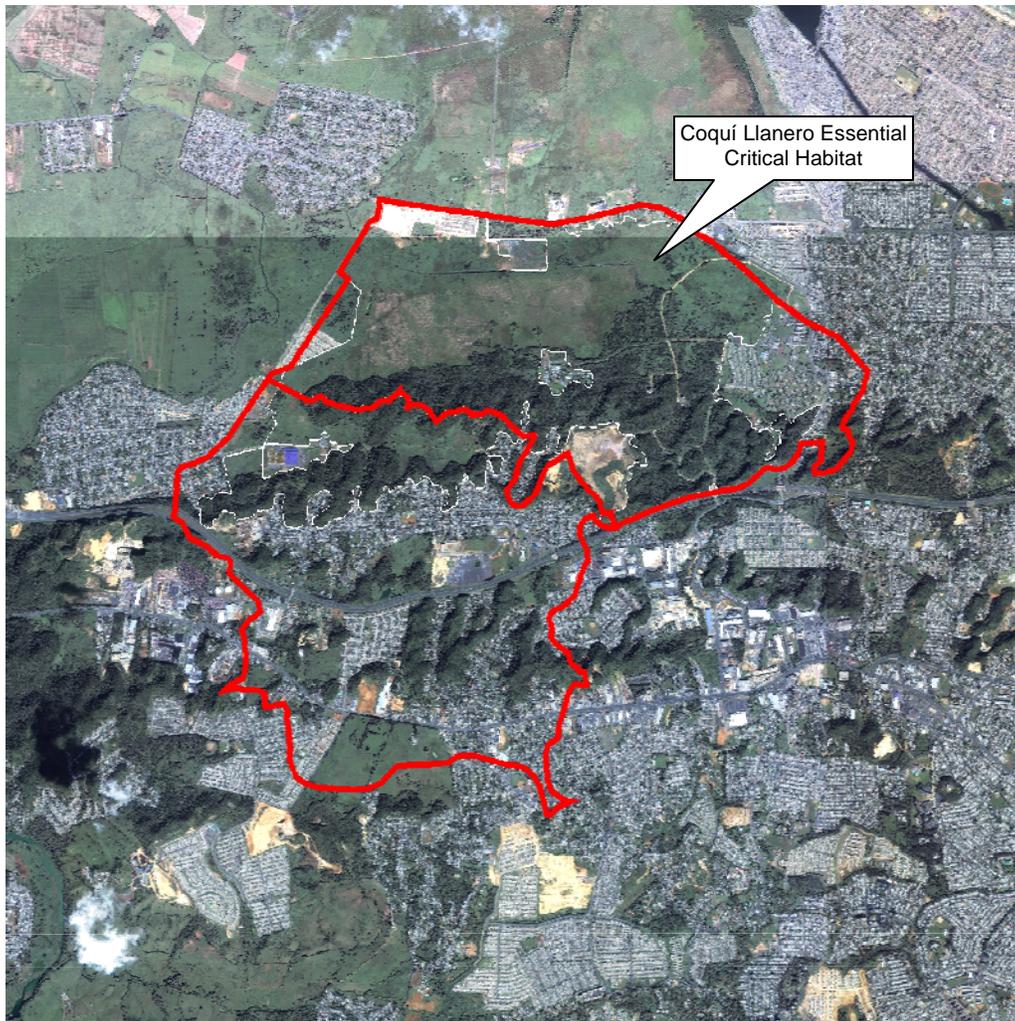


# Delimitation of the Watershed Tributary to the delimited Habitat of the Coquí Llanero, Sabana Seca, PR



July, 2007

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# Gregory L. Morris Engineering

## Delimitation of the Watershed Tributary to the Delimited Habitat of the Coquí Llanero Sabana Seca, PR

July 6, 2007

### 1. **INTRODUCTION**

#### 1.1. **Scope and Purpose**

In 2005 new Coquí species was identified in a wetland adjacent to the former Sabana Seca Naval Communication Station in Toa Baja. An area of Essential Critical Habitat was delimited that includes the wetland and adjacent areas. This report describes the limits of the watershed which is tributary to the identified Essential Critical Habitat area of the Coquí Llanero (*Eleutherodactylus juanriveroi*) as delimited by the Department of Natural and Environmental Resources (DNER).

