an area of 50 meters at each side of the excavation area. An additional 200 meters shall be established on both sides as buffer zones. The survey shall be performed along the entire area. Special care in observance shall be given to the construction site.
4) Nests and any evidence of crawls shall be mapped and noted on standard daily field sheets provided by the Department of Natural and Environmental Resources (DNER). A final report summarizing the monitoring activities shall be submitted to the USFWS.

5) If a nest occurs within the footprint of the area to be affected by the proposed installation and/or excavation activities, nest relocation shall be conducted the same morning at the same beach. Tracks shall be erased and nest camouflaged to avoid possible poaching. Any signs of poaching shall be immediately reported to the DNER and the USFWS. The area designated for relocation of nests shall be coordinated with the DNER and the USFWS. No personnel or vehicles are allowed to enter to the area designated for relocation.
6) No lights, vegetation removal, or impacts to nesting habitat shall be allowed.
7) DNER and USFWS shall be notified 48 hours prior to construction.
8) During construction, a fence shall be installed along the entire length of the beachfront shoreline so that no turtle can crawl up into the work area. A night security guard shall be posted on site.

6.1.7 Conclusion

Based on the Current information available from DNER and the information within this document, PREPA recommends a "No Affect" determination for the Loggerhead Sea Turtle.

6.2 *Chelonia mydas*- Green Sea Turtle

Status: Threatened

6.2.1 General Species Biology

The green turtles grow to a length of approximately 5 feet long and can weigh up to 690 pounds. The average weight of mature green turtles is around 330 pounds. The green turtle anatomically similar to other members in its family but may be distinguished by its short snout and its unhooked beak. The carapace of the green turtle has variations in color and pattern that change over time. The carapaces' of hatchlings are mostly black with light colored plastrons. Juveniles turn dark brown to olive. As adults, carapaces are largely brown, spotted or marbled with variegated rays. (Wiki)

C. mydas ecology changes drastically with each stage of its life history. Hatchlings are carnivorous pelagic organisms. As juveniles and adults, green turtles are commonly found closer inshore in seagrass meadows and are herbivorous grazers.

Nesting/mating season varies between populations. The Caribbean population has a nesting season from June to September.

6.2.2 Distribution and Abundance

The green turtle is globally distributed and generally found in tropical and subtropical waters along the continental coast and islands between 30□ North and 30□ South. There are two distinct populations of green turtles: the Atlantic subpopulation and the Indo-Pacific subpopulation.

The Atlantic subpopulation can generally be found throughout the entire Atlantic Ocean. Major nesting sites for this population are found on islands in the Caribbean, along the eastern shores of the continental U.S., the eastern coast of South America, and on isolated North Atlantic islands. In the Caribbean Sea, major nesting sites have been found on Aves Island, the U. S. Virgin Islands, Puerto Rico, and Costa Rica.

Critical habitat was designated in 1998 for green turtles in the coastal waters around Culebra Island, Puerto Rico.

6.2.3 Current Conditions

In Puerto Rico, all sandy beaches are considered suitable sea turtle nesting habitat according to NOAA's Environmental Sensitivity Index. The marine beaches associated with the Via Verde Pipeline which border PR-165 (Levittown beachfront) are moderately eroded and have been armored with stone rip-rap. These areas were not considered to be suitable habitat for sea turtle nesting. The central and western ends of this shoreline (Station 4336+06 to Station 4385+00) do include some sandy expanses with natural vegetation above the mean high water line.

The Puerto Rico Department of Natural Resources (DNER) currently monitors and maintains a comprehensive data base for sea turtle nesting sites in Puerto Rico. The DNER maps and data base for the Levittown shoreline area were reviewed on February 21, 2011. No nest sites, false crawls or habitat utilization of this beach front area, Station 4336+06 to Station 4435+10, have been documented. All pipeline laydown and extra work areas in this segment of the Via Verde pipeline project are located landward of the mean higher high water mark and the pipeline will be embedded at a depth of 55 feet below ground surface in this area.

6.2.4 Summary of Impacts

Due to specific construction methods (sheet piling and continuous silt fence) and location of construction activities on or near beaches, impacts to potential sea turtle nesting areas are not expected.

6.2.5 Indirect, Interdependent, Interrelated and Cumulative Effects

No indirect, interdependent, interrelated or cumulative effects are expected.

6.2.6 Conservation Measures and Recommendations

1) A turtle monitoring program should be implemented 70 days prior to the commencement of construction activities and will cease once all equipment and personnel have vacated the premises. Monitoring shall be performed daily between hours of dawn and 8:00. The surveys shall be conducted by personnel with appropriate DNER Endangered Species Permit.
2) A schedule for the monitoring program shall be submitted to the US Fish & Wildlife Service (USFWS), Boquerón Field Office, at least 15 days prior to commencement of the activities.
3) The area to be surveyed shall be clearly marked with flagging and shall encompass an area of 50 meters at each side of the excavation area. An additional 200 meters shall be established on both sides as buffer zones. The survey shall be performed along the entire area. Special care in observance shall be given to the construction site.
4) Nests and any evidence of crawls shall be mapped and noted on standard daily field sheets provided by the Department of Natural and Environmental Resources (DNER). A final report summarizing the monitoring activities shall be submitted to the USFWS.
5) If a nest occurs within the footprint of the area to be affected by the proposed installation and/or excavation activities, nest relocation shall be conducted the same morning at the same beach. Tracks shall be erased and nest camouflaged to avoid possible poaching. Any signs of poaching shall be immediately reported to the DNER and the USFWS. The area designated for relocation of nests shall be coordinated with the DNER and the USFWS. No personnel or vehicles are allowed to enter to the area designated for relocation.
6) No lights, vegetation removal, or impacts to nesting habitat shall be allowed.

7) DNER and USFWS shall be notified 48 hours prior to construction.
8) During construction, a fence shall be installed along the entire length of the beachfront shoreline so that no turtle can crawl up into the work area. A night security guard shall be posted on site.

6.2.7 Conclusion

Based on the Current information available from DNER and the information within this document, PREPA recommends a "No Affect" determination for the Green Turtle.

6.3 *Dermochelys coriacea*- Leatherback sea turtle

Status: Endangered

6.3.1 General Species Biology

The leatherback sea turtle is the largest of all living sea turtles and is the only living species in the genus *Dermochelys*. It is easily distinguished between other sea turtles as it is the only one to have a non-bony shell and its carapace is covered by skin and oily flesh. Leatherbacks average size is between 3.3 to 6.6 feet long and adults weigh between 500 and 1,500 pounds. The turtle's dorsal surface is colored dark grey to black with white blotches and spots. The hydrodynamic carapace and large flippers are key characteristics that make the leatherback uniquely equipped for long distance foraging migrations. Leatherbacks' diet consist of soft bodied pelagic prey such as jellyfish and salps; however, they are also known to forage in coastal waters. Unlike other sea turtles, this species feeds in areas of colder water where there is an abundance of jellyfish and other prey. Due to their obligate feeding nature, leatherback turtles help control jellyfish populations. (wiki)

6.3.2 Distribution and Abundance

Leatherback's have the largest distribution of all extant sea turtles. The leatherback can be found in all tropical and subtropical oceans, and its range extends into the Arctic circle. In the Atlantic Ocean, the leatherback turtle population ranges across the entire region and can be found as far north as the North Sea and as far south as the Cape of Good Hope.

Leatherbacks can be found primarily in the open ocean and follow their jellyfish prey throughout the day. Pacific leatherbacks migrate from nesting sites in Indonesia to the coasts of California to feed on jellyfish.

Nesting grounds for the leatherback sea turtle are found around the world. The largest nesting assemblages are found on the coasts of northern South American and west Africa. In the U.S. Caribbean, Puerto Rico and the U.S. Virgin Islands support minor nesting colonies. These colonies represent the most significant leatherback nesting activity within the U.S.

Critical habitat was designated in 1979 for the leatherback turtle that included coastal waters adjacent to Sandy Point, St. Croix, U.S. Virgin Islands (NOAA website). In February 2010 and again in November 2010, the Sierra Club petitioned NMFS to revise the critical habitat designation for leatherback sea turtles to include waters adjacent to a major nesting beach in Puerto Rico. To date, the critical habitat designation for this species has not been revised to include coastal water in Puerto Rico.

6.3.3 Current Conditions

In Puerto Rico, all sandy beaches are considered suitable sea turtle nesting habitat according to NOAA's Environmental Sensitivity Index. The marine beaches associated with the Via Verde Pipeline which border PR-165 (Levittown beachfront) are moderately eroded and have been armored with stone rip-rap. These areas were not considered to be suitable habitat for sea turtle nesting. The central and western ends of this shoreline (Station 4336+06 to Station 4385+00) do include some sandy expanses with natural vegetation above the mean high water line.

The Puerto Rico Department of Natural Resources (DNER) currently monitors and maintains a comprehensive data base for sea turtle nesting sites in Puerto Rico. The DNER maps and data base for the Levittown shoreline area were reviewed on February 21, 2011. No nest sites, and only one false crawl have been documented for this beach front area (Station 4336+06 to Station 4435+10). All pipeline laydown and extra work areas in this segment of the Via Verde pipeline project are located landward of the mean higher high water mark and the pipeline will be embedded at a depth of 55 feet below ground surface in this area.

6.3.4 Summary of Impacts

Due to the methods and location of construction activities on or near beaches, impacts to potential sea turtle nesting areas will be affectively be avoided.

6.3.5 Indirect, Interdependent, Interrelated and Cumulative Effects

No indirect, interdependent, interrelated or cumulative effects are expected.

6.3.6 Conservation Measures and Recommendations

1) A turtle monitoring program should be implemented 70 days prior to the commencement of construction activities and will cease once all equipment and personnel have vacated the premises. Monitoring shall be performed daily between hours of dawn and 8:00. The surveys shall be conducted by personnel with appropriate DNER Endangered Species Permit.
2) A schedule for the monitoring program shall be submitted to the US Fish & Wildlife Service (USFWS), Boquerón Field Office, at least 15 days prior to commencement of the activities.
3) The area to be surveyed shall be clearly marked with flagging and shall encompass an area of 50 meters at each side of the excavation area. An additional 200 meters shall be established on both sides as buffer zones. The survey shall be performed along the entire area. Special care in observance shall be given to the construction site.
4) Nests and any evidence of crawls shall be mapped and noted on standard daily field sheets provided by the Department of Natural and Environmental Resources (DNER). A final report summarizing the monitoring activities shall be submitted to the USFWS.
5) If a nest occurs within the footprint of the area to be affected by the proposed installation and/or excavation activities, nest relocation shall be conducted the same morning at the same beach. Tracks shall be erased and nest camouflaged to avoid possible poaching. Any signs of poaching shall be immediately reported to the DNER and the USFWS. The area designated for relocation of nests shall be coordinated with the DNER and the USFWS. No personnel or vehicles are allowed to enter to the area designated for relocation.
6) No lights, vegetation removal, or impacts to nesting habitat shall be allowed.
7) DNER and USFWS shall be notified 48 hours prior to construction.
8) During construction, a fence shall be installed along the entire length of the beachfront shoreline so that no turtle can crawl up into the work area. A night security guard shall be posted on site.

6.3.7 Conclusion

Based on the Current information available from DNER and the information within this document, PREPA recommends a "No Affect" determination for the Leatherback Sea Turtle.

6.4 *Eretmochelys imbricata*- Hawksbill Turtle

Status: Endangered

6.4.1 General Species Biology

The hawksbill turtle is small to medium size compared to other sea turtle species and weigh ton average 100 to 150 pounds; however they can reach weights up to 200 pounds. The carapace of an adult hawksbill ranges from dark to golden brown with streaks of orange, red, and/or black. The shells of hatchlings are mostly brown. The rear edge of the carapace is usually serrated. (NOAA website)

The hawksbill's head is elongated, tapering to a point, with a beak like mouth, which allows the turtle to reach into holes and crevices of coral reefs for sponges and other invertebrates. The primary food source of the hawksbill turtle are sponges. Coral reefs are recognized as the resident foraging habitat for juveniles, subadults, and adults. Posthatchlings are considered pelagic and often take shelter in floating weed lines and debris that accumulate in convergence zones.

6.4.2 Distribution and Abundance

Hawksbills occur in tropical and subtropical waters of the Atlantic, Pacific, and Indian Oceans. This species is widely distributed in the Caribbean Sea and western Atlantic Ocean. In U.S. Caribbean Sea waters, the hawksbill is most common in Puerto Rico and its associated islands and in the U.S. Virgin Islands. In the continental U.S., hawksbills can be seen along the Gulf states and eastern seaboard.

Within U.S. jurisdiction in the Caribbean Sea, nesting occurs on beaches in Puerto Rico and the U.S. Virgin Islands. The most important sites are Mona Island, Puerto Rico, and Buck Island, St. Croix, U.S. Virgin Islands. Nesting also occurs on other beaches of St. Croix, Culebra Island, Vieques Island, mainland Puerto Rico, St. John, and St. Thomas (USFWS, multispecies recovery....). Within their range, hawksbills typically nest in low densities. The largest known nesting concentrations in the Caribbean are the Yucatan Peninsula, Mexico (Meylan 1989- USFWS Recovery plan).

Critical habitat has been designated for this species. In June 1982 and September 1998, critical habitat was designated on selected beaches and/or waters of Mona, Monito, Culebrita, and Culebra Island, Puerto Rico.

6.4.3 Current Conditions

In Puerto Rico, all sandy beaches are considered suitable sea turtle nesting habitat according to NOAA's Environmental Sensitivity Index. The marine beaches associated with the Via Verde Pipeline which border PR-165 (Levittown beachfront) are moderately eroded and have been armored with stone rip-rap. These areas were not considered to be suitable habitat for sea turtle nesting. The central and western ends of this shoreline (Station 4336+06 to Station 4385+00) do include some sandy expanses with natural vegetation above the mean high water line. Hawksbill turtles have been known to utilize similar areas for nesting.

The Puerto Rico Department of Natural Resources (DNER) currently monitors and maintains a comprehensive data base for sea turtle nesting sites in Puerto Rico. The DNER maps and data base for the Levittown shoreline area were reviewed on February 21, 2011. No nest sites, false crawls or habitat utilization of this beach front area, Station 4336+06 to Station 4435+10, have been documented. All pipeline laydown and extra work areas in this segment of the Via Verde pipeline project are located landward of the mean higher high water mark and the pipeline will be embedded at a depth of 55 feet below ground surface in this area.

6.4.4 Summary of Impacts

Due to the methods and location of construction activities on or near beaches, impacts to potential sea turtle nesting areas are not expected.

6.4.5 Indirect, Interdependent, Interrelated and Cumulative Effects

No indirect, interdependent, interrelated or cumulative effects are expected.

6.4.6 Conservation Measures and Recommendations

1) A turtle monitoring program should be implemented 70 days prior to the commencement of construction activities and will cease once all equipment and personnel have vacated the premises. Monitoring shall be performed daily between hours of dawn and 8:00. The surveys shall be conducted by personnel with appropriate DNER Endangered Species Permit.
2) A schedule for the monitoring program shall be submitted to the US Fish & Wildlife Service (USFWS), Boquerón Field Office, at least 15 days prior to commencement of the activities.
3) The area to be surveyed shall be clearly marked with flagging and shall encompass an area of 50 meters at each side of the excavation area. An additional 200 meters shall be established on both sides as buffer zones. The survey shall be performed

along the entire area. Special care in observance shall be given to the construction site.

4) Nests and any evidence of crawls shall be mapped and noted on standard daily field sheets provided by the Department of Natural and Environmental Resources (DNER). A final report summarizing the monitoring activities shall be submitted to the USFWS.
5) If a nest occurs within the footprint of the area to be affected by the proposed installation and/or excavation activities, nest relocation shall be conducted the same morning at the same beach. Tracks shall be erased and nest camouflaged to avoid possible poaching. Any signs of poaching shall be immediately reported to the DNER and the USFWS. The area designated for relocation of nests shall be coordinated with the DNER and the USFWS. No personnel or vehicles are allowed to enter to the area designated for relocation.
6) No lights, vegetation removal, or impacts to nesting habitat shall be allowed.
7) DNER and USFWS shall be notified 48 hours prior to construction.
8) During construction, a fence shall be installed along the entire length of the beachfront shoreline so that no turtle can crawl up into the work area. A night security guard shall be posted on site.

6.4.7 Conclusion

Based on the Current information available from DNER and the information within this document, PREPA recommends a "No Affect" determination for the Hawksbill Turtle.

6.5 *Lepidochelys kempii*- Kemp's ridleys sea turtle

Status: Endangered

6.5.1 General Species Biology

Kemp's ridleys are considered to be the smallest marine sea turtles, weighing on average 100 pounds and 2-3 feet in length. Their carapace is grayish in color and is often as wide as it is long, giving it a circular shape.

The Kemp's ridleys are omnivorous as adults and feed on mollusks, crustaceans, jellyfish, algae, and sea urchins.

Juvenile Kemp's ridleys utilize floating sarggassum as refuge and/or food. These juveniles are found between northwest Atlantic waters and the Gulf of Mexico until they reach maturity or sub-adult phase.

Nesting season for Kemp's ridleys is April to August and nesting mostly occurs in the Mexican state of Tamaulipas and occasionally on Padre Island, Texas in the U.S. The female turtles land in groups on beaches in an arribada or group nesting.

6.5.2 Distribution and Abundance

The Kemp's ridleys has a restricted distribution. Kemp's ridleys are distributed throughout the Gulf of Mexico and U.S. Atlantic seaboard from Florida to New England. (Draft Recovery Plan 2010)

On February 17, 2010, both USFWS and NMFS received petitions to designated critical habitat for Kemp's ridleys sea turtles for nesting beaches along the Texas coast and marine habitats in the Gulf of Mexico and Atlantic Ocean. The petition is currently under review.

Kemp's ridleys turtles are not known to nest in Puerto Rico but utilize coastal marine habitats for foraging.

The population of this species has been in sharp decline since nesting aggregations were discovered in 1947 at Rancho Nuevo, Mexico (Draft Recovery Plan). At this time the adult female population was estimated to be in excess of 40,000 individuals. The lowest recorded nest count was 702 in 1985 at Ranch Nuevo. As of 2009, over 20,000 nests were recorded at Rancho Nuevo and adjacent camps (recovery plan). The Draft Recover Plan indicates that the number of nests recorded from 2005 to 2009 indicates a female population of approximately 5,500 in the Gulf of Mexico.

6.5.3 Current Conditions

In Puerto Rico, all sandy beaches are considered suitable sea turtle nesting habitat according to NOAA's Environmental Sensitivity Index. The marine beaches associated with the Via Verde Pipeline which border PR-165 (Levittown beachfront) are moderately eroded and have been armored with stone rip-rap. These areas were not considered to be suitable habitat for sea turtle nesting. The central and western ends of this shoreline (Station 4336+06 to Station 4385+00) do include some sandy expanses with natural vegetation above the mean high water line.

The Puerto Rico Department of Natural Resources (DNER) currently monitors and maintains a comprehensive data base for sea turtle nesting sites in Puerto Rico. The DNER maps and data base for the Levittown shoreline area were reviewed on February 21, 2011. No nest sites, false crawls or habitat utilization of this beach front area, Station 4336+06 to Station 4435+10, have been documented. All pipeline laydown and extra work areas in this segment of the Via Verde pipeline project are located landward of the mean higher high water mark and the pipeline will be embedded at a depth of 55 feet below ground surface in this area.

6.5.4 Summary of Impacts

Due to the methods and location of construction activities on or near beaches, impacts to potential sea turtle nesting areas are not expected.

6.5.5 Indirect, Interdependent, Interrelated and Cumulative Effects

No indirect, interdependent, interrelated or cumulative effects are expected.

6.5.6 Conservation Measures and Recommendations

1) A turtle monitoring program should be implemented 70 days prior to the commencement of construction activities and will cease once all equipment and personnel have vacated the premises. Monitoring shall be performed daily between hours of dawn and 8:00. The surveys shall be conducted by personnel with appropriate DNER Endangered Species Permit.
2) A schedule for the monitoring program shall be submitted to the US Fish & Wildlife Service (USFWS), Boquerón Field Office, at least 15 days prior to commencement of the activities.
3) The area to be surveyed shall be clearly marked with flagging and shall encompass an area of 50 meters at each side of the excavation area. An additional 200 meters shall be established on both sides as buffer zones. The survey shall be performed along the entire area. Special care in observance shall be given to the construction site.
4) Nests and any evidence of crawls shall be mapped and noted on standard daily field sheets provided by the Department of Natural and Environmental Resources (DNER). A final report summarizing the monitoring activities shall be submitted to the USFWS.
5) If a nest occurs within the footprint of the area to be affected by the proposed installation and/or excavation activities, nest relocation shall be conducted the same morning at the same beach. Tracks shall be erased and nest camouflaged to avoid

possible poaching. Any signs of poaching shall be immediately reported to the DNER and the USFWS. The area designated for relocation of nests shall be coordinated with the DNER and the USFWS. No personnel or vehicles are allowed to enter to the area designated for relocation.

6) No lights, vegetation removal, or impacts to nesting habitat shall be allowed.
7) DNER and USFWS shall be notified 48 hours prior to construction.
8) During construction, a fence shall be installed along the entire length of the beachfront shoreline so that no turtle can crawl up into the work area. A night security guard shall be posted on site.

6.5.7 Conclusion

Based on the Current information available from DNER and the information within this document, PREPA recommends a "No Affect" determination for the Leatherback Sea Turtle.

7 Direct Impacts, Indirect Impacts, and Cumulative Impacts

Construction impacts associated with the Via Verde Pipeline will be temporary. The total project area encompasses approximately 1,114 acres, over one-half of which will be allowed to recruit back to, or will be restored to, its natural pre-construction state. The permanent right-of-way, to be maintained in a naturally vegetated state, will be limited to approximately 554 acres. The natural vegetation to be allowed in this area will include all but the largest and most deep rooted of the tree species and will continue to provide habitat.

7.1 Construction Impacts to Existing Land Use, Land Cover, and Conservation Areas

Construction impacts to existing land use/land cover would typically be temporary and are expected to have minimal, long-term impacts. Activities associated with the construction of the Via Verde Pipeline Project would result in temporary impacts to existing land use/land cover, such as clearing of vegetation and excavation of the pipeline trench. Typically, an approximately 100-foot-wide construction ROW (60-foot in waters of the U.S.) would be needed for the construction of the proposed mainline and laterals. Following construction, the ROW would be reestablished to its pre-existing contours to the extent practicable, and the temporary construction ROW would be allowed to revert to natural conditions. The permanent ROW would consist of an approximately 50-foot-wide easement in uplands that would be re-contoured and

maintained free of deeply rooted vegetation throughout the life of the Project. The permanently maintained ROW would provide open areas to aid in aerial surveillance and to permit emergency access to the pipeline for inspection and maintenance. In areas where the Via Verde Pipeline corridor is collocated within existing utility ROWs, PREPA will use the existing ROWs to the extent practicable to avoid the clearing of additional lands.

The vast majority of the Project is located in low-populated rural areas. Impacts to land use/land cover would vary according to the type crossed and the distance traversed. Only a minor portion of the land use/land cover potentially impacted by the construction of the proposed Project would include conservation areas maintained under local or state jurisdiction (i.e., state forests, wildlife preserves, forested wetlands, and forests) and residential areas. Long-term impacts lasting the life of the Project would occur within the permanent ROW with regard to certain agricultural uses and development of commercial or residential structures. Silviculture and citrus groves would not be permitted within the permanent ROW, and commercial or residential building construction within the permanent ROW would be prohibited. To the extent these uses or development rights exist in the permanent ROW prior to construction, there may be a permanent loss of these uses. Other agricultural uses may be allowed over the permanent ROW after the Project's construction phase is complete.

All other land use/land cover would not be lost or changed, but would be allowed to revert to natural conditions. Tree removal would be required for construction within forested areas, and would be conducted in accordance with applicable local nonprocedural standards to the extent practicable

7.2 Construction Impacts to Existing Listed Species

The temporary construction impacts required for the pipeline installation may result in impacts to hawks, the nightjar, and the boa.

