Las Cruces Guatemala Post-Flood Analysis and Mitigation: Part 2

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in association with Engineers Without Borders USA
Chicagoland Professional Chapter

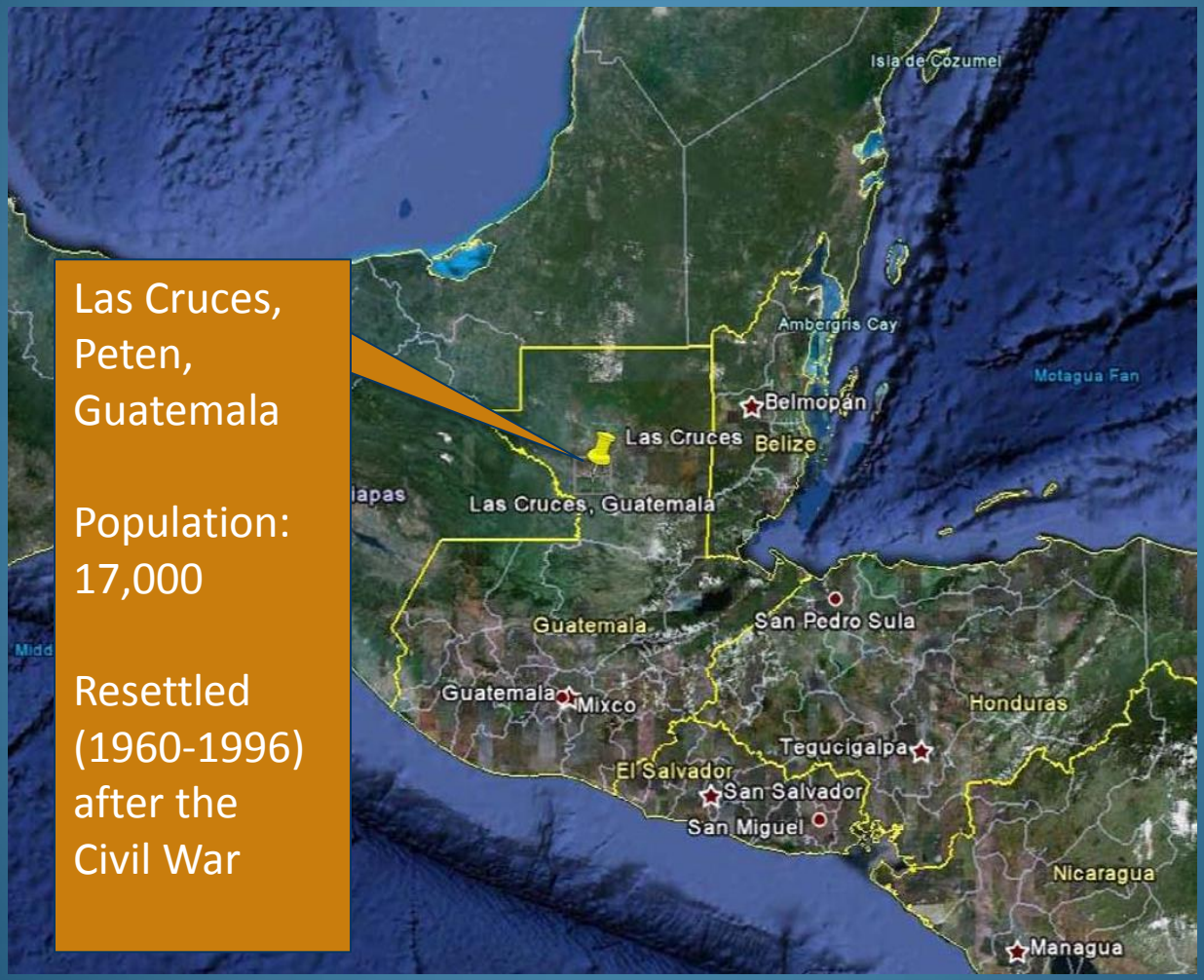
Engineers Without Borders USA

An opportunity to use your skills and abilities to meet the needs of communities abroad, solve complex problems, see life through from a new perspective, engage people who you would otherwise never meet , and have an experience of a life time.