#### 1.2. **Report Limitations**

The report presents surface water drainage patterns only; it does not discuss groundwater flow patterns.

#### 1.3. **Authorization**

Preparation of this report has been performed through contract with the Water Plan Office (*Oficina Plan de Agua*) of the Department of Natural and Environmental Resources.

## **2. STUDY AREA DESCRIPTION**

The identified Essential Critical Habitat of the Coqui Llanero consists of wetlands in which the species has been observed plus adjacent undeveloped upland areas. This habitat includes floodplain areas inundated by Río de la Plata, limestone hills (mogotes), and blanket sands which comprise the valleys between the mogotes. The species has been identified and is known to reproduce in the wetland area.

The Essential Critical Habitat area as delimited by DNER is presented in **Figure 1**. It includes two principal types of habitat.

- Wetlands on the Río de la Plata floodplain (474 cuerdas), an area where the species is known to reproduce, generally occupies the northwestern portion of the Essential Critical Habitat area; and
- Additional areas (1,195 cuerdas) which also include some wetlands, relatively level upland areas, and steep limestone haystack hills (mogotes).

Elevations in the area range from 1 to 125 meters above sea level. Rio La Plata is the principal source of flooding in the area and its channel is located approximately 5 km east of the western limit of the identified habitat.

The habitat area has also been outlined on a recent aerial photo, as shown in **Figure 2**. To the west this habitat is circumscribed by a recent housing development, which tends to separate the habitat area from the remaining portion of the Río de la Plata floodplain

### 3. **WATERSHED LIMITS**

Watershed limits have been determined based on USGS topographic mapping, aerial photography and site visits on June 12 and June 20, 2007.

Being an area of karst topography plus river floodplain, stormwater drainage patterns within the study area are influenced by several factors.

- Wetland areas within the Essential Critical Habitat area may be affected by overflow from Río de la Plata. The FEMA map for the area (**Figure 3**) indicates that wetlands in the northwestern area of the Essential Critical Habitat may be inundated by the 100-year flood from Río de la Plata.
- Surface drainage patterns from specific storms are affected by the capacity of sinkholes, which may vary overtime.
- Drainage canals dug many decades ago for agricultural purposes have modified drainage conditions. These canals accelerate and concentrate runoff but have not modified the watershed boundaries.
- The Toa Baja landfill operation has modified the drainage pattern within its boundaries, and drainage patterns from the landfill can change over time as a result of earth movement. The specific drainage pattern within the landfill area has not been delimited in this study. However, it is known that leachate from the landfill does flow north to enter the Essential Critical Habitat area, as observed during the field inspection on June 20.

The delimitation prepared here shows the entire area which can potentially contribute runoff that enters the Essential Critical Habitat during severe rainstorms, based on surface topography.

From the standpoint of delimiting watersheds, the Essential Critical Habitat will be subdivided into two-areas based on runoff and flow patterns anticipated during rains not sufficient to cause flooding by Río de La Plata.

1. The **NORTH WATERSHED** is delimited in **Figure 4** and **Figure 5**. It receives runoff from the following directions: (1) from the south it may receive both surface and shallow sub-surface runoff from the mogotes; (2) from the east it receives runoff from the developed portion of the naval communications station; (3) from the north it receives runoff from the adjacent small community along highway PR-867, the highway, and small businesses including the go-kart racing track; and (4) from the west it receives runoff

from a portion of the exiting urban developments bordering the Brisas de Campanera urbanization (**Figure 7A**). This area also receives all runoff from the South Watershed via the drainage canal depicted in **Figure 4** and **Figure 5**, and which runs along the east side of the Brisas de Campanera development. A photograph of the channel which conveys runoff into the North Watershed area of the Essential Critical Habitat area is shown in **Figure 7B**. See **Figure 7C** for photos location.