A study prepared by Mr. Derek Hengstenberg, a recognized expert on these raptor species and current avian biologist with Tetra Tech, provides recommendations for studies and impact minimization procedures which, if adhered to, will result in the project not likely to have an adverse effect on the broad-winged and sharp-shinned hawks.

The Puerto Rican boa was assumed to exist throughout the project area. Minimal disturbances to selected habitat types will not likely affect this species. In addition, a boa management plan

has been prepared which includes active and on-going monitoring of all construction activities and provisions for relocation of this species.

Puerto Rican nightjar exists within a limited range along the southernmost expanse of the project area. Provisions have been made to allow for nightjar critical habitat to be assessed during the breeding/nesting season (April to June) with limited clearing allowed should nest sites be located. The project will enlist the services of a professional avian biologist, familiar with the nightjar, to monitor construction activity in the night jar habitat areas during the breeding/nesting season.

8 Conclusions

Table 15 presents the findings determination for each species and where applicable makes recommendations for mitigation measures, future studies, and resource conservation/preservation measures. The Applicant (PREPA) has reviewed the current status of those ESA species identified as existing or likely to occur within the project area. Puerto Rican broad-winged hawk, the Puerto Rican boa, the Puerto Rican parrot, DaDhnopsis helleriana, Ottoschulzia rhodoxylon, Cornutia obovata, and Solanum drymophilum , the environmental baseline for the action area, the effects of the proposed pipeline construction, operation, maintenance, and cumulative effects. Based on this analysis using the best available scientific and commercial information, and advanced construction practices (HDDs), it is the applicant's opinion that the action, as proposed, is not likely to jeopardize the continued existence of the six species of fauna and one plant species documented to occur within the limits of the project right of way.

If all of the procedures identified are implemented, it is expected that any effects to critical habitat and individual species will be mitigated and a MANLAA determination could be given for plant species. Pre-construction surveys would avoid direct impacts to listed species whenever possible and others could be transplanted, etc.

Table 15: Section 7 Affects Determination

PREPA VIA VERDE PIPELINE USACE/USFWS SECTION 7 AFFECTS DETERMINATION						
SCIENTIFIC NAME	COMMON NAME	NAME SPANISH	GROUP	STATUS	DISTRIBUTION	
Accipiter striatus venator	Puerto Rican Sharp-Shinned Hawk	Falcon de Sierra	Bird	E	Monte Guilarte State Forest	May Affect
Agelaius xanthomus	Yellow-Shouldered Black Bird	Mariquita	Bird	E, CH	Coastal Forest	No Affect
Amazona vittata vittata	Puerto Rican Parrot	Cotorra Puertorriqueña	Bird	E	Rio Abajo State Forest	MANLAA
Auerodendron pauciflorum	No Common Name	No Common Name	Plant	E	Rio Abajo State Forest	MANLAA
Banara vanderbilitii	No Common Name	Palo de Ramon	Plant	E	Rio Lajas Hills	MANLAA
Buteo platypterus brunnescens	Puerto Rican Broad-Winged Hawk	Guaraguao de Bosque	Bird	E	Monte Guilarte State Forest	May Affect
Buxus vahalii	Val's Boxwood	Diablito de Tres Cuernos	Plant	E	Tallaboa Limestone Hills	MANLAA
Calyptronoma rivalis	No Common Name	Palma de Manaca	Plant	T	Rio Abajo State Forest	MANLAA
Caprimulgus noctitherus	Puerto Rican Nightjar	Guabairo	Bird	E	Coastal Forest	MANLAA
Catesbaea melanocarpa	No Common Name	No Common Name	Plant	E	Dry Limestone Hills, Guayanilla to Ponce	MANLAA
Chamaecrista glandulosa var mirabilis	No Common Name	No Common Name	Plant	E	Tortuguero Lagoon Natural Reserve	MANLAA
Chelonia mydas	Green Sea Turtle	Peje Blanco	Reptile	T, CH	Coastal Zones	No Affect
Cordia bellonis	No Common Name	No Common Name	Plant	E	Rio Abajo State Forest	MANLAA
Cordia rupicola	Chigger Palo	Palo de Nigua	Plant	E		MANLAA
Cornutia obovata	No Common Name	Palo de Nigua	Plant	E	Rio Abajo State Forest	MANLAA
Cyathea dryopteroides	Elfin Tree Fern	Helecho de Bosque Enano	Plant	E	Monte Guilarte State Forest	MANLAA
Daphnopsis hellerana	No Common Name	No Common Name	Plant	E	Nevares Limestone Hills, Near Sabana Seca, Primate Center	MANLAA
Dermochelys coriacea	Leatherback Sea Turtle	Tinglar	Reptile	E, CH	Coastal Zones	No Affect
Eleutherodactylus jaunaruveroi	Plains Coqui	Coqui Llanero	Amphibian	Under Review		MANLAA
Epicrates inornatus	Puerto Rican Boa	Boa Puertorriqueña	Reptile	E	Forested Volcanic and Limestone (Karst) Hills	May Affect
Eretmochelys imbricata	Hawksbill Sea Turtle	No Common Name	Reptile	E, CH	Coastal Zones	No Affect
Eugenia woodburyana	No Common Name	No Common Name	Plant	E	Encarnación West of Las	MANLAA

PREPA VIA VERDE PIPELINE USACE/USFWS SECTION 7 AFFECTS DETERMINATION						
					Cucharas	
Goetzea elegans	Beautiful Goetzea	Matabuey	Plant	E	Coastal Zones	MANLAA
Juglans jamaicensis	West Indian Walnut	Nogal	Plant	E	Monte Guilarte State Forest (La Silla de Calderon)	MANLAA
Mitracarpus maxwelliae	No Common Name	No Common Name	Plant	E	Guanica Commonwealth Forest	No Affect
Mitracarpus polycladus	No Common Name	No Common Name	Plant	E	Guanica Commonwealth Forest	No Affect
Myrcia paganii	No Common Name	No Common Name	Plant	E	Biafara Arrozal	MANLAA
Patagioenas (Columba) inornata wetmorei	Puerto Rican Plain Pigeon	Paloma Sabanera	Bird	E	Lower Montane Forest and Riparian Habitats	No Affect
Ottoschulzia rhodoxylon	No Common Name	Palo de Rosa	Plant	E	Media Luna Ward, Candelaria Ward, Sabana Ward	MANLAA
Pelecanus occidentalis	Brown Pelican	Pelicano Pardo	Bird	E	Coastal Zones, Lago Dos Bocas, No Nesting	No Affect
Peltophryne lemur	Puerto Rican Crested Toad	Sapo Concho	Amphibian	T	Northern Karst Regions	MANLAA
Pleodendron macranthum	No Common Name	Chupacallos	Plant	E	Rio Abajo State Forest	MANLAA
Polystichum calderonense	No Common Name	No Tiene Nombre Comun	Plant	E	Cerrote Peñuelas	MANLAA
Schoepfia arenaria	No Common Name	No Tiene Nombre Comun	Plant	T	Rio Abajo State Forest (Cuesta de los Perros)	MANLAA
Solanum drymophilum	No Common Name	Erubia	Plant	E	Rio Abajo State Forest	MANLAA
Stahlia monosperma	No Common Name	Cobana Negra	Plant	E	Northern Wetlands and White Sands	MANLAA
Sterna dougallii	Roseate Tern	Palometa	Bird	T, CH	Coastal Areas and Offshore Cays, Nesting	No Affect
Tectaria estremerana	Halberd Fern	Helecho alabarda	Plant	E	Rio Abajo State Forest	MANLAA
Thelypteris inabonensis	No Common Name	No Common Name	Plant	E	None Identified near project	MANLAA
Thelypteris yaucoensis	No Common Name	No Common Name	Plant	E	None Identified near project	MANLAA
Thelypteris verecunda	No Common Name	Helecho doncella del Barrio Charcas	Plant	E	None identified near project	MANLAA
Trichechus manatus manatus	Antillean Manatee	Manati Antillano	Mammal	E	Coastal Zones	No Affect
Trichilia triacantha	No Common Name	Bariaco	Plant	E	Encarnacion,	MANLAA

PREPA VIA VERDE PIPELINE USACE/USFWS SECTION 7 AFFECTS DETERMINATION						
					(Urb. El Peñon), Tallaboa Poniente	
Zanthoxylum thomasianum	St. Thomas Prickly Ash		Plant	E	Northern Karst Regions	MANLAA

Determination: No Affect = No Affect; MANLAA = May Affect Not Likely to Adversely Affect; May Affect = May Affect.
Status: E = Endangered; T = Threatened; CH = Critical Habitat

Appendix 1 - Puertorican Nightjar (Guabairo) Habitat Quantitative Analysis

This document prepared by Asesores Ambientales y Educativos, Inc. (AAE) and provided to the Corps and FWS by email dated June 21, 2011.

Puertorican Nightjar (Guabairo) Habitat Quantitative Analysis

Background:

The Puerto Rico Electric and Power Authority ("PREPA") currently generates almost 70% of its electric power using liquid petroleum fuels. By comparison, the U.S. mainland relies on oil for only 1% of its electric power generation. The cost of electricity in Puerto Rico (currently 26 cents per kWh) is now over two and one-half times the average cost in the mainland United States. Puerto Rico's dependence on oil-fired generation is economically debilitating. That dependence, along with the exorbitant cost of oil, negatively affects island-based consumers and businesses alike, and represents a persistent drag on the progress of economic recovery.

To reduce this dependency on imported oil, PREPA has proposed to build the Vía Verde Pipeline Project – a natural gas pipeline that is designed to transport natural gas from the EcoEléctrica liquefied natural gas terminal on Puerto Rico's southwest coast to three PREPA power plants located on the north coast. The Project will allow units at the three PREPA power plants to be converted for dual fuel usage, so they will be able to run on natural gas, fuel oil, or a mixture of both. The conversion of these units will improve the operational flexibility of PREPA's system, and allow PREPA to generate electricity at the lowest possible cost. In this regard, the Project is an important first step in PREPA's promise to generate electricity in an efficient, affordable and environmentally sound manner.

As part of the permitting process for the Via Verde Project, PREPA completed a series of field studies to identify habitats associated with Federally Listed Species in an effort to avoid them, or in the event that habitat cannot be avoided, to reduce as much as possible the impacts associated with the proposed action. In doing so, PREPA hired experts to evaluate each of the habitats to be affected and present specific actions aimed to meet the requirements of the applicable laws as to avoid the habitat, reduce potential impacts, and (as a final action) mitigate unavoidable impacts.

The Via Verde Project will run through the Peñuelas Dry Limestone Karst Area, a segment that has been classified as habitat for the Puertorican Nightjar (Nightjar). At the request of the U.S. Fish and Wildlife Service (FWS), PREPA evaluated several alternative project alignments in this area in an effort to select one that, based on scientific data, minimizes impact to the Nightjar's habitat to the maximum extent practicable while at the same time allowing construction of the Via Verde project to occur.

Within the Peñuelas Dry Limestone Karst Area, three different alignments were evaluated in detail in an effort to achieve the goal mentioned above. The first one considered a pipeline alignment that basically ran through the center of the designated habitat (the Original Alignment). The others two options considered: (1) an alignment that ran west of the original alignment (outside of the designated habitat), and then went

into the Nightjar habitat on the north east corner (Alternative Alignment 1), and (2) an alignment that integrated part of the original alignment route presented back on March 23, 2011, and incorporated the use of existing dirt roads (Alternative Alignment 2). This last alignment ran mostly through secondary low quality Nightjar habitat that houses an extensive population of *Leucaena* leucocephala and Woody Vines.

This analysis identifies the efforts implemented by PREPA to avoid and reduce to a minimum impact to the designated Nightjar habitat within the Dry Limestone Karst Area. Specifically, this analysis contains an individual evaluation of each of the alignments considered, and compares potential habitat impacts of the selected alignment with other similar projects developed within the area under consideration.

Nightjar Habitat Impacts based on the Alignments Evaluated:

The evaluation took into consideration the amount of area to be impacted as well as its quality for each of the alignments. The table below summarizes the results obtained from this effort.

Table # 1

Alternative Evaluated	Area Impacted	Prime Habitat % / Total Length [1]	Habitat Impact Reduction (%)	*Gasoducto del Sur* Impacts
March 23, 2011 (Original Alignment)	12.84 Cuerdas	**43.4%** (2,625 Mts. / 6,048 Mts.)		55.4 Cuerdas
May 18, 2011 (Alternative Alignment 1)	5.79 Cuerdas	**56.0%** (2,066 Mts. / 3,693 Mts.)	55%	55.4 Cuerdas
June 6, 2011 (Alternative Alignment 2)	1.92 Cuerdas.	**6.3%** (410 Mts. / 6,494 Mts.)	85%	55.4 Cuerdas

Note # 1: Habitat evaluated through field surveys completed in all three options. These were habitats housing mature undisturbed of dry limestone forest (Vilella, 1987) where the vegetation tends to form complete floor cover.

Based on the data in Table #1 (above), Alternative Alignment 2 (that is, the option evaluated on June 6, 2011 that runs east of the March 23, 2011 alignment) is the one that reduces and minimizes impacts related with Nightjar habitat to the maximum extent practicable. Not only does this option have the least impact in terms of total area, measured in *cuerdas*,[1] but is also the one that shows a reduced impact in terms of the total length of prime habitat crossed.

Mitigation Options to be Considered:

Two options (in addition to the avoidance efforts discussed above) were evaluated in an effort to address and mitigate impacts from a project of this nature. One is based on the

[1] One *cuerdas* is equal to 0.971 acres.

implementation of a Mitigation Plan that considers the acquisition of private lands that harbor the Federally Listed Species under consideration. The second is based on a pre-negotiated monetary agreement that considers, as well, the purchase of private lands that are suitable habitat for the endangered species subject to evaluation.

Table # 2 below presents a summary of the evaluation of both options and its comparison to previous mitigation recommendations and mitigation ratios accepted by the FWS, as well as the United States Army Corps of Engineers (USACE).

Table #2

Alternative Considered	Total Area Impacted	Habitat Mitigation Ratio (7:1)	Habitat Mitigation Ratio (18:1)	Monetary Mitigation
Gasoducto del Sur	55.4 Cuerdas	385.0 Cuerdas	997.0 Cuerdas	$5,000,000
Vía Verde Project	2.0 Cuerdas	14.0 Cuerdas	36.0 Cuerdas	$180,000

Considering the analysis described above, PREPA is recommending that the acquisition of pre-determined private lands that harbor suitable habitat for the Nightjar be considered, and accepted, as appropriate mitigation. Funds needed to achieve this goal could be transferred to the Department of Natural and Environmental Resources (DNER), with the requirement this transfer be completed no later than 180 days after the effective date of the permit to be issued by the USACE. If the transfer of requisite funds to the DNER is not acceptable, PREPA would be willing to look into what authority it may have to negotiate the direct acquisition of suitable lands with the requirement these lands then be immediately transferred to the DNER.

Appendix 2 - Various Shapefiles

File “20110711-For-BA.lyr” includes the following shapefiles:

- Mtg-2Jul2011(revised alignment)
    - 62122011_COE-CL
    - 62122011_COE_WORKSPACE

  Note: These are DRAFT GIS shapefiles of centerline and ROW based on updates to date provided by applicant at meeting July 2nd..
- E-mail-26Jun2011(adds)
    - Vega Baja Axelrod Surveys
    - Note: Additional Listed Plants Survey
- E-mail-17Jun2011(adds)
    - Centerline 3-17-2011

  Note: This alignment reflects revisions between time of application and revisions as of this date.
    - Boa
    - Guabayro Habitat
    - Listed Plants Reduce Footprint
    - Listed Plants Surveys
    - Crested Toad Ponds
- E-mail-15June2011
    - Realignment

  Note: files provided by this email that were subsequently re-transmitted in later email were deleted.

Appendix 3 - Various Species Surveys and Studies

These listed documents follow this page.

- Search of Puerto Rican Crested Toad
- Description of Impacts – Puerto Rican Boa, February 22, 2011
- Preliminary Population Assessment of the Puerto Rican Nightjar, March 8, 2011
- Survey Report for the Puerto Rican Parrot, March 2011
- Raptor Survey for Puerto Rican Broad-wing hawk and Puerto Rican sharp-shinned hawk, February 2011.
- Federally Listed Plants Species Report, March 2011.
- Via Verde -Manatí Pineapples area, karst hills by pass- space availability and dominant plants species report, June 28, 2011.

Search of the Puerto Rican crested toad (*Peltophryne lemur*) and coquí llanero (*Eleutherodactylus juanariveroi*) in areas proposed for the construction of *Vía Verde*

For:

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SUMMARY

The government of Puerto Rico, through the Puerto Rico Electric Power Authority, proposes the construction of a pipeline that would run from the Eco-Electric plant in Guayanilla, southwestern Puerto Rico, to Central Palo Seco in the municipality of Cataño. The project is known as *Vía Verde* and will have a total length of 92 miles. As part of environmental assessment required for the construction of the project, it was necessary to conduct a study to determine the presence of the Puerto Rican crested toad (*Peltophryne lemur*) and coquí llanero (*Eleutherodactylus juanariveroi*) in specific sections within the proposed alignment of the pipeline. Both species are considered endangered. Although the study areas meet many of the habitat requirements for the crested toad, during the search period no individuals of this species were found. However, this study documents the presence of a new location for the coquí llanero.

INTRODUCTION

The government of Puerto Rico, through the Puerto Rico Electric Power Authority, proposes the construction of a 24-inches diameter steel pipe to transport natural gas from the Eco-Electric plant in Guayanilla, southwestern Puerto Rico to Central Palo Seco in the municipality of Cataño. This project is known as *Vía Verde* and will have a total length of 92 miles, running through the municipalities of Peñuelas, Adjuntas, Utuado, Arecibo, Barceloneta, Manatí, Vega Baja, Vega Alta, Dorado, Toa Baja, Cataño, Bayamón and Guaynabo.

Construction of the project includes cleaning of right of way, digging trenches, installing pipe and testing the pipe installed. The right of way to be established during construction will be 150 feet wide along the entire alignment and include areas of maintenance and operation. Within this right of way, 50 feet will be for permanent operational maintenance of the pipeline. This 50-feet transect will be kept free of deep-rooted vegetation and any construction. According to the environmental impact statement (EIS), the remainder of the maintenance right of way will be reforested. On the other hand, the trenches will have a depth of five to six feet and a width of four to five feet. The same excavated material will be used to cover the installed pipe.

As indicated in the EIS, the proposed project will cross roads and water bodies. To minimize the impact in both cases, boring will be used under roads and water bodies (Section 1.2, pages 10 and 11). In these areas, the right of way will be greater than 150 feet and less than 300 feet. The areas affected by the construction of *Vía Verde* will be restored. In the case of wetlands, vegetation to be impacted or removed will be mitigated once finished the construction. However, in forested areas the right of way will be kept free of vegetation.

As part of the environmental requirements for the proposed project, an inventory of the flora and fauna elements was conducted along the proposed alignment. However, due to the magnitude of the project and the diversity of habitats through which it crosses, it becomes necessary to supplement the information related to specific wildlife species previously identified by regulatory agencies. Among the species of interest are the Puerto Rican crested toad (*Peltophryne lemur*) and coquí llanero (*Eleutherodactylus juanariveroi*). In regard to the crested toad, the project would impact an area in the municipality of Peñuelas that has been identified as potential habitat for the species. In addition, *Vía Verde* is proposed to cross historical crested toad sites, in northern Puerto Rico, specifically in the municipalities of Manatí and Vega Baja.

Some of these areas are also listed as potential habitat for the species (USFWS 1992). In the case of coquí llanero, the pipeline would traverse wetland areas in the municipality of Toa Baja, that has been identified as potential habitat for the species. The purpose of this report is to present the findings on efforts to document the presence of crested toad and coquí llanero in three areas within the proposed alignment for the *Vía Verde* project.

Description of target species

Crested toad

Individuals of crested toad are medium-sized (64-120 mm, SVL), characterized by supraorbital crests and a long upturned snout (Figure 1). Its dorsal color is brown-blackish with white or yellow marbling; females are off-white in the ventral area, while males are yellowish. The species exhibits sexual dimorphism, females being larger than males (120 mm females, 85 mm males), in addition females have prominent cephalic crests and lack nuptial pads on the first fingers (Rivero 1998).

The crested toad is the only species of toad endemic to Puerto Rico and Virgin Gorda. On Virgin Gorda, the species has not been observed in the last three decades and is now considered extinct (Díaz-Lameiro et al. 2010). In Puerto Rico, the historical distribution of the species is associated with lowland limestone forest in both the north and south parts of the Island. Historical records in the north include locations in the municipalities of Isabela, Quebradillas, Arecibo, Barceloneta, Bayamón, and Vega Baja, whereas in the south the species is known for the municipalities of Guánica and Coamo (USFWS 1992, Díaz-Lameiro et al. 2010). The species was considered extinct in Puerto Rico until it was rediscovered in Isabela in 1966 (García Díaz 1967), and in Quebradillas in 1974 (Rivero 1980). In southern Puerto Rico the crested toad was rediscovered in 1984 in the Guánica National Forest (Moreno 1985). Currently, the only known wild populations of this species are located in Guánica, Guayanilla and Yauco. In 2006 the species was reintroduced at El Tallonal Private Reserve in Arecibo, and 2007 tadpoles were released in the municipality of Coamo. At present, *P. lemur* is listed as an endangered species by the U.S. Fish and Wildlife Service and the Puerto Rico Department of Environment and Natural Resources. In addition, the species is on the red list of threatened species of the International Union for the Conservation of Nature (IUCN 2009).

The habitat of *P. lemur* is associated with humid, arid or semiarid limestone forests, characterized by a high content of cavities and cracks in soil with good drainage and diverse vegetation (USFWS 1992). Areas of runoff accumulation or permanent ponds that serve for breeding are essential components of habitat for the species. The period of greatest activity of the species is during the rainy season, specifically after heavy rain, when both males and females leave their refuges and travel long distances to get to the permanent or temporary pools where

individuals congregate to breed (USFW 1992, Rivero 1998). The crested toad has the ability to travel about two miles from cavities and crevices used as retreat sites in the wooded hills (Moreno 1985, Lentini 1992, Johnson 2001).

Coquí Llanero

The coquí llanero (*Eleutherodactylus juanariveroi*) was discovered in 2004 in seasonally flooded herbaceous wetland in the municipality of Toa Baja. This species is the smallest of the genus *Eleutherodactylus* on the Island. Adults are 15 mm in body length on average (Ríos-López and Thomas 2007). Its color ranges from yellow to yellowish brown with a light, longitudinal, reversed comma mark on each side; its mid -dorsal zone is broadly bifurcated and has two conspicuous post-tympanic glands (Figure 2). The call consists of a series of short high pitched notes with call duration varying from 4 to 21 seconds. The calling activity starts at sunset and decreases before midnight.

The coquí llanero is characterized by the smallest geographical distribution of all frogs in Puerto Rico. The only known population, is located in the Sabana Seca, Ingenio Ward within the Sabana Seca U.S. Naval Security Group Activity property and the Caribbean Primate Research Center in the municipality of Toa Baja. The species is considered a habitat specialist, limited to a 180 hectares of seasonally flooded palustrine wetland at 17 m (55.8 ft) above sea level on limestone formation (Ríos- López and Thomas 2007). The 25% of the wetland vegetation consists of two rare species of ferns, *Blechnum serrulatum* (Blechnaceae), *Thelypteris interrupta* (Thelypteridaceae) and *Sagittaria lancifolia* (Alismataceae), a plant where the coquí llanero lays its eggs. This species has been designated as critically endangered (DRNA 2007) and its habitat has been designated as Essential Critical Habitat (DNER 2007).