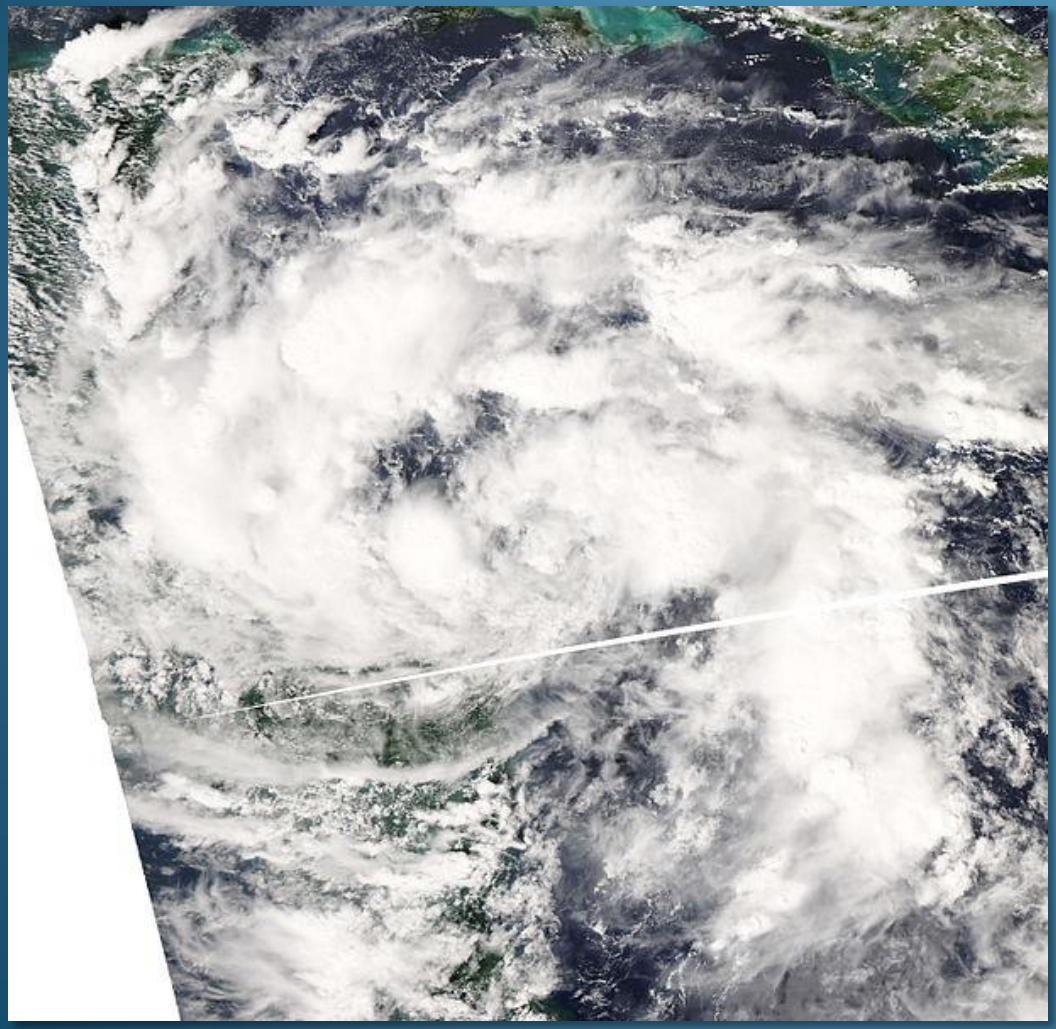
Applying Flood Mitigation Abroad

- The problem and need in Las Cruces
- The EWB Approach
- Our solution

Location


Las Cruces, Peten, Guatemala
Population: 17,000
Resettled (1960-1996) after the Civil War
Isla de Cozumel
Ambergris Cay
Belmopán
Belize
Las Cruces
Las Cruces, Guatemala
Motagua Fan
Guatemala
San Pedro Sula
Guatemala
Mixco
Honduras
Tegucigalpa
El Salvador
San Salvador
San Miguel
Nicaragua
Managua

What happened?