Field inspection on June 20, 2007 determined that this watershed receives leachate from the Toa Baja Municipal Landfill, via drainage along the perimeter fence road on the Naval Station site. The area where this drainage was observed is shown in **Figure 6**. This problem is known to regulatory agencies but we did not investigate the status of any remedial actions.

2. The **SOUTH WATERSHED** receives runoff from limestone topography and drains through a dug canal and into the North Watershed. It is delimited in **Figure 4** and **Figure 5**.

During smaller rainfall events, the drainage within this watershed will discharge primarily to sinkholes and runoff will not be generated from the entire watershed area. However, during extreme rainfall and flooding events the watershed which may contribute runoff to this area is very large and is delimited in **Figure 4** and **Figure 5**. Personnel of our office have observed that surface runoff from the south side of PR-22 entered the Critical Habitat area as a result of rains that occurred during the week of October 10, 2005.

#### **4. CONCLUSIONS**

1. Runoff from the North Watershed drains into a wetland area where the species is known to reproduce. While there are some canals that have historically drained this area, over much of the area these canals are in disuse and have filled with sediment. As a result, stormwater runoff from this area may be dispersed over a wide area within the wetland during a rainfall event. The North Watershed, and a particularly on the Naval Station site, has been of low density. An increase in land use intensity may be expected to significantly affect water quality and flooding hydroperiod. This area also receives landfill leachate.
2. The South Watershed has intense land use and probably generates significant amounts of contaminants. However, this effect on the species habitat may actually be more limited than in the North Watershed because this runoff generally tends to pass through canals and along distinctive drainage paths, instead of spreading out across a large wetland area.
3. There are actively maintained artificial drainage channels that runs and help drain wetland areas in the North Watershed. We do not know how water levels and wetland drainage may influence the habitat for this species.

## 5. **RECOMMENDATIONS**

1. North Watershed Management. Because runoff from the North Watershed drains directly to the wetland areas where the species is known to reproduce, and because this runoff may become dispersed within this wetland, water quality controls are particularly important in this watershed. Strict development controls are recommended within the North Watershed, focusing on “green” stormwater management strategies. These controls should focus on techniques such as the following:
  - Route all runoff through detention structures designed to maximize contaminant capture.
  - Maximize green area and minimize impervious surfaces.
  - Utilize vegetation buffers and maintain runoff dispersed (rather than concentrated) is so far as possible.

Other strategies may also be useful. It is recommended that the Department establish “green” guidelines for storm water management in environmental sensitive areas, and that said guidelines be applied within the Northern Watershed.

Landfill leachate is a strong contaminant that enters the North Watershed. There is also a significant amount of eroded soil from the landfill that enters the wetlands, draining north through the monkey farm area. An aggressive management program should be implemented to address both sources of contaminants.

A vegetative buffer zone is recommended around all wetland areas within the Essential Critical Habitat area. This buffer should be established based on hydrologic units related to wetland limits and surface drainage features, such as canals. The objective is to maximize the potential for vegetative cleaning of runoff. As such, these buffers should be established in coordination with the “green” stormwater guidelines.

2. South Watershed Management. Outside of the Essential Critical Habitat area, the South Watershed is much more developed than the North Watershed. This area contains industrial activities, two major highways (PR-2 and PR-22), and extensive areas of urban development. There is not a large amount of land area that is available for new development, and much of the residential area has been developed in an informal manner, lacking even basic stormwater drainage infrastructure such as pipes.

“Green” stormwater management guidelines should be applied within the South Watershed area to the extent practical. However, the combination of existing known flooding problems within this area plus the existing high density of existing development will require that each situation be considered on a case-by-case basis to seek opportunities for water quality enhancement.

Inasmuch as runoff in the South Watershed tends to flow along defined channels, erosion and the transport of eroded material along these channels is a potentially significant issue.

3. All Watersheds. Community education should be undertaken in the urbanizations adjacent to the Essential Critical Habitat area. A key element of this education should focus on avoiding the discharge of contaminants (detergents, oil, etc) onto streets which drains into the wetland.