METHODOLOGY

Crested toad

The search was focused in three sections within the *Vía Verde* project alignment that are considered part of the historical distribution of the species. One of these locations is in the municipality of Peñuelas and the other two are located in the municipalities of Manatí and Vega Baja. Prior to the field visits, a simple water flow accumulation model was developed using geographic information system (GIS). For the development of the model, digital elevation maps for Puerto Rico were used, each built with 30-meter cells. Using the spatial analysis hydrology tool, a flow management tool was applied to create a grid using the elevation information. The numerical model uses this information to calculate what flow would follow the raindrops falling on each plot. As a result of this analysis, maps that identified the areas where the accumulation of water will occur were created (Figures 3, 4 and 5). This tool is frequently used to identify watersheds, streams and rivers, among others. All water accumulation areas indicated by the model that were located in the proposed alignment of *Vía Verde* were identified. Then, all those areas were visited and the search was narrowed to 100 feet to each side of the proposed alignment. All areas identified were visited during the day, which allowed identifying the landscape and its associated habitat. In addition, visits were carried out at night to detect the species. During the visits, substrates such as small caves and rock shelters were searched actively. The presence of cavities and cracks in the limestone are of vital importance for this species, as it provides hydrated places where the crested toad can hide during the day (Matos-Torres 2003). Moreover, tadpoles were searched and identified in all areas where pools were identified. All visits were conducted between the months of November and December 2010.

Coquí Llanero

For the coquí llanero, habitat assessment and search for the species was conducted along the proposed alignment of the project in the municipality of Toa Baja. Prior to the field visits, equidistant points on the aerial photo were set along the proposed alignment and were used as search reference (Figure 6). Visits were conducted during daylight in December 2010 and day and night during the month of January and February 2011. In addition, playback calls were used during night to encourage males to vocalize.

RESULTS AND DISCUSSION

Crested toad

No individuals of crested toad were either observed or heard during the visits conducted to determine the presence of the species in the study areas (Table 1). Tadpoles of the species were not observed on any of the temporary and permanent ponds found throughout the areas studied. However, the presence of the toad in those areas cannot be categorically discarded because the search coincided with the period of low activity for the species and therefore, the probability of detection was significantly reduced. The active period for the species coincides with the rainy season, when males and females leave their places of refuge to breed in permanent or temporary ponds (USFW 1992, Rivero 1998). Furthermore, amphibians are ectotherms and their nocturnal activity is determined by air temperature, where activity increases with higher temperatures (Lampo and Bayliss 1996, Duellman and Trueb 1994).

` As part of efforts to increase the chances of finding the species, a flow accumulation model was used. The model identified a total of 27 sites within a range of approximately 200 feet along the search sections in the pipeline alignment. Of these, 5 accumulation areas were in the south (Figure 7), 9 on Vega Baja (Figure 8) and 14 in the path of Manatí (Figure 11). All areas were visited and evaluated according to the habitat requirements of the species. Many of the habitat requirements of the species such as continuous limestone forest areas, caves and crevices between rocks and temporary ponds were present in the visited areas (USFW 1992). In addition, the sites visited are within the historical distribution range of the species in both north and south of the Island (USFWS 1992). Below is a description of the sites identified as potential for the presence of the species.

South Section

Of the five areas identified by the model in the south, three have the potential to be habitat for the species (Figure 7). Area 1 and 5 hold water intermittently and both are surrounded by dry forest. Area 2 consists of two permanent ponds surrounded by dry forest. The areas have a separation of thirty feet among them but lies within the same channel. The ponds are being used by the common toad (*Rhynella marina*) and white-lip frog (*Leptodactylus albilabris*). During the visits, adult and tadpoles of both species were observed.

Vega Baja Section

The flow accumulation model identified 9 areas within the proposed route along the Vega Baja section (Figure 8). Within the visited areas a permanent artificial pond was identified as potential breeding place for the species, the pond is near the accumulation area number two. This pond is located in a flat area about 75 m away from the nearest haystack hill and is surrounded by pastures (Figure 9). In this pond, tadpoles of the common toad were observed. However, in this section, the area with the greatest potential for occurrence of the species is located between points 5 and 6 (see Figure 8). This area consists of a sinkhole that flows into an intermittent streambed which forms small temporary ponds during rain periods (Figure 10). This site is within part of a limestone forest that is in good condition, and is characterized by a large number of cavities and leaflitter (see Figure 10). The sinkhole runs between the haystack hills, connecting with other streambeds until reaches a residence backyard. These forests are part of the limestone area where individuals of crested toad had been observed in the past (Bird-Picó and Binet, personal communication).

Manatí Section

In this section the model of flow accumulation identified a total of 14 areas (Figure 11). Of these, the areas 6, 7 and 12 contain potential habitat for the crested toad. Area 6 consists of a sinkhole that collects runoff water. It is surrounded by limestone forest and contains cavities that can serve as retreat sites for the species. Area 7 is a sinkhole with a small permanent pond in which tadpoles of white-lipped frog were observed. This area is surrounded by both limestone forest and open areas. Finally, the area 12 is a sinkhole that collects runoff water forming small intermittent ponds. This area is adjacent on one side to a haystack hill and to an abandoned agricultural field on the other side. All ponds contained tadpoles of the white-lipped frog.

During visits to this section, the presence of the Puerto Rico boa (*Epicrates inornatus*) was documented in two locations (Figure 12). In one of the places, a dead juvenile individual, probably attacked by a predator, was found (Figure 13). In addition, at least one individual of *Ottoschulzia rhodoxylon* was observed on the top of one of the haystack hills (Figure 12).

Coquí llanero

The studied section can be described as heterogeneous in terms of its vegetation. The area extends from road PR-165 to the south of road PR- 867, and comprises a mosaic of herbaceous wetland and upland. The dominant vegetation in these areas was improved pastures, cattail (*Typha domingensis*) and black mimosa (*Mimosa pigra*). In terms of the amphibian community, the common coquí (*Eleutherodactylus coqui*), the Antillean coquí (*Eleutherodactylus antillensis*), whistling coquí (*Eleutherodactylus cochranae*), white-lip frog (*Leptodactylus albilabris*) and common Scinax (*Scinax rubra*; introduced to the Island in 1988), were the most commonly observed and/or heard. The coquí llanero was neither heard nor observed in this area during the study. The area near point three was not visited for safety reasons. An illegal drug dealer was operating in this site.

The section that runs from road PR-867 and ends in road PR-165 to the north is mostly comprised by areas of improved pastures, interrupted by canals and lagoons populated by *Panicum aquaticum, Cyperus giganteus, Eichhornia crassipes, Alternanthera philoxeroides* and *Pistia stratiotes*, among others. Closer to the coast, in addition to areas covered by grass, there are groups of trees and shrubs that include almond, coconut palms and mangroves, among others. During visits to this portion of the section, the presence of at least six individuals of the coquí llanero was detected (Figure 6). The species was heard in the grassy vegetation along the sides of the water channel. This site represents the first location for the coquí llanero outside of the habitat originally described for the species.

CONCLUSION

Study areas were monitored between November and December 2010 for the detection of the Puerto Rican crested toad, and extended until February for the presence of the coquí llanero. The crested toad was not detected during that period neither in the north nor in the south of the Island. However, the presence of the toad in those areas cannot be categorically discarded since the habitat is suitable for the species. Moreover, the areas that were monitored are within the historical range of this species. In terms of the coquí llanero, the species was detected in December and January along the side of one of the channels that runs through the study area in the municipality of Toa Baja.

LITERATURE CITED

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Appendix

Figure 1. Photo of a male of crested toad (*Peltophryne lemur*). Photo: Alberto R. Puente-Rolón

Figure 2. Photo of a male of the coquí llanero (*Eleutherodactylus juanariveroi*). Source: Ríos López, 2007.

Figura 3. Aerial photo showing the water flow accumulation model for Peñuelas section.

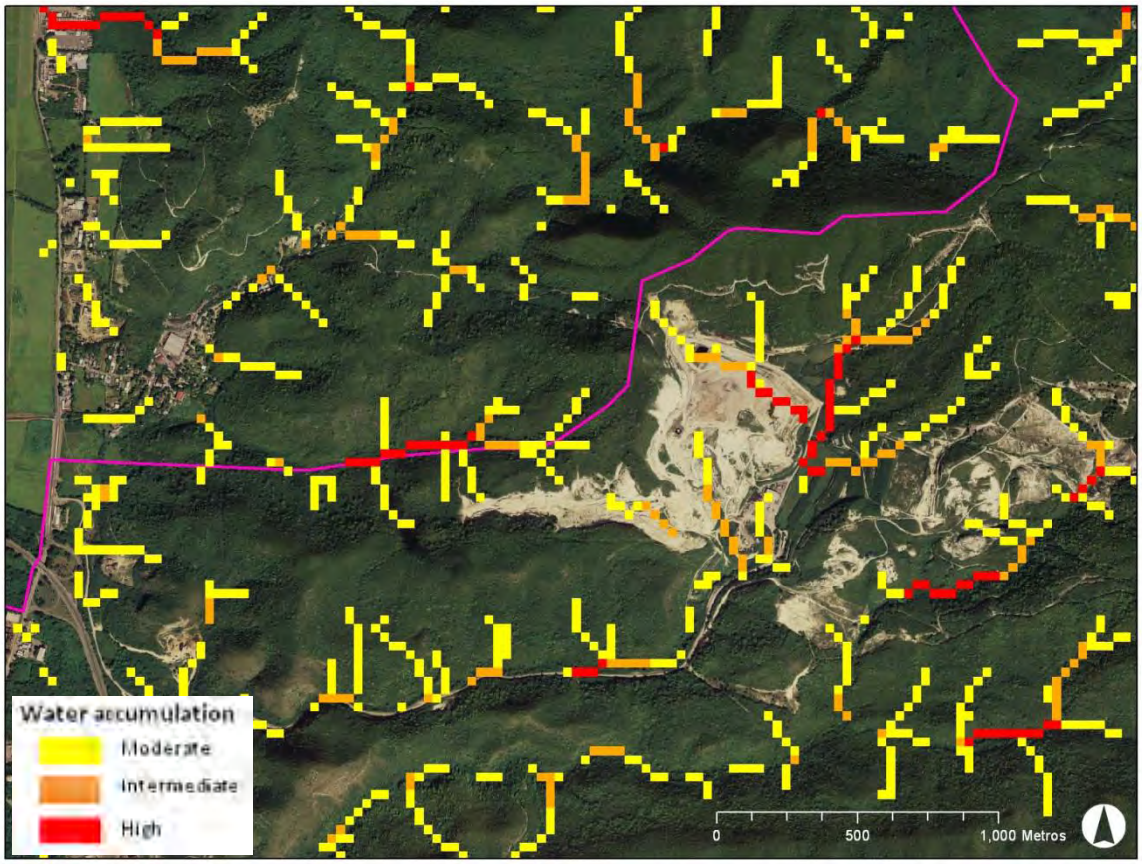

Figure 4. Aerial photo showing the water flow accumulation model for Vega Baja section.

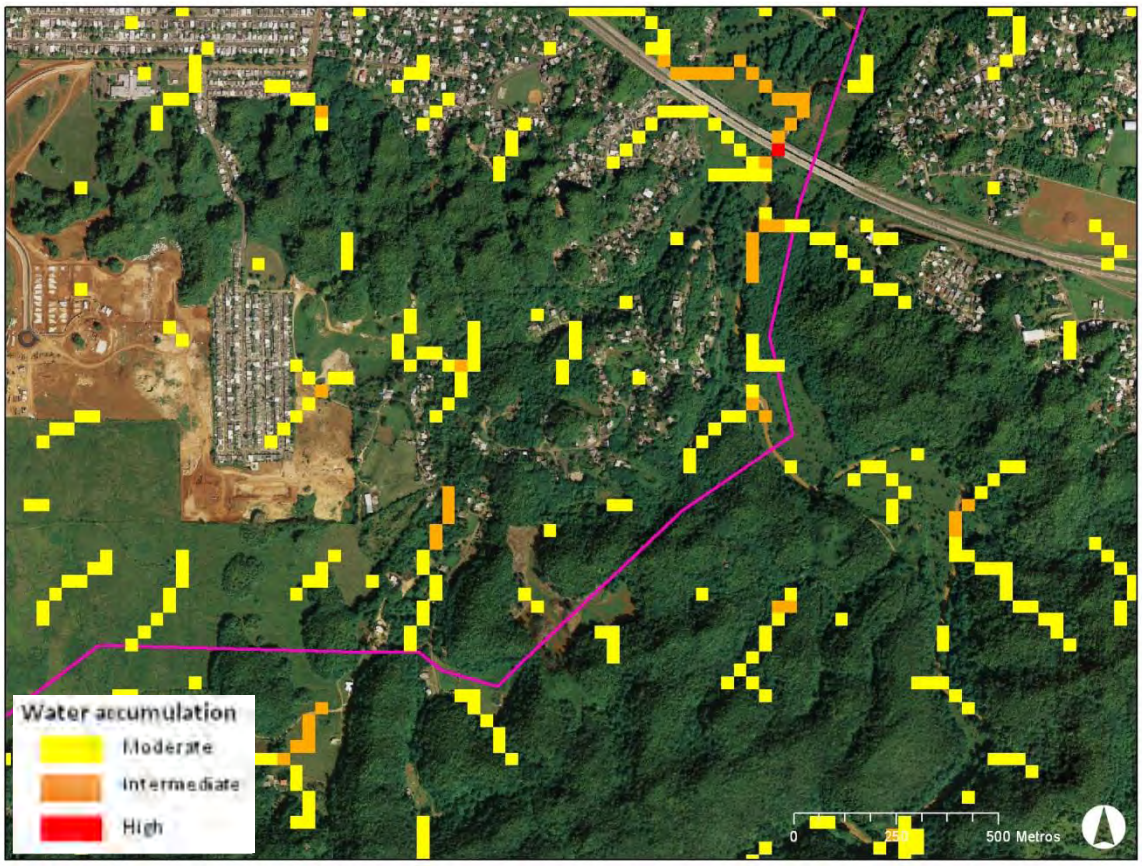

Figure 5. Aerial photo showing the water flow accumulation model for Manatí section.

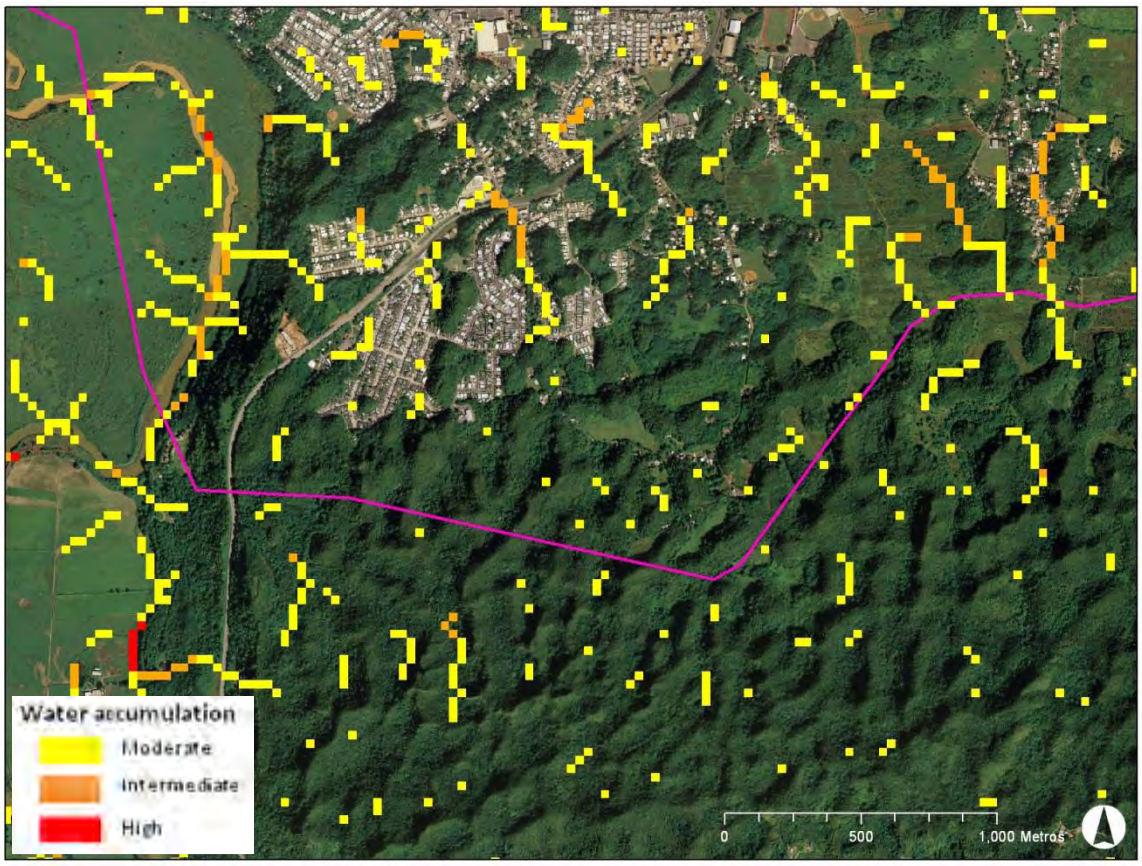

Figure 6. Aerial photo of the section studied at the municipality of Toa Baja. Points 1-9 were used as reference points within the alignment. The blue dot in the figure point out the locality where the species was heard.

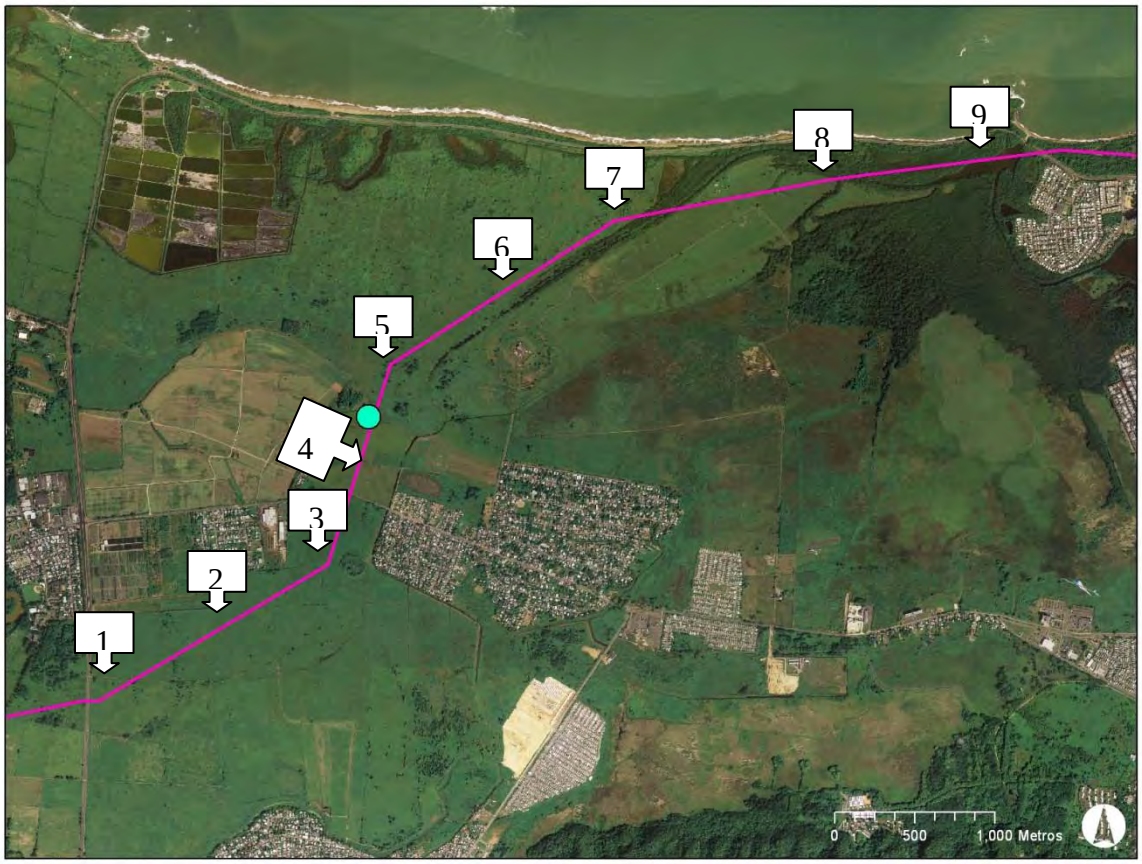

Figure 7. Aerial photo of Peñuelas section showing the areas of accumulation that were identified for the search of the crested toad and the permanent ponds identified as potential reproduction areas for the species (ponds are represented by blue points).

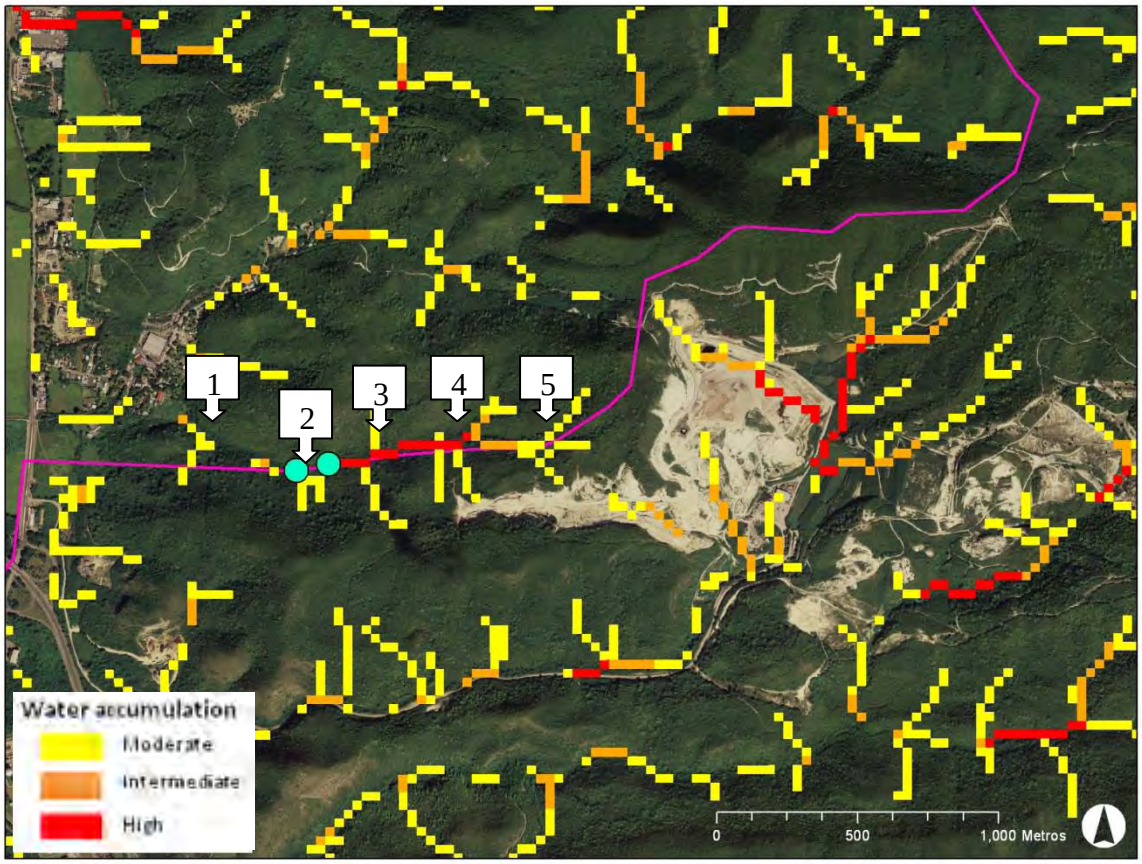

Figure 8. Aerial photo of Vega Baja section showing the areas of accumulation that were identified for the search of the crested toad.

