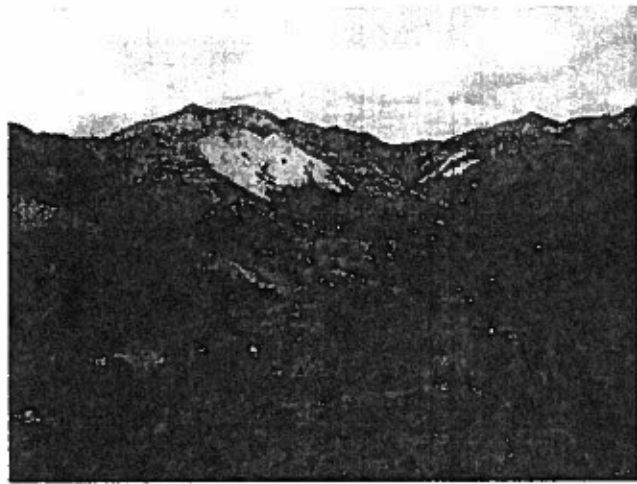




**TETRA TECH**

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

**Via Verde Project  
Puerto Rico**



**Prepared for:**

**Assesores Ambientales y Educativos  
&  
Puerto Rico Electric Power Authority**

**By:**

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**February 2011**

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### 3.0 RESULTS AND DISCUSSION

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

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

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

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



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



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

## 2.0 METHODS

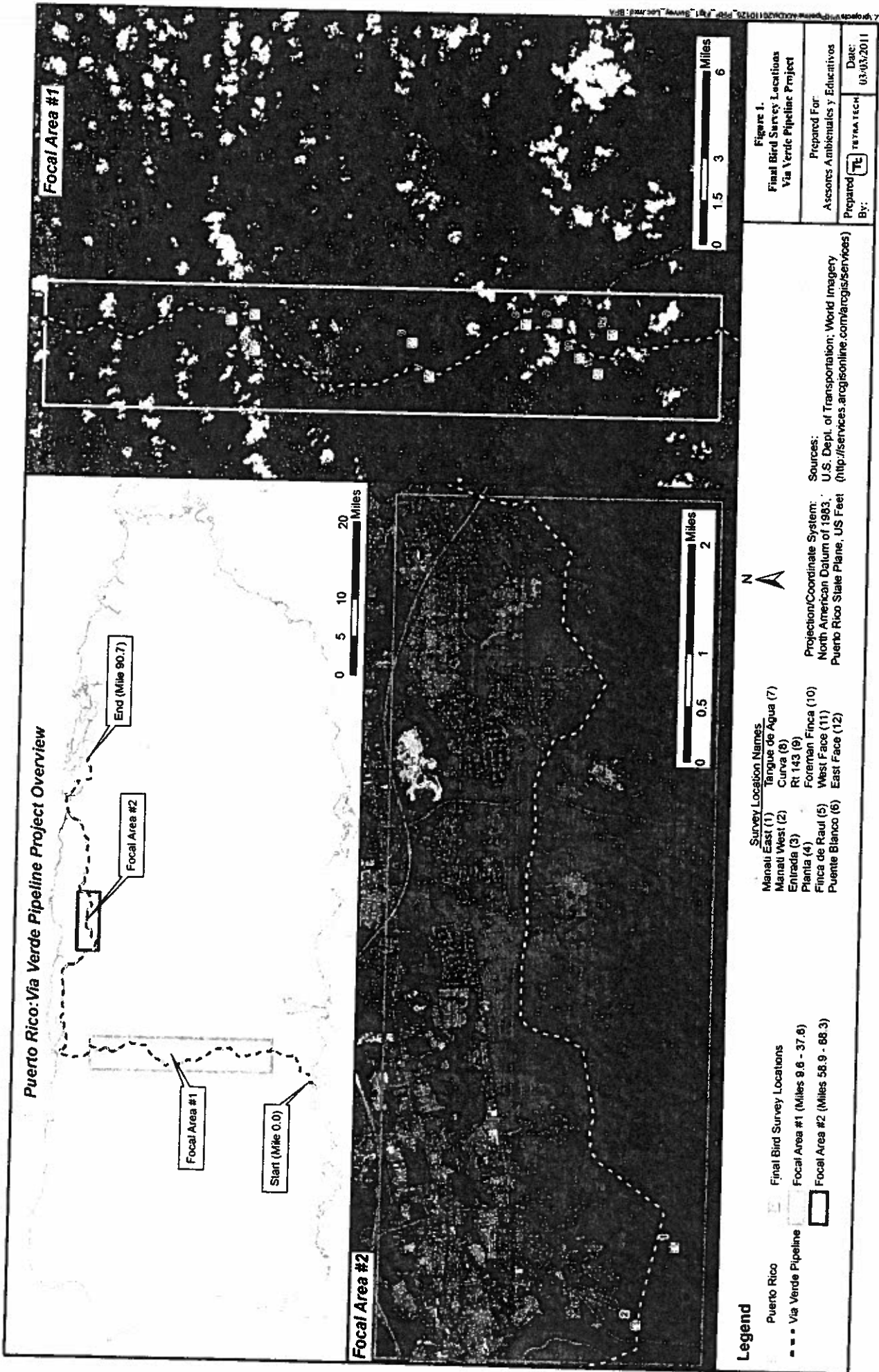
Tetra Tech biologists conducted birds surveys for parrots, broad-winged hawks, and sharp-shinned hawks from observation points in forested areas within the Project area (Figure 1.0). Areas selected for surveys were identified during an initial biological evaluation (Focal Areas 1 and 2) and ground-truthed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

