

Via Verde NG Pipeline Project

Biological Assessment

Puerto Rico Electric Power Authority

August 2010

Updated April 2011

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1 Introduction

This Biological Assessment (BA) was prepared by BCPeabody Construction Services, Inc. and Coll Rivera Environmental for Asesores Ambientales y Educativos, Inc. and Puerto Rico Electric Power Authority (PREPA, the applicant). The purpose of this BA is to evaluate the effects of PREPA's proposed construction of a 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)

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.

Environmental Sensitivity Index: Puerto Rico

Interactive Map Atlas and Associated Data

Cardona Alonzo, J. E, and J. L. Chabert Llompert. *Preliminary Population Assessment of the Puerto Rican Nightjar (Caprimulgus noctitherus) at the Via Verde Proposed Right of Way, Penuelas, Puerto Rico*. March 8, 2011. Appendix 1.

Coll Rivera Environmental. *Descriptions of Impacts to the Puerto Rican Boa (Epicrate nornatus) Habitat*. February 2010. Appendix 1.

Tetra Tech, Inc. *2011 Endangered Raptor Survey Report for the Puerto Rican Broad-winged Hawk and Puerto Rican Sharp-shinned Hawk*. February 2011. Appendix 1.

Tetra Tech, Inc. *2011 Survey Report for the Endangered Puerto Rican Parrot*. March 2011. Appendix 1.

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*. Appendix 1.

Asesores Ambientales y Educativos, Inc. *Via Verde Federally Listed Plant Species Report*. March 2011. Appendix 1.

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, Declaración 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, Declaración de Impacto Ambientales. (Appendix D of the USACE Joint Permit Application)

PREPA - Via Verde Project, *Declaración 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 has been 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 provide information to the U.S. Army Corps of Engineers (USACE) to assist it 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 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) have been identified as potentially occurring within the project limits. Species list presented includes all individual species that are 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.

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. These letters are available in Appendix 3.

The applicant attended a meeting on December 8, 2010 with USFWS at its 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 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 offices. This meeting was held to discuss the particulars of an Essential Fish Habitat (EFH) survey.

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 its 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 Offices. 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 has 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 are attached to this BA in Appendix 1. All formal correspondence from USFWS and NMFS has been included in Appendix 3 of this document.

3 Description of Proposed Action

Installation of the approximately 92 mile pipeline will require an initial construction right-of-way (ROW) approximately 100 feet wide and, in uplands, 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 of which are Waters of the United States. The actual construction corridor within the ROW will vary from 50 feet in some sensitive habitats to a maximum of 100 feet. In areas of sensitive habitat, the construction corridor will be reduced to limit the amount of temporary impacts (i.e. wetland habitat = max. 60 feet wide; estuarine habitat = max 50 feet wide). The pipeline will traverse 235 waterbodies (rivers, wetlands, canals); however, the pipeline will not traverse any shorelines or coastal beaches. The project will temporarily impact approximately 369 acres of jurisdictional bodies of water (Waters of the U.S.).

The project will not result in any permanent wetland impacts since all disturbed wetlands will be restored to pre-construction grades, stabilized, and revegetated. The total temporary impact area has been limited to 1.7 square miles. Although the project is being reviewed as an Individual Permit (IP), the project was designed to qualify for review and verification through the USACE Nationwide Section 404 Permit Program.

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 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	63.50	5.80

Subtropical Wet Forest	12.25 – 13.5, 15 - 25	11.25	147.53	13.48
Lower Montane Rain Forest	13.5 – 15.0	1.50	10.59	0.97
Subtropical Moist Forest	5.25 – 12.25, 25 – 92	72.30	872.51	79.74

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 been included in the PREPA, Via Verde Project, *Declaraciòn de Impacto Ambientales*. (Appendix D of the USACE Joint Permit Application)

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 HABITAT SUMMARY ENTIRE VIA VERDA CORRIDOR ROUTE (MM 0.0 TO MM 90.3)				
Municipality	Mile Marker	Map Number	Park/Reserve Name	Comments
Peneulas, Adjuntas	13.75 to 16.3	1	No habitat identified	2 occurrences, verify species status
Utuaado	22.35 to 55	2	No critical habitat identified	See Hengstenberg report for Focal Area 1
Utuaado, Arecibo	29.1 to 30.05	3	Bosque Estatal deRio Abjo	corridor route follows transportation ROW of PR 10 for entire length
Arecibo	31.1 to 32.5	4	Bosque Estatal deRio Abjo	Check Hengstenberg data for Focal Area 2
Arecibo	45.4 to 45.7	5	Reserva Cano Tiburones	check Coll data for % cover TE,flora/fauna
Arecibo	47.2 to 48.7	6	Reserva Cano Tiburones	outside of ROW
Arecibo	49.0 to 49.7	7	Reserva Cano Tiburones	check Coll data for % cover TE,flora/fauna
Barceloneta	53.2 to 54.2	8	Reserva Natural Hacienda la Esperanza	corridor route traverses disturbed agricultural lands, temp herbaceous impacts
Vega Baja, Vega Alta	70.6 to 71.5	9	Bosque Estatal de Vega	Check Hengstenberg data for Focal Area 2
Vega Alta	72.4 to 73.6	10	No critical habitat identified	Check Hengstenberg data for Focal Area 2
Dorado, Toa Baja	80.4 to 81.8	11	No critical habitat identified	Horizontal directional drill, no surface impacts
Notes:				
Mile Marker - Via Verde Pipeline, begin Peneulas MM 0.0 to end Guayanabo MM 92				
Map Number - BCPeabody Critical Habitats and Wildlife Elements August 27, 2010				
Critical Habitat Name - Local, Commonwealth, Federal Protection Areas identified				

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			
Scientific Name	Common Name	Distribution	Species
<i>Accipiter striatus venator</i>	PR Sharp-Shinned Hawk	Monte Guilarte State Forest	Endangered
<i>Buxus vahlii</i>	Val's Boxwood	Talaboia Limestone Hills	Endangered

Federal Protected Species- Caribbean List			
<i>Caprimulgus noctitherus</i>	Puerto Rican Nightjar	Coastal Forest	Endangered
<i>Chelonia mydas</i>	Green Sea Turtle	Coastal Zones	Threatened
<i>Cyathea dryopteroides</i>	Elfin Tree Fern	Monte Guilarte State Forest	Endangered
<i>Eretmochelys imbricata</i>	Hawksbill Sea Turtle	Coastal Zones	Endangered
<i>Eugenia woodburyana</i>	No Common Name	Encarnacion West of Las Cucharas	Endangered
<i>Pelecanus occidentalis</i>	Brown Pelican	Coastal Zones, No Nesting	Endangered
<i>Polystichum calderonense</i>	No Common Name	Cerro Peñuelas	Endangered
<i>Stahlia monosperma</i>	No Common Name	Tallaboa	Endangered
<i>Sterna dougallii</i>	Roseate Tern	Coastal Areas and Offshore Cays, Nesting	Threatened
<i>Trichechus manatus manatus</i>	Antillean Manatee	Coastal Zones	Endangered
<i>Trichilia triacantha</i>	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 identified the following federally threatened or endangered species as likely to occur in those ecological life zones: *Accipter striatus venator*, *Amazona vittata vittata*, *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
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SCIENTIFIC NAME	COMMON NAME	DISTRIBUTION	STATUS
<i>Accipiter striatus venator</i>	PR Sharp-Shinned Hawk	Monte Guilarte State Forest	Endangered
<i>Buteo platypterus brunnescens</i>	Puerto Rican Broad-Winged Hawk	Monte Guilarte State Forest	Endangered
<i>Cyathea dryopteroides</i>	Elfin Tree Fern	Monte Guilarte State Forest	Endangered
<i>Eleutherodactylus jasperi</i>	Golden Coqui	Forested Mountains w/ elevations over 700 m.	Threatened
<i>Epicrates inornatus</i>	Puerto Rican Boa	Forested Volcanic and Limestone (Karst) Hills	Endangered
<i>Juglans jamaicensis</i>	West Indian Walnut	Monte Guilarte State Forest (La Silla de Calderón)	Endangered
<i>Polystichum calderonense</i>	No Common Name	Cerrote Peñuelas	Endangered

3.1.3 Utuado

In the municipality of Utuado, in the barrios of Río Abajo, Río 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 Río 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
<i>Accipiter striatus venator</i>	PR Sharp-Shinned Hawk	Monte Guilarte State Forest	Endangered
<i>Amazona vittata vittata</i>	Puerto Rican Parrot	Rio Abajo State Forest	Endangered
<i>Auerodendron pauciflorum</i>	No Common Name	Rio Abajo State Forest	Endangered
<i>Buteo platypterus brunnescens</i>	Puerto Rican Broad-Winged Hawk	Monte Guilarte State Forest	Endangered
<i>Calyptronoma rivalis</i>	No Common Name	Rio Abajo State Forest	Threatened
<i>Cordia bellonis</i>	No Common Name	Rio Abajo State Forest	Endangered
<i>Cornutia obovata</i>	No Common Name	Rio Abajo State Forest	Endangered
<i>Epicrates inornatus</i>	Puerto Rican Boa	Forested Volcanic and Limestone (Karst) Hills	Endangered
<i>Juglans jamaicensis</i>	West Indian Walnut	Monte Guilarte State Forest (La Silla de Calderón)	Endangered
<i>Pelecanus occidentalis</i>	Brown Pelican	Lago Dos Bocas, no nesting	Endangered
<i>Patagioenas (Columba) inornata wetmorei</i>	Puerto Rican Plain Pigeon	Lower Montane Forest and Riparian Habitats	Endangered
<i>Pelecanus occidentalis</i>	Brown Pelican	Coastal Zones, Lago Dos Bocas, No Nesting	Endangered
<i>Pleodendron macranthum</i>	No Common Name	Rio Abajo State Forest	Endangered
<i>Schoepfia arenaria</i>	No Common Name	Río Abajo State Forest (Cuesta de los Perros)	Threatened
<i>Solanum drymophilium</i>	Erubia	Rio Abajo State Forest	Endangered
<i>Tectaria estremerana</i>	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 (DRNA), 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 estremarana*.