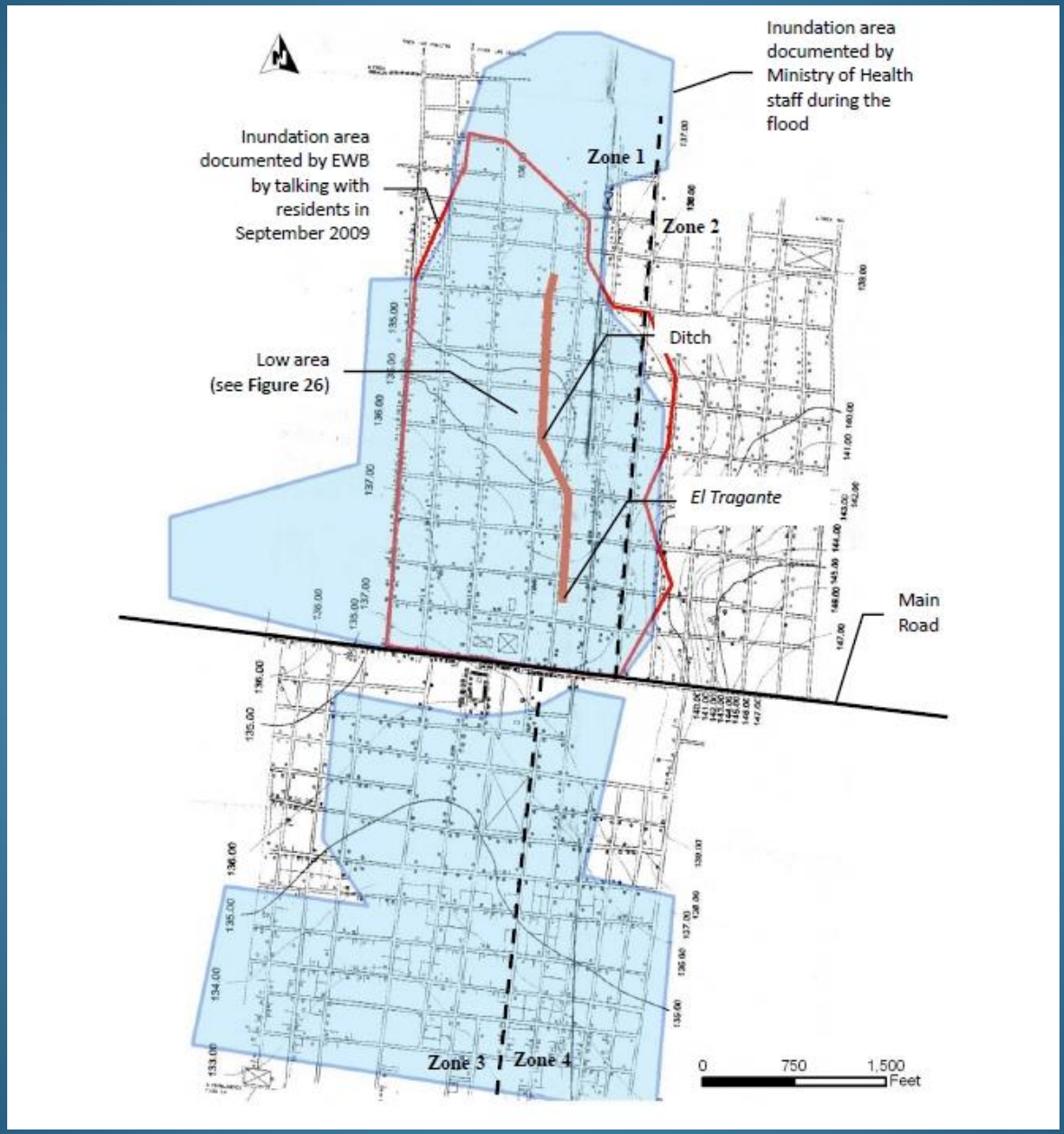
- Tropical Depression 16
- October 2008
- 18 days of consistent rainfall


