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 sp[illegible]havior, location or even the presence of adults when they are not [illegible]ct. 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 [illegible]ted on the southwest coast in Guánica forest has been documented, and a sm[illegible] 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.

(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.

(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.

The routes of the Vía Verde Pipeline project will temporarily (100-feet Right–of-Way) affect approximately 307acres of potential *Epicrates inornatus* habitat during the construction phase of the project. Permanent (50-feet Right–of-Way) impact was estimated at approximately 154 acres.

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.

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 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

in December 2010 and during the day and night during the month of January and February 2011. Playback calls were used during the night to encourage males to vocalize.

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

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

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

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

5.2.7.3 *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

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

A variety of fruits, seeds and livestock feed make up the diet of this species. Approximately 7O percent of the foods come from tree branches, and 30 percent from the ground. Principal foods are royal palm (*Roystonea borinquena*); mountain immortelle (*Erythrina poeppigiana*); West Indies trema (*Trema lamarckiana*); and white prickle (*Zanthoxylum martinicense*). Water is usually taken from the axils of bromeliads or from water-retaining blossoms of the African tulip-tree (*Spathodea campanulata*) (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.

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.

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

near Guayanilla and Parguera. The Conservation Trust of Puerto Rico has also acquired lands in the Guayanilla-Peñuelas region, this area includes mature dry forest where nightjars are abundant. The present distribution represents only a small fraction (estimated at 3%) of the nightjar's former range, which is known to have included moist limestone forests along the north coast as far eastward as Bayamon, and may have extended inland to the lower cordillera.

The current population is estimated to be between 1,400 and 2,000 mature birds and expected to be stable as long as the habitat is not altered and introduced predators such as and cats, are controlled. The current classification is mainly due to the special habitat on which it depends being heavily fragmented and degraded. As a result of this habitat fragmentation, the population is very patchily distributed. Disturbances that could significantly threaten nightjars in their remaining forest refuges include tree cutting, road and utility line construction and maintenance, extensive recreational use of the forests, wild fires, and grazing by domestic stock. About half of the current nightjar habitat is in protected public forests, but the remainder, including lands adjacent to the public forests, is privately held forestland susceptible to conversion to other uses.

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

5.2.5.3 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.**

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.

3.2.5.2 *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

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

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.

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

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.

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

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 brunnescens* – (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

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.

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

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

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.

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.**

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

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:

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

5.1.29 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

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.

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

5.1.28.3 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.;**

5.1.27.2 Distribution and Abundance

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

5.1.27.3 Current Conditions

***T. yaucoensis* was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor. Additionally, this species was not observed during the threatened and endangered vegetation survey conducted by Franklin Axelrod, Ph.D.**; 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;

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

5.1.26.1 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

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

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

5.1.25.3 *Current Conditions*

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

(USFWS 1990). The species and the maiden hair of Puerto Rico (Adiantum vivesii) share local habitats and characteristics.

5.1.24.3 *Current Conditions*

***T. estremerana* was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor Additionally, this species was not observed during the threatened and endangered vegetation survey conducted by Franklin Axelrod, Ph.D.;** 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.

- 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 not detected. Therefore, the Project may affect, but is not likely to adversely affect *S. monosperma* species.

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

Federal Status: Endangered

5.1.24.1 General Species Biology

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

5.1.24.2 Distribution and Abundance

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

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;

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

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. drymophillum* was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor Additionally, this species was not observed during the threatened and endangered vegetation survey conducted by Franklin Axelrod, Ph.D.**; 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.

5.1.21.3 *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.

- 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 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.

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;

- 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. calderonense* is only

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;

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.

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

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.

5.1.16.7 Conclusion

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

5.1.17 *Myrcia paganii* – (No Common Name)

Federal Status: Endangered

5.1.17.1 General Species Biology

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

5.1.17.2 Distribution and Abundance

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

5.1.17.3 Current Conditions

***M. paganii* was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor. Additionally, this species was not observed during the threatened and endangered vegetation survey conducted by Franklin Axelrod, Ph.D.**; 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

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.

5.1.14.7 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-glubose, and from 0.8 to 1.3 centimeters in diameter. The corolla is white, narrowly funnelform, minutely glandular-papillose, and 5 to 6 millimeters long. The capsule is about 1.5 millimeters in diameter, opening by a transverse circular split at about the middle. The seeds are ellipsoid, brownish-black, and 1.2 millimeters long and 0.8 millimeter wide (Proctor 1991a).

5.1.15.2 Distribution and Abundance

M. 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.

5.1.14.3 *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.

5.1.13.7 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.

5.1.13.3 *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.

- 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 son April 19, 1985.

5.1.13.2 Distribution and Abundance

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

5.1.12.2 *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;

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.

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

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

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

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 *Cyatheales*. The genus name *Cyathea* is derived from the Greek kyatheion, meaning "little cup", and refers to the cup-shaped sori on the underside of the fronds. Several botanists have previously classified this species in the Alsophila genus. They are mostly terrestrial ferns, usually with a single tall stem. *Cyathea dryopteroides* is a small tree fern about 2 feet tall with a trunk of an inch in diameter. Fronds are 3 feet long. Like all ferns, this species reproduces by spores. Plants in state of reproduction as

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

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

5.1.7.7 *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 km^2 (1,200 acres). In Anegada the species is locally abundant in limestone and sand dunes, showing a slight preference for limestone.

5.1.8.3 *Current Conditions*

***C. rupicola* was not observed during the Coll Rivera Environmental field surveys of the project's proposed corridor. Additionally, this species was not observed during the threatened and endangered vegetation survey conducted by Franklin Axelrod, Ph.D.;**

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.

- 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 that wide. The corolla is white with four subcylindrical lobes. Fruit, appearing from October to January, is a dotted, drupe 5 mm (0.25 inches) long. This dioecious species produces white, axillary, unisexual flowers which have a thin and reduced Corolla. Plants are dense and shrubby, with shade branches that become divergent at obtuse angles. These branches ensnare the plant to adjacent trees. The species entered federal lists on January 10, 1997.

5.1.7.2 Distribution and Abundance

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

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