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

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

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

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



**Puerto Rico: Via Verde Pipeline Project Overview**

0 5 10 20 Miles

Focal Area #1

End (Mile 90.7)

Focal Area #2

Focal Area #1

Start (Mile 0.0)

Focal Area #2

0 0.5 1 2 Miles

0 1.5 3 6 Miles

**Legend**

- Puerto Rico
- Via Verde Pipeline
- Final Bird Survey Locations
- Focal Area #1 (Miles 9.6 - 37.6)
- Focal Area #2 (Miles 58.9 - 88.3)

- Survey Location Names**
- Manau East (1)
  - Manau West (2)
  - Enrada (3)
  - Finca de Rauli (4)
  - Puente Blanco (6)
  - Tanque de Agua (7)
  - Curva (8)
  - RT 143 (9)
  - Foreman Finca (10)
  - West Face (11)
  - East Face (12)



**Projection/Coordinate System:**  
 North American Datum of 1983, U.S. Dept. of Transportation; World Imagery  
 Puerto Rico State Plane, US Feet (<http://services.arcgis.com/arcgis/Services>)

**Figure 1.**  
 Final Bird Survey Locations  
 Via Verde Pipeline Project

Prepared For:  
 Acciones Ambientales y Educativas

Prepared By: TEL TERRA 1654

Date:  
 US-03/2011

## 1.0 INTRODUCTION

### 1.1 Project Overview

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

### 1.2 Project Area Description

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

### 1.3 Goal and Objectives

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

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

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TETRA TECH

**2011 Survey Report for the Endangered  
Puerto Rican Parrot**

**Via Verde Project  
Puerto Rico**



**Prepared for:**

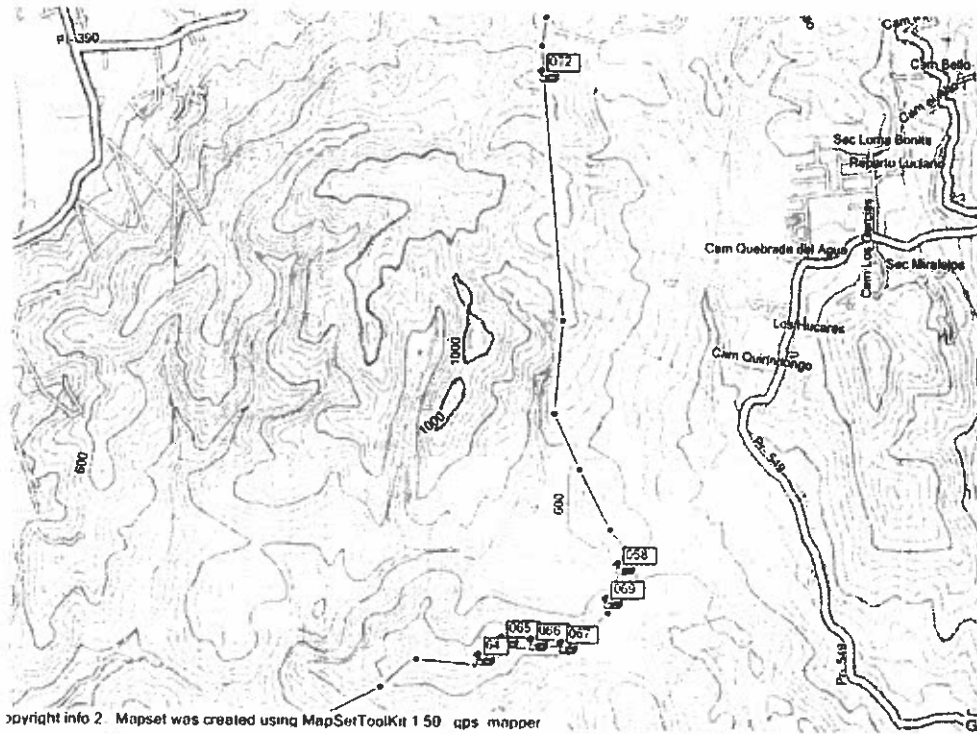
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Puerto Rico Electric Power Authority**

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**March 2011**

**Fig. 1. Approximate location of the study area.**



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

**South Transect Route**

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

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

**Center Transect Route**

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

**Table 2. Results for each transect route**  
**North Transect Route**

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

**Table 1. Moon stages during the sampling period.**

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

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

## RESULTS

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

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

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

Summarized descriptions of results for each transect route follow (Table 2):

The reported number of Nightjars represents the maximum detected for each route across all morning and evening sessions, respectively.

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

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



the dawn of March 2, 2011.