2008 Flood


2008 Flood


Before


During

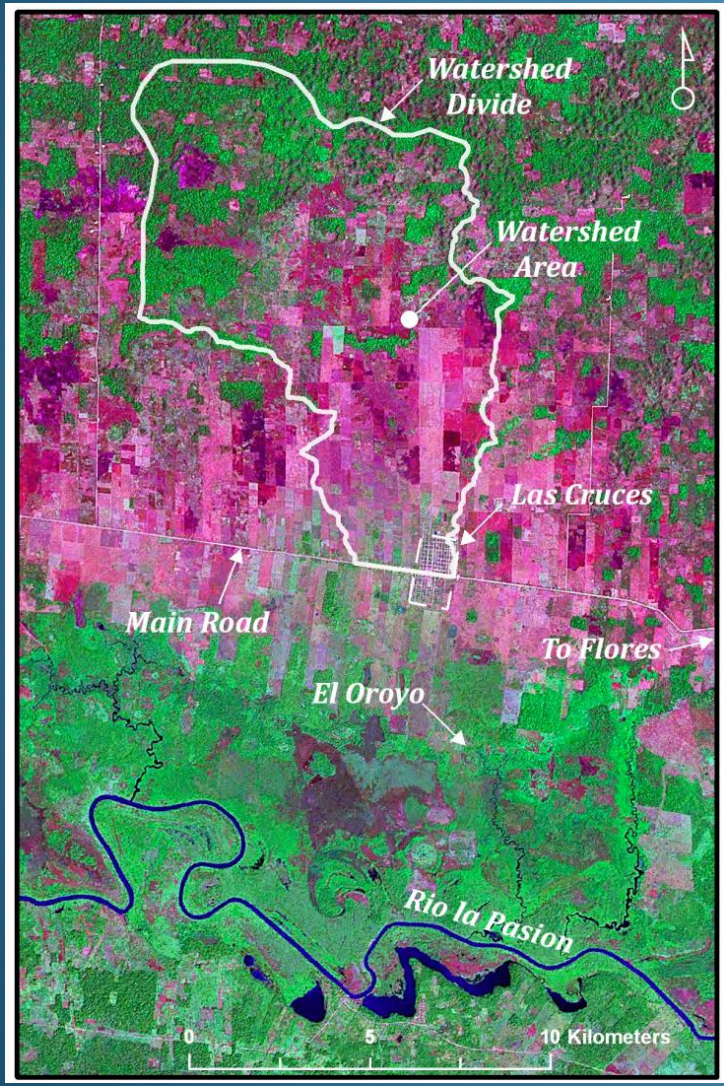

Inundation area documented by Ministry of Health staff during the flood
Inundation area documented by EWB by talking with residents in September 2009
Zone 1
Zone 2
Ditch
Low area (see Figure 26)
El Tragante
Main Road
Zone 3
Zone 4
0
750
1,500
Feet

Recurring flooding problems

- **2008**
  - 7,000 residents displaced for one month
  - 17,000 affected by flooding and well contamination
  - 780 mm of water in October (previous record – 550)
- **2010**
  - Large area inundated, but not as deep as 2008
  - 200 mm of rain fell in two days
  - Approximately a “50-year” event
- **Yearly flooding events**
  - Each year certain locations can expect ½ meter of flooding inside homes and businesses