Table 6: Protected Species- Arcibo

Federal Protected Species – Caribbean List			
Scientific Name	Common Name	Location	Status
<i>Accipiter striatus venator</i>	Puerto Rican Sharp-shinned hawk	Rio Abajo State Forest	Endangered
<i>Amazona vittatta vittatta</i>	Puerto Rican Parrot	Rio Abajo State Forest	Endangered
<i>Auerodendron pauciflorum</i>	No Common Name	Rio Abajo State Forest	Endangered
<i>Buteo platypterus brunnescens</i>	Puerto Rican Broad-winged Hawk	Rio Abajo State Forest	Threatened
<i>Calyptronoma rivalis</i>	No Common Name	Rio Abajo State Forest	Endangered
<i>Chelonia mydas</i>	Green sea turtle	Coastal Zones	Threatened
<i>Cordia bellonis</i>	No Common Name	Rio Abajo State Forest	Endangered
<i>Cornutia obovata</i>	chigger stick	Rio Abajo State Forest	Endangered
<i>Dermochelys coriacea</i>	Leatherback sea turtle	Coastal Zones	Endangered
<i>Epicrates inornatus</i>	Puerto Rican boa	Forested Volcanic and Limestone (karst) hills	Endangered
<i>Eretmochelys imbricata</i>	Hawksbill sea turtle	Coastal Zones	Endangered
<i>Goetzea elegans</i>	Matabuey	Cambalachee State Forest	Endangered
<i>Myrcia paganii</i>	No Common Name	Biafara Arrozal	Endangered
<i>Ottoschulzia rhodoxylon</i>	Rosewood	Cambalachee State Forest, Sabana Hoyos	Threatened
<i>Pelicanus occidentalis</i>	Brown Pelican	Coastal Zones, no nesting	Endangered
<i>Pelytophyryne lemur</i>	Puerto Rico crested toad	Northern karst regions	Threatened
<i>Pleodendron macranthum</i>	chupacallos	Rio Abajo State Forest	Endangered
<i>Schoepfia arenaria</i>	No Common Name	Río Abajo State Forest (Cuesta de los Perro)	Threatened
<i>Solanum drymophilum</i>	Erubia	Rio Abajo State Forest	Endangered
<i>Tectaria estremarana</i>	No Common Name	Rio Abajo State Forest	Endangered
<i>Trichechus manatus</i>	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 will be considered to have the potential to occur throughout the entire project construction corridor right-of-way. A boa monitoring and protection plan will be implemented for this species. 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, therefore no impacts to federally listed threatened and endangered species that may occur in those areas are anticipated.

Table 7: Protected Species- Barceloneta

Federal Protected Species – Caribbean List			
Scientific Name	Common Name	Location	Status
<i>Chelonia mydas</i>	Green Sea turtle	Marine Coastal	Threatened
<i>Dermochelys coriacea</i>	Leatherback Sea Turtle	Marine Coastal	Endangered
<i>Epicrates inornatus</i>	Puerto Rican Boa	Forested Volcanic Limestone (Karst) Hills /	Endangered
<i>Eretmochelys imbricata</i>	Hawksbill Sea Turtle	Marine Coastal	Endangered
<i>Pelecanus occidentalis</i>	Brown Pelican	Coastal Zones	Endangered
<i>Sterna dougallii</i>	Roseate Tern	Coastal Zones	Threatened
<i>Trichechus manatus manatus</i>	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. The forest located within the mogotes (haystacks) area in the southeast of the Municipality 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*), has the potential to occur within the limits of the construction right of way, although it was 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
<i>Agelaius xanthomus</i>	Yellow-Shouldered Black Bird	Coastal Forest	Endangered
<i>Chamaecrista glandulosa var mirabilis</i>	No Common Name	Tortuguero Lagoon Natural Reserve	Endangered
<i>Chelonia mydas</i>	Green Sea Turtle	Coastal Zones	Threatened
<i>Epicrates inornatus</i>	Puerto Rican Boa	Forested Volcanic / Limestone (Karst) Hills	Endangered
<i>Pelecanus occidentalis</i>	Brown Pelican	Coastal Zones, No Nesting	Endangered
<i>Schoepfia arenaria</i>	No Common Name	Tortuguero Lagoon Natural Reserve	Threatened
<i>Sterna dougallii</i>	Roseate Tern	Coastal Areas and Offshore Cays, Nesting	Threatened

<i>Trichechus manatus manatus</i>	Antillean Manatee	Coastal Zones	Endangered
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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 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
<i>Chamaecrista glandulosa var mirabilis</i>	No Common Name	Tortuguero Lagoon Natural Reserve	Endangered
<i>Chelonia mydas</i>	Green Sea Turtle	Coastal Zones	Threatened
<i>Daphnopsis hellerana</i>	No Common Name	Bloques Carmelo	Endangered
<i>Dermochelys coriacea</i>	Leatherback sea turtle	Coastal Zones	Endangered
<i>Epicrates inornatus</i>	Puerto Rican boa	Forested Volcanic and Limestone hills	Endangered
<i>Eretmochelys imbricata</i>	Hawksbill sea turtle	Coastal Zones	Endangered
<i>Pelecanus occidentalis</i>	Brown Pelican	Coastal Zones	Endangered
<i>Ottoschulzia rhodoxylon</i>	Stick of roses	Sabana Ward	Endangered
<i>Schoepfia arenaria</i>	No Common Name	Tortuguero Lagoon Natural Reserve	Threatened
<i>Trichechus manatus manatus</i>	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. A boa monitoring and protection plan will be implemented for this species. The project will not result in any impacts to marine or coastal zone habitats and all open water crossings will be directionally drilled, therefore no impacts to those federally listed threatened and endangered species identified as marine/coastal are anticipated.

The Ramon stick (*Banara vanderbiltii*), 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
<i>Banara vanderbiltii</i>	Ramón stick	Near Rio Lajas Limestones	Endangered
<i>Chamaecrista glandulosa</i> <i>var mirabilis</i>	No Common Name	Sardinera	Endangered
<i>Daphnopsis hellerana</i>	No Common Name	Rio Lajas	Endangered
<i>Eretmochelys imbricata</i>	Hawksbill sea turtle	Coastal Zones	Endangered
<i>Epicrates inornatus</i>	Puerto Rican Boa	Forested Volcanic / Limestone (Karst) Hills	Endangered
<i>Ottoschulzia rhodoxylon</i>	Rosewood	Cerro Higuillar, Espinosa Ward, Maguayo Ward	Endangered
<i>Pelecanus occidentalis</i>	Brown Pelican	Coastal Zones	Endangered
<i>Trichechus manatus</i> <i>manatus</i>	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
<i>Banara vanderbiltii</i>	Ramón stick	Rio Lajas Hills	Endangered
<i>Chelonia mydas</i>	Green Sea Turtle	Coastal Zones	Threatened
<i>Daphnopsis hellerana</i>	No Common Name	Nevarés Limestone Hills, Near Sabana Seca, Primate Center	Endangered
<i>Epicrates inornatus</i>	Puerto Rican boa	Forested Volcanic and Limestone hills	Endangered
<i>Eretmochelys imbricata</i>	Hawksbill sea turtle	Coastal Zones	Endangered
<i>Ottoschulzia rhodoxylon</i>	Stick of roses	Media Luna Ward, Candelaria Ward	Endangered
<i>Pelecanus occidentalis</i>	Brown Pelican	Coastal Zones	Endangered
<i>Trichechus manatus manatus</i>	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
<i>Chelonia mydas</i>	Green Sea Turtle	Coastal Zones	Threatened
<i>Eretmochelys imbricata</i>	Hawksbill Sea Turtle	Marine Coastal	Endangered
<i>Pelecanus occidentalis</i>	Brown Pelican	Coastal Zones, No Nesting	Endangered
<i>Trichechus manatus manatus</i>	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, therefore no impacts to those federally listed threatened and endangered species identified as marine/coastal are anticipated. All impacts to herbaceous wetlands will be temporary and all disturbed areas will be restored to natural grade and allowed to naturally revegetate.

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. A boa monitoring and protection plan will be implemented for this species. A copy of this document has been included as part of this Biological Evaluation.

