Barrio Los Pinos Storm Water Drainage, Santa Cruz, Bolivia

Focus Engineering: Amanda Schmidt, Giancarlo Calbimonte, Kerri Sleeman
International Senior Design, Fall 2007



Problem Statement:

Focus Engineering conducted storm drainage research to develop design solutions for a neighborhood flooding problem in Barrio Los Pinos (UV118A), Santa Cruz, Bolivia. During rainy season Moscú Avenue and the road west of Walter Henry School flood. Removal of the culvert at University Entrance Road in 2005 has changed water drainage and contributes to the flooding. The challenge for Focus Engineering was to mitigate the flooding at Moscú Avenue and the interior neighborhood.

Background:

An existing earthen canal begins at the entrance of the Evangelical University and continues west entering the 6th Ring Canal. This canal flows north, crossing under the paved Moscú Avenue and discharging into the "curichi", a deep swampy pond. The curichi is heavily filled with debris from the local residents dumping

Methods and Procedures Utilized:

- Topographic Surveying
- Soil Sampling and Analysis
- Visual Site Inspections
- Meetings with District, Barrio President, and residents
- Previous ISD Reports

Problem Areas:

Four main problem areas were determined (see Figure 1).

1. Flooding at the Moscú Avenue and Urbanización Road intersection.
2. A removed culvert under University Entrance Road at the University entrance.
3. Flooding along Horse Road near the Walter Henry School.
4. 6th Ring Canal and University Canal Road canal rehabilitation.


Flooding at Moscú and Urbanización intersection

Removed culvert at university entrance

Overgrown and debris filled canal along University Canal Road

Debris in curichi

Figure 1: Map of Barrio Los Pinos Problem Areas

Design Solutions:

Problem 1: Direct storm water at the intersection into a new underground pipe and earthen canal system. Underground piping would carry the storm water west along Urbanización Road and empty into a new earthen canal running south along the soccer field road, and emptying into the curichi (see Figure 2).

Figure 2: Problem 1 Solution Map

Problem 2: Replace the culvert that was removed when University Entrance Road was paved in 2006 and create a low elevation area to direct flow to the culvert.

Problem 3: Implementation of the recommended design solutions for the other problem areas may lessen the flooding along Horse Road. After these options have been constructed, a new feasibility study should be conducted to determine the new extent of flooding and alternative solutions if needed.

Problem 4: The culverts should be cleaned out and debris removed in front of and inside the three culverts at University Canal Road and 6th Ring intersection and 6th Ring underneath Moscú Avenue. Additionally, the canals must be retrenched and graded and a new trench constructed at the 6th Ring canal between University Canal Road and Moscú Avenue.

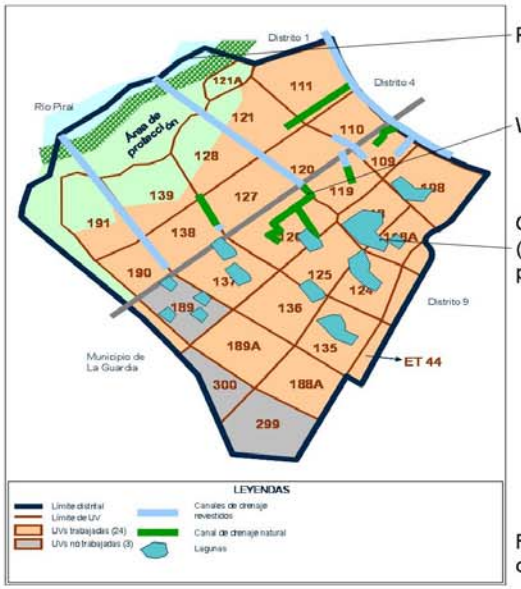

Figure 3: Map of District 10

Project Implementation:

Storm Water will drain into the curichi, to Watt's canal, on through 6th Ring into the Piraí River (see Figure 3).

Flood waters transport trash, raw sewage, and other debris into the neighborhood. Implementing this storm water drainage system will divert the debris to the canals where it can be properly cleaned up and disposed of.

Design options are based on the recommendation that the curichi is the preferred, and only, drainage option for the area. It is recommended that the ability for the curichi and Watts Canal to handle the increased water volume is verified.

Regular maintenance of the storm water drainage routes should be conducted once each year prior to the rainy season. The earthen canals should be retrenched and debris removed. Debris, sediment, and garbage should be removed from in front of and inside the culverts. Sediment should be cleaned out of the manholes and underground piping.

Construction Cost and Time:

The total estimated costs to implement this storm drainage system for the barrio is $874,148 Bs. Solution 1-B is estimated to cost $672,209 Bs, 2-A $59,997 Bs, 4-A and 4-B $141,942 Bs. Construction project length is estimated to be approximately 2 months during dry season.