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

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

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

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

## **STUDY AREA**

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

## **FIELD ACTIVITIES**

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

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

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

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

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

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

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

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

## **PROJECT APPROACH**

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

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

## **METHODOLOGY**

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

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

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

## INTRODUCTION

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

## SPECIES DESCRIPTION

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

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

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

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

Prepared for  
**Asesores Ambientales y Educativos, Inc.**

**March 8, 2011**

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

#### **Impacts to the Puerto Rican boa's habitat**

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

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



### **Description of the Puerto Rican boa**

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

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

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

### **Methodology**

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

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

**Vía Verde Natural Gas Pipeline Project**

Prepared for:

**Puerto Rico Energy and Power Authority**

Prepared by:



COLE RIVERA  
ENVIRONMENTAL

22 de febrero de 2011

Table 1. Dates of visits.

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

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



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

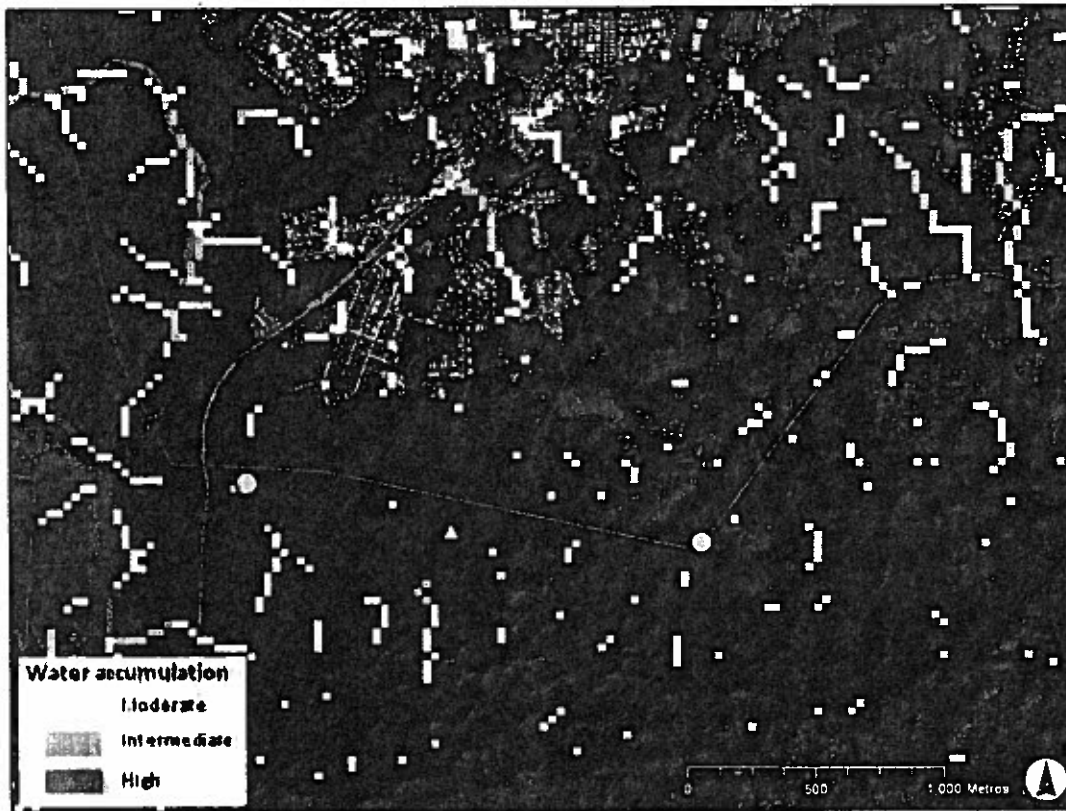


Figure 11. Aerial photo of Vega Baja section showing the areas of accumulation that were identified for the search of the crested toad.