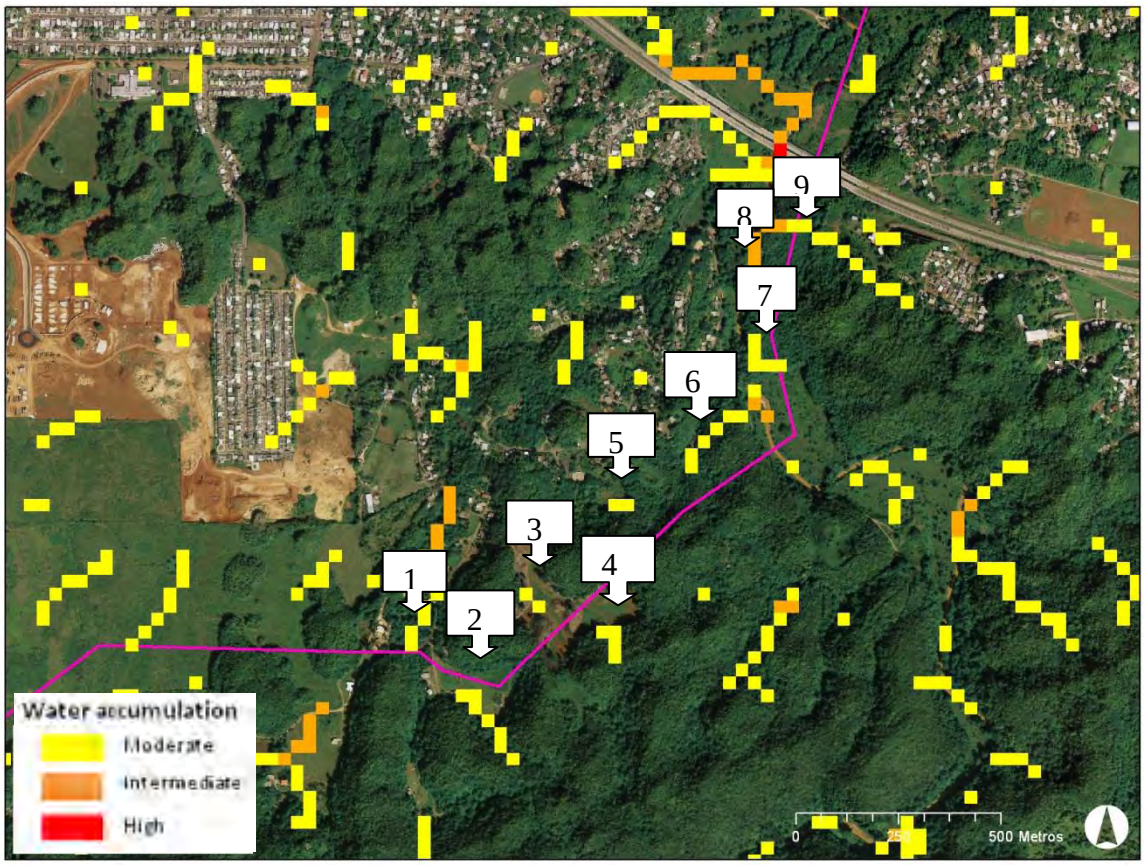

Figure 9. Photo of the artificial pond found near the second water accumulation area.

Figure 10. Photos showing the area between point 5 and 6, these areas were identified as potential habitat for the crested toad.

Figure 11. Aerial photo of Vega Baja section showing the areas of accumulation that were identified for the search of the crested toad.

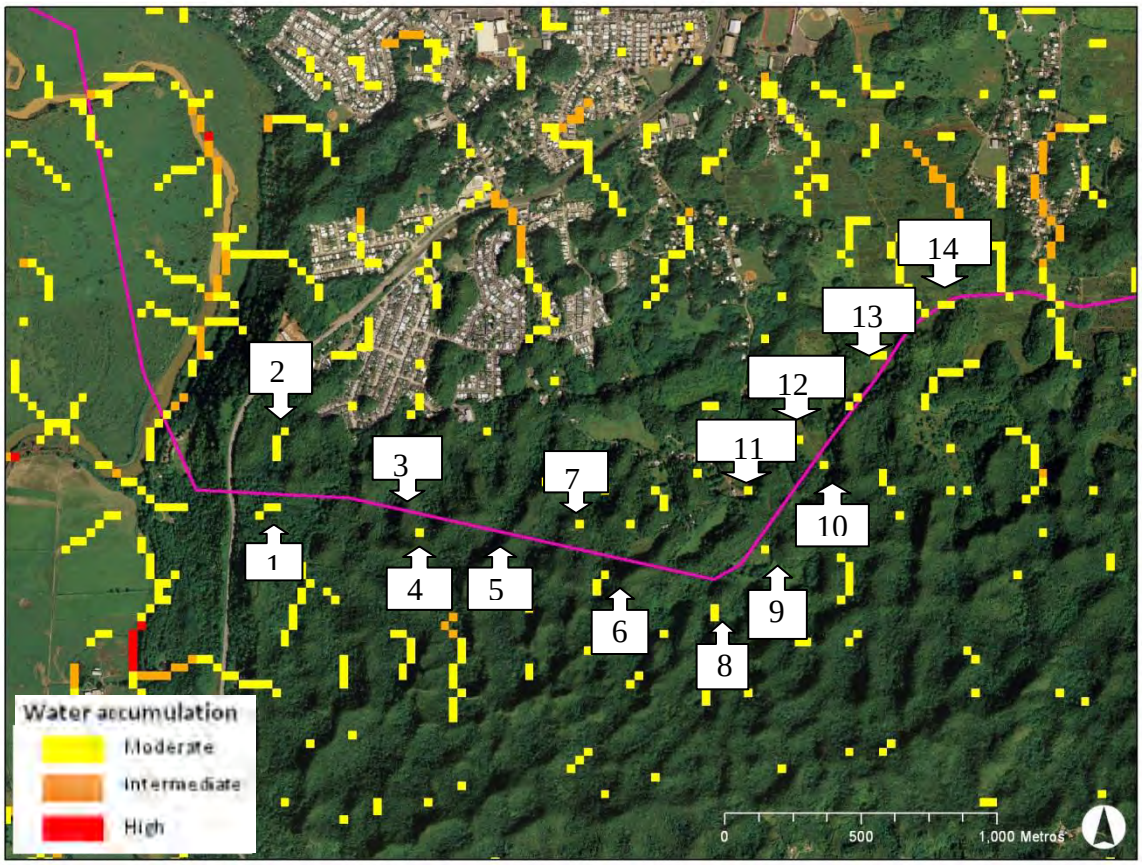

Figure 12. Aerial photo showing the localities of the Puerto Rican boa (blue points) and *Ottoschulzia rhodoxylon* (blue triangle).

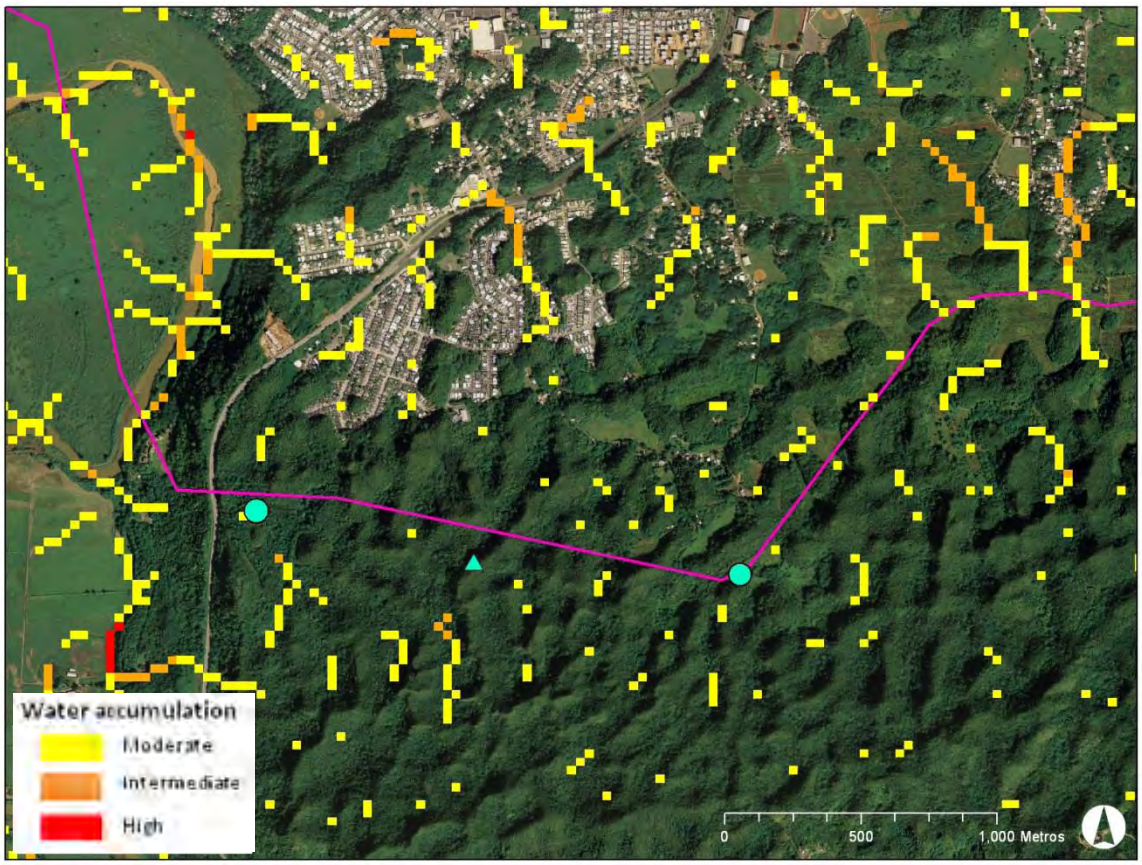

Figure 13. Photo of the dead individual of the Puerto Rican boa that was found at the Manatí section.

Table 1. Dates of visits.

Section	Date
Crested toad	
South	November 19, 2010
	November 20, 2010
	December 4, 2010
	December 11, 2010
	December 13, 2010
Vega Baja	December 1, 2010
	December 20, 2010
	December 27, 2010
Manatí	December 2, 2010
	December 15, 2010
	December 28, 2010
Coquí llanero	
Toa Baja	December 30, 2010
	January 10, 2011
	January 31, 2011
	February 16, 2011

DESCRIPTION OF IMPACTS TO THE PUERTO RICAN BOA (*Epicrates inornatus*) HABITAT

Vía Verde Natural Gas Pipeline Project

Prepared for:

Puerto Rico Energy and Power Authority

Prepared by:

COLL RIVERA ENVIRONMENTAL

Environmental Studies,
Permitting and Consulting

22 de febrero de 2011

Description of the Puerto Rican boa

The Puerto Rican boa is a member of the Boidae family. The genus (*Epicrates*) is distributed in South America, Central America, and the Greater Antilles. The Puerto Rican boa, *E. inornatus*, is endemic to Puerto Rico. This species can be found in altitudes that range from sea level to about 400 m above sea level (USFWS, 1986). This boa tolerates a wide variety of habitat types ranging from wet montane to subtropical dry forest (Rivero, 1998), however, it is most often found in the northern limestone karst belt from western Carolina to Aguadilla (USFWS, 1986). The least probable areas where the boa is found are in the drier regions of southern Puerto Rico, although there are reports of captures in these areas.

The Puerto Rican boa can grow up to a length of 6 to 7 feet, which makes it the largest snake inhabiting the Puerto Rico island shelf (USFWS, 1986). The coloration of this species can be varied. In some cases individuals can poses from 66 to 73 dark dorsal spots or lines, in others the individual does not poses any dorsal markings (Joglar, 2005) at all. Juveniles have reddish brown ground color with numerous pronounced markings (USFWS, 1986). The color variation of this species is from tan to dark brown (Rivero, 1998). The mandible area of *E. inornatus* is wide in comparison with other genus that exist in Puerto Rico.

The Puerto Rican boa is found on the ground or in trees. *E. inornatus* is a nocturnal species, but can be found during the day in open areas, areas with abundant sunlight, and at the borders of forests (Joglar, 2005). The Puerto Rican boa (*E. inornatus*) is not venomous and like the rest of the Boidae family it is a constrictor, therefore it kills its prey by wrapping around it and using its powerful muscles to cause asphyxia. The diet of *E. inornatus* consists of rats, mice, birds, small mammals including bats, and lizards.

Methodology

The methodology described in this section was used to estimate the areas of Puerto Rican boa habitat that could be affected by the construction and operation of the Via Verde Pipeline.

A screening using GIS technology was used to identify the areas where *E. inornatus* could be present (including all forested areas), given that these areas show the common habitat characteristics of this species. Using the measurement tool of the GIS software we were able to estimate the length where the pipeline route would affect the habitat of the Puerto Rican boa. These segments were then multiplied by 100 feet, and then by 50 feet to respectively obtain the area of temporary and permanent impact to the boa's habitat.

Impacts to the Puerto Rican boa's habitat

The routes of the Vía Verde pipeline will temporarily (100-feet Right–of-Way) affect 307.48 acres of potential *Epicrates inornatus* habitat during the construction phase of the project. Permanent (50-feet Right–of-Way) impact was estimated at 153.69 acres.

However, impacts to *E. inornatus* habitat areas are probably reduced due to the fact that forested areas in the Municipality of Peñuelas show other conditions that are not part of the typical habitat of this species. In fact, the Caribbean Endangered Species Map, published by the U.S. Fish and Wildlife Service, does not include this species for the Municipality of Peñuelas. If the Peñuelas area is not taken into account, the temporary impacts to the boa's habitat will be 199.79 acres. The permanent impact to this specie's habitat will be 99.86 acres.

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PRELIMINARY
POPULATION ASSESSMENT OF THE PUERTO RICAN NIGHTJAR (CAPRIMULGUS NOCTITHERUS) AT THE VIA VERDE PROPOSED RIGHT OF WAY PEÑUELAS, PUERTO RICO

Prepared for
Asesores Ambientales y Educativos, Inc.

March 8, 2011

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INTRODUCTION

On February 2011, *Asesores Ambientales y Educativos Inc.*, retained professional services to conduct a Population Assessment to determine the presence, if any, and population index of the caprimulgid bird Puerto Rican Nightjar (*Caprimulgus noctitherus*), a federally listed endangered species in the proposed Vía Verde Right of Way (ROW), at the Guayanilla Hills in Peñuelas, Puerto Rico. **Figure 1** presents the approximate location of the study area on the Peñuelas USGS Topographic Map. The PR Nightjar was detected in the proposed Vía Verde ROW during the population assessment study. This report summarizes the project approach, field activities and findings of the project.

SPECIES DESCRIPTION

The Puerto Rican Nightjar is small nocturnal bird with fluffy variegated plumage mottled dark brown black and gray, closely resembling the forest leaf litter. It has a white band across the throat and white spots near the end of the tail feathers. Males have an external white band in the tail, visible only during flight. It captures flying insect prey by sallying from perches well above the ground. Individuals often use favorite perches for foraging.

Nesting occurs from late February to early July, peaking from April to June. Males call throughout the year with a minimum during September and October and peaking during April and May. With an average clutch size of two eggs, the Nightjar nests on a depression built on the leaf litter. The incubation period lasts approximately 19 days and both parents participate in incubation and brooding. The youth abandon the nest by the 14^{th} day after hatching.

Currently, Nightjars are locally found only in the dry limestone forest of Southwestern Puerto Rico.

PROJECT APPROACH

The purpose of the population assessment was to obtain factual population information by conducting preliminary dawn and dusk surveys along established transect routes where point count stations were located, and broadcasting a taped PR Nightjar song to entice call-back behavior from male individuals during surveys.

The population assessment included a review of available information, site visits to establish appropriate transect routes and point count stations, and conducting dawn and dusk surveys on each station. Transect routes, and point count station (PCS) locations were established in coordination between the United States Fish and Wildlife Service (USFWS) and the project consultants.

METHODOLOGY

Seven point count locations were established along three transect routes located along the proposed Vía Verde ROW. PCS locations were distributed as follows; one in the North, four in the Center and two in the South transect routes, as agreed with the USFWS.

The initial PCS location in each transect route was located at least 100 meters from the forest edge as defined by the predominant vegetation following an agreement with the USFWS. All PCS locations were clearly marked with surveyor's flagging tape at intervals of at least 160 meters. **Figure No. 1**, shows PCS locations as determined with a Global Position System Receiver (Garmin GPSmap 76C x) for georeferencing. In the field, distance between PCS locations was measured with a surveyor's measuring tape.

On the evening of February 20th, the three experienced bird field survey observers who participated in this investigation met at the study area to become attuned and approximately matched with Nightjar call loudness at varying distances up to around 75 meters. In addition, an evaluation of the efficiency of tape recorders at a broadcasting

distance of about 75 meters was conducted. Although there is an inherent error present in estimating distances during field surveys, the conclusion on whether nightjars are present on the ROW should not be affected. During practice trials, all observers reported hearing the broadcasted calls in all cases, including different tape recorder models.

Since the purpose of this study is to estimate the number of singing males within the selected transect routes along the proposed Vía Verde ROW, taped recording broadcast levels were considered adequate so as not attract individuals from outside the designated 75 meter PCS radius.

The described method utilizes a one minute recorded tape broadcasting of the call of a male Nightjar after a listening period of two minutes. Another two minutes listening period is conducted after the tape broadcast. Presumably, males that remain silent during the first listening period are enticed into singing after the broadcast. In this study the maximum number of Nightjars heard at each transect route will be reported regardless of the listening period (before or after the taped broadcast).

Field surveys began on February 21 and ended on March 2, 2011. Each PCS was surveyed a total of three dawns and three dusk sessions. An attempt was made to survey each PCS by the same observer, to minimize inter-observer variability. This may result in a systematic bias, but overall study findings should remain unaffected.

Field survey methodology followed R. González, 2010. After arriving at the prescribed PCS, each observer recorded the time of the first Nightjar heard. PCS's surveys were conducted simultaneously with each observer recording the first calling Nightjar independently. The observer then waited a period of five minutes. At the end of the five minute period, observers recorded during two minutes each singing male Nightjar within a 75 meter radius around the PCS. This was followed by a one minute broadcast of a taped recording of a male singing Nightjar. After the tape broadcast each singing Nightjar male within a two minute period was recorded, as described above. As an aid

in discerning different individual Nightjars, each observer noted the compass direction of each Nightjar heard. After the last two minute period described above, the survey session was considered completed.

STUDY AREA

The study area is a tract of land of undulating and hilly mature secondary dry forest of varying height and dominant tree species, interspersed with *Leucaena sp*. stands. The understory is made up mainly of plants scarcely one inch in diameter at breast height, with an occasional tree of considerably larger diameter. In general, the understory is devoid of a leafy stratum. The terrain is characteristically rugged, with occasionally exposed, weathered limestone and shallow soils overlain by humus. Leaf litter varied in thickness to a maximum of about 2 inches. The Vía Verde ROW is approximately 100 feet wide and traverses the forest types in this area a distance of approximately three miles according to information supplied by *Asesores Ambientales y Educativos Inc.* The study area is considered Nightjar habitat by the DNER and the USFWS, as confirmed by previous research.

FIELD ACTIVITIES

Field reconnaissance was conducted prior to the establishment of transect routes for this study. The USFWS participated in the field reconnaissance and assisted in the selection of transect routes. In addition, experienced USFWS personnel were present during one of the Nightjar count sessions (dusk, February 23, 2011).

Fixed PCS Nightjar counts were conducted along trails established by the contractor following the proposed Vía Verde ROW. Footpaths were accessed via tertiary roads (North route) and dirt roads.

The seven PCS's, distributed among the three transect routes were surveyed a total of three dawns and three dusks each, beginning the dusk of February 21 and ending on

the dawn of March 2, 2011.

Counts were conducted during cool clear nights with moonlight of declining luminosity throughout the sampling period. On February the 21th, the moon was decreasing in luminosity from the Full Moon which occurred on February 18. The maximum luminosity of the moon on February 21, based on existing tables was 87.4% with moonrise occurring at 10:06 pm and the Three Quarter Moon for Puerto Rico, occurred at 07:09 pm on February 24. By the end of the sampling period, on March the 2nd, moon luminosity had decreased from the 3rd Quarter phase to 4.7%. **Table 1** shows details of moon stages during the sampling period. During the field investigation, wind varied from slight to moderate breezes and no significant rain was recorded in the study area or during surveys.

The North transect route consisted of one PCS at 100 meters from the forest edge. This PCS was designated N1. The Center transect route consisted of four PCS located at 160 meter intervals with the first station located at a 100 meters from the forest edge. These were designated as C1 through C4. The South transect rout consisted of two PCS designated S1 and S2. S1 was located at 100 meters from the forest edge. Sampling station S2 was located approximately 190 meter from S1 to account for the extreme undulating topography of the area. This was made to ensure that no single bird was counted simultaneously on the two stations and to avoid overlapping of the 75 meter radius circles of the adjacent PCS's. Stations were georeferenced with a global positioning unit (GPS), as described above.

Each observer reached their respective PCS about 1.5 hour before sunrise and approximately 1 hour before sunset. After reaching the PCS, each observer followed the methodology described above. Summarized results of the PCS counts are shown on **Table 2**.

RESULTS

Following the above described methodology, results of this study found that Nightjars are found within the proposed Vía Verde ROW. Nightjars were heard calling at each PCS location, except during the morning sessions at PCS C3 in the Center transect route. Furthermore, individual sessions where no Nightjars were detected tended to occur in the morning (**Table 2**). The only evening session where no Nightjars were detected occurred in the Center PCS C3 on February 24.

Overall a total of 66 Nightjars were detected in all seven PCS locations during this study. This total does not represent individual Nightjars, since the results of the three morning and three evening sessions, at all PCS locations were pooled. The same individual bird may have been detected more than once in different survey sessions.

Henceforth, the *maximum* number of Nightjars detected is reported as representing the *minimum* number of individuals in each transect route, since other individuals may be present and not singing. Furthermore, results indicate the maximum number counted in all three morning and evening sessions, respectively, as the maximum count is the relevant figure in this study.

Summarized descriptions of results for each transect route follow (**Table 2**):
The reported number of Nightjars represents the maximum detected for each route across all morning and evening sessions, respectively.

North transect route (a single PCS location) - During the morning sessions two Nightjars were the maximum number heard. During the evening sessions the maximum number of Nightjars heard was also two.

Center transect route (four PCS locations) - During the morning sessions across all four PCS locations three Nightjars were the maximum number heard. During the evening sessions the maximum number heard was five.

South transect route (two PCS locations) - During the morning sessions across the two PCS locations three Nightjars were the maximum number heard. During the evening sessions the maximum number heard was four.

Table 1. Moon stages during the sampling period.