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
<i>Banara vanderbiltii</i>	Ramón stick	PR-2	Endangered
<i>Buxus vahlii</i>	Val's Boxwood	Hato Tejas, Parque de las Ciencias	Endangered
<i>Daphnopsis hellerana</i>	No Common Name	Sabana Seca, PR-2	Endangered
<i>Epicrates inornatus</i>	Puerto Rican Boa	Forested Volcanic / Limestone (Karst) Hills	Endangered
<i>Ottoschulzia rhodoxylon</i>	Stick of roses	Hata Tejas, Parque de las Ciencias	Endangered
<i>Patagioenas (Columba) inornata wetmorei</i>	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
<i>Agelaius xanthomus</i>	Yellow-Shouldered Black Bird	Coastal Forest	Endangered
<i>Patagioenas (Columba) inornata wetmorei</i>	Puerto Rican Plain Pigeon	Lower Montane Forest and Riparian Habitats	Endangered
<i>Ottoschulzia rhodoxylon</i>	Stick of roses	Hata Tejas, Parque de las Ciencias	Threatened
<i>Epicrates inornatus</i>	Puerto Rican Boa	Forested Volcanic / Limestone (Karst) Hills	Endangered
<i>Pelecanus occidentalis</i>	Brown Pelican	Coastal Zones, No Nesting	Endangered
<i>Trichechus manatus manatus</i>	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 provide the USACE with information that will assist it in determining whether the proposed action is "likely to adversely affect" a listed species or its designated critical habitat.

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 (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 (Appendix 3), 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 vittata vittata*); Puerto Rican crested toad (*Pelyophryne 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 vanderbiltii*), diablito de tres cuernos (*Buxus valhi*), *Cordia bellonis*, *Daphnopsis helleriana*, palo de rosa (*Ottoshulzia rhodoxylon*), *Myrica paganii*, *Tectarea estremarana*, *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 (*Zanthoxylum 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*)." 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. No critical habitats have been published for these 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. In order 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 will be reduced.

The areas included in this survey 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 rupicola*, 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 designated study areas.

Conservation measures for each species have been described below; however, it is recommended that all species of threatened or endangered plants that are found within the proposed construction corridor, be transplanted, when appropriate. Unless limited by the size (e.g. large trees), all listed species of plants found inside the established construction right of way which will be or have the potential to be impacted by the pipeline construction, will be relocated pursuant to an agreement to be established between Departamento de Recursos Naturales y Ambientales (DNER) and the United States Fish and Wildlife Service (USFWS). The relocation of threatened and endangered plant species will be accomplished by DRNA biologists, with prior notification to the USFWS. Relocations will be to established protection areas (Guajataca and Río Abajo forest, and other public properties) whenever possible to ensure long-term protection. The area chosen for the transplantation of individuals will be selected in conjunction with the USFWS (for species listed by the federal Government) and/or the DNER; with concurrent permission from the Manager/Owner of the forest or place where sowing or transplants will occur. The characteristics of the premises where transplants (soils, geology, associated vegetation, etc.) are carried out shall be similar to the affected location.

Relocation methodology could include transplantation, spreading seed, and/or division by vegetative methods. Propagation of seeds and cuttings may be more appropriate for woody species since transplantation of these species often fails. Seeds and cuttings will be taken of all individuals affected to the maximum extent possible.

In those areas where listed species have been identified, detailed studies of the vegetation will be undertaken by professional botanists prior to commencing clearing activities. The purpose of this study is to identify and mark all plants listed by the USFWS and the DNER for relocation. After of this study, a plan detailing specific procedures will be prepared for the USFWS (for species listed by the federal Government) or the DNER (for species listed by the State Government) for final approval. These procedures will be developed or compiled by botanical professionals or horticulturists. Methodology of relocation for transplants of trees will be prepared by a certified arborist (International Society of Arboriculture) and will comply with ANSI 300 "Transplanting Standards" (parameters of transplants). Once the relocation procedures are completed, funds will be provided to the DNER for the long-term maintenance and monitoring required for the relocated species.

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 and endangered vegetation survey conducted by Franklin Axelrod, Ph.D.;** however, 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 expected to this species. However, there is a possibility of indirect impacts if its habitat is affected.

5.1.1.5 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 *A. pauciflorum*.

5.1.1.6 Conservation Measures and Recommendations

Conservation measures include:

- The acquisition of land where individuals or populations of *A. pauciflorum* are known to exist, or other areas with suitable habitat for this species;

- Reduction of the construction ROW width from 100 feet to a total of 60 feet on steep slopes and narrow ridges
- The restoration of habitat between the construction ROW (60 to 100 feet) and the permanent ROW (50 feet);
- Conducting specific surveys for this species before construction takes place within suitable *A. pauciflorum* habitat;
- Transplanting *A. pauciflorum* individuals (if found) when appropriate.
- Collecting seeds and seedlings if available.
- Reproducing individuals through softwood cutting methodology;
- Establishment of a propagation project for the species.

5.1.1.7 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 is not likely to adversely affect *A. pauciflorum* species.

5.1.2 *Banara vanderbiltii* – (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. vanderbiltii 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.

5.1.2.4 Summary of Impacts

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

5.1.2.5 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 *B. vanderbiltii*.

5.1.2.6 Conservation Measures and Recommendations

Conservation measures include:

- The acquisition of land where individuals or populations of *B. vanderbiltii* are known to exist, or other areas with suitable habitat for this species;
- Reduction of the construction ROW width from 100 feet to a total of 60 feet on steep slopes and narrow ridges
- The restoration of habitat between the construction ROW (100 feet) and the permanent ROW (50 feet);
- Conducting specific surveys for this species before construction takes place within suitable *B. vanderbiltii* habitat;
- Transplanting *B. vanderbiltii* individuals (if found) when appropriate.
- Collecting seeds and seedlings if available.
- Reproducing individuals through softwood cutting methodology;
- Establishment of a propagation project for the species.

5.1.2.7 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 is not likely to adversely affect *B. vanderbiltii* 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 expected to this species. However, there is a possibility of indirect impacts if its habitat is affected.

5.1.3.5 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 *B. vahlii*.

5.1.3.6 Conservation Measures and Recommendations

Conservation measures include:

- The acquisition of land where individuals or populations of *B. vahlii* are known to exist, or other areas with suitable habitat for this species;
- Reduction of the construction ROW width from 100 feet to a total of 60 feet on steep slopes and narrow ridges;
- The restoration of habitat between the construction ROW (100 feet) and the permanent ROW (50 feet);
- Conducting specific surveys for this species before construction takes place within suitable *B. vahlii* habitat;
- Transplanting *B. vahlii* individuals (if found) when appropriate.
- Collecting seeds and seedlings if available.
- Reproducing individuals through softwood cutting methodology;
- Establishment of a propagation project for the species.

5.1.3.7 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 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; however, potential suitable habitat may exist in the Arecibo/Utuado section of Project route.

5.1.4.4 Summary of Impacts

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

5.1.4.5 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. rivalis*.

5.1.4.6 Conservation Measures and Recommendations

Conservation measures include:

- The acquisition of land where individuals or populations of *C. rivalis* are known to exist, or other areas with suitable habitat for this species;
- Reduction of the construction ROW width from 100 feet to a total of 60 feet on steep slopes and narrow ridges;
- The restoration of habitat between the construction ROW (100 feet) and the permanent ROW (50 feet);
- Conducting specific surveys for this species before construction takes place within suitable *C. rivalis* habitat;
- Transplanting *C. rivalis* individuals (if found) when appropriate.
- Collecting seeds and seedlings if available.
- Establishment of a propagation project for the species.

5.1.4.7 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 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.;** however, 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 expected to this species. However, there is a possibility of indirect impacts if its habitat is affected.

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

Conservation measures include:

- The acquisition of land where individuals or populations of *C. melanocarpa* are known to exist, or other areas with suitable habitat for this species;
- Reduction of the construction ROW width from 100 feet to a total of 60 feet on steep slopes and narrow ridges;
- The restoration of habitat between the construction ROW (100 feet) and the permanent ROW (50 feet);

- Conducting specific surveys for this species before construction takes place within suitable *C. melanocarpa* habitat;
- Transplanting *C. melanocarpa* individuals (if found) when appropriate.
- Collecting seeds and seedlings if available.
- Reproducing individuals through softwood cutting methodology;
- Establishment of a propagation project for the species.

5.1.5.7 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 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 expected to this species. However, there is a possibility of indirect impacts if its habitat is affected.

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*

Conservation measures include:

- The acquisition of land where individuals or populations of *C. glandulosa var. mirabilis* are known to exist, or other areas with suitable habitat for this species;
- Reduction of the construction ROW width from 100 feet to a total of 60 feet on steep slopes and narrow ridges;
- The restoration of habitat between the construction ROW (100 feet) and the permanent ROW (50 feet);
- Conducting specific surveys for this species before construction takes place within suitable *C. glandulosa var. mirabilis* habitat;

- Transplanting *C. glandulosa* var. *mirabilis* individuals (if found) when appropriate.
- Collecting seeds and seedlings if available.
- Reproducing individuals through softwood cutting methodology;
- Establishment of a propagation project for the species.

5.1.6.7 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 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 than 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 forests 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 Río 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.; however, 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 expected to this species. However, there is a possibility of indirect impacts if its habitat is affected.

5.1.7.5 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. 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

Conservation measures include:

- The acquisition of land where individuals or populations of *C. bellonis* are known to exist, or other areas with suitable habitat for this species;
- Reduction of the construction ROW width from 100 feet to a total of 60 feet on steep slopes and narrow ridges;
- The restoration of habitat between the construction ROW (100 feet) and the permanent ROW (50 feet);
- Conducting specific surveys for this species before construction takes place within suitable *C. bellonis* habitat;
- Transplanting *C. bellonis* individuals (if found) when appropriate.
- Collecting seeds and seedlings if available.
- Reproducing individuals through softwood cutting methodology;
- Establishment of a propagation project for the species.