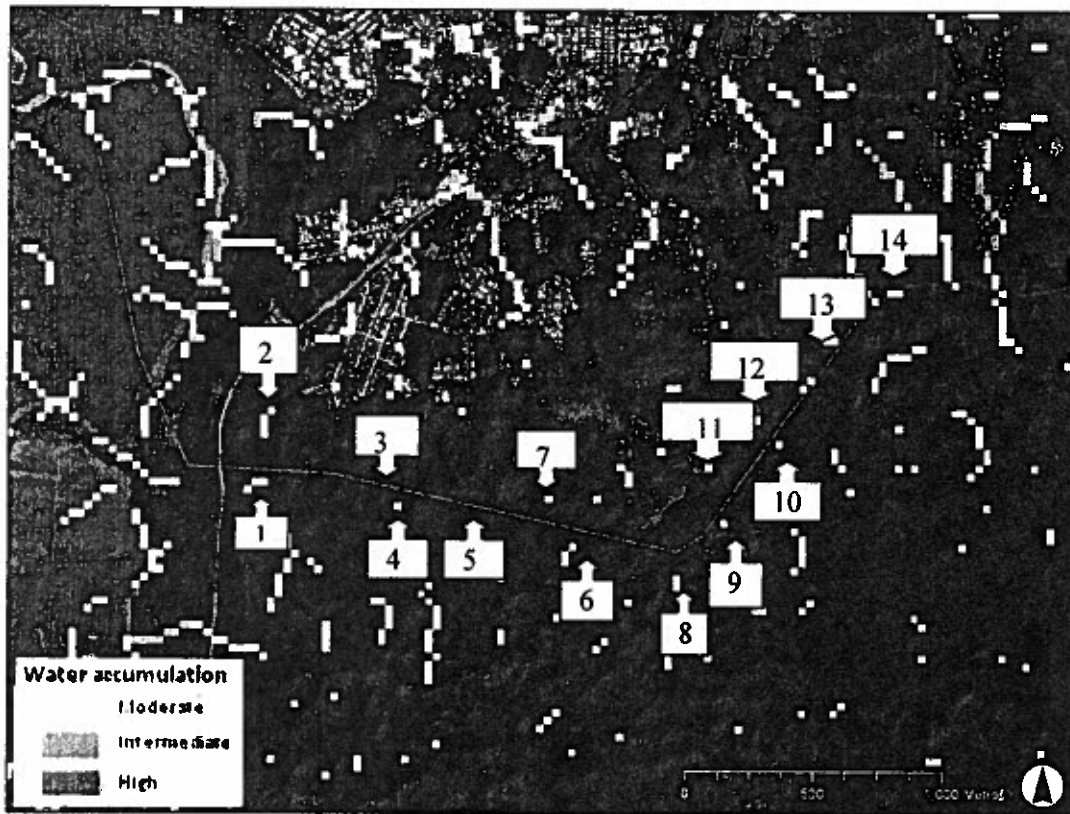


Figure 10. Photos showing the area between point 5 and 6, these areas were identified as potential habitat for the crested toad.

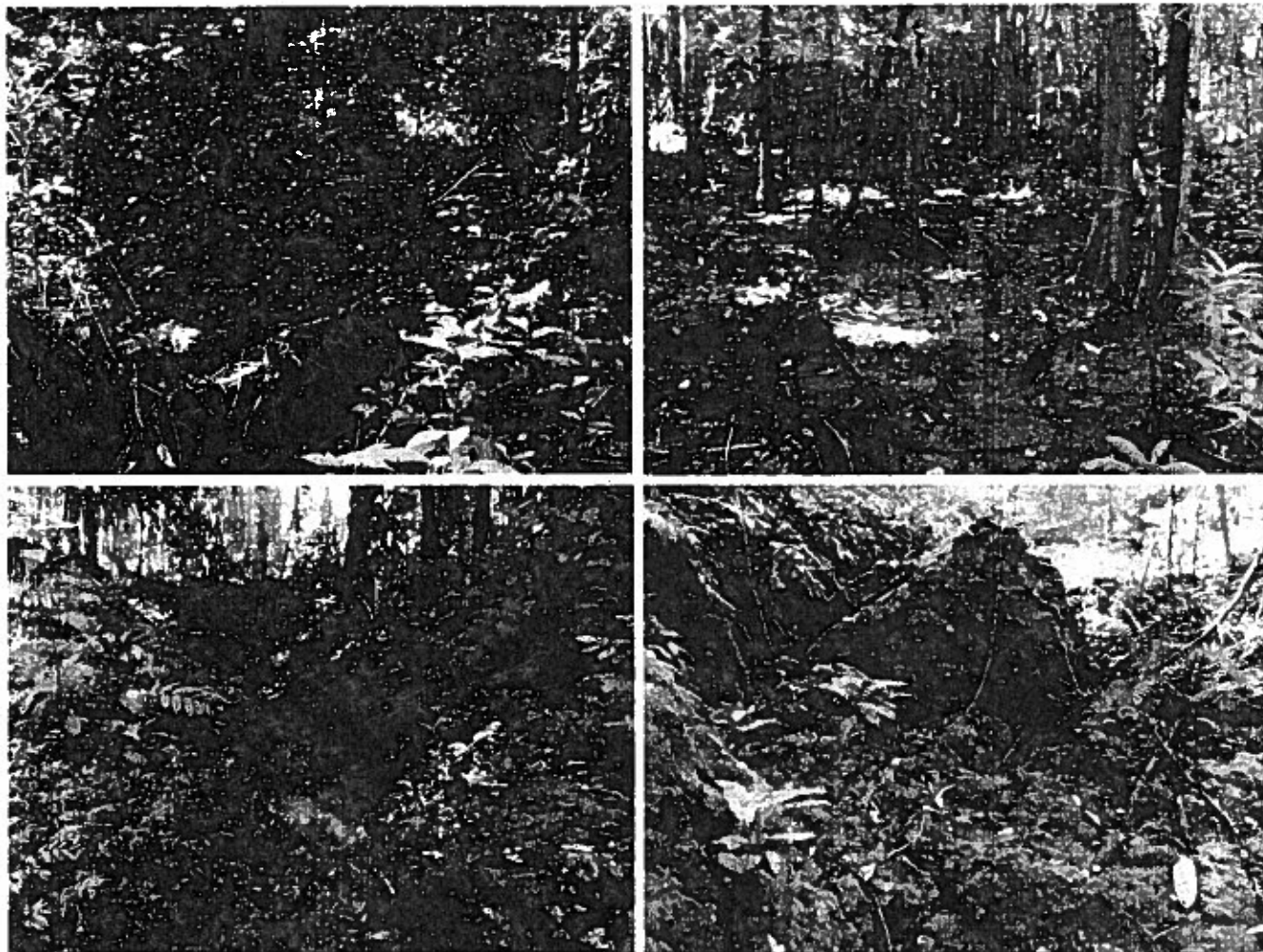


Figure 9. Photo of the artificial pond found near the second water accumulation area.