# FIGURES

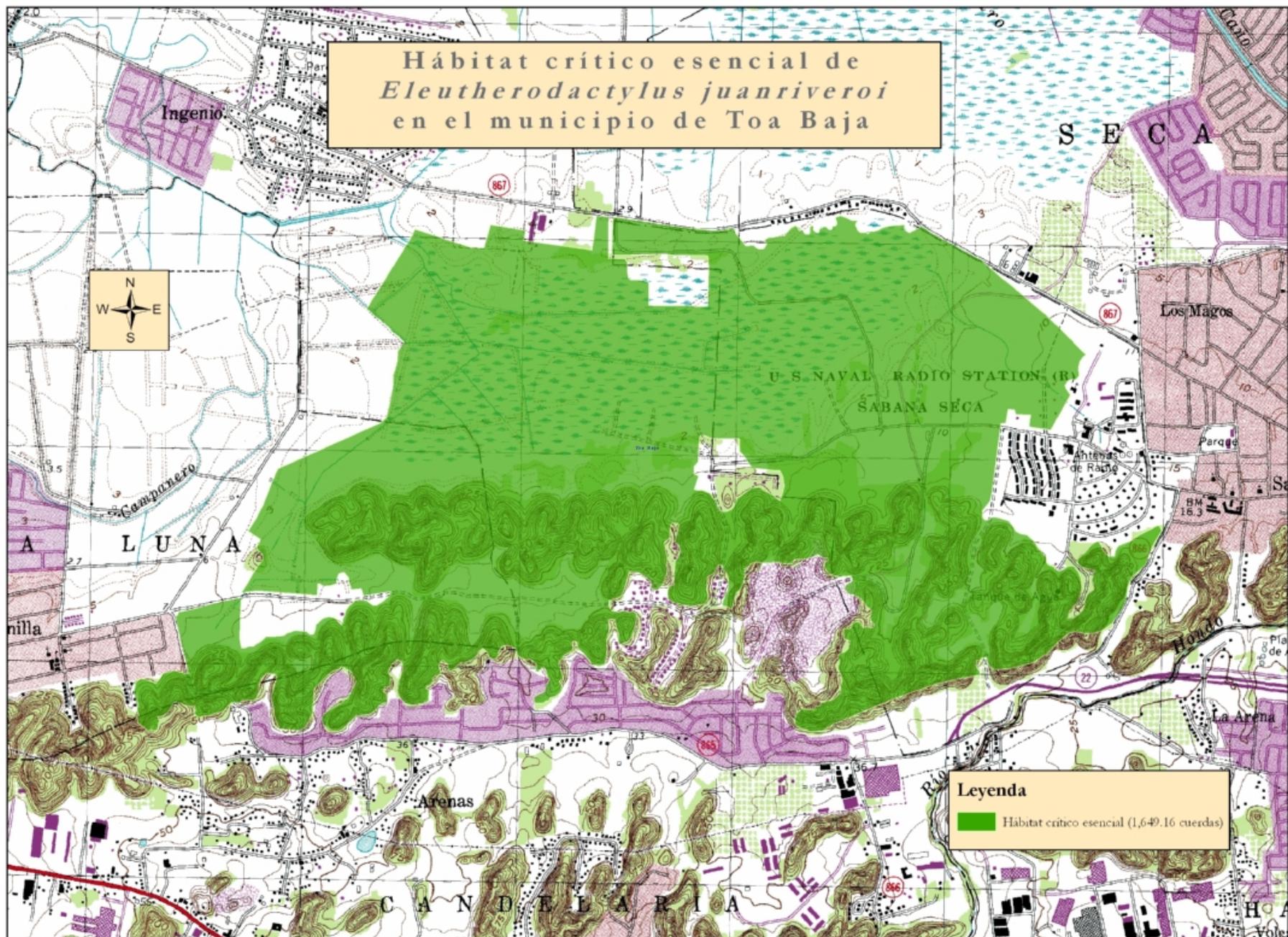


Figure 1: Habitat for Coquí Llanero (*Eleutherodactylus juanriveroi*) in Toa Baja as identified by DNER.