5.1.7.7 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 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 km² (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.;**

however, 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 expected to this species. However, there is a possibility of indirect impacts if its habitat is affected.

5.1.8.5 *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. rupicola*.

5.1.8.6 *Conservation Measures and Recommendations*

Conservation measures include:

- The acquisition of land where individuals or populations of *C. rupicola* are known to exist, or other areas with suitable habitat for this species;
- The restoration of habitat between the construction ROW (100 feet) and the permanent ROW (50 feet);
- Conducting specific surveys for this species before construction takes place within suitable *C. rupicola* habitat;
- Transplanting *C. rupicola* individuals (if found) when appropriate.
- Collecting seeds and seedlings if available.
- Reproducing individuals through softwood cutting methodology;
- Establishment of a propagation project for the species.

5.1.8.7 *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 *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.;** however, 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 expected to this species. However, there is a possibility of indirect impacts if its habitat is affected.

5.1.9.5 *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. obovata*.

5.1.9.6 Conservation Measures and Recommendations

Conservation measures include:

- The acquisition of land where individuals or populations of *C. obovata* are known to exist, or other areas with suitable habitat for this species;
- Reduction of the construction ROW width from 100 feet to a total of 60 feet on steep slopes and narrow ridges;
- The restoration of habitat between the construction ROW (100 feet) and the permanent ROW (50 feet);
- Conducting specific surveys for this species before construction takes place within suitable *C. obovata* habitat;
- Transplanting *C. obovata* individuals (if found) when appropriate.
- Collecting seeds and seedlings if available.
- Reproducing individuals through softwood cutting methodology;
- Establishment of a propagation project for the species.

5.1.9.7 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 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 *Cyatheaales*. 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 expected to this species. However, there is a possibility of indirect impacts if its habitat is affected.

5.1.10.5 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 *Cyathea dryopteroides*.

5.1.10.6 Conservation Measures and Recommendations

Conservation measures include:

- The acquisition of land where individuals or populations of *C. dryopteroides* are known to exist, or other areas with suitable habitat for this species;
- Reduction of the construction ROW width from 100 feet to a maximum of 60 feet on steep slopes and narrow ridges;
- The restoration of habitat between the construction ROW (100 feet) and the permanent ROW (50 feet);
- Conducting specific surveys for this species before construction takes place within suitable *C. dryopteroides* habitat;
- Transplanting *C. dryopteroides* individuals (if found) when appropriate.
- Collecting seeds and seedlings if available.
- Establishment of a propagation project for the species.

5.1.10.7 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 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.;** however, 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 expected to this species. However, there is a possibility of indirect impacts if its habitat is affected.

5.1.11.5 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. 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

Conservation measures include:

- The acquisition of land where individuals or populations of *D. hellerana* are known to exist, or other areas with suitable habitat for this species;
- Reduction of the construction ROW width from 100 feet to a maximum of 60 feet on steep slopes and narrow ridges;
- The restoration of habitat between the construction ROW (100 feet) and the permanent ROW (50 feet);
- Conducting specific surveys for this species before construction takes place within suitable *D. hellerana* habitat;
- Transplanting *D. hellerana* individuals (if found) when appropriate.
- Collecting seeds and seedlings if available.
- Reproducing individuals through softwood cutting methodology;
- Establishment of a propagation project for the species.

5.1.11.7 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 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.;** however, 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 expected to this species. However, there is a possibility of indirect impacts if its habitat is affected.

5.1.12.5 *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 *E. woodburyana*.

5.1.12.6 *Conservation Measures and Recommendations*

Conservation measures include:

- The acquisition of land where individuals or populations of *E. woodburyana* are known to exist, or other areas with suitable habitat for this species;

- Reduction of the construction ROW width from 100 feet to a maximum of 60 feet on steep slopes and narrow ridges;
- The restoration of habitat between the construction ROW (100 feet) and the permanent ROW (50 feet);
- Conducting specific surveys for this species before construction takes place within suitable *E. woodburyana* habitat;
- Transplanting *E. woodburyana* individuals (if found) when appropriate.
- Collecting seeds and seedlings if available.
- Reproducing individuals through softwood cutting methodology;
- Establishment of a propagation project for the species.

5.1.12.7 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 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 on 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.;** however, 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 expected to this species. However, there is a possibility of indirect impacts if its habitat is affected.

5.1.13.5 *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 *G. elegans*.

5.1.13.6 *Conservation Measures and Recommendations*

Conservation measures include:

- The acquisition of land where individuals or populations of *G. elegans* are known to exist, or other areas with suitable habitat for this species;
- Reduction of the construction ROW width from 100 feet to a maximum of 60 feet on steep slopes and narrow ridges;
- The restoration of habitat between the construction ROW (100 feet) and the permanent ROW (50 feet);
- Conducting specific surveys for this species before construction takes place within suitable *G. elegans* habitat;
- Transplanting *G. elegans* individuals (if found) when appropriate.
- Collecting seeds and seedlings if available.
- Reproducing individuals through softwood cutting methodology;
- Establishment of a propagation project for the species.

5.1.13.7 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 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.;** however, 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 expected to this species. However, there is a possibility of indirect impacts if its habitat is affected.

5.1.14.5 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 *J. jamaicensis*.

5.1.14.6 Conservation Measures and Recommendations

Conservation measures include:

- The acquisition of land where individuals or populations of *J. jamaicensis* are known to exist, or other areas with suitable habitat for this species;
- Reduction of the construction ROW width from 100 feet to a maximum of 60 feet on steep slopes and narrow ridges;
- The restoration of habitat between the construction ROW (100 feet) and the permanent ROW (50 feet);
- Conducting specific surveys for this species before construction takes place within suitable *J. jamaicensis* habitat;
- Transplanting *J. jamaicensis* individuals (if found) when appropriate.
- Collecting seeds and seedlings if available.
- Reproducing individuals through softwood cutting methodology;
- Establishment of a propagation project for the species.

5.1.14.7 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 is not likely to adversely affect *J. jamaicensis* species.

5.1.15 *Mitracarpus maxwelliae*

5.1.15.1 General Species Biology

Mitracarpus maxwelliae 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-globose, 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. maxwelliae 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. maxwelliae* 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. maxwelliae*.

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. maxwelliae*.

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.;** however, 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 expected to this species. However, there is a possibility of indirect impacts if its habitat is affected.

5.1.17.5 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 *M. paganii*.

5.1.17.6 Conservation Measures and Recommendations

Conservation measures include:

- The acquisition of land where individuals or populations of *M. paganii* are known to exist, or other areas with suitable habitat for this species;
- Reduction of the construction ROW width from 100 feet to a maximum of 60 feet on steep slopes and narrow ridges;
- The restoration of habitat between the construction ROW (100 feet) and the permanent ROW (50 feet);
- Conducting specific surveys for this species before construction takes place within suitable *M. paganii* habitat;
- Transplanting *M. paganii* individuals (if found) when appropriate.
- Collecting seeds and seedlings if available.
- Reproducing individuals through softwood cutting methodology;
- Establishment of a propagation project for the species.

5.1.17.7 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 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 expected to this species. However, there is a possibility of indirect impacts if its habitat is affected.

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

As explained above, 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.**

Other conservation measures include:

- The acquisition of land where individuals or populations of *O. rhodoxylon* are known to exist, or other areas with suitable habitat for this species;
- Reduction of the construction ROW width from 100 feet to a maximum of 60 feet on steep slopes and narrow ridges;
- The restoration of habitat between the construction ROW (100 feet) and the permanent ROW (50 feet);
- Conducting specific surveys for this species before construction takes place within suitable *O. rhodoxylon* habitat;
- Transplanting *O. rhodoxylon* individuals (if found) when appropriate.
- Collecting seeds and seedlings if available.
- Reproducing individuals through softwood cutting methodology;
- Establishment of a propagation project for the species.

5.1.18.7 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 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.;** however, 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 expected to this species. However, there is a possibility of indirect impacts if its habitat is affected.

5.1.19.5 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 *P. macranthum*.

5.1.19.6 Conservation Measures and Recommendations

Conservation measures include:

- The acquisition of land where individuals or populations of *P. macranthum* are known to exist, or other areas with suitable habitat for this species;

- Reduction of the construction ROW width from 100 feet to a maximum of 60 feet on steep slopes and narrow ridges;
- The restoration of habitat between the construction ROW (100 feet) and the permanent ROW (50 feet);
- Conducting specific surveys for this species before construction takes place within suitable *P. macranthum* habitat;
- Transplanting *P. macranthum* individuals (if found) when appropriate.
- Collecting seeds and seedlings if available.
- Reproducing individuals through softwood cutting methodology;
- Establishment of a propagation project for the species.

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 expected to this species.** However, there is a possibility of indirect impacts if its habitat is affected. 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. calderoense* 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.;** however, 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 expected to this species. However, there is a possibility of indirect impacts if its habitat is affected.

5.1.20.5 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 *P. calderonense*.

5.1.20.6 Conservation Measures and Recommendations

Conservation measures include:

- The acquisition of land where individuals or populations of *P. calderonense* are known to exist, or other areas with suitable habitat for this species;
- Reduction of the construction ROW width from 100 feet to a maximum of 60 feet on steep slopes and narrow ridges;
- The restoration of habitat between the construction ROW (100 feet) and the permanent ROW (50 feet);
- Conducting specific surveys for this species before construction takes place within suitable *P. calderonense* habitat;

- Transplanting *P. calderonense* individuals (if found) when appropriate.
- Establishment of a propagation project for the species.