Date	Moonrise	Moonset	Illuminated	Phase
Feb 21, 2011	- 10:06 PM	9:01 AM -	87.4%	
Feb 22, 2011	- 11:08 PM	9:48 AM -	78.2%	
Feb 23, 2011		10:38 AM	67.5%	
Feb 24, 2011	12:09 AM	11:30 AM	56.3%	3Q at 7:27 PM
Feb 25, 2011	1:09 AM	12:25 PM	45.1%	
Feb 26, 2011	2:05 AM	1:20 PM	34.4%	
Feb 27, 2011	2:56 AM	2:16 PM	24.8%	
Feb 28, 2011	3:44 AM	3:10 PM	16.4%	
Mar 1, 2011	4:27 AM	4:02 PM	9.7%	
Mar 2, 2011	5:06 AM	4:53 PM	4.7%	

Table 2. Results for each transect route

North Transect Route

CPS Sta.	Date	First Call	Before Recording	After Recording
N1	27-Feb-11	5:48 AM	0	0
N1	28-Feb-11	5:57 AM	1	0
N1	1-Mar-11	5:45 AM	2	1
N1	26-Feb-11	6:43 PM	1	2
N1	27-Feb-11	6:37 PM	2	0
N1	28-Feb-11	6:36 PM	1	0

Table 2. (Cont.) Results for each transect route

Center Transect Route

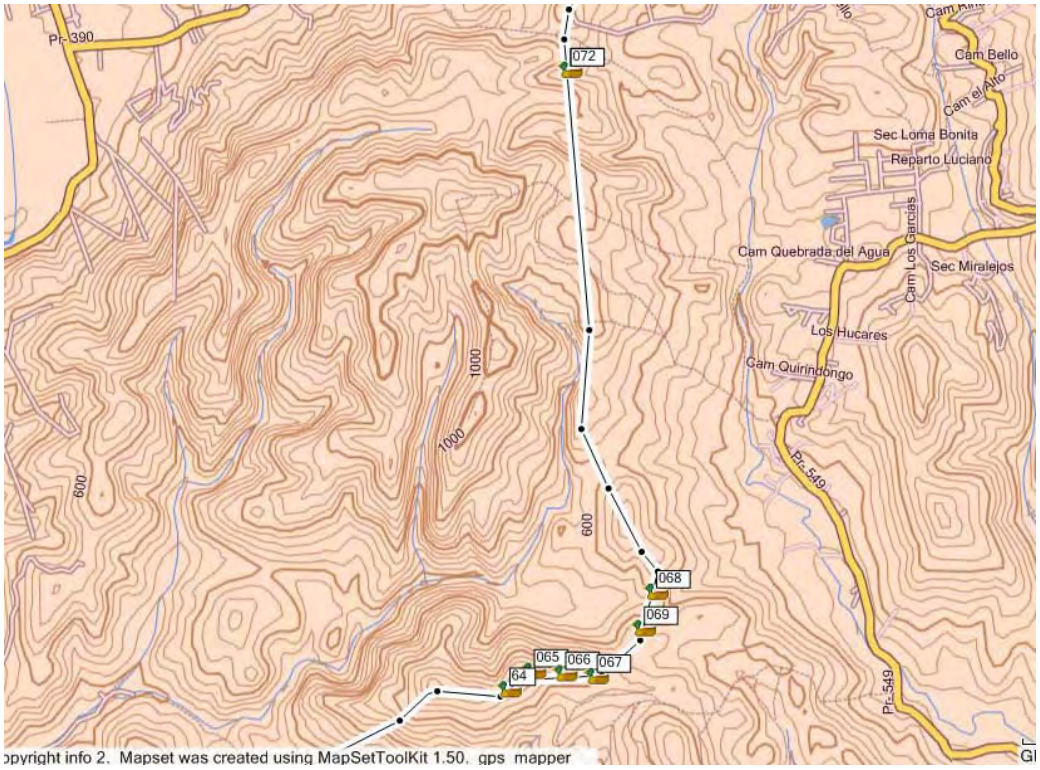
CPS Sta.	Date	First Call	Before Recording	After Recording
C1	22-Feb-11	5:45AM	0	0
C1	24-Feb-11	5:35AM	1	1
C1	25-Feb-11	5:35AM	0	1
C1	21-Feb-11	6:49 PM	1	0
C1	23-Feb-11	6:40 PM	1	0
C1	24-Feb-11	6:52 PM	0	1
C2	22-Feb-11	5:45 AM	2	1
C2	24-Feb-11	5:25 AM	1	1
C2	1-Mar-11	5:26 AM	0	0
C2	21-Feb-11	6:45 PM	0	2
C2	23-Feb-11	6:44 PM	0	1
C2	28-Feb-11	6:41 PM	2	1
C3	24-Feb-11	5:30 AM	0	0
C3	25-Feb-11	5:29 AM	0	0
C3	28-Feb-11	5:35 AM	0	0
C3	23-Feb-11	6:35 PM	0	2
C3	24-Feb-11	6:49 PM	0	0
C3	27-Feb-11	6:46 PM	0	2
C4	25-Feb-11	5:25 AM	0	1
C4	28-Feb-11	5:39 AM	0	1
C4	1-Mar-11	5:40 AM	0	1
C4	24-Feb-11	6:42 PM	3	2
C4	27-Feb-11	6:43 PM	0	3
C4	28-Feb-11	6:41 PM	2	1

Table 2. (Cont.) Results for each transect route

South Transect Route

CPS Sta.	Date	First Call	Before Recording	After Recording
S1	23-Feb-11	5:45 AM	0	0
S1	26-Feb-11	5:25 AM	1	0
S1	27-Feb-11	5:51 AM	0	0
S1	22-Feb-11	6:40 PM	0	1
S1	25-Feb-11	6:42 PM	2	1
S1	26-Feb-11	6:41 PM	2	1
S2	23-Feb-11	5:48 AM	0	1
S2	26-Feb-11	5:30 AM	1	1
S2	27-Feb-11	5:45 AM	1	2
S2	22-Feb-11	6:25 PM	0	1
S2	25-Feb-11	6:43 PM	0	3
S2	26-Feb-11	6:44 PM	3	1

Fig. 1. Approximate location of the study area.



TETRA TECH

2011 Survey Report for the Endangered Puerto Rican Parrot

Via Verde Project

Puerto Rico

Prepared for:

Assessores Ambientales y Educativos
&
Puerto Rico Electric Power Authority

By:

Tetra Tech, Inc.
451 Presumpscot St.
Portland, Maine 04103

March 2011

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1.0 INTRODUCTION

1.1 Project Overview

This report describes the results pertaining to the endangered Puerto Rican parrot (*Amazona vittata*) along the proposed Via Verde Pipeline (Project area) within the municipalities of Manati, Utuado, and Adjuntas, Puerto Rico. The objective of these surveys was to document occurrence of three endangered species; Puerto Rican parrot, the Puerto Rican broad-winged hawk (*Buteo platypterus brunnescens*) and the Puerto Rican sharp-shinned hawk (*Accipiter striatus venator*) within two focal areas of concern. A separate report has been prepared for the broad-winged hawk and the sharp-shinned hawk. Puerto Rican parrots are federally endangered and protected under the Endangered Species Act. The Puerto Rican parrot is restricted to two forested areas of Puerto Rico. The El Yunque National Forest was host to the only remnant population of parrots (Snyder et al. 1987, White et al. 2005) until 20 parrots were released into the Rio Abajo in 2006. The bird survey was designed provide a baseline dataset on these endangered species in forested areas of concern within the Project area. These data may provide useful information to help minimize potential environmental impacts from the proposed Project.

1.2 Project Area Description

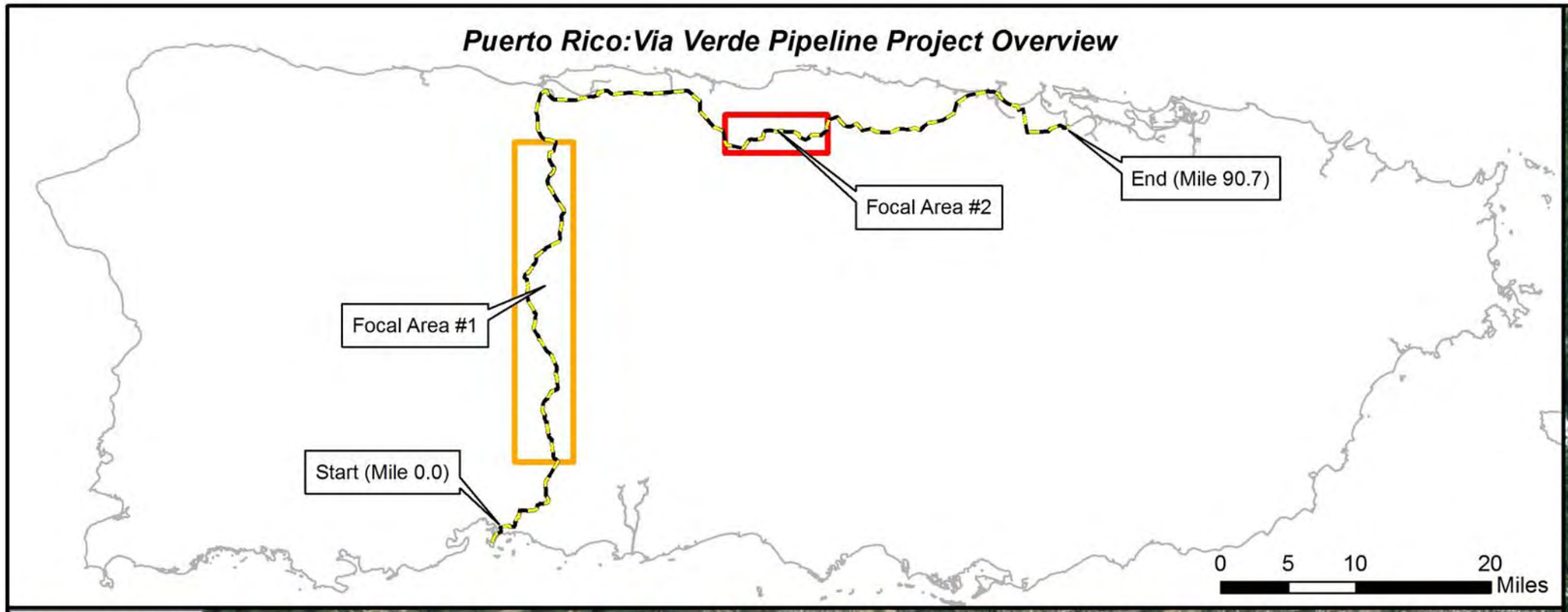
The Puerto Rico Electric Power Authority (PREPA) is proposing to construct a 24 inch diameter natural gas pipeline (Via Verde) originating from the municipality of Peñuelas and crossing the island through the central mountain region from the south to the north towards San Juan (Figure 1-0). The U.S. Fish and Wildlife Service (USFWS) has commented on the project and has requested surveys for endangered raptors and parrots to be conducted in areas of potential habitat along the pipeline corridor. During consultation, USFWS has stated that it is important to determine the number of breeding territories that may be affected by project construction, as well as the amount of habitat potentially affected. The following report describes how Tetra Tech, Inc. (Tetra Tech) evaluated the Project area for endangered parrots.

1.3 Goal and Objectives

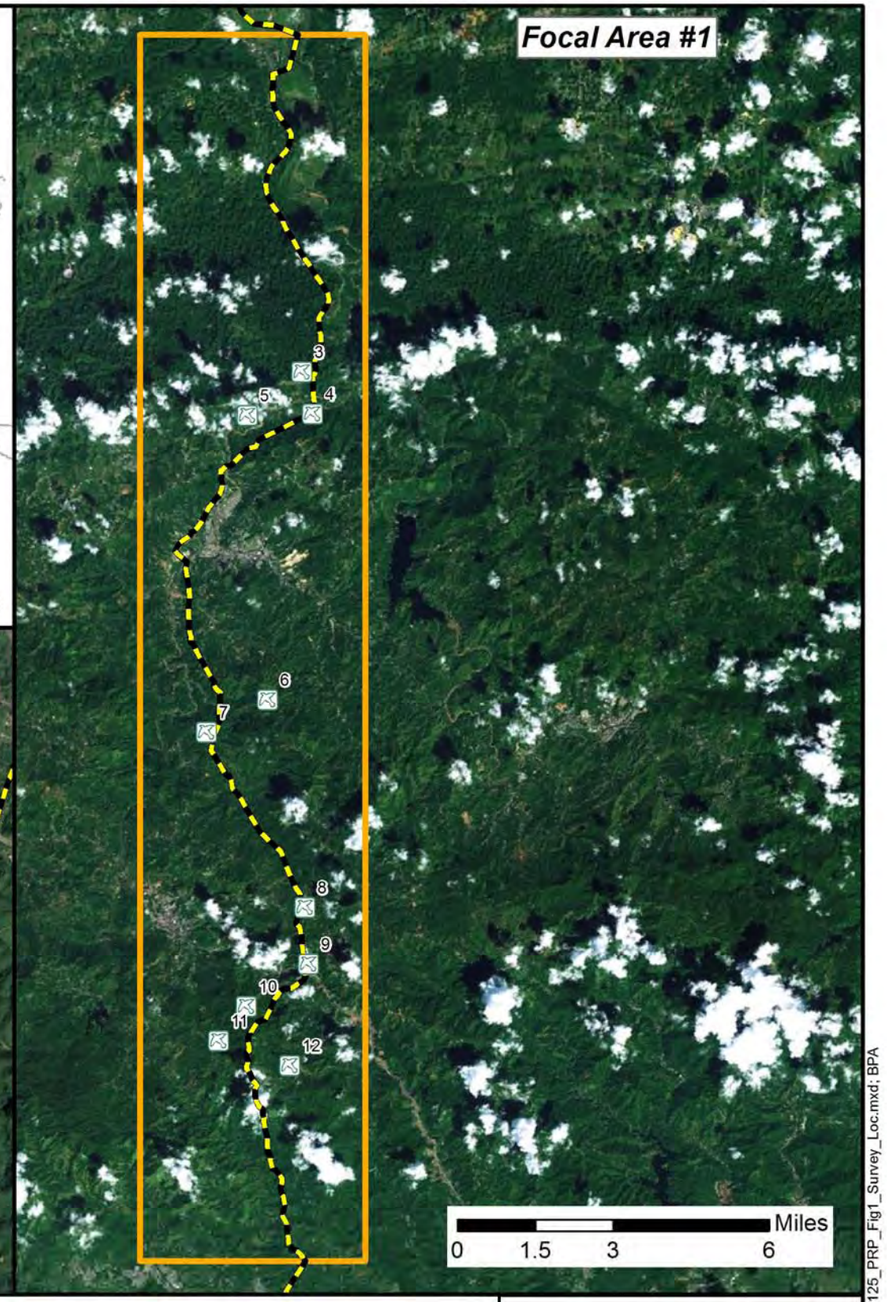
The goal of the surveys was to identify the spatial and temporal use of the Project area by Puerto Rican parrots in addition to endangered raptors during January 2011. Objectives for the Puerto Rican Parrot aspect of the survey were to:

1) determine occurrence of endangered parrots within the Project area;
2) identify potential nesting territories;
3) identify movements of endangered parrots;
4) spot map identified territories; and
5) calculate percentage of habitat to be impacted in indentified territories.

Puerto Rico:Via Verde Pipeline Project Overview



Focal Area #1



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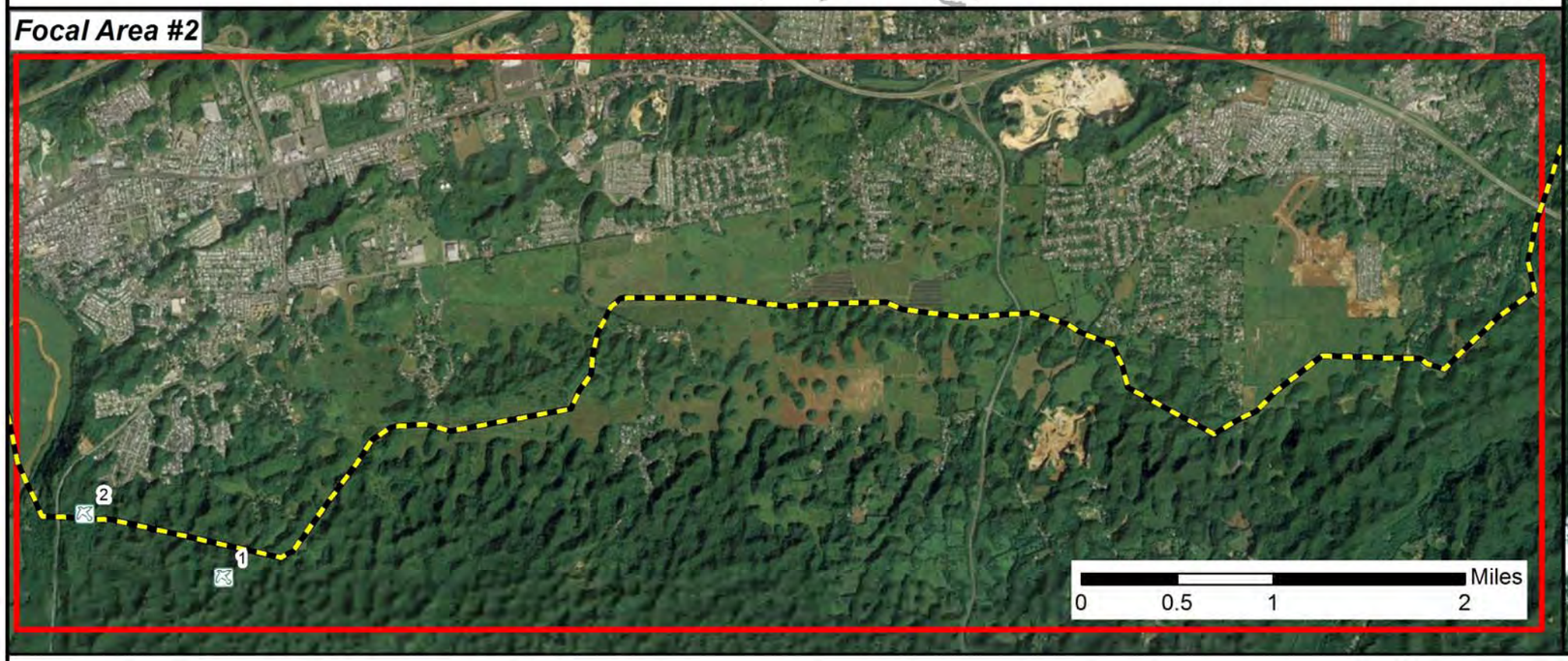

Legend

- Puerto Rico
- Via Verde Pipeline
- Final Bird Survey Locations
- Focal Area #1 (Miles 9.6 - 37.6)
- Focal Area #2 (Miles 58.9 - 68.3)

Survey Location Names

Manati East (1)	Tangue de Agua (7)
Manati West (2)	Curva (8)
Entrada (3)	Rt 143 (9)
Planta (4)	Foreman Finca (10)
Finca de Raul (5)	West Face (11)
Puente Blanco (6)	East Face (12)

N

Projection/Coordinate System:
North American Datum of 1983,
Puerto Rico State Plane, US Feet

Sources:
U.S. Dept. of Transportation; World Imagery
(http://services.arcgisonline.com/arcgis/services)

Figure 1.
Final Bird Survey Locations
Via Verde Pipeline Project

Prepared For:
Asesores Ambientales y Educativos

Prepared By: TETRA TECH

Date: 03/03/2011

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2.0 METHODS

Tetra Tech biologists conducted birds surveys for parrots, broad-winged hawks, and sharp-shinned hawks from observation points in forested areas within the Project area (Figure 1.0). Areas selected for surveys were identified during an initial biological evaluation (Focal Areas 1 and 2) and ground-truthed during a site-reconnaissance trip in December 2010. After consultation with USFWS on survey design, bird surveys were conducted from 12 observation points located within forested sections of the Project area during the month of January 2011. Each observation point was surveyed twice during the survey period of January 12–January 28, 2011 for a total of 24 surveys. Bird survey methodology was modeled upon previous broad-winged hawk and sharp-shinned hawk studies conducted on the island of Puerto Rico (Rivera-Milan 1995, Delannoy 1997, Hengstenberg and Vilella 2005, Vilella and Hengstenberg 2006). This survey methodology is also applicable for identifying presence/absence of parrots.

Surveys were designed to cover areas identified to have potential habitat in both the karst and central mountain regions. Potential habitat of concern was identified through a desktop biological evaluation and confirmed through USFWS consultation as well as a site-reconnaissance survey to the Project area in December 2010. Representative photos of observation points within the central mountain region and within the northern karst region are shown in Figure 2-0 and Figure 2-1.

Bird surveys were conducted by one to two biologists from the morning to early afternoon hours (~0700 to ~1300). One to three survey locations were covered on a daily basis. All surveys were conducted on days with suitable weather conditions (i.e., minimal precipitation and fog).

Biologist used high quality binoculars (10x42 mm), spotting scopes (15–46x60 mm), and range finders to record data on species composition, habitat use patterns, and movements of endangered raptors and parrots in the Project area. Field identification references included A Guide to the Birds of Puerto Rico by Raffaele 1989. Focal species were spot-mapped and their global positioning system (GPS) position was recorded on field maps.

Tetra Tech compiled all data from the January surveys and prepared the following biological survey results and discussion for the Puerto Rican Parrot. This report contains all relevant information including maps of survey observation points. This information can be used by Assessores Ambientales y Educativos (AAE), PREPA, and the USFWS to determine the anticipated effects on the Puerto Rican Parrot by the Via Verde Project.

Figure 2-0. View looking northeast of Rio Ajbajo Forest sotuthern border from Point 5 (Fina de Raul).

Figure 2-1. View looking southwest from Point 5 (Fina de Raul).

3.0 RESULTS AND DISCUSSION

During 12 days between January 12 and January 27, 2011, 24 bird surveys taken from 12 observation points resulted in 144 hours of direct, visual observation (Table 3-0). All surveys were conducted in good weather days.

Table 3-0. Summary of survey effort during January 2011 bird surveys, Via Verde Project.

Date	Observation Point	Observation Point	Observation Point	Daily Survey Effort
1/12/2011	Point 1 (Manati West)	*Vega Baja survey**		1
1/13/2011	Point 3 (Entrada)	Point 4 (Planta)	Point 5 (Finca Raul)	3
1/14/2011	Point 6 (Puente Blanco)	Point 7 (Water tank)		2
1/17/2011	Point 8 (Curva)	Point 9 (Rt 143)	Point 10 (Foreman)	3
1/18/2011	Point 11 (West Face)			1
1/19/2011	Point 12 (East Face)	Point 1 (Manati West)	Point 2 (Manati East)	3
1/20/2011	Point 3 (Entrada)	Point 4 (Planta)	Point 5 (Finca Raul)	3
1/21/2011	Point 6 (Puente Blanco)	Point 7 (Water tank)		2
1/24/2011	Point 8 (Curva)	Point 9 (Rt 143)		2
1/25/2011	Point 10 (Foreman)	Point 12 (East Face)		2
1/26/2011	Point 11 (West Face)			1
1/27/2011	Point 1 (Manati West)	Point 2 (Manati East)		2
**Not included in survey total*			**Survey Total**	**24**

There were 3 observation points located near the Rio Abajo Forest southeastern boundary (Point 3, Point 4, and Point 5) where the closest population of Puerto Rican parrots resides in relation to the footprint of the Via Verde Project Area (Figure 1). These 3 points had excellent viewsheds of the forested slopes that border the Rio Grande de Arecibo and the Rio Abajo Forest. No Puerto Rican Parrots were observed or heard during the surveys at any of the observation points. There were at least 4 to 5 pairs of Red-tailed hawks (*Buteo jamaicensis jamaicensis*), a natural predator of Puerto Rican parrot (Snyder et al. 1987, White et al. 2005), observed within the viewshed of these three observation points. The home range and habitat use patterns of the Puerto Rican parrot from the Rio Abajo population is still unknown but currently being studied. The high density of Red-tailed Hawks observed, juxtaposition of Highway 10, and fragmented habitat blocks that compose the landscape along the southeastern boundary of Rio Abajo Forest, may impede or deter Puerto Rican parrots from using these forested blocks in great frequency.

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TETRA TECH

2011 Endangered Raptor Survey Report for the Puerto Rican Broad-winged Hawk and Puerto Rican Sharp-shinned Hawk

Via Verde Project

Puerto Rico

Prepared for:

Assessores Ambientales y Educativos
&
Puerto Rico Electric Power Authority

By:

Tetra Tech, Inc.
451 Presumpscot St.
Portland, Maine 04103

February 2011

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1.0 INTRODUCTION

1.1 Project Overview

This report describes the results from the endangered raptor surveys along the proposed location of the Via Verde Pipeline (Project area) within the municipalities of Manati, Utuado, and Adjuntas, Puerto Rico. The function of these surveys was to document occurrence of the Puerto Rican broad-winged hawk (*Buteo platypterus brunnescens*) and Puerto Rican sharp-shinned hawk (*Accipiter striatus venator*) within the two focal areas of concern. Both endangered raptors are non-migratory and remain on Puerto Rico year-round. They are federally endangered and protected under the Endangered Species Act. The endangered raptor surveys provide a baseline dataset on these species in forested areas of concern within the Project area. These data may provide useful information to help minimize potential environmental impacts from the proposed Project.