Figure 2: Coquí Llanero habitat on aerial photo as identified by DNER.

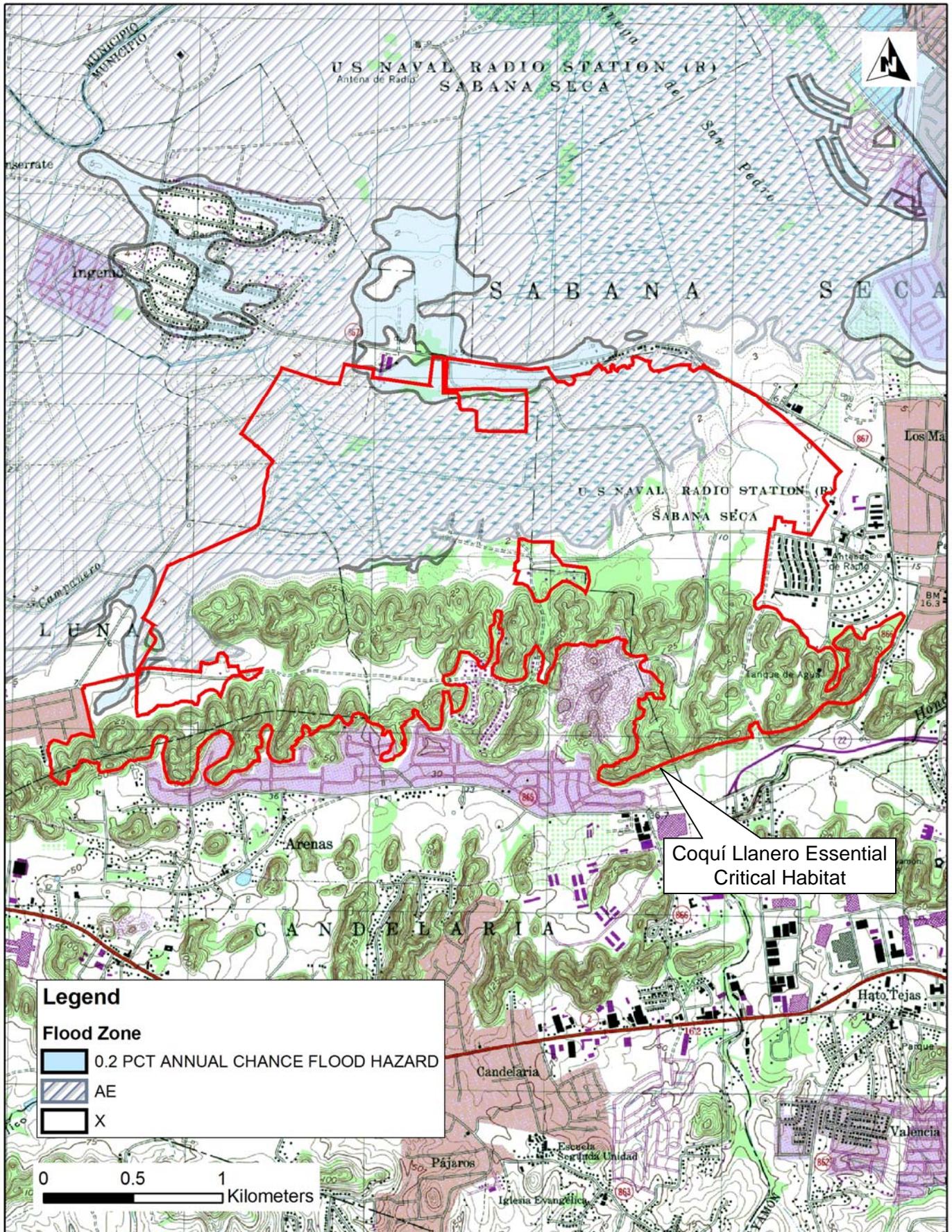


Figure 3: FEMA map showing Coquí Llanero Essential Habitat.