EWB Approach

Local Data – Flooding Factors

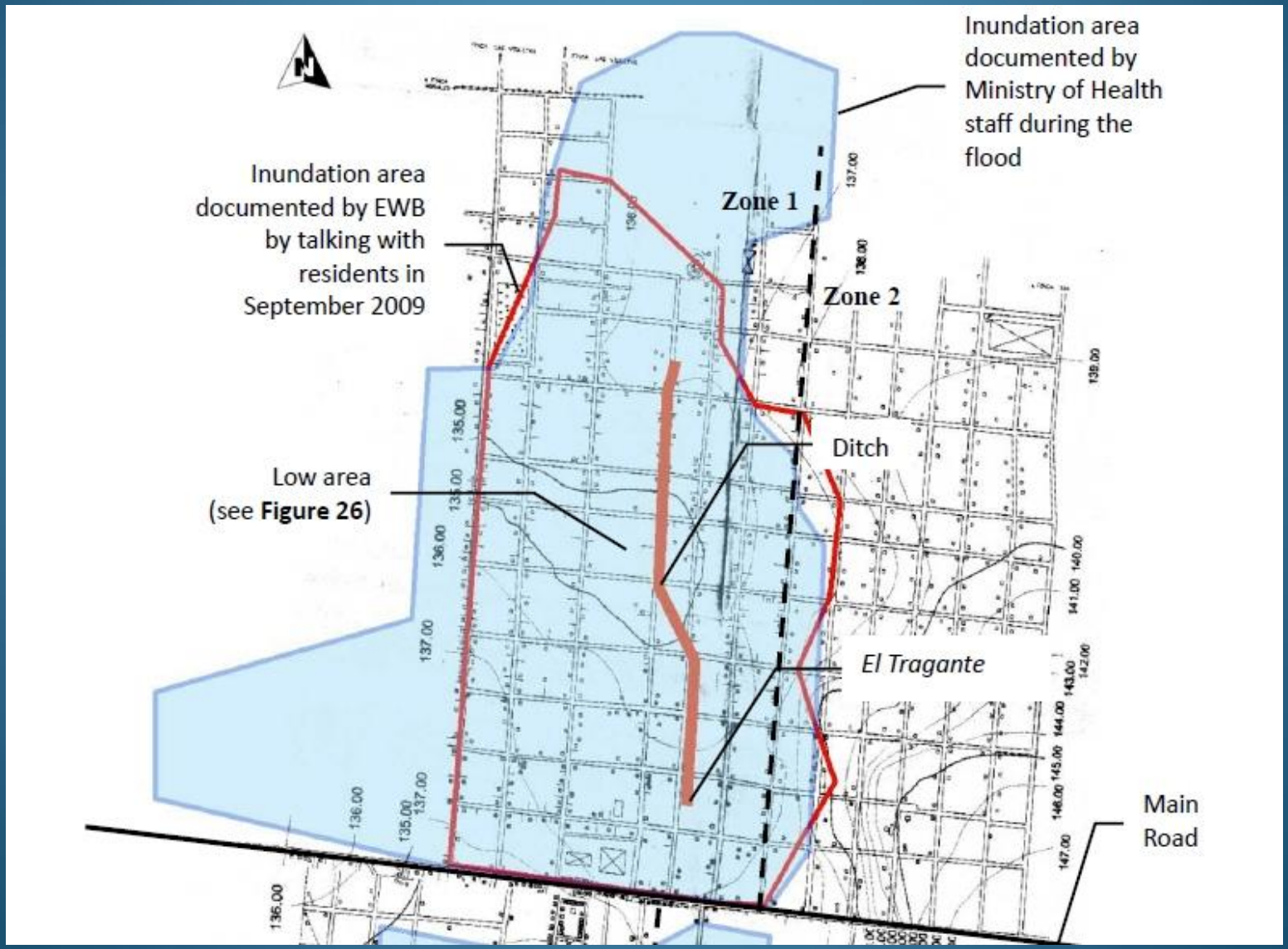


- Rainfall
- Location
- Urbanization
  - Jungle areas are green
  - Ranches and plantations are pink
- Topography

Location


Las Cruces
Image © 2013 DigitalGlobe
© 2013 INEGI
© 2013 Google
Image U.S. Geological Survey
Google earth