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 biological evaluation. Sections of pipeline running just south of Rio Abajo through the volcanic region to just north of Ponce may require further survey. **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 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 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*

Conservation measures include:

- The acquisition of land where individuals or populations of *S. arenaria* are known to exist, or other areas with suitable habitat for this species;
- The restoration of habitat between the construction ROW (100 feet) and the permanent ROW (50 feet);
- Conducting specific surveys for this species before construction takes place within suitable *S. arenaria* habitat;
- Transplanting *S. arenaria* individuals (if found) when appropriate.
- Collecting seeds and seedlings if available.
- Reproducing individuals through softwood cutting methodology;
- Establishment of a propagation project for the species.

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.

5.1.22 *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. drymophilum* 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 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 expected to this species. However, there is a possibility of indirect impacts if its habitat is affected.

5.1.22.5 *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. drymophillum*.

5.1.22.6 *Conservation Measures and Recommendations*

Conservation measures include:

- The acquisition of land where individuals or populations of *S. drymophillum* are known to exist, or other areas with suitable habitat for this species;
- Reduction of the construction ROW width from 100 feet to a maximum of 60 feet on steep slopes and narrow ridges;
- The restoration of habitat between the construction ROW (100 feet) and the permanent ROW (50 feet);
- Conducting specific surveys for this species before construction takes place within suitable of *S. drymophillum* habitat;
- Transplanting *S. drymophillum* individuals (if found) when appropriate.
- Collecting seeds and seedlings if available.
- Reproducing individuals through softwood cutting methodology;
- Establishment of a propagation project for the species.

5.1.22.7 *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 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.;** however, 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 expected to this species. However, there is a possibility of indirect impacts if its habitat is affected.

5.1.23.5 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. monosperma*.

5.1.23.6 Conservation Measures and Recommendations

Conservation measures include:

- The acquisition of land where individuals or populations of *S. monosperma* are known to exist, or other areas with suitable habitat for this species;

- Reduction of the construction ROW width from 100 feet to a maximum of 60 feet on steep slopes and narrow ridges;
- The restoration of habitat between the construction ROW (100 feet) and the permanent ROW (50 feet);
- Conducting specific surveys for this species before construction takes place within suitable *S. monosperma* habitat;
- Transplanting *S. monosperma* individuals (if found) when appropriate.
- Collecting seeds and seedlings if available.
- Reproducing individuals through softwood cutting methodology;
- Establishment of a propagation project for the species.

5.1.23.7 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 is not likely to adversely affect *S. monosperma* species.

5.1.24 *Tectaria estremarana* – (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 livesii*) 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.;** however, 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 expected to this species. However, there is a possibility of indirect impacts if its habitat is affected.

5.1.24.5 *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 *T. estremerana*.

5.1.24.6 *Conservation Measures and Recommendations*

Conservation measures include:

- The acquisition of land where individuals or populations of *T. estremerana* are known to exist, or other areas with suitable habitat for this species;
- Reduction of the construction ROW width from 100 feet to a maximum of 60 feet on steep slopes and narrow ridges;
- The restoration of habitat between the construction ROW (100 feet) and the permanent ROW (50 feet);
- Conducting specific surveys for this species before construction takes place within suitable *T. estremerana* habitat;
- Transplanting *T. estremerana* individuals (if found) when appropriate.
- Establishment of a propagation project for the species.

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 expected to this species.**

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 Quebradillas. 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 limestone 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.;** however, 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 expected to this species. However, there is a possibility of indirect impacts if its habitat is affected.

5.1.25.5 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 *T. inabonensis*.

5.1.25.6 Conservation Measures and Recommendations

Conservation measures include:

- The acquisition of land where individuals or populations of *T. inabonensis* are known to exist, or other areas with suitable habitat for this species;
- Reduction of the construction ROW width from 100 feet to a maximum of 60 feet on steep slopes and narrow ridges;
- The restoration of habitat between the construction ROW (100 feet) and the permanent ROW (50 feet);
- Conducting specific surveys for this species before construction takes place within suitable *T. inabonensis* habitat;
- Transplanting *T. inabonensis* individuals (if found) when appropriate.
- Establishment of a propagation project for the species.

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 biological evaluation. **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 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.;** however, 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 expected to this species. However, there is a possibility of indirect impacts if its habitat is affected.

5.1.26.5 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 *T. verecunda*.

5.1.26.6 Conservation Measures and Recommendations

Conservation measures include:

- The acquisition of land where individuals or populations of *T. verecunda* are known to exist, or other areas with suitable habitat for this species;
- Reduction of the construction ROW width from 100 feet to a maximum of 60 feet on steep slopes and narrow ridges;
- The restoration of habitat between the construction ROW (100 feet) and the permanent ROW (50 feet);
- Conducting specific surveys for this species before construction takes place within suitable *T. verecunda* habitat;
- Transplanting *T. verecunda* individuals (if found) when appropriate.
- Establishment of a propagation project for the species.

5.1.26.7 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 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 stелate-puberulous on both sides. This fern has inframedial to medial sori, which are ciliated with minute forked and 3-branched hair, and have small indusium often hidden by the sporangia (Proctor, 1989).

5.1.27.2 *Distribution and Abundance*

Thelypteris yaucoensis 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.;** however, 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 expected to this species. However, there is a possibility of indirect impacts if its habitat is affected.

5.1.27.5 *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 *T. yaucoensis*.

5.1.27.6 *Conservation Measures and Recommendations*

Conservation measures include:

- The acquisition of land where individuals or populations of *T. yaucoensis* are known to exist, or other areas with suitable habitat for this species;
- Reduction of the construction ROW width from 100 feet to a maximum of 60 feet on steep slopes and narrow ridges;

- The restoration of habitat between the construction ROW (100 feet) and the permanent ROW (50 feet);
- Conducting specific surveys for this species before construction takes place within suitable *T. yaucoensis* habitat;
- Transplanting *T. yaucoensis* individuals (if found) when appropriate.
- Establishment of a propagation project for the species.

5.1.27.7 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 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

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).

5.1.28.2 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 Quebradillas. 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.

5.1.28.3 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.;**

however, potential suitable habitat for this species may exist on the Utuado/Adjuntas section, specifically where *P. montana* dominates along the Project route.

5.1.28.4 Summary of Impacts

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

5.1.28.5 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 *T. inabonensis*.

5.1.28.6 Conservation Measures and Recommendations

Conservation measures include:

- The acquisition of land where individuals or populations of *T. inabonensis* are known to exist, or other areas with suitable habitat for this species;
- Reduction of the construction ROW width from 100 feet to a maximum of 60 feet on steep slopes and narrow ridges;
- The restoration of habitat between the construction ROW (100 feet) and the permanent ROW (50 feet);
- Conducting specific surveys for this species before construction takes place within suitable *T. inabonensis* habitat;
- Transplanting *T. inabonensis* individuals (if found) when appropriate.
- Establishment of a propagation project for the species.

5.1.28.7 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 biological evaluation. Sections of pipeline running just south of Rio Abajo through the volcanic region to just north of Ponce may require further survey. **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 is not likely to adversely affect *T. inabonensis* species.

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.; however, 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 expected to this species. However, there is a possibility of indirect impacts if its habitat is affected.

5.1.29.5 *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 *Z. thomasianum*.

5.1.29.6 Conservation Measures and Recommendations

Conservation measures include:

- The acquisition of land where individuals or populations of *Z. thomasianum* are known to exist, or other areas with suitable habitat for this species;
- Reduction of the construction ROW width from 100 feet to a maximum of 60 feet on steep slopes and narrow ridges;
- The restoration of habitat between the construction ROW (100 feet) and the permanent ROW (50 feet);
- Conducting specific surveys for this species before construction takes place within suitable *Z. thomasianum* habitat;
- Transplanting *Z. thomasianum* individuals (if found) when appropriate.
- Collecting seeds and seedlings if available.
- Reproducing individuals through softwood cutting methodology;
- Establishment of a propagation project for the species.

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 expected to this species.** However, there is a possibility of indirect impacts if its habitat is affected. Therefore, the Project may affect, but is not likely to adversely affect *Z. thomasianum* species.

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

Federal Status: Endangered

5.2.1.1 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.

5.2.1.2 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.

5.2.1.3 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 biological evaluation. The species is considered to occur within 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 Biological Evaluation (BE) 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 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 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.

5.2.1.4 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 = 91 acres

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.

5.2.1.5 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.

5.2.1.6 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 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.

5.2.1.7 Conclusion

Based on the findings of the surveys and the information within this BA, the Project may affect, but is not likely to adversely affect the Puerto Rican sharp-shinned hawk.

5.2.2 *Amazona vittata* – (Cotorra Puertorriqueña)

Federal Status: Endangered

5.2.2.1 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.

5.2.2.2 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.

5.2.2.3 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.

5.2.2.4 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 (see map in Appendix 2).**

5.2.2.5 Indirect, Interdependent, Interrelated and Cumulative Effects

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

5.2.2.6 Conservation Measures and Recommendations

Prior to construction of the pipeline, it is recommended that another Puerto Rican parrot survey be conducted with input from USFWS and DNER. This survey would verify the introduced

Puerto Rican parrot population has not begun using the pipeline construction area. This survey would ensure that the project area is not part of the parrot's home range.