1.2 Project Area Description

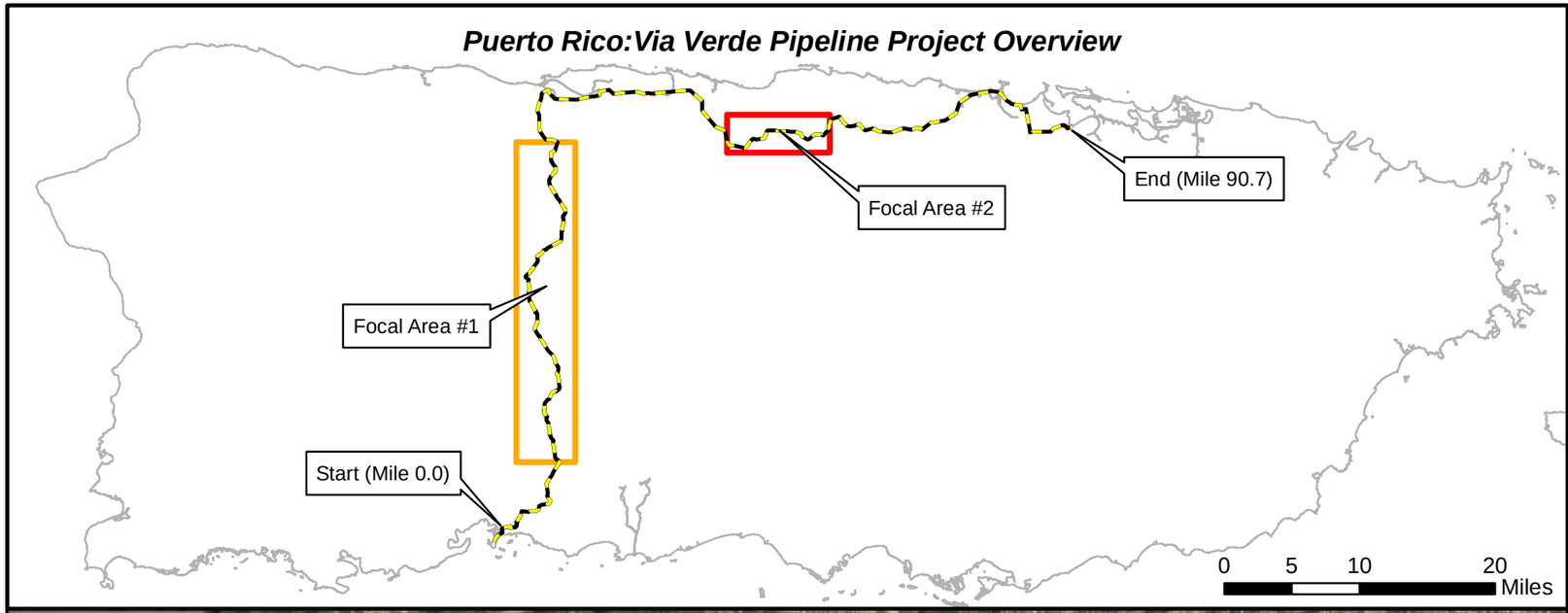
The Puerto Rico Electric Power Authority (PREPA) is proposing to construct a 24 inch diameter natural gas pipeline (Via Verde) originating from the municipality of Peñuelas and crossing the island through the central mountain region from the south to the north towards San Juan (Figure 1-0). The U.S. Fish and Wildlife Service (USFWS) has commented on the project and has requested surveys for endangered raptors to be conducted in areas of potential habitat along the pipeline corridor. During consultation, USFWS has stated that it is important to determine the number of breeding territories that may be affected by project construction, as well as the amount of habitat potentially affected. Until further studies demonstrate otherwise, the USFWS assumes that suitable habitat within the proposed pipeline corridor is occupied by endangered raptors for breeding, and potential take may be anticipated in those areas. The following report describes how Tetra Tech, Inc. (Tetra Tech) evaluated the Project area for endangered raptors.

1.3 Goal and Objectives

The goal of the surveys was to identify the spatial and temporal use of the Project area by Puerto Rican Broad-winged hawks and Puerto Rican sharp-shinned hawks during January 2011. Objectives for the raptor survey were to:

1) determine occurrence of endangered raptors within the Project area;
2) identify potential nesting territories and conduct nest searches;
3) identify movements of endangered raptors;
4) spot map identified territories; and
5) calculate percentage of habitat to be impacted in indentified territories.

Puerto Rico:Via Verde Pipeline Project Overview



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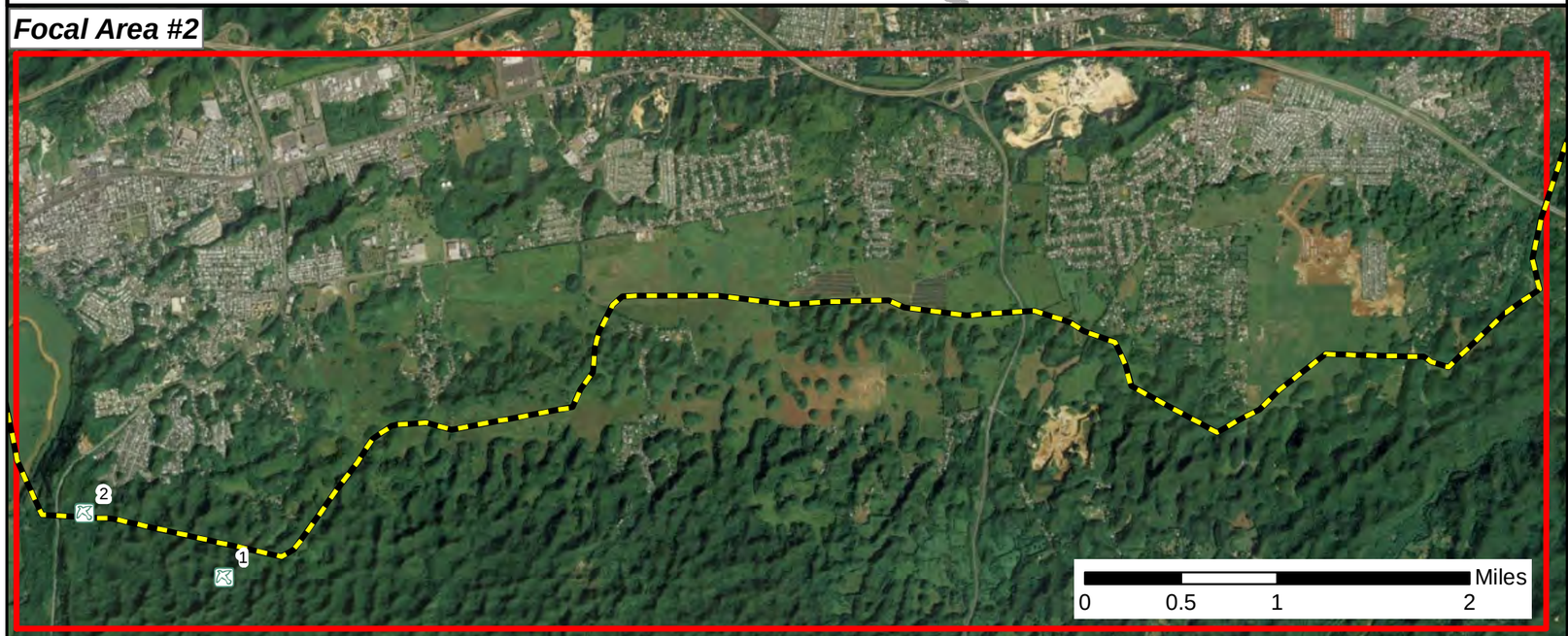

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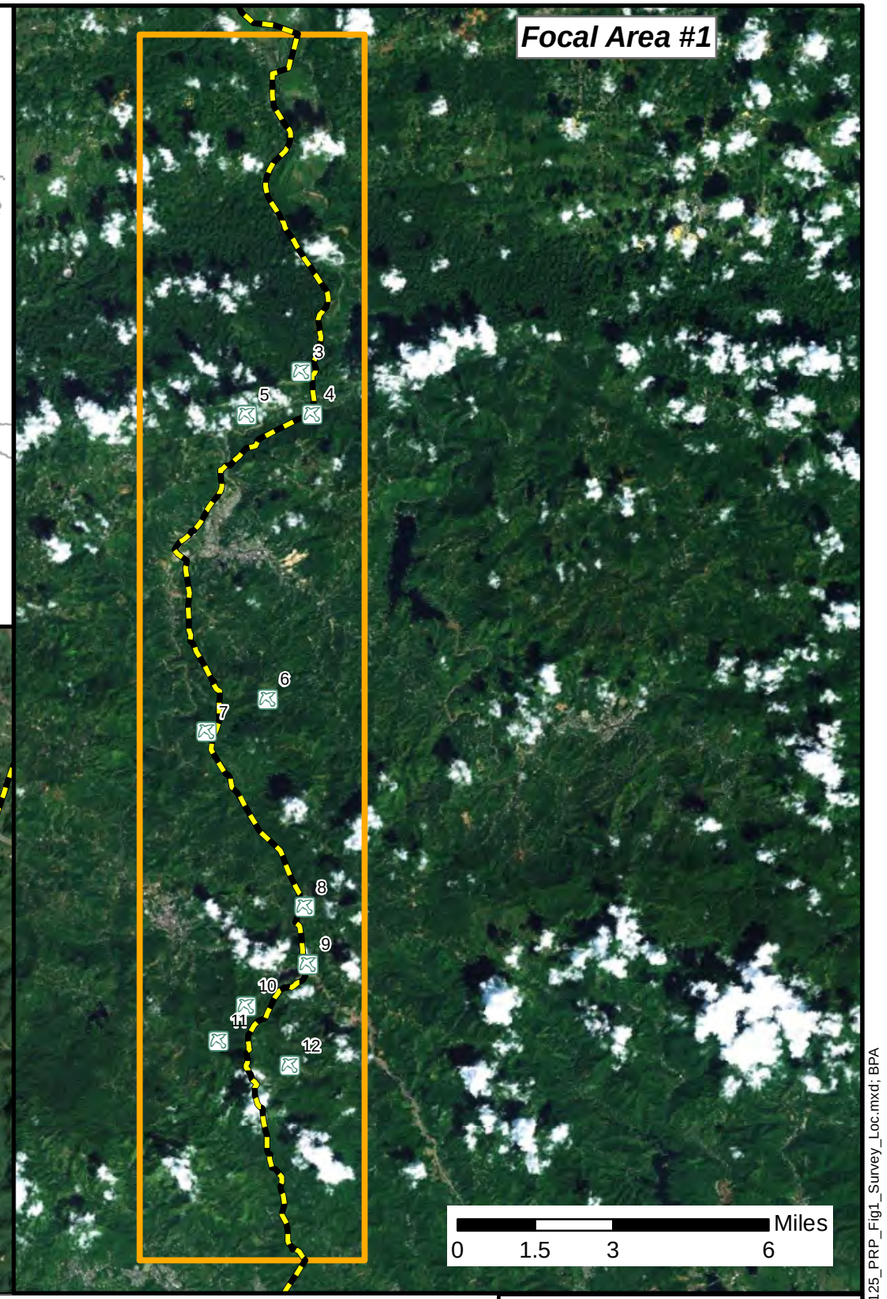

Legend

- Puerto Rico
- Via Verde Pipeline
- Final Raptor Survey Locations
- Endangered Raptors Focal Area #1 (Miles 9.6 - 37.6)
- Endangered Raptors Focal Area #2 (Miles 58.9 - 68.3)

Survey Location Names

Manati East (1)	Tangue de Agua (7)
Manati West (2)	Curva (8)
Entrada (3)	Rt 143 (9)
Planta (4)	Foreman Finca (10)
Finca de Raul (5)	West Face (11)
Puente Blanco (6)	East Face (12)

N

Projection/Coordinate System:
North American Datum of 1983,
Puerto Rico State Plane, US Feet

Sources:
U.S. Dept. of Transportation; World Imagery
(http://services.arcgisonline.com/arcgis/services)

Figure 1-0.
Final Raptor Survey Locations
Via Verde Pipeline Project

Prepared For:
Asesores Ambientales y Educativos

Prepared By: TETRA TECH

Date: 01/25/2011

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2.0 METHODS

Tetra Tech biologists conducted raptor surveys for broad-winged hawks and sharp-shinned hawks from observation points in forested areas within the Project area (Figure 1.0). Areas selected for surveys were identified during an initial biological evaluation (Focal Areas 1 and 2) and ground-truthed during a site-reconnaissance trip in December 2010. After consultation with USFWS on survey design, raptor surveys were conducted from 12 observation points located within forested sections of the Project area during the month of January 2011. Each observation point was surveyed twice during the survey period of January 12–January 28, 2011 for a total of 24 surveys; both species are engaged in epigamic and territorial aerial displays during this time period. Raptor survey methodology was modeled upon previous broad-winged hawk and sharp-shinned hawk studies conducted on the island of Puerto Rico (Rivera-Milan 1995, Delannoy 1997, Hengstenberg and Vilella 2005, Vilella and Hengstenberg 2006).

Surveys were designed to cover areas identified to have potential habitat in both the karst and central mountain regions. Potential habitat of concern was identified through a desktop biological evaluation and confirmed through USFWS consultation as well as a site-reconnaissance survey to the Project area in December 2010. Representative photos of observation points within the central mountain region and within the northern karst region are shown in Figure 2-0 and Figure 2-1.

Raptor surveys were conducted by one to two biologists from the morning to early afternoon hours (~0700 to ~1300) when both species of raptors are engaged in aerial displays above the canopy. One to three survey locations were covered on a daily basis. All surveys were conducted on days with suitable weather conditions (i.e., minimal precipitation and fog).

Biologist used high quality binoculars (10x42 mm), spotting scopes (15–46x60 mm), and range finders to record data on species composition, habitat use patterns, and movements of endangered raptors in the Project area. Field identification references included Raffaele (1989), Wheeler and Clark (1995), Dunne et al. (1988), Clark and Wheeler (2001), and Liguori (2005). Raptors were spot-mapped and their global positioning system (GPS) position was recorded on field maps. If a surveyed area confirmed courtship display behavior of either broad-winged hawk and/or sharp-shinned hawk, biologists conducted areas searches to further evaluate those habitats for the presence of a nest site.

Tetra Tech compiled all data from the January surveys and prepared the following biological survey results and discussion. This report contains all relevant information including maps of survey observation points and raptor spot maps. This information can be used by Assessores Ambientales y Educativos (AAE), PREPA, and the USFWS to determine the anticipated effects on these species by the Via Verde Project.

Figure 2-0. View looking east of the central mountain region from Point 7 (Water tank).

Figure 2-1. View looking west of the northern karst region from Point 1 (Manati East).

3.0 RESULTS

During 12 days between January 12 and January 27, 2011, 24 raptor surveys taken from 12 observation points resulted in 144 hours of direct, visual observation (Table 3-0). A total of four sharp-shinned hawks and one broad-winged hawk were observed from five different observation points (Table 3-1). All sightings were of adult birds.

Table 3-0. Summary of survey effort during January 2011 raptor surveys, Via Verde Project.

Date	Observation Point	Observation Point	Observation Point	Survey Effort
1/12/2011	Point 1 (Manati West)	*Vega Baja survey**		1
1/13/2011	Point 3 (Entrada)	Point 4 (Planta)	Point 5 (Finca Raul)	3
1/14/2011	Point 6 (Puente Blanco)	Point 7 (Water tank)		2
1/17/2011	Point 8 (Curva)	Point 9 (Rt 143)	Point 10 (Foreman)	3
1/18/2011	Point 11 (West Face)			1
1/19/2011	Point 12 (East Face)	Point 1 (Manati West)	Point 2 (Manati East)	3
1/20/2011	Point 3 (Entrada)	Point 4 (Planta)	Point 5 (Finca Raul)	3
1/21/2011	Point 6 (Puente Blanco)	Point 7 (Water tank)		2
1/24/2011	Point 8 (Curva)	Point 9 (Rt 143)		2
1/25/2011	Point 10 (Foreman)	Point 12 (East Face)		2
1/26/2011	Point 11 (West Face)			1
1/27/2011	Point 1 (Manati West)	Point 2 (Manati East)		2
**Not included in survey total*			**Survey Total**	**24**

Table 3-1. Summary of endangered raptor observations, Via Verde Project.

Date	Broad-winged Hawk	Sharp-shinned Hawk	Observation Point
1/12/2011		X	Point 1 (Manati West)
1/13/2011		X	Point 3 (Entrada)
1/13/2011	X		Point 4 (Planta)
1/17/2011		X	Point 10 (Foreman)
1/25/2011		X	Point 12 (East Face)

All five of the endangered raptors observed were sighted flying in close proximity to (<600 feet) or within the Project area. The locations and movements of these raptors are plotted in Figures 3-0 to Figure 3-4. No territorial or epigamic displays were observed. The chronology of raptor observations is as follows:

- On January 12, 2011 at 1015 hour, an adult sharp-shinned hawk adult was observed from Point 1 (Manati West). The bird appeared to be hunting as it flew east to west above the canopy until it perched for <2 minutes on top of a mogote about 1,000 feet east of the observation point. The adult then dove east from its perch out of sight.
- On January 13, 2011 at 0802 hour, an adult broad-winged hawk was observed from Point 4 (Planta) as it vocalized and flew low above the canopy south of Highway 10, just west of the Project area.
- On January 13, 2011 at 0920 hour, a sharp-shinned hawk adult was observed from Point 3 (Entrada). The bird moved west to east then perched near Point 3 (Entrada).
- On January 17, 2011 at 0705 hour, an adult sharp-shinned hawk flew east to west low over the canopy of a Sierra Palm Forest near Point 10 (Foreman). The bird was observed for approximately 30 seconds.
- On January 25, 2011 at 0730 hour, an adult sharp-shinned hawk vocalized as it flew north to south low over the canopy near the ridge of Cerro Garrote near Point 12 (East Face).

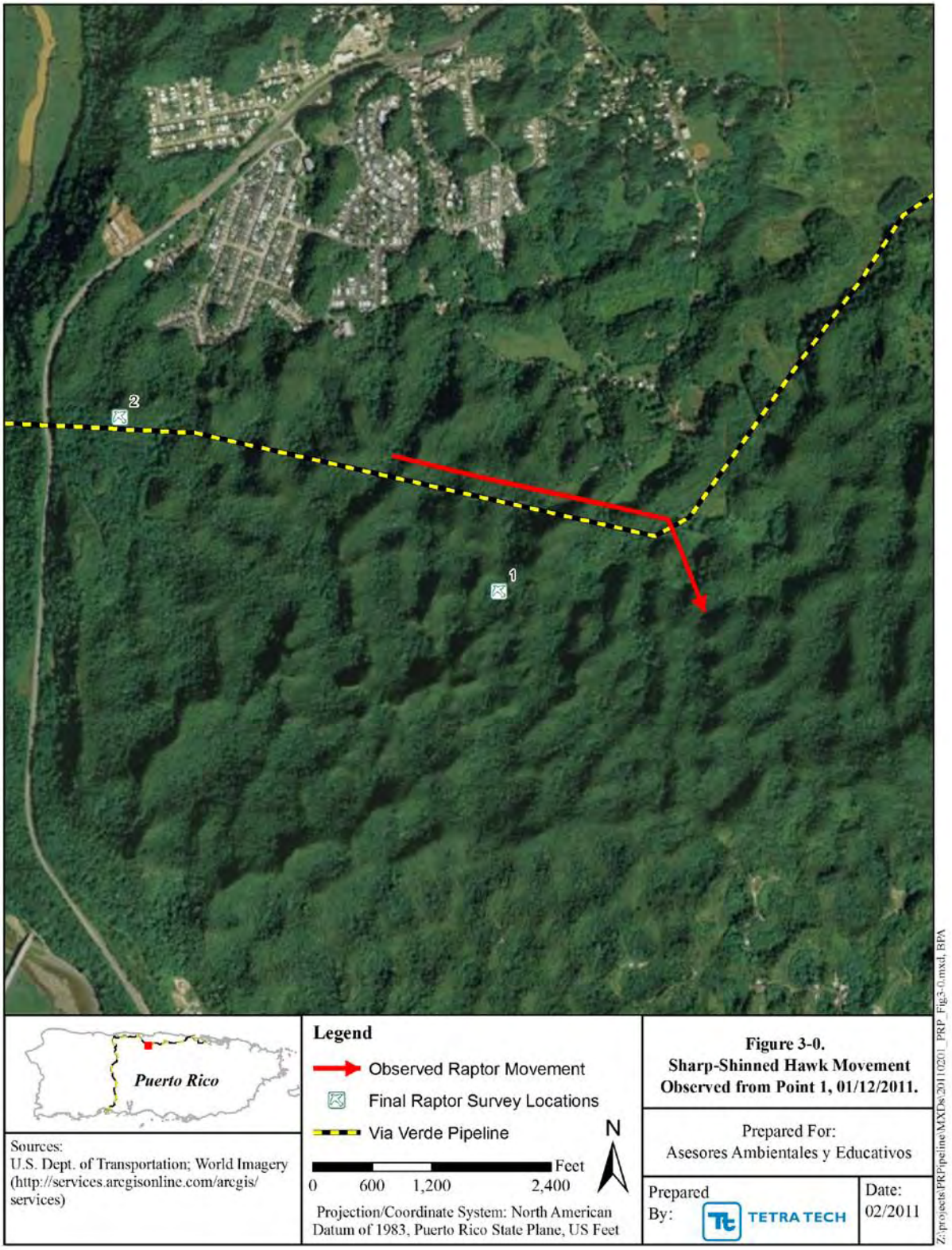

Figure 3-0. Sharp-shinned hawk movement observed from Point 1 on January 12, 2011.

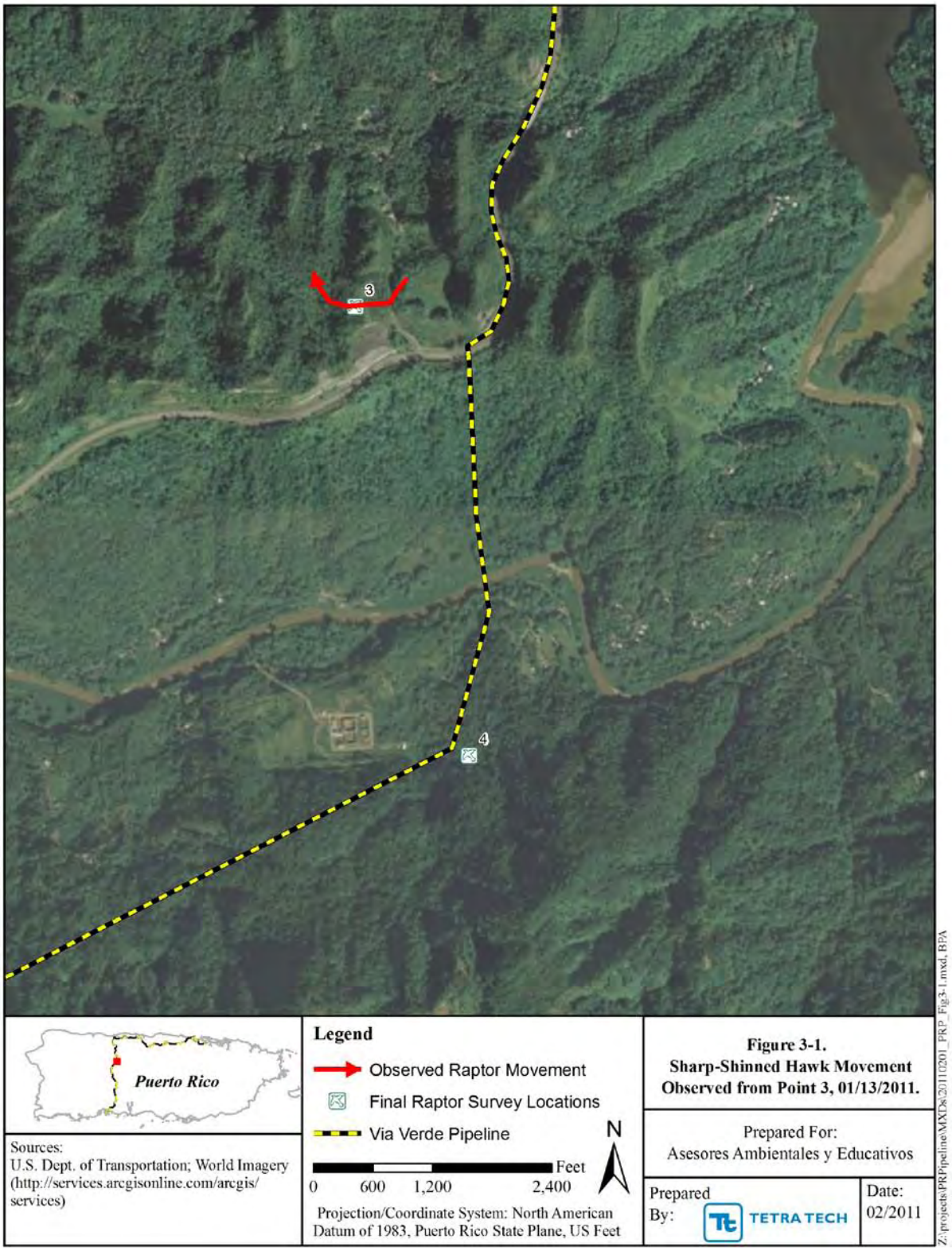

Figure 3-1. Sharp-shinned hawk movement observed from Point 3 on January 13, 2011.