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

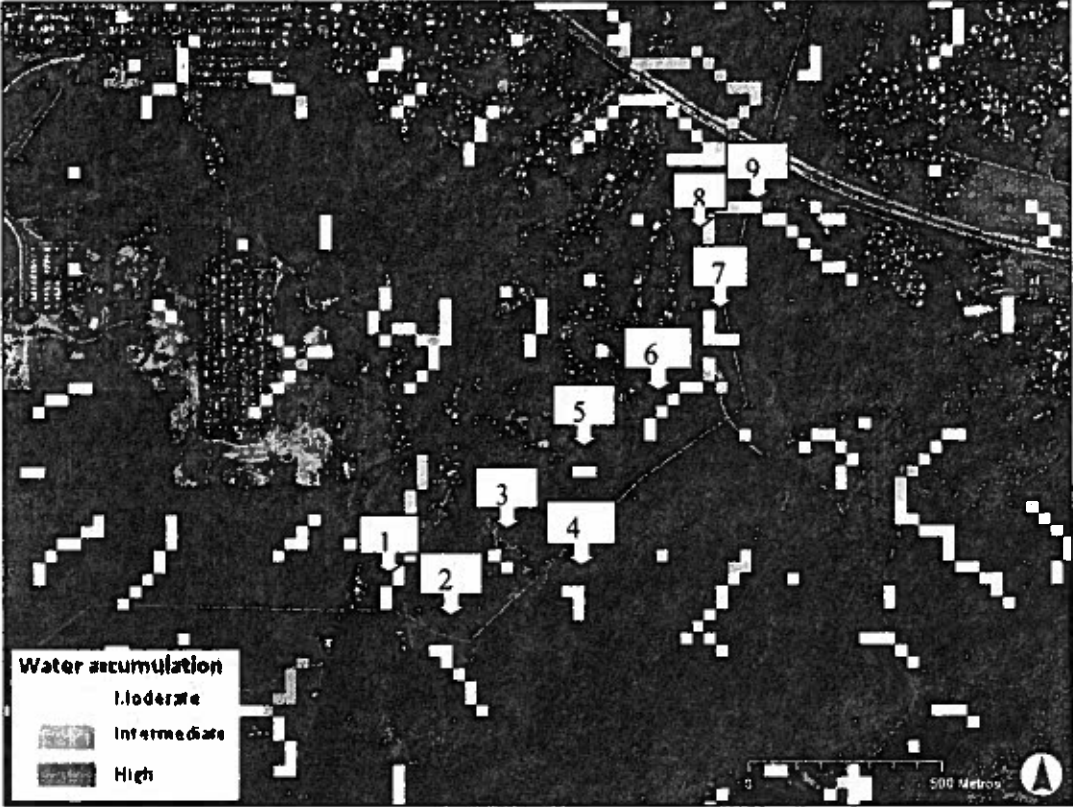


Figure 7. Aerial photo of Peñuelas section showing the areas of accumulation that were identified for the search of the crested toad and the permanent ponds identified as potential reproduction areas for the species (ponds are represented by blue points).