5.2.2.7 Conclusion

Puerto Rican parrots have not been documented in the proposed project area; however, further studies may be required to document home range and habitat use. With acceptance of the recommendations and conservation measures, the Project may affect, but is not likely to adversely affect the Puerto Rican parrot.

5.2.3 *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 DRNA, 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. Therefore, the Yellow-Shouldered Blackbird would not be affected by the project (Recommended: No Affect).

5.2.4 *Buteo platypterus brunescens* – (Puerto Rico Broad-winged Hawk)

Federal Status: Endangered

5.2.4.1 *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.

5.2.4.2 *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.

5.2.4.3 *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 Biological Evaluation (BE) 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 summarized 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.

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.

5.2.4.4 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 19 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 19 miles of impacts = 115 acres
- Permanent impacts 50 feet X 19 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.

5.2.4.5 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.

5.2.4.6 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. Mitigation consists of planting 3 trees for every tree removed. Trees will be planted in 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.

5.2.4.7 Conclusion

Based on the surveys, the Project may affect, but is not likely to adversely affect the Puerto Rican broad-winged hawk.

5.2.5 *Caprimulgus noctitherus* – (Puerto Rican Nightjar)

Federal Status: Endangered

5.2.5.1 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.

5.2.5.2 *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 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.

5.2.5.3 Current Conditions

The Puerto Rican nightjar and its habitat are known to occur within the 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 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.

5.2.5.4 Summary of Impacts

It is expected that an area of approximately 34 acres (70 feet right-of-way through 4 miles only at the mountainous areas of Peñuelas between mile marker 3 and 4) of habitat will be directly impacted by the construction of the proposed pipeline, which includes both permanent and temporary impacts. The permanent impact will be approximately 24.4 acres due to the permanent maintenance ROW. The temporary impact would be approximately 9.6 acres due to the construction activities, which increase the ROW an additional 20 feet for temporary access. 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.

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

5.2.5.5 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.

5.2.5.6 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.

It is recommended that habitat restoration, conservation, and purchasing of lands critical to the nightjar be proposed to compensate for habitat loss. It is recommended that these measures take place concurrent with or prior to impacts to nightjar habitat

- 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.

5.2.5.7 Conclusion

A determination of May Affect but Not Likely to Adversely Affect (MANLAA) is proposed for this the species, if appropriate avoidance measures are taken. Direct and indirect impacts to the Puerto Rican nightjar can be minimized through conservation measures and specialized construction techniques.

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

Federal Status: Endangered

5.2.6.1 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 70 percent of the foods come from tree branches, and 30 percent from the ground. Principal foods are royal palm (*Roystonea borinquena*); mountain immortelle (*Erythrina poeppigiana*); West Indies trema (*Trema lamarckiana*); and white prickly (*Zanthoxylum martinicense*). Water is usually taken from the axils of bromeliads or from water-retaining blossoms of the African tulip-tree (*Spathodea campanulata*) (USFWS, 1982).

5.2.6.2 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.

5.2.6.3 Current Conditions

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

5.2.6.4 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.

5.2.6.5 *Indirect, Interdependent, Interrelated and Cumulative Effects*

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

5.2.6.6 *Conservation Measures and Recommendations*

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

5.2.6.7 *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, the project will not affect this species.

5.2.7 *Eleutherodactylus jaunariveroi- (Coqui Ilanero or Plains Coqui)*

Status: Under Review

5.2.7.1 *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.

5.2.7.2 *Distribution and Abundance*

The *Eleutherodactylus jaunariveroi* 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.

5.2.7.3 *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 coqui 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 (see map in Appendix 2).**

5.2.7.4 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 (see map in Appendix 2).**

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

5.2.7.5 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.

5.2.7.6 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 coqui llanero 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 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.

5.2.7.7 Conclusion

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

5.2.8 *Epicrates inornatus* – (Puerto Rican Boa)

Federal Status: Endangered

5.2.8.1 *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.

5.2.8.2 *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.

5.2.8.3 *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-foot Right-of-Way) affect approximately 307 acres of potential *Epicrates inornatus* habitat during the construction phase of the project. Permanent (50-foot Right-of-Way) impact was estimated at approximately 154 acres.

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. The permanent impact to this species' habitat will be approximately 99 acres.

5.2.8.4 Summary of Impacts

As previously mentioned, it is expected that approximately 199 acres 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.

5.2.8.5 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.

5.2.8.6 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 DRNA 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 DRNA 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 DRNA.

5.2.8.7 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, the Project may affect, but is not likely to adversely affect this species.

5.2.9 *Peltophryne lemur* – Puerto Rican Crested Toad

Federal Status: Threatened

5.2.9.1 *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.

5.2.9.2 *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.

5.2.9.3 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 area 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.

5.2.9.4 Summary of Impacts

Adjustments and realignments of the proposed pipeline corridor has reduced the potential direct impacts of potential reproductive habitat for the Puerto Rican crested toad. As a result of these actions, a single potential reproductive site may be directly

impacted. It is estimated that approximately 18.5 acres of potential habitat for the Puerto Rican crested toad would be temporarily impacted (see maps in Appendix 3). All impacts will be temporary in nature and the entire ROW will be restored to preconstruction conditions in any areas known to be potential crested toad habitat.

5.2.9.5 Indirect, Interdependent, Interrelated and Cumulative Effects

No indirect, interdependent, interrelated or cumulative effects are expected due to the fact that all areas within potential crested toad habitat will be completely restored to preconstruction conditions.

5.2.9.6 Conservation Measures and Recommendations

The Puerto Rican crested or Concho toad is very difficult to detect due to its 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.

5.2.9.7 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 and restoration of all potential habitat within the project area, the Project may affect, but is not likely to adversely affect this species.

5.2.10 *Trichechus manatus manatus*- (Antillean manatee)

Status: Endangered

5.2.10.1 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.

5.2.10.2 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.

5.2.10.3 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.

5.2.10.4 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.**

5.2.10.5 Indirect, Interdependent, Interrelated and Cumulative Effects

Due to the location and methods of pipeline construction, there are no expected interdependent, interrelate or cumulative effects to the Antillean manatee.

5.2.10.6 Conservation Measures and Recommendations

No specific conservation measures are proposed for this species.

5.2.10.7 Conclusion

Based on current research and known distribution of the Antillean manatee, and the information contained herein, the Project would not affect the Antillean Manatee.

6 NMFS Listed Species

In a letter dated March 24, 2011, NMFS requested they be provided with details of the project in order to evaluate potential project impacts to listed corals, sea turtles, and ESA-designated coral critical habitat, along Puerto Rico's north coast. Additionally, in the same letter, NMFS requested that the following information be provided:

1. The final pipeline route, including the distance of the pipeline from sea turtle nesting beaches, sea turtle refuge and foraging habitat, listed coral colonies, and designated coral critical habitat, and information regarding the location of the proposed staging areas along the pipeline.

Response: *The final pipeline route was provided to the Corps (96 pages depicting aerial plan views of the pipeline corridor). The only location where the route was possibly located near sea turtle nesting beaches was at Levittown near Punta Salinas. To ensure no effect would occur to potential nesting habitat, a decision was made to place the pipeline 55-feet below ground at this area using Horizontal Directional Drilling (HDD) to place the pipe. All temporary HDD workpads will be positioned landward of the beach area and no activity will occur within the beach habitat. In addition to this decision to use HDD, the DNER was consulted to determine if any of the beach was identified as sea turtle nesting habitat. DNER confirmed that no sightings have ever been made of nesting sea turtles at the subject stretch of beach at the Levittown area. At no point will the pipeline extend waterward of the mean-high-waterline (MHW) where sea turtle refuge or foraging habitat is located. The pipeline will not be located waterward of the MHW nor positioned in any way to affect designated coral critical habitat. At the major river systems along the northern shoreline the pipeline will cross these waterways using HDD to ensure no impact will occur to marine or anadromous habitat. The crossing locations are all well inland from the mouth of any of these river systems (the closest crossing occurs at Rio Hondo where the pipe will be 80-ft below the bed of the river and 1,500-feet inland from the mouth of the river to the Atlantic Ocean). No staging areas are proposed near marine habitat or Essential Fisheries Habitat*

(EFH). Upland areas will be used to the maximum extent practicable to stage equipment and, in those locations where the pipeline will cross Palustrine Emergent wetlands, pipeline sections will be connected and placed within the authorized construction zone, always distanced from any open shoreline.

2. Information regarding the size of the proposed right of way (ROW) for the pipeline and expected maintenance activities within this ROW over the lifetime of the project.

Response: *As previously discussed at the Project Delivery Team meetings hosted by the U.S. Army Corps of Engineers, the construction right-of-way will be 100-feet wide in uplands and no more than 60-feet wide in Palustrine Wetlands. One hundred percent of the wetland ROW will be restored to preconstruction conditions after placement of the pipeline. Only in the upland locations will a 50-foot wide ROW be maintained to restrict the return of deep rooted vegetation (to ensure pipeline safety). Within this 50-foot ROW, scrub-shrub and grass communities will be allowed to reestablish naturally (but for the identified deep rooted species). Removal of suspect species will be done periodically (multiple year periods) using manual labor in the vicinity of all waterways, i.e. small streams in the interior sections, and light equipment, i.e. select mowers, in locations away from any surface waterways. Appropriate erosion control methods will always be incorporated during maintenance activities to ensure no erosion occurs into open streams or waterways.*

3. A copy of the geologic analyses that have been conducted to determine whether soils are adequate for use of the proposed horizontal directional drilling (HDD) technology to install the pipeline in wetlands and other water bodies, including information regarding projects that have successfully employed HDD in coastal mangrove wetlands and the length of crossing constructed using HDD in mangrove wetlands.