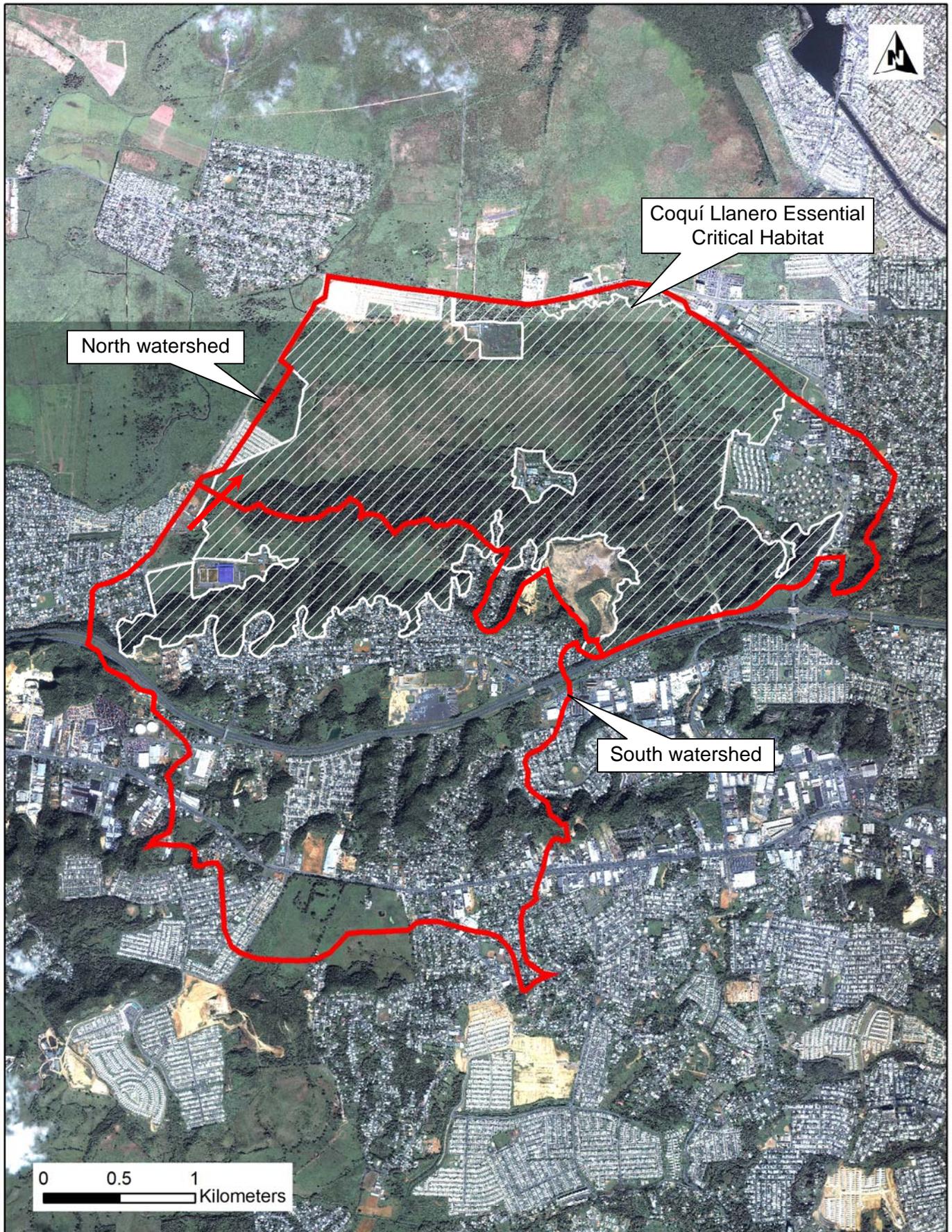


Figure 4: Watersheds contributing to the Coquí Llanero habitat.