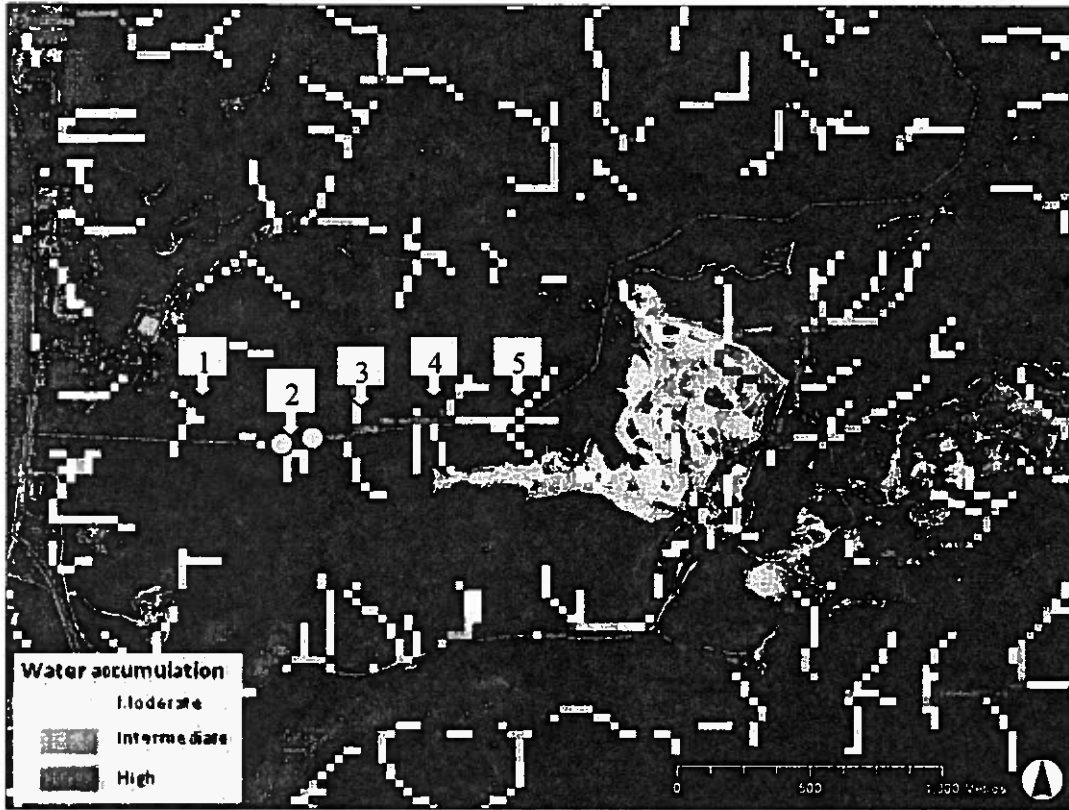


Figure 6. Aerial photo of the section studied at the municipality of Toa Baja. Points 1-9 were used as reference points within the alignment. The blue dot in the figure point out the locality where the species was heard.

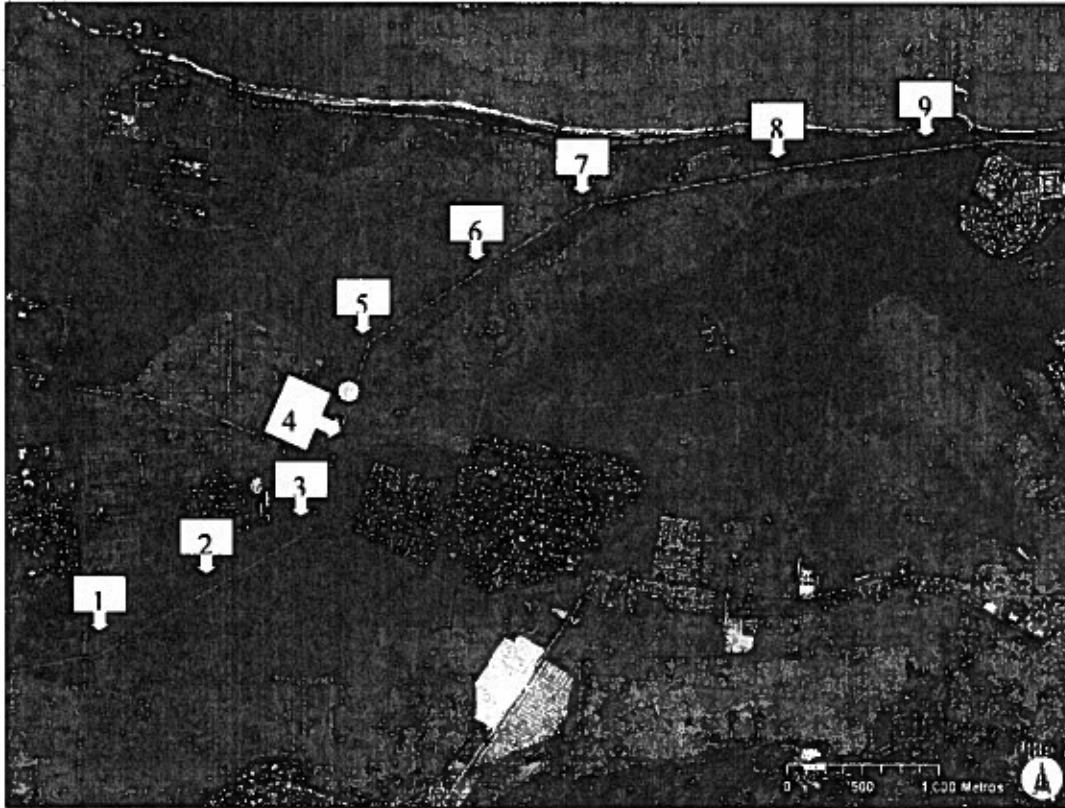


Figure 5. Aerial photo showing the water flow accumulation model for Manatí section.