Response: *The geologic information obtained from the HDD core borings is being provided to the Corps of Engineers for the administrative record. These borings confirm that the pipeline will be located in dense clay layers that are optimal for HDD techniques (and minimize the risk of any frac-out) All proposed HDD crossings have been designed using approved industry techniques and standards. The depths of all crossings (all greater than or equal to 40-feet below the bottom elevation of any waterbody) go beyond normal crossing*

depths and have been designed to specifically minimize any risk to the aquatic resources being crossed.

4. Information regarding proposed access to the pipeline route and ROW for construction and maintenance activities during initial installation of the pipeline and throughout the expected lifetime of the project, especially in the area of coastal water bodies.

Response: *As discussed at the interagency PDT meetings, routine maintenance will take place using pipeline inspection gauge (PIG) technology. This technique avoids the need for maintenance roads and access to remote sections of the pipeline. At no time during construction or maintenance will any activity take place in or near areas that are designated critical habitat for marine or anadromous species.*

5. A detailed description of the methods to be employed during the installation of the pipeline, including maps of construction areas and descriptions of excavation, backfill, HDD, spill response plans for HDD, and any other techniques to be employed during pipeline installation.

Response: *Information on construction techniques have been provided to the U.S. Army Corps of Engineers. In forested wetland areas, i.e. mangrove habitat, the pipeline will be placed using HDD technology that will result in no impact to the aquatic resource. In palustrine wetland areas, i.e. previously disturbed wetlands that were converted to ranching or farming activities, etc., the pipeline will be placed in an open trench excavated using equipment that will maintain, wherever possible, vertical walls to minimize the width of the requisite trench and construction footprint. Excavated hydric soils will be temporarily stockpiled next to the trench and immediately placed back into the trench to bury the pipeline once it is in place. The construction ROW in these areas where the pipeline will be placed in Palustrine wetlands will be restricted to 60-feet, or less. All hydric soil overburden (displaced by the pipe) will be removed to pre-identified, approved upland sites and surface topography will be restored to pre-construction conditions. All wetland habitat to be temporarily impacted will be restored and revegetated. At the southern terminus of the pipeline, near the EcoElectrica facility, approximately 770 linear feet of estuarine habitat will be crossed. At this location, to further minimize impacts, the pipeline will be suspended above ground using a structural rack system. These racks will be spaced approximately 30-*

40 feet apart and the pipeline will be located several feet above ground to avoid impact to the habitat. The structural racks may impact (due to the diameter of the pilings) approximately 350 square feet of total area along this 770-foot stretch. These impacts are being coordinated closely with the NMFS Habitat Conservation Division staff and the U.S. Army Corps of Engineers. Field surveys along this small section of the pipeline confirmed no critical habitat and no T&E species present in this area.

A spill response plan for HDD was submitted to the U.S. Army Corps of Engineers.

6. Details of all sediment and control measures and their maintenance schedules to be employed as part of pipeline construction.

Response: *A detailed sediment control plan was provided to the U.S. Army Corps of Engineers.*

7. An analysis of alternatives, including different routes, placement of the pipeline on pilings rather than burial, and alternatives to the construction of a natural gas pipeline, such as the use of solar energy, as well as assessment of the environmental impacts of each alternative.

Response: *A detailed alternatives analysis was submitted to the U.S. Army Corps of Engineers.*

8. An evaluation of the potential impacts on listed sea turtles and corals and their habitat. Please see the review of potential impacts on listed sea turtles and corals and their habitat below.

Response: *A detailed review of the pipeline alignment location, coordinated with the DNER, confirmed no potential threat or impact to listed sea turtles and corals, and their habitat. The pipeline will not be located in any way that poses a realistic threat to either of these species. Please see the review of these species below:*

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). In addition to these species, this section will also cover Kemp's ridleys turtle (*Lepidochelys kempi*).

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. 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. 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.

6.1.4 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 in order 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 at excavated areas so that no turtle can fall into an open excavation. 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, the Project would not affect 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.

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 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 in order 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 at excavated areas so that no turtle can fall into an open excavation. 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, the Project would not affect 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.

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, 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.

6.3.4 Summary of Impacts

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

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 in order 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 at excavated areas so that no turtle can fall into an open excavation. 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, the Project would not affect 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.

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. 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 in order 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 at excavated areas so that no turtle can fall into an open excavation. 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, the Project would not affect 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 sargassum 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 designate 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 in order 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 at excavated areas so that no turtle can fall into an open excavation. 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, the Project would not affect the Kemp's Ridley's Sea Turtle.

6.6 *Acropora cervicornis*- Staghorn Coral

Status: Threatened

6.6.1 General Species Biology

The staghorn coral is a branching coral characterized by staghorn antler-like colonies with cylindrical branches ranging from a few centimeters to over 6.5 feet. The tissue color ranges from golden yellow to medium brown.

The dominant mode of reproduction is asexual with new colonies forming when branches break off and reattach to substrate. Sexual reproduction of this species is via broadcast spawning gametes into the water annually in August or September.

This coral is the fastest growing of all known western Atlantic corals. Staghorn coral has been one of the three most important Caribbean corals in terms of its contribution to reef growth and fish habitat.

6.6.2 Distribution and Abundance

The staghorn coral is found throughout the Florida Keys, the Bahamas, and widely distributed in the Caribbean islands. Staghorn coral occurs in back reef and fore reef environments from 0-98 feet deep.

Critical habitat for elkhorn and staghorn corals were designated in November 2008 in four areas: Florida, Puerto Rico, St. John/St. Thomas, and St. Croix. The Puerto Rico area comprised approximately 1,383 square miles of marine habitat (Federal Register/ Vol 73, No. 229)

6.6.3 Current Conditions

Currently, there are a number of stressors affecting the *Acropora* corals, both natural and anthropogenic. Without sufficient light, the ability for corals to grow and maintain photosynthetic rates is reduced. Land based sources of pollution such as sewage discharge, stormwater runoff, sediment loading associated with uncontrolled non-point source pollution cause stress to this species. Corals grow best in marine waters that are clear and free from excess nutrients, runoff, or algal blooms.

The proposed project is land based and does not involve any marine based development.

The pipeline has been designed to avoid impacting any marine habitats. Horizontal Directional Drilling (HDD) methods will be utilized when crossing major waterbodies. This method prevents the potential for sedimentation that can be associated with other pipeline installation methods. The pipeline laydown and extra work areas near coastal waters 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.

6.6.4 Summary of Impacts

Due to the stringent methods and location of construction activities on or near beaches and waterbodies, direct impacts to corals are not expected. Construction methods and sediment control methods will prevent any impacts to corals. Maintenance of the pipeline will be conducted by pipeline inspection gauges (PIG) and will not require any future open trenching or earth moving.

6.6.5 Indirect, Interdependent, Interrelated and Cumulative Effects

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

6.6.6 Conservation Measures and Recommendations

A sediment control plan has been provided to USACE. This will prevent any sediments from impacting offshore marine environments.

6.6.7 Conclusion

Based on the Current information available from DNER and the information within this document, the Project would not affect the staghorn coral.

6.7 *Acropora palmata*- Elkhorn Coral

Status: Threatened

6.7.1 General Species Biology

Elkhorn coral is the larger species of *Acropora* in the Atlantic. The elkhorn coral is a branching coral with flattened to near round frond-like branches reaching up to 50 cm across. The elkhorn can grow up to 12 feet in diameter. The tissue color ranges from a brown to a yellowish-brown.

The dominant mode of reproduction is asexual with new colonies forming when branches break off and reattach to substrate. Sexual reproduction of this species is via broadcast spawning gametes into the water annually in August or September.

This coral is fast growing, with colonies reaching their maximum size in approximately 10-12 years. Elkhorn coral has been one of the three most important Caribbean corals in terms of its contribution to reef growth and fish habitat.

6.7.2 Distribution and Abundance

The elkhorn coral is found throughout the Florida Keys, the Bahamas, and widely distributed in the Caribbean islands. Elkhorn coral is found in shallow water, 3-6 feet deep, throughout the Caribbean and Florida reefs. This coral species prefers exposed reef crest and fore reef environments in water depths less than 20 feet.

Critical habitat for elkhorn and staghorn corals were designated in November 2008 in four areas: Florida, Puerto Rico, St. John/St. Thomas, and St. Croix. The Puerto Rico area comprised approximately 1,383 square miles of marine habitat (Federal Register/ Vol 73, No. 229)

6.7.3 Current Conditions

Currently, there are a number of stressors affecting the *Acropora* corals, both natural and anthropogenic. Without sufficient light, the ability for corals to grow and maintain photosynthetic rates is reduced. Land based sources of pollution such as sewage discharge, stormwater runoff, sediment loading associated with uncontrolled non-point source pollution cause stress to this species. Corals grow best in marine waters that are clear and free from excess nutrients, runoff, or algal blooms.

The proposed project is land based and does not involve any marine based development.

The pipeline has been designed to avoid impacting any marine habitats. Horizontal Directional Drilling (HDD) methods will be utilized when crossing major waterbodies. This method prevents the potential for sedimentation that can be associated with other pipeline installation methods. The pipeline laydown and extra work areas near coastal waters 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.