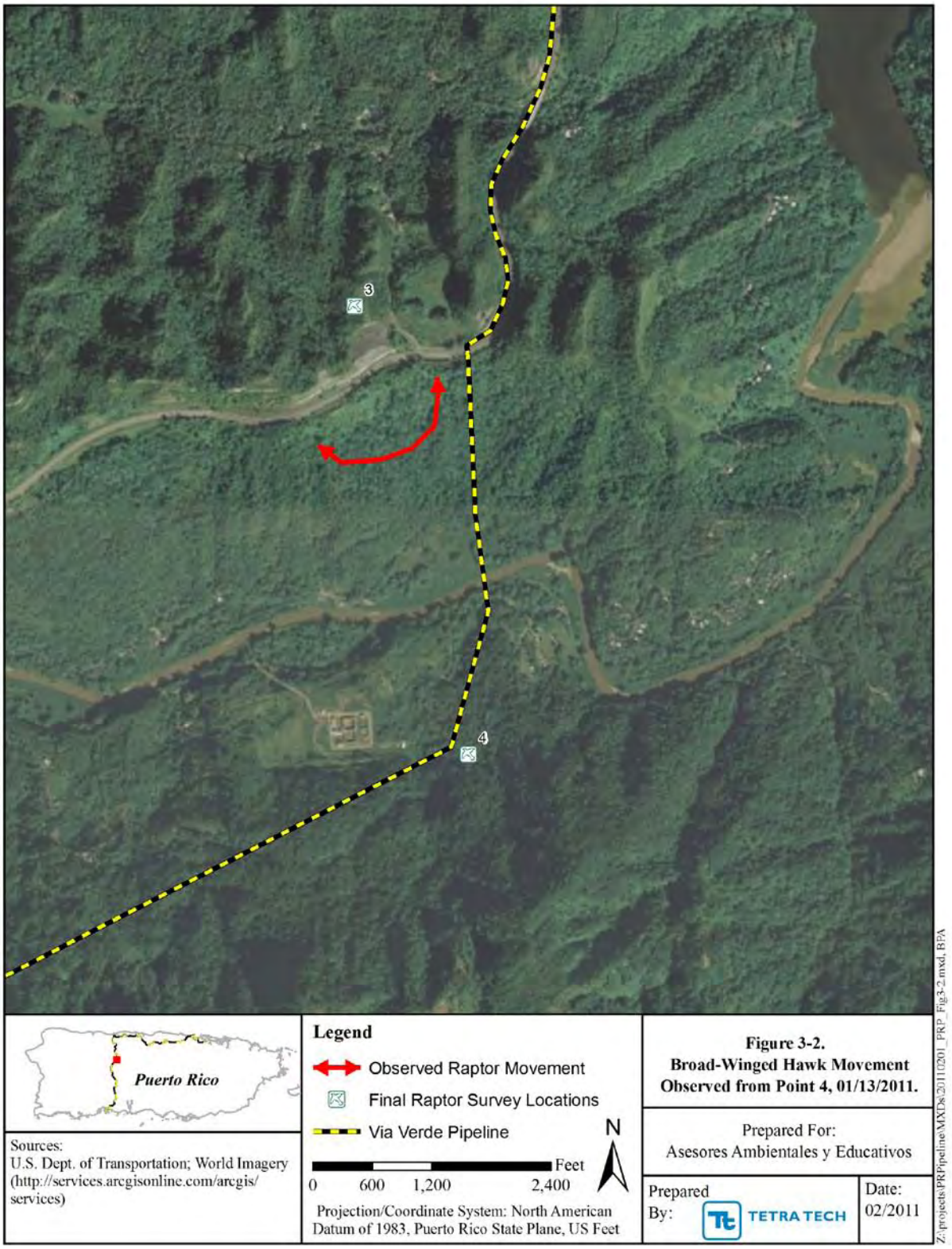

Figure 3-2. Broad-winged hawk movement observed from Point 4 on January 13, 2011.

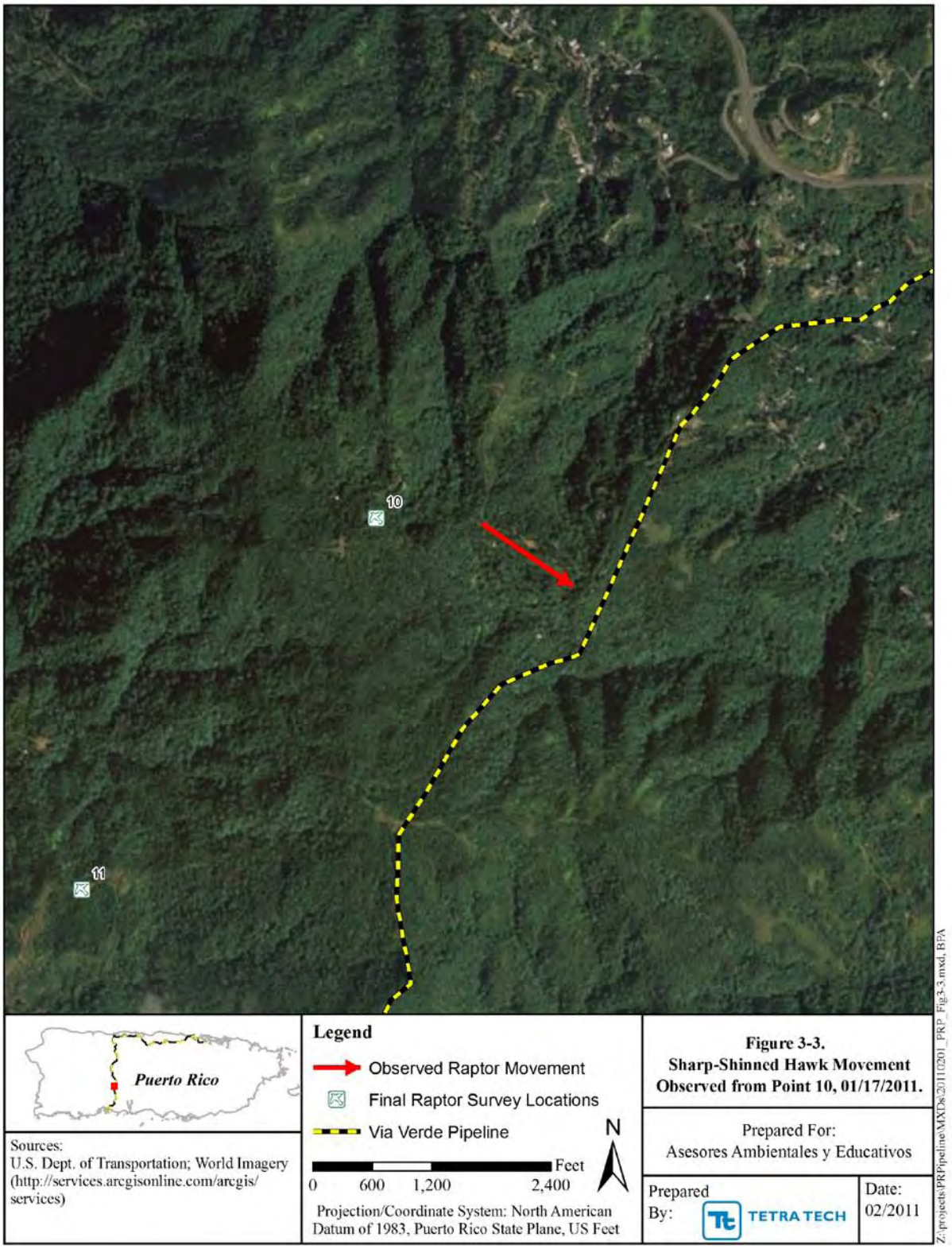

Figure 3-3. Sharp-shinned hawk movement observed from Point 10 on January 17, 2011.

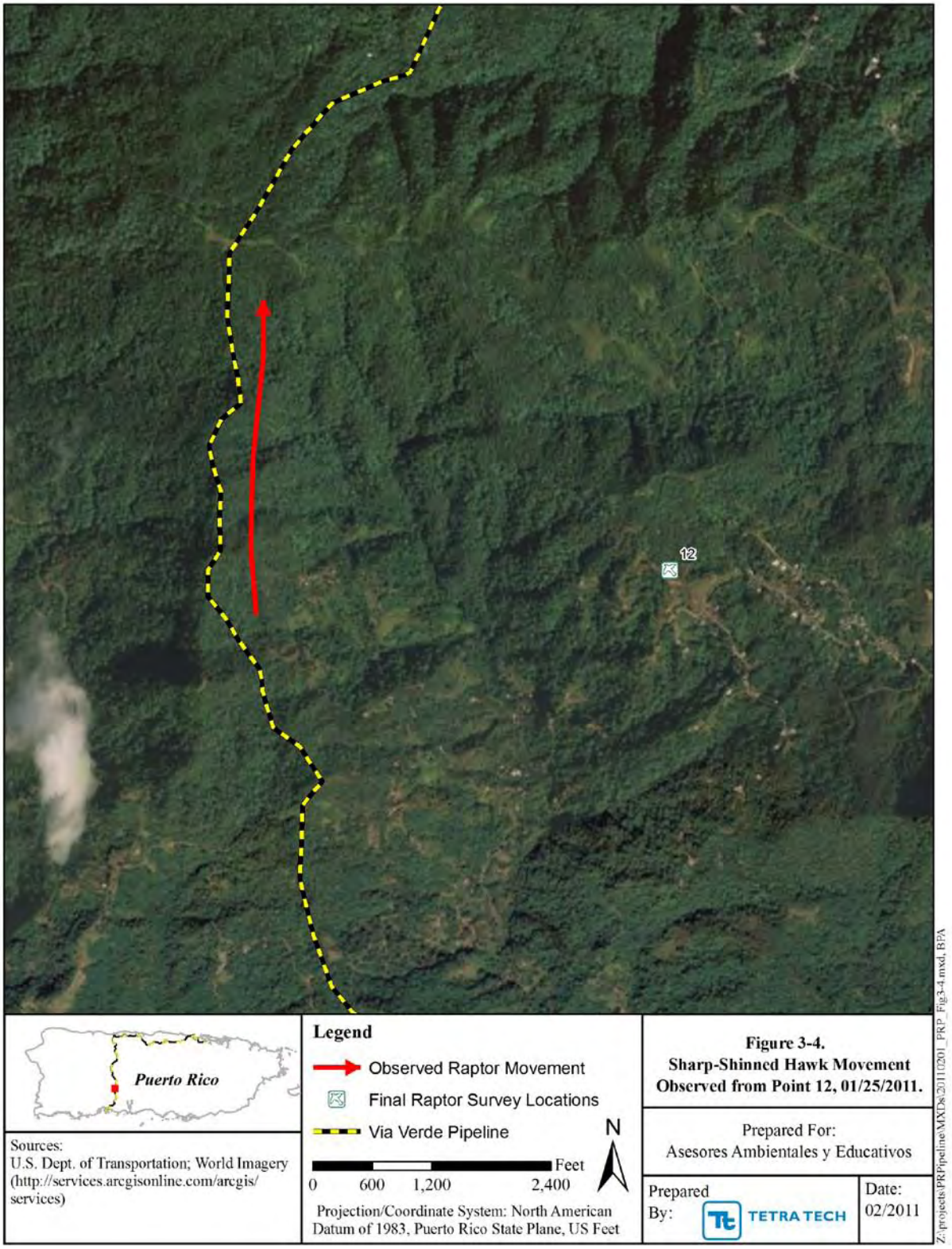

Figure 3-4. Sharp-shinned hawk movement observed from Point 12 on January 25, 2011.

4.0 DISCUSSION

During raptor surveys in January 2011, all four sharp-shinned hawks and the only broad-winged hawk observed flew alone (single individual). On two occasions, vocalizations were heard in addition to sighting of the birds. A sharp-shinned hawk vocalized from Point 12 and a broad-winged hawk vocalized from Point 3.

Two of the four sharp-shinned hawk observations were from the karst region (Point 1 and Point 3) while the other two observations occurred at higher altitudes in the central mountain region (Point 10 and Point 12). Sharp-shinned hawks are not known to nest or be frequently observed within the karst regions of Puerto Rico (Rivera-Milan 1995, Delannoy 1997). In the highest elevation forest of the central mountain region, in Adjuntas where the pipeline intersects, we confirmed the presence of sharp-shinned hawks; they were observed flying low over the canopy above Sierra Palm Forests from two different observation points.

Courtship and territorial displays of sharp-shinned hawks have been associated with certain montane habitats within the wet and moist forest life zones in Puerto Rico (Rivera-Milan 1995, Delannoy 1997). Broad-winged hawks have been observed in both the karst and central mountain regions in Puerto rico (Rivera-Milan 1995, Delannoy and Tossas 2000, Delannoy and Tossas 2002, Hengstenberg and Vilella 2005, Vilella and Hengstenberg 2006). The lone broad-winged hawk was observed in the transition zone between the karst forests of Rio Abajo Forest and the central mountains of Utuado. The broad-winged hawk was observed along a slope north of the Rio Grande of Arecibo River and south of Rio Abajo Forest.

The surveys documented the presence of adult birds in their appropriate habitats within or in close proximity to the Project area. However, during the survey period no courtship and territorial display flights, which indicate nesting activity (Delannoy and Cruz 1988, Delannoy 1997, Delannoy and Tossas 2000, and Hengstenberg and Vilella 2005, Vilella and Hengstenberg 2006) and allow researchers to identify territories for active nest searches, were observed. Because nesting territories could not be identified during the 24 surveys in January 2011, an area of impact to nesting territories could not be calculated. Based on previous studies conducted on broad-winged hawks in Puerto Rico, their nesting territory (core area) represents a smaller portion of their overall home range (Vilella and Hengstenberg 2006).

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VIA VERDE
FEDERALLY LISTED PLANTS SPECIES REPORT

Prepared by: Asesores Ambientales y Educativos Inc.

130 Winston Churchill Ave.

PMB 145

San Juan, PR 00926

Prepared for: Puerto Rico Power Electric Authority

PO Box 364267

San Juan, PR 00936-4267

March 2011

VIA VERDE
FEDERALLY LISTED PLANTS SPECIES REPORT
March 2011

Prepared by: Asesores Ambientales y Educativos Inc.

INTRODUCTION

In November 2010, *Asesores Ambientales y Educativos Inc*. (AAE), retained the professional services of Franklin Axelrod, Ph. D., to conduct a survey for the presence of Federally Listed Plants Species along three segments along the proposed Via Verde Project. After performing the field surveys during the months of November 2010 through March 2011, only 3 individual plants of the species *Ottoschulzia rhodoxylon* (palo de rosa) were found in the Manatí segment. No individuals of any of the other species were encountered in the study areas. Realignments and reduction of the construction footprint at some segments have been suggested by AAE in order to avoid and minimize impact over habitats with the potential presence of federally listed plant species and of other important wildlife.

PROJECT DESCRIPTION

The Via Verde project is a 24-inch natural gas pipeline to be installed between the Peñuelas Ecoelectrica LNG terminal and three Puerto Rico Electric Power Authority (PREPA) power plants along the north coast of Puerto Rico. The pipeline will be buried at 3 feet underground and will have a total length of 92 miles. The required width of the construction right-of-way will be 100 feet, while the operational width of the right-of way-is reduced to 50 feet. On steep slopes and along narrow ridges the construction footprint will be reduced to 60 feet. The purpose of the pipeline is to allow and supply natural gas to three power plants that are currently using more expensive liquid fuels.

In order to minimize environmental and socio-economic impact during construction and/or installation of the Via Verde Pipeline, underground installation methods such as horizontal directional drilling or the bore technique will be utilized at major river crossings, forested wetlands, road crossings and coastal areas.

STUDY AREAS

The following three study areas were identified jointly by the US Fish and Wildlife Service (USFWS) and the PREPA team as potential suitable habitats for federally listed plant species within the project proposed construction right-of-way.

Area 1 - Dry limestone hills in Peñuelas

Between mileposts 4 and 6 (See Figure 1) the proposed alignment crosses a zone of dry limestone forest. The following federally listed plant species may possibly occur along this segment: 1) *Ottoschulzia rhodoxylon* (palo de rosa), 2) *Trichilia triacantha* (bariaco), 3) *Buxus vahlii* (diablito de tres cuernos), 4) *Eugenia woodburyana*, 5) *Catesbaea melanocarpa*, 6) *Cordia rupicola*, 7) *Mitracarpus maxwelliae*, and 8) *Mitracarpus polycladus*.

Area 2 -Central Mountain Range (Volcanic)

Between mileposts 13.5 and 15 (See Figure 1) the proposed alignment crosses a zone of volcanic lower montane wet forest. The following federally listed plant species may possibly occur along this segment: 1) *Thelypteris inabonensis,* 2) *Thelypteris yaucoensis,* 3) *Thelypteris verecunda,* 4) *Juglan sjamaicensis* (nogal), and 5) *Polystichum calderoense.*

Area 3 - Moist Karst (Manatí)

Between mileposts 59 and 60.5 (See Figure 1) the proposed alignment crosses a fraction of the northern karst belt, which is located at the subtropical moist forest life zone. The following federally listed plant species may possibly occur along this segment: 1) *Cordia bellonis,* 2) *Ottoschulzia rhodoxylon* (palo de rosa), 3) *Daphnopsis helleriana,* 4) *Solanum drymophilum* (erubia), 5) *Pleodendron macranthum* (chupacallos), 6) *Myrcia paganii,* 7) *Schoepfia arenaria,* 8) *Tectaria estremerana, and* 9) *Auerodendron pauciflorum.*

Figures 2 and 3 illustrate locations of the study areas and hotspots that were carefully searched.

METHODS

Prior to making a final survey area at the Peñuelas dry limestone study area, a USFWS botanist accompanied Dr. Axelrod and Mr. Yousev García on a preliminary reconnaissance of the target area identified by USFWS. The other two study areas, Manatí and Central Mountains, were not visited by USFWS personnel.

All three study areas were initially visited by Dr. Axelrod accompanied by Mr. García of AAE to identify "hotspots" with greater potential for the presence of listed plant species and to eliminate areas with lesser potential. Prior to Dr. Axelrod visits, the study segments were identified and marked (and sometimes flagged) in the field by Mr. García using a Garmin GPSMAP 60CSx equipment (loaded with the Via Verde Pipeline Alignment) and also geo-referenced on-site using the USGS topographic map and aerial photograph for each area. In order to avoid and/or minimize potential impact on listed species, walking trails along the study areas were prepared by hand with machetes. Also, to avoid and/or minimize impacts on the tops of mogotes (limestone hills), a route alternate to the original alignment was identified and surveyed at the Manatí study area.

After visiting the segments and identifying the hotspots, transects parallel to the axis were prepared for detailed surveys. Transects were located at a distance of from 15 feet to 50 feet from each other, depending on terrain morphology and vegetation density. Finally, each transect was walked and inspected slowly, with frequent stops, by Dr. Axelrod, so that complete coverage could be made within each survey area. The study areas were surveyed during the months of November 2010 through March 2011. Figures 4, 5, 6 and 7 illustrate the GPS track logs of the surveyed areas.

Results

Peñuelas Dry Limestone

The initial survey area proposed by USFWS treated the whole southern section of Peñuelas as one piece; but, after an initial reconnaissance of this area, Dr. Axelrod felt that only the southern third, which happens to be the older section (at least 50 years), had a strong possibility of containing endangered plants. During a preliminary field visit with the USFWS botanist, a rare vine (not currently listed on the federal register) was observed by him in this southern section. This discovery made our team especially careful in going over this section; indeed, several individuals of *Polygala cowellii* (another rare, unlisted plant) were observed, but no listed plants were seen. The middle section was extensively disturbed, evidence by the omnipresence of *Leucaena leucocephala* and *Jasminum fluminense*, and did not warrant further

field surveys. The northern section is composed of woods with a different, younger vegetation (tree diameter much smaller, with fewer older trees) that, in the opinion of Dr. Axelrod, was unlikely to contain the listed endangered species; but, even so, he checked for the presence of listed species and found none.

Volcanic Central Mountain Range

The section in Peñuelas near Cerrote has been disturbed in the recent past (some old and abandoned houses) and is honeycombed with jeep trails. Due to these anthropogenic impacts, the habitat and vegetation are not at all similar to that of areas in which the target species of endangered plants occur elsewhere in the region. For example, *Thelypteris yaucoensis* and *Polystichum calderonensis* are known only from exposed rocky summits of more or less pristine mountains; *Thelypteris inabonensis* occurs in a very moist area near a stream and waterfall; *Thelypteris verecunda* occurs only in a limestone area; all these populations are also many miles outside of the target area. *Juglans jamaicensis* is known from a single population many miles away in a coffee plantation where it is a relict; since this tree was collected in this area over a hundred years ago, it was carefully looked for, but not found. The section in Adjuntas site has been clear-cut more recently and shows evidence of having had extensive coffee planting. That area will be removed from the final survey areas.

Manatí Moist Karst

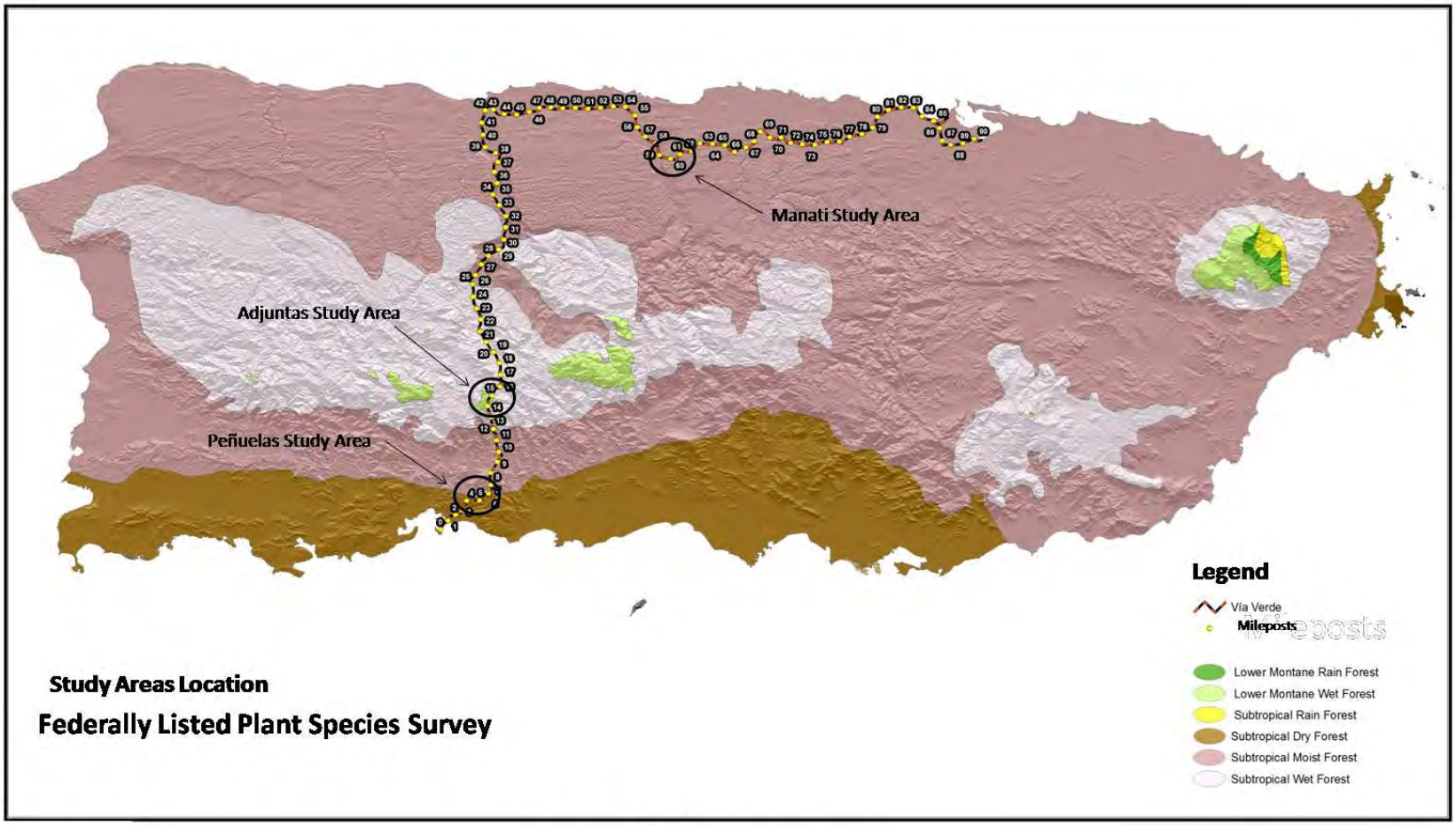
The limestone hill region of Manatí is thoroughly disturbed, evidenced by the extensive occurrence of 'weedy' vegetation - it even includes an old dump at its western end. Due to this disturbance the lower slopes of these hills do not warrant intensive surveys. However, the upper slopes do contain *Ottoschulzia rhodoxylon*. Dr. Axelrod found three different individuals of *Ottoschulzia* in this area; he suspects that more are present. One of the individuals was near the initial alignment and the other two are a little bit further to the north. The latter were found during an inspection for a potential access road that came to be also the final alignment for the gas pipeline. The species will be marked in the field, eliminating any threat to this specie. The geographic coordinates (WGS 84) of the *Ottoschulzia* individuals found will be made available to the USFWS upon request.