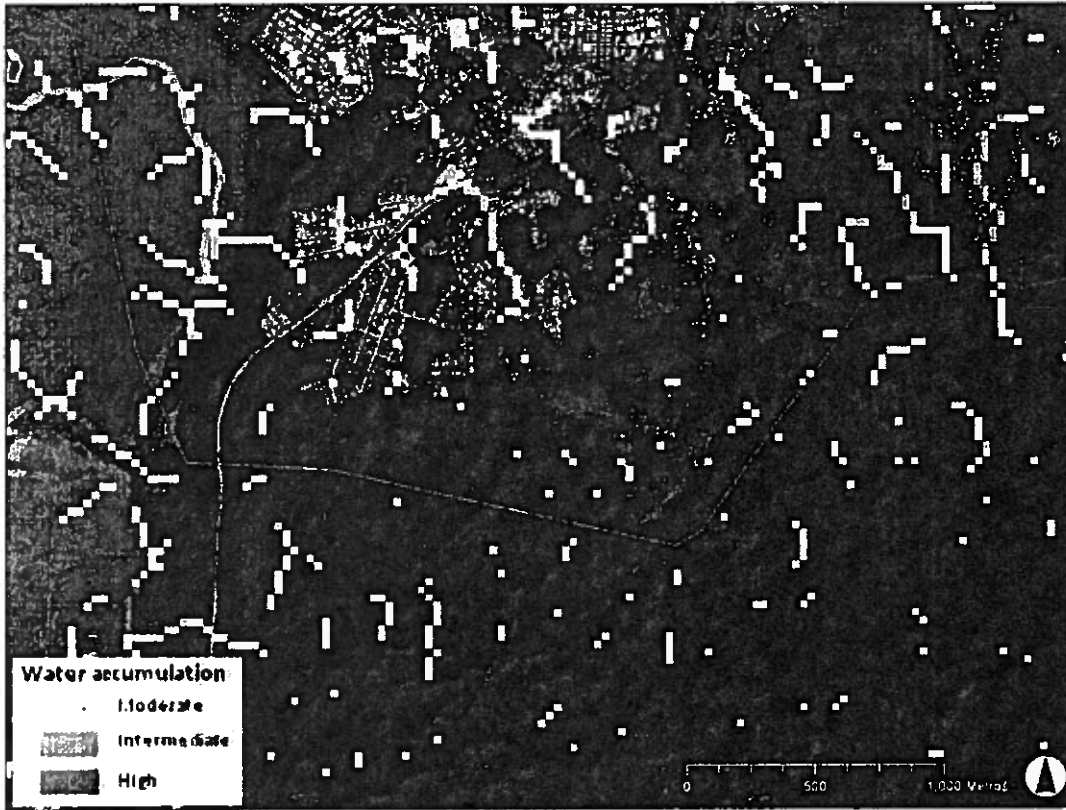


Figure 4. Aerial photo showing the water flow accumulation model for Vega Baja section.

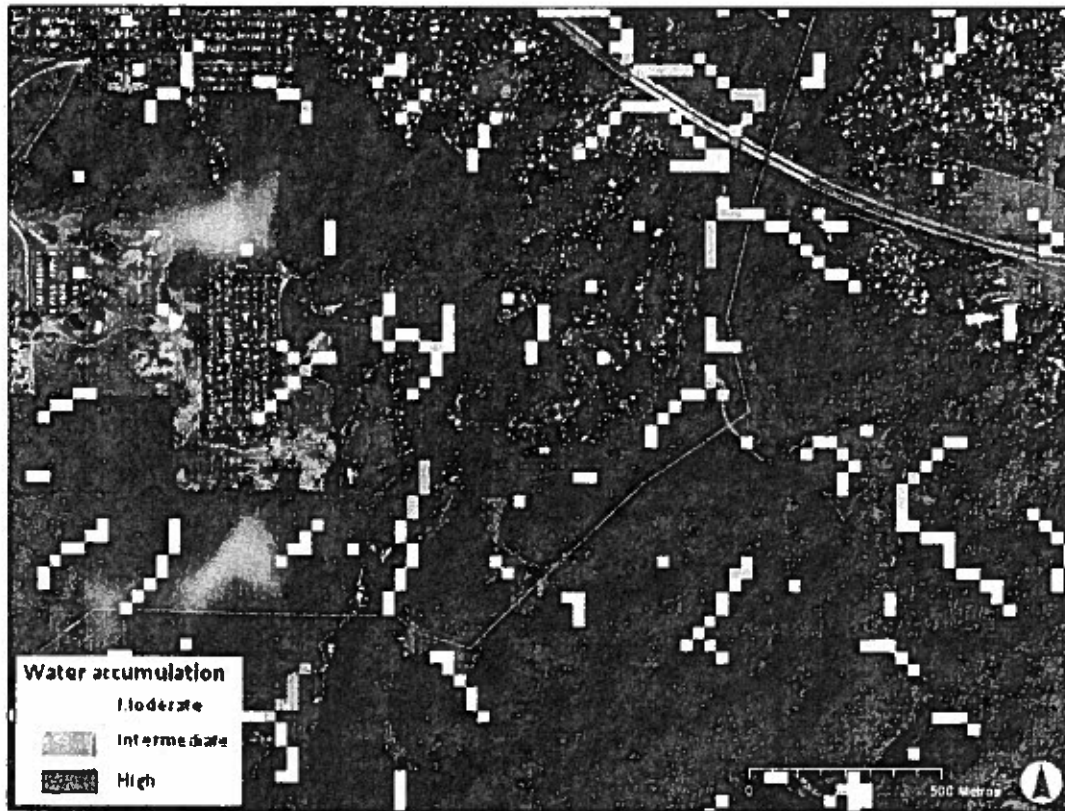


Figura 3. Aerial photo showing the water flow accumulation model for Peñuelas section.