Topography - The Bathtub

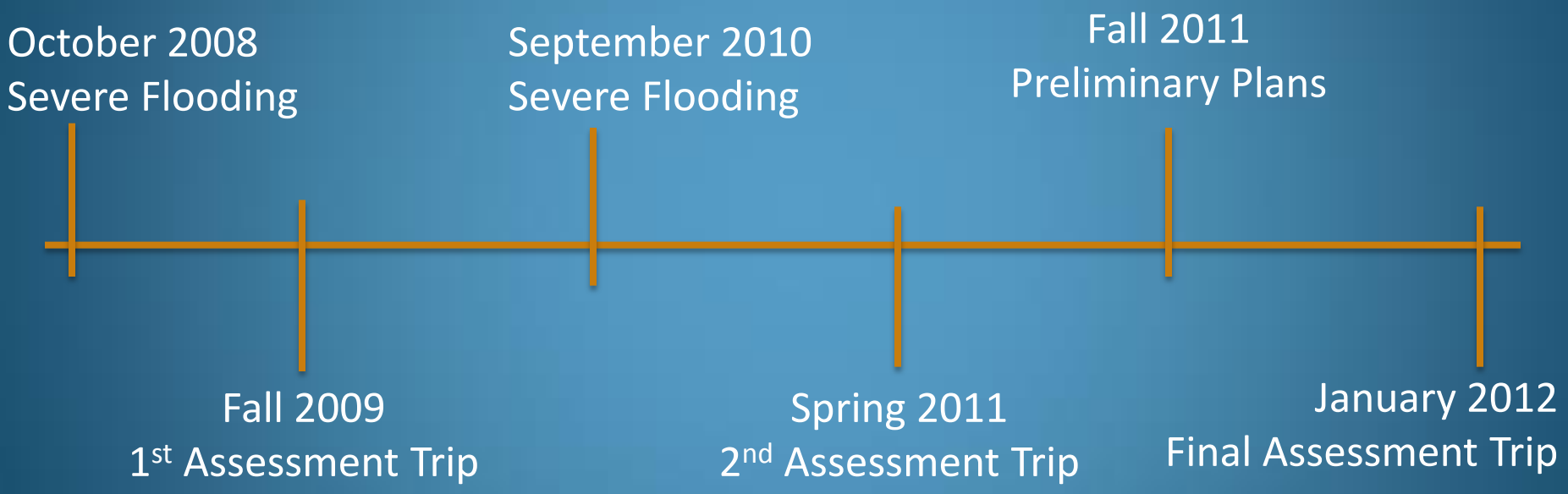


El Tragante

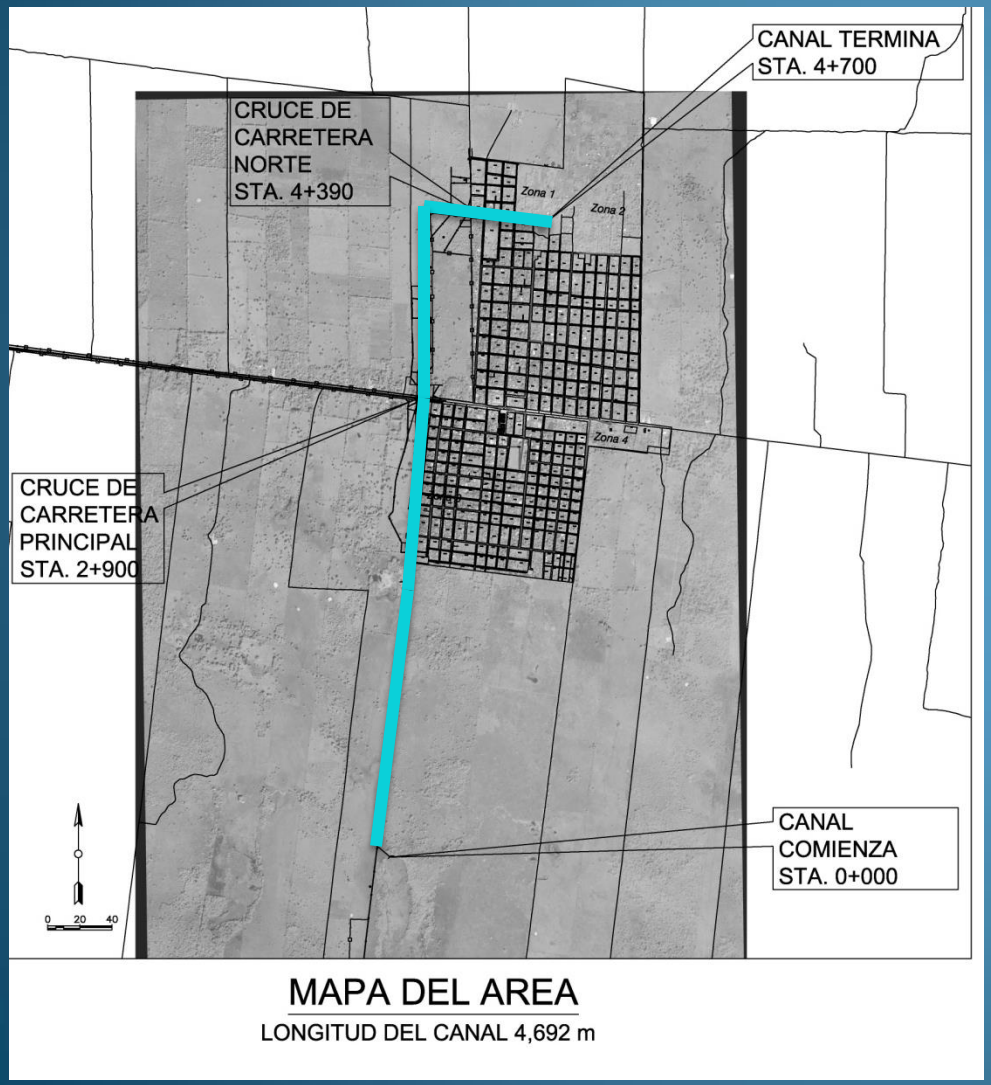
- Karst cavern
- Only known outlet

- 24” equivalent diameter
- Also waste outlet

Working with the Community



Preliminary Proposed Improvements



- Construct a 4.7 km long channel to intercept flows and divert them around the west side of town
- Connect to wetland located south of town where it will overflow to forested area on its way to Rio de la Passion
- Construct two roadway bridge crossings

2012 Trip

- Rod Beadle – Team Lead
- Nick Textor – Hydraulics and Hydrology
- Kevin Coughlin – Cost Estimating
- Local Flood Committee – Formed after 2008 Flood

Communication - Español

- Show plans
- Work with landowners
- Work with the municipality
- Work with Segeplan
- Get direction for final plans hand-off

Being There

NIMBY

What about pipes?