6.7.4 Summary of Impacts

Due to the stringent methods and location of construction activities on or near beaches and waterbodies, direct impacts to corals are not expected. Construction methods and sediment control methods will prevent any impacts to corals. Maintenance of the pipeline will be conducted by pipeline inspection gauges (PIG) and will not require any future open trenching or earth moving.

6.7.5 Indirect, Interdependent, Interrelated and Cumulative Effects

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

6.7.6 Conservation Measures and Recommendations

A sediment control plan has been provided to USACE. This will prevent any sediments from impacting offshore marine environments.

6.7.7 Conclusion

Based on the Current information available from DNER and the information within this document, the project would not affect the elkhorn coral.

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

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. If all of the procedures identified are implemented, it is expected that any effects to suitable habitat and individual species will be mitigated and that a may affect, but not likely to adversely affect (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.

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Table 15: Section 7 Affects Determination

PREPA VIA VERDE PIPELINE USFWS/NMFS SECTION 7 AFFECTS DETERMINATION							
SCIENTIFIC NAME	COMMON NAME	NAME SPANISH	GROUP	STATUS	DISTRIBUTION	DETERMINATION	COMMENTS
<i>Accipiter striatus venator</i>	Puerto Rican Sharp-Shinned Hawk	Falcon de Sierra	Bird	E	Monte Guilarte State Forest	MANLAA	See Appendix 1
<i>Agelaius xanthomus</i>	Yellow-Shouldered Black Bird	Mariquita	Bird	E, CH	Coastal Forest	No Affect	
<i>Amazona vittata vittata</i>	Puerto Rican Parrot	Cotorra Puertorriqueña	Bird	E	Rio Abajo State Forest	MANLAA	See Appendix 1
<i>Auerodendron pauciflorum</i>	No Common Name	No Common Name	Plant	E	Rio Abajo State Forest	MANLAA	See Appendix 1
<i>Banara vanderbiltii</i>	No Common Name	Palo de Ramon	Plant	E	Rio Lajas Hills	MANLAA	See Appendix 1
<i>Buteo platypterus brunnescens</i>	Puerto Rican Broad-Winged Hawk	Guaraguao de Bosque	Bird	E	Monte Guilarte State Forest	MANLAA	See Appendix 1
<i>Buxus vahalii</i>	Val's Boxwood	Diablito de Tres Cuernos	Plant	E	Tallaboa Limestone Hills	MANLAA	See Appendix 1
<i>Calyptronoma rivalis</i>	No Common Name	Palma de Manaca	Plant	T	Rio Abajo State Forest	MANLAA	See Appendix 1
<i>Caprimulgus noctitherus</i>	Puerto Rican Nightjar	Guabairo	Bird	E	Coastal Forest	MANLAA	See Appendix 1
<i>Catesbaea melanocarpa</i>	No Common Name	No Common Name	Plant	E	Dry Limestone Hills, Guayanilla to Ponce	MANLAA	See Appendix 1
<i>Chamaecrista glandulosa var mirabilis</i>	No Common Name	No Common Name	Plant	E	Tortuguero Lagoon Natural Reserve	MANLAA	See Appendix 1
<i>Chelonia mydas</i>	Green Sea Turtle	Peje Blanco	Reptile	T, CH	Coastal Zones	No Affect	Marine/Coastal Species
<i>Cordia alliodora</i>	No Common Name	No Common Name	Plant	E	Rio Abajo State Forest	MANLAA	See Appendix 1
<i>Cordia alliodora</i>	Chigger Palo	Palo de Nigua	Plant	E		MANLAA	See Appendix 1
<i>Cornutia obovata</i>	No Common Name	Palo de Nigua	Plant	E	Rio Abajo State Forest	MANLAA	See Appendix 1
<i>Cyathea dryopteroides</i>	Elfin Tree Fern	Helecho de Bosque Enano	Plant	E	Monte Guilarte State Forest	MANLAA	See Appendix 1
<i>Daphnopsis hellerana</i>	No Common Name	No Common Name	Plant	E	Nevarés Limestone Hills, Near Sabana Seca, Primate Center	MANLAA	See Appendix 1
<i>Dermochelys coriacea</i>	Leatherback Sea Turtle	Tinglar	Reptile	E, CH	Coastal Zones	No Affect	Marine/Coastal Species
<i>Eleutherodactylus jaunaruveroi</i>	Plains Coqui	Coqui Llanero	Amphibia	Under Review		MANLAA	See Appendix 1
<i>Epicrates inornatus</i>	Puerto Rican Boa	Boa Puertorriqueña	Reptile	E	Forested Volcanic and Limestone (Karst) Hills	MANLAA	See Appendix 1, Management Plan to be Provided
<i>Eretmochelys imbricata</i>	Hawksbill Sea Turtle	No Common Name	Reptile	E, CH	Coastal Zones	No Affect	Marine/Coastal Species
<i>Eugenia woodburyana</i>	No Common Name	No Common Name	Plant	E	Encarnación West of Las Cucharas	MANLAA	See Appendix 1
<i>Goetzea elegans</i>	Beautiful Goetzea	Matabuey	Plant	E	Coastal Zones	MANLAA	See Appendix 1
<i>Juglans jamaicensis</i>	West Indian Walnut	Nogal	Plant	E	Monte Guilarte State Forest (La Silla de Calderon)	MANLAA	See Appendix 1
<i>Mitracarpus maxwelliae</i>	No Common Name	No Common Name	Plant	E	Guanica Commonwealth Forest	No Affect	

PREPA VIA VERDE PIPELINE USFWS/NMFS SECTION 7 AFFECTS DETERMINATION							
<i>Mitracarpus polycladus</i>	No Common Name	No Common Name	Plant	E	Guanica Commonwealth Forest	No Affect	
<i>Myrcia paganii</i>	No Common Name	No Common Name	Plant	E	Biafara Arrozal	MANLAA	See Appendix 1
<i>Patagioenas (Columba) inornata wetmorei</i>	Puerto Rican Plain Pigeon	Paloma Sabanera	Bird	E	Lower Montane Forest and Riparian Habitats	No Affect	
<i>Ottoschulzia rhodoxylon</i>	No Common Name	Palo de Rosa	Plant	E	Media Luna Ward, Candelaria Ward, Sabana Ward	MANLAA	See Appendix 1
<i>Pelecanus occidentalis</i>	Brown Pelican	Pelicano Pardo	Bird	E	Coastal Zones, Lago Dos Bocas, No Nesting	No Affect	
<i>Peltophryne lemur</i>	Puerto Rican Crested Toad	Sapo Concho	Amphibia n	T	Northern Karst Regions	MANLAA	See Appendix 1, Management Plan to be Provided
<i>Pleodendron macranthum</i>	No Common Name	Chupacallos	Plant	E	Rio Abajo State Forest	MANLAA	See Appendix 1
<i>Polystichum calderonense</i>	No Common Name	No Tiene Nombre Comun	Plant	E	Cerrote Peñuelas	MANLAA	See Appendix 1
<i>Schoepfia arenaria</i>	No Common Name	No Tiene Nombre Comun	Plant	T	Rio Abajo State Forest (Cuesta de los Perros)	No Determination	See Appendix 1
<i>Solanum drymophilum</i>	No Common Name	Erubia	Plant	E	Rio Abajo State Forest	MANLAA	See Appendix 1
<i>Stahlia monosperma</i>	No Common Name	Cobana Negra	Plant	E	Northern Wetlands and White Sands	MANLAA	See Appendix 1
<i>Sterna dougallii</i>	Roseate Tern	Palometa	Bird	T, CH	Coastal Areas and Offshore Cays, Nesting	No Affect	Marine/Coastal Species
<i>Tectaria estremerana</i>	Halberd Fern	Helecho alabarda	Plant	E	Rio Abajo State Forest	MANLAA	See Appendix 1
<i>Thelypteris inabonensis</i>	No Common Name	No Common Name	Plant	E	None Identified near project	MANLAA	See Appendix 1
<i>Thelypteris yaucoensis</i>	No Common Name	No Common Name	Plant	E	None Identified near project	MANLAA	See Appendix 1
<i>Thelypteris verecunda</i>	No Common Name	Helecho doncella del Barrio Charcas	Plant	E	None identified near project	MANLAA	See Appendix 1
<i>Trichechus manatus manatus</i>	Antillean Manatee	Manati Antillano	Mammal	E	Coastal Zones	No Affect	Marine/Coastal Species
<i>Trichilia triacantha</i>	No Common Name	Bariaco	Plant	E	Encarnacion, (Urb. El Peñon), Tallaboa Poniente	MANLAA	See Appendix 1
<i>Zanthoxylum thomasianum</i>	St. Thomas Prickly Ash		Plant	E	Northern Karst Regions	MANLAA	See Appendix 1

Status

E = Endangered
T = Threatened
CH = Critical Habitat

Determination

No Affect = No Affect
MANLAA = May Affect Not Likely to Adversely Affect
May Affect = May Affect
No Determination = Determination to be Made by USFWS

APPENDIX 1
SELECTED SPECIES SURVEYS AND STUDIES

APPENDIX 2
POTENTIAL HABITAT MAPS
TEMPORARY IMPACT MAPS

APPENDIX 3
UNITED STATES FISH AND WILDLIFE SERVICE
NATIONAL MARINE FISHERIES SERVICE
Technical Assistance and Correspondence

APPENDIX 4

Letter from PREPA to DNER- Puerto Rican Crested Toad
Letter from DNER Regarding the Rio Abajo State Park Puerto Rican Parrot population