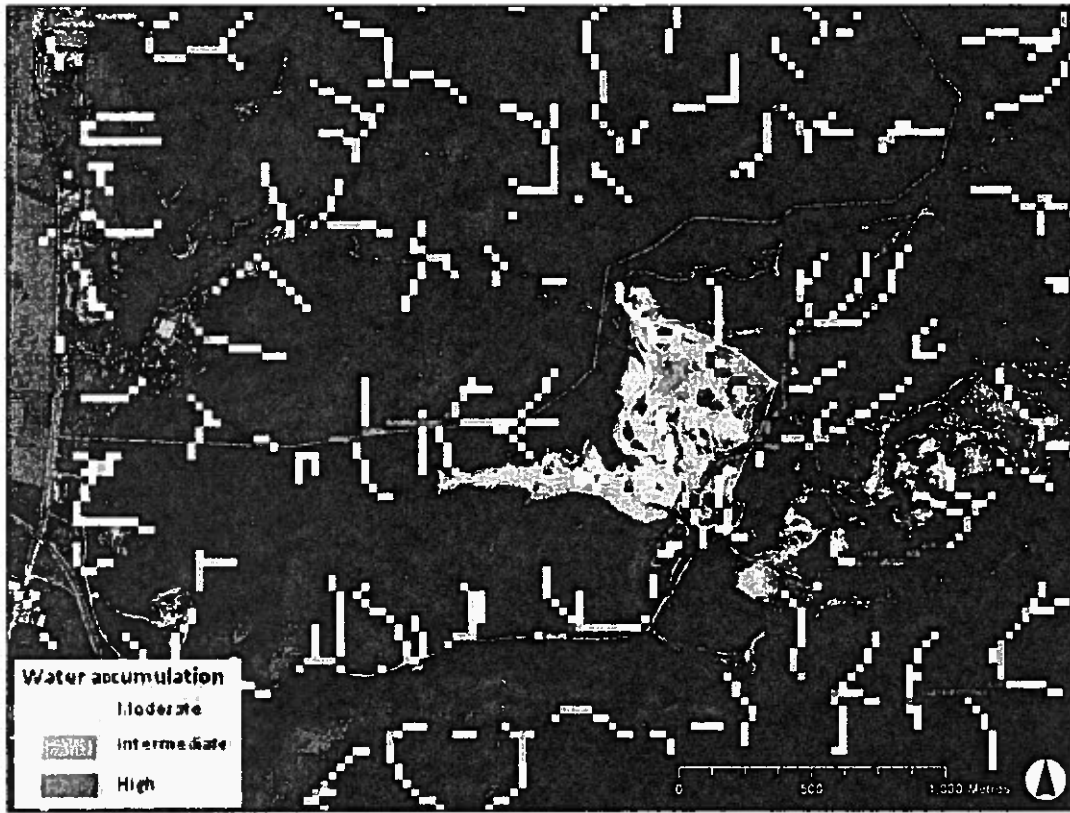


Figure 2. Photo of a male of the coquí llanero (*Eleutherodactylus juanariveroi*).  
Source: Ríos López, 2007.

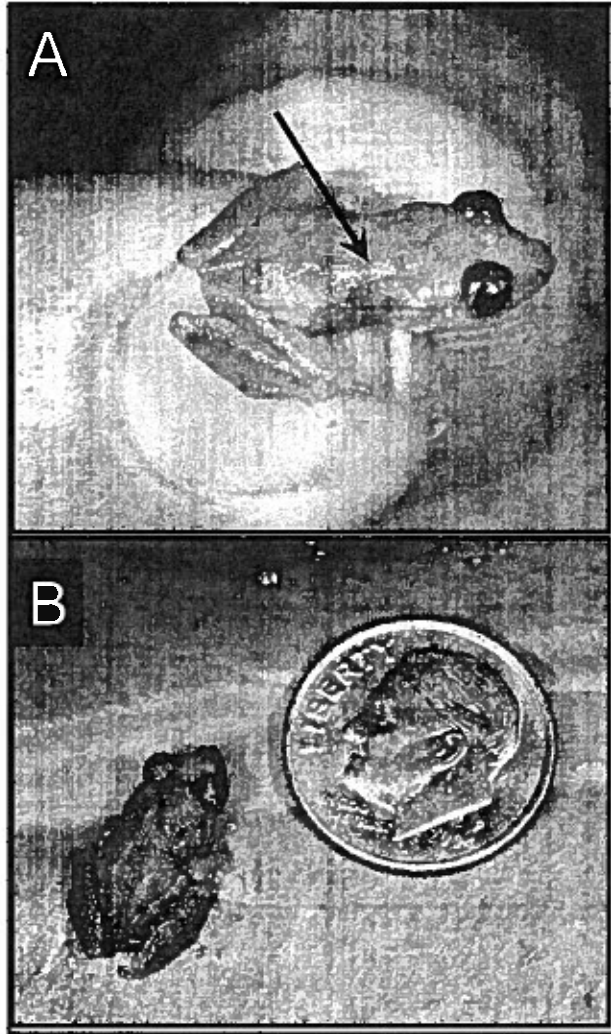


Figure 1. Photo of a male of crested toad (*Peltophryne lemur*). Photo: Alberto R. Puentes-Rolón