Trip Outcomes

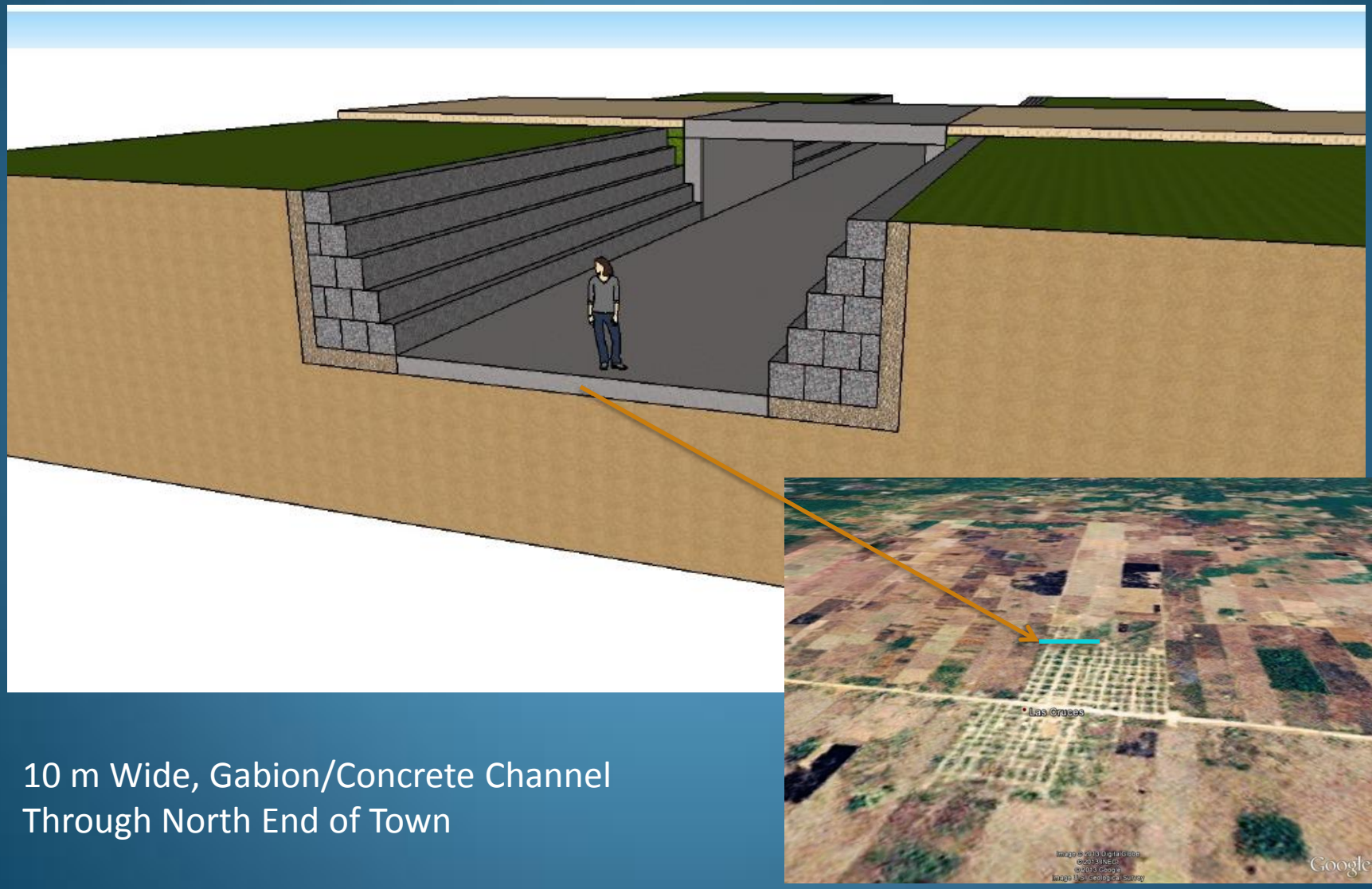
- Met with Municipality
- Met with Segeplan
- Had support and funding of these two groups

Designing the Solution

- Utilize Hydrologic and Hydraulic Tools
- Design to mitigate the 2010 storm
- Determine the effectiveness of design