Conclusions and Recommendations

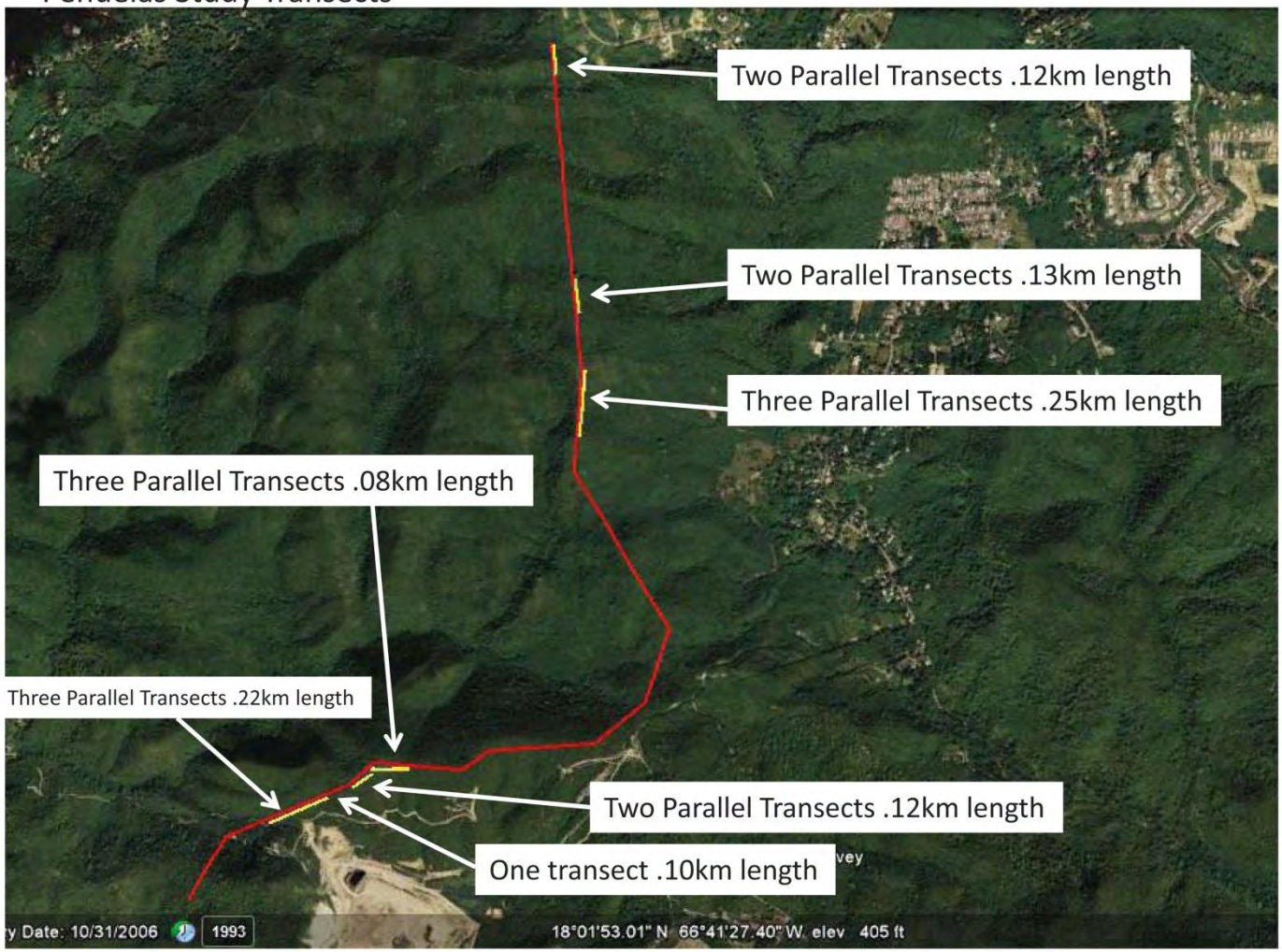
After performing a survey for federally listed species in three segments of the Via Verde gas pipeline project, only *Ottoschulzia rhodoxylon* was found at the Manatí moist karst segment. The rest of the target species were not found. In general, most of the study areas have been subject to human disturbance principally for past agricultural activities and even at potential hotspots – areas where human disturbance seemed minimal – listed plant species were not found.

In order to minimize potential impact to listed plant species and other important wildlife habitats, it is recommended that the construction footprint be minimized and limited in width from 100 feet to 60 feet on steep slopes and along narrow ridges. AAE also recommends that staging areas be located at flatland areas along the alignment that have been colonized by common grasses, *Spathodea campanulata* and *Leucaena leucocephala* .

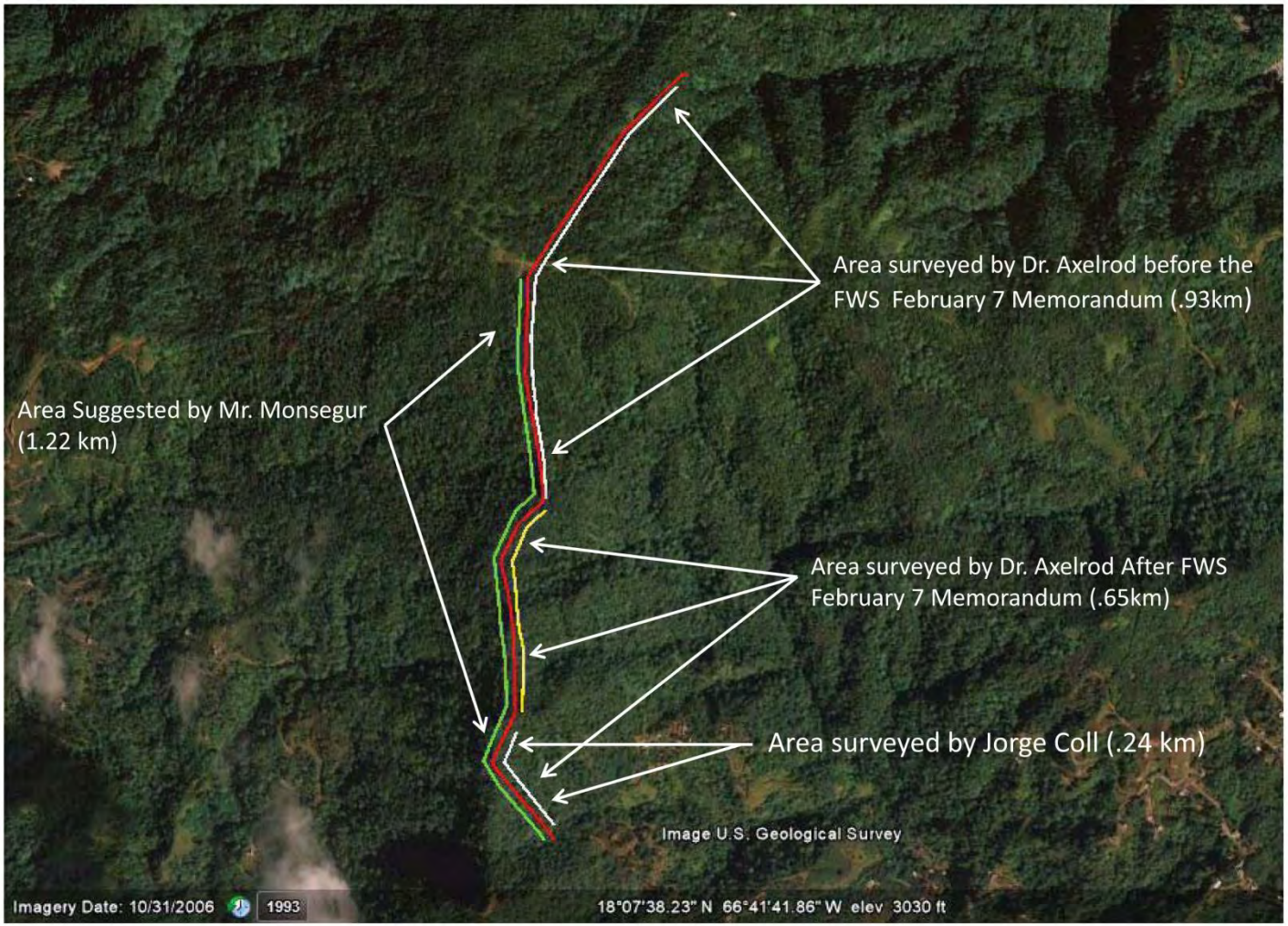
Ottoschulzia individuals should be marked at the field with 'do-not-cut' flagging' and heavy equipment operators should be instructed to watch out for those locations and to preserve the individuals. Finally, it is recommended that biologists be present at the field during land clearing activities to assure that the *Ottoschulzia* are protected and that the construction footprint occurs strictly inside of the studied areas.


Manati Study Area
Adjuntas Study Area
Peñuelas Study Area
Legend
Vía Verde
Mileposts
Lower Montane Rain Forest
Lower Montane Wet Forest
Subtropical Rain Forest
Subtropical Dry Forest
Subtropical Moist Forest
Subtropical Wet Forest
Study Areas Location
Federally Listed Plant Species Survey
1:450,000
0 4.5 9 18 27 36
Km

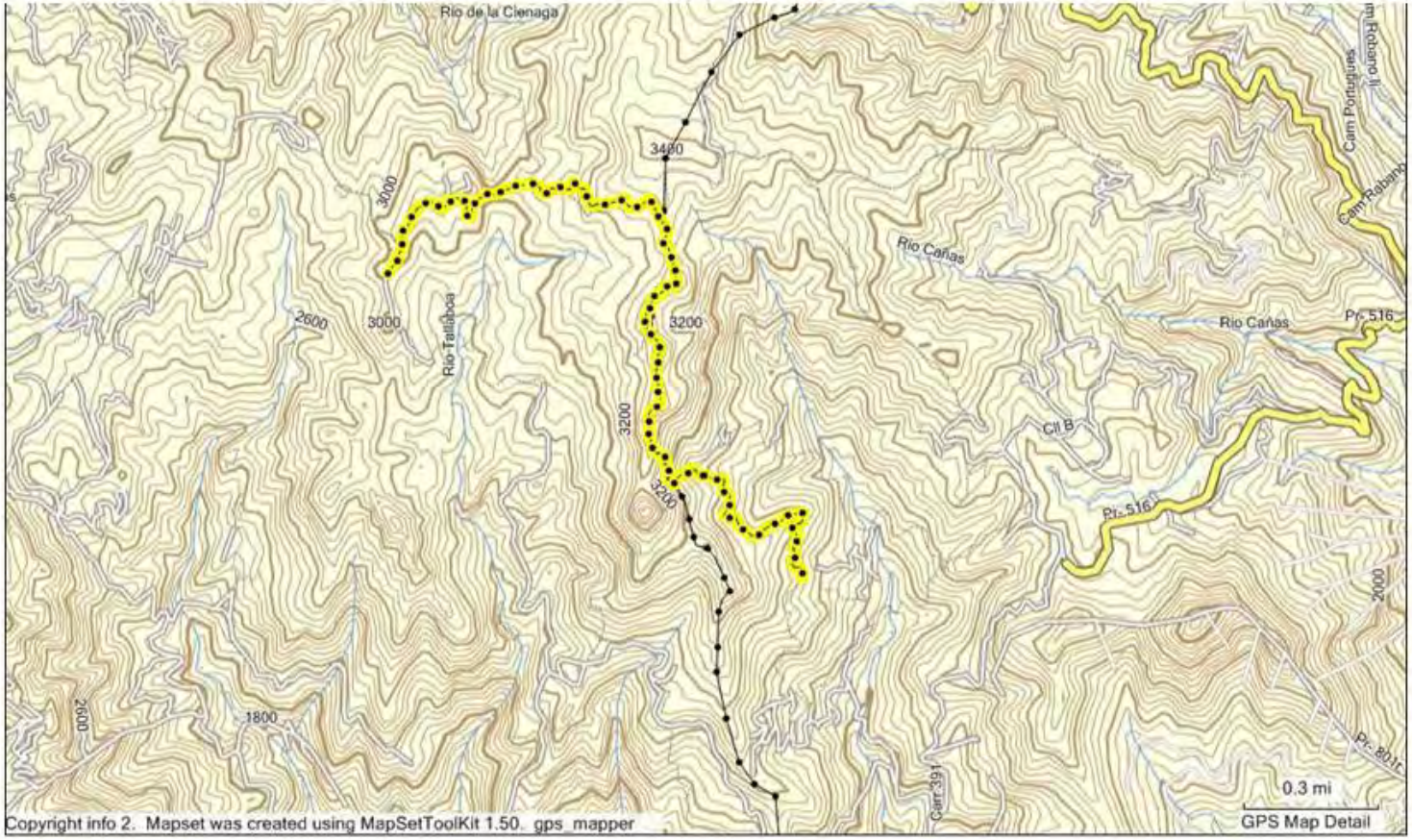
Peñuelas Study Transects



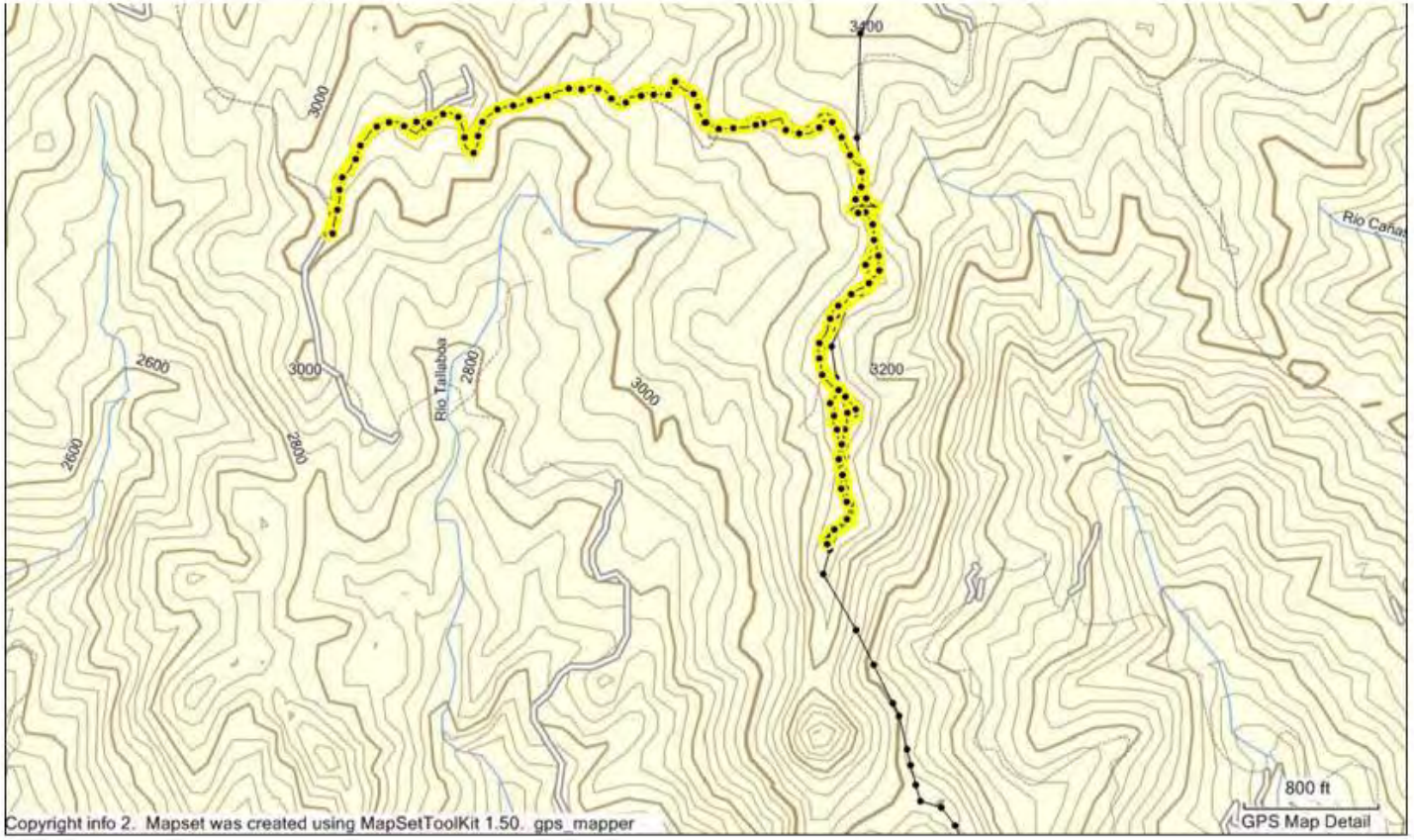
Cerrote Study Area



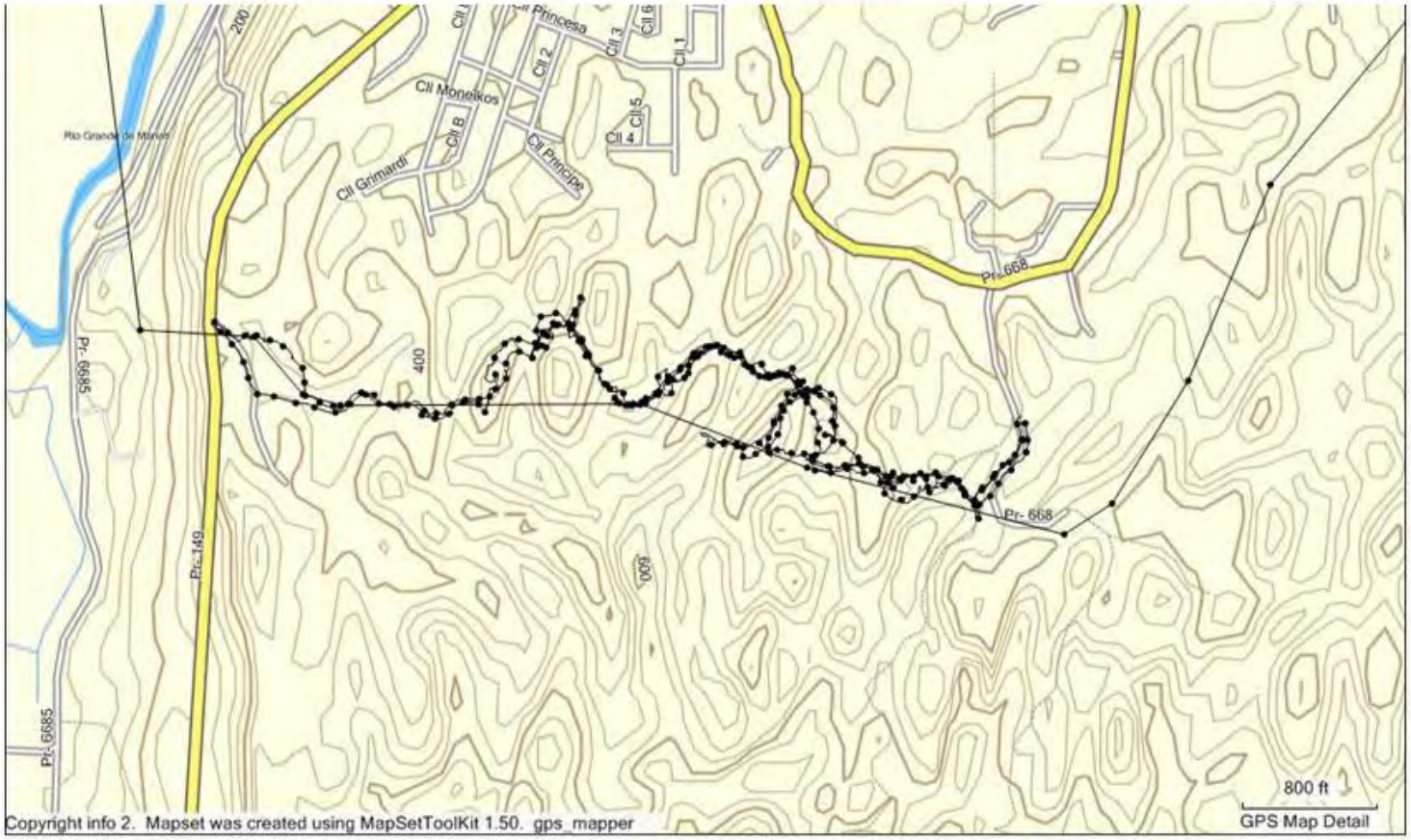
Peñuelas Dry Limestone Study Area GPS Track Log



Cerrote de Peñuelas Study Area GPS Track Log



Cerro Garrote Study Area GPS Track Log



Manatí Karst Study Area GPS Track Log

Via Verde -Manatí Pineapples area, karst hills by pass- space availability and dominant plants species report

Prepared by: Yousev García Ramos June 28, 2011

During June 28, 2011 a site visit was conducted at Manatí municipality, to measure the available space between two karst hills (mogotes) where the Via Verde pipeline will be installed (See Figure 1) using an existing dirt road. Construction foot print at that segment is proposed to be reduced from 100 feet to 60 feet wide. During the site inspection, space available along the existing dirt road between the mogotes for pipe installation was measured using a Leica Disto Laser Distance Meter (see photographic record ,photo 1) and also general plant species composition at the area was documented (see photographic record, photos 2- 4).

Findings

After conducting the site visit to the study area, it was confirm that there is enough space between the mogotes bases, to allow for the proposed construction foot print of 60 feet needed for Via Verde pipeline installation. Along the segment of approximately 300 meters long, available space between the bases of the mogotes is never less than the proposed 60 feet wide foot print.

The dominant plant species present, are opportunistic and invasive ones including: *Leucaena leucocephala*, African Tulip (mehaito) and woody vines typical of disturbed areas. Photos 2-4 at the attached photographic record, clearly illustrate the site conditions observed during our site inspection.


PR-22
N
Study Area
PR-137
Image U.S. Geological Survey
© 2011 Google
Image © 2011 GeoEye
©2010 Google
1995
18°25'28.56" N 66°27'08.51" W elev 292 ft
Eye alt 22872 ft

Photo 1. Leica Laser Distance Meter

Photo 2. Site Conditions Along Dirt Road

Photo 3. Site Conditions Along Dirt Road

Photo 4. Site Conditions Along Dirt Road Borders and Mogotes Bases