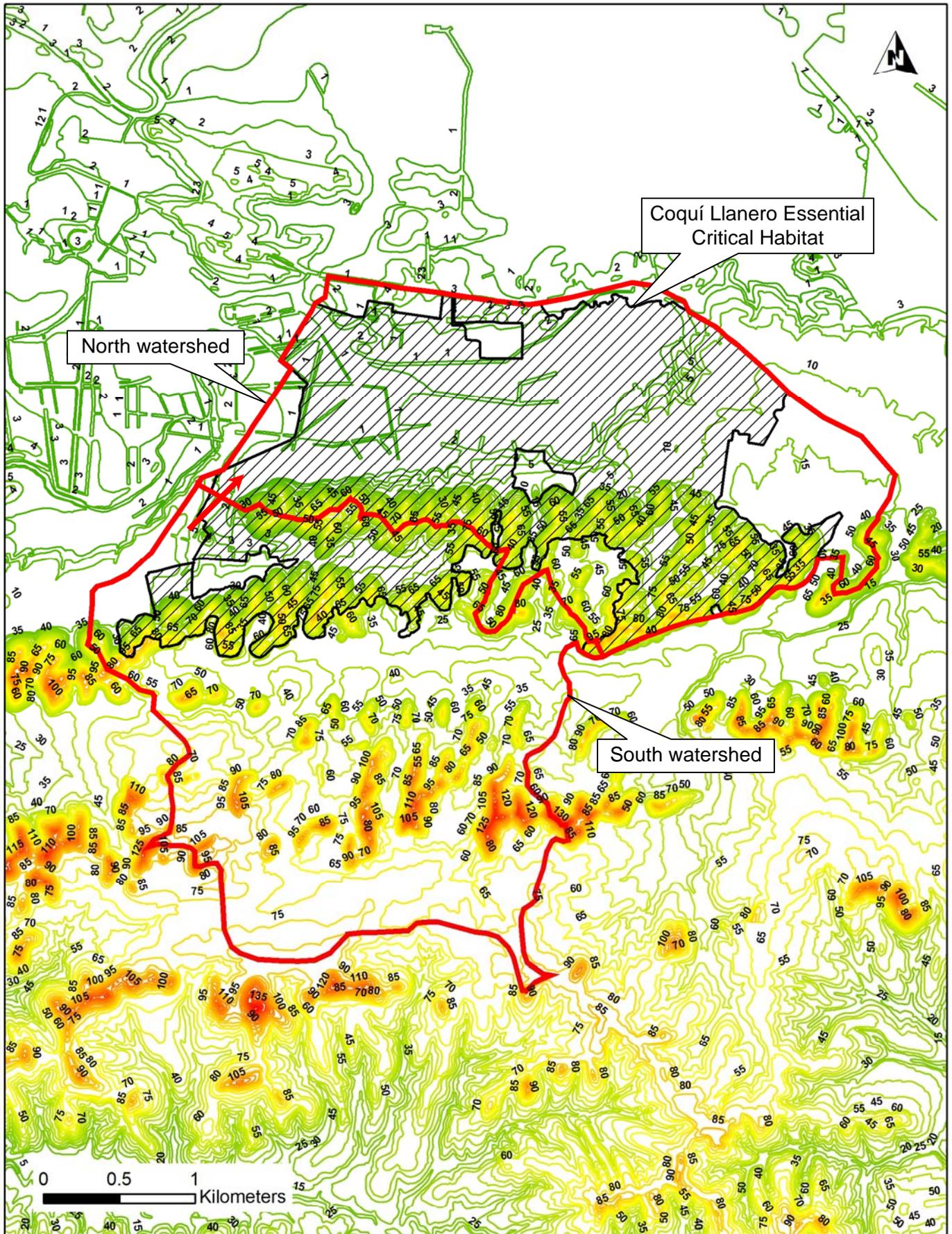


Figure 5: Topographic features of the watershed contributing to the Coquí Llanero habitat.



Figure 6: Toa Baja landfill leachate flow patterns.



Figure 7(A): Urb. Brisas de Campanero, surface drainage into Essential Critical Habitat wetland.



Figure 7(B): Drainage channel which conveys flow from South watershed into North watershed (location of arrow in Figures 4 and 5).



Figure 7(C): Location map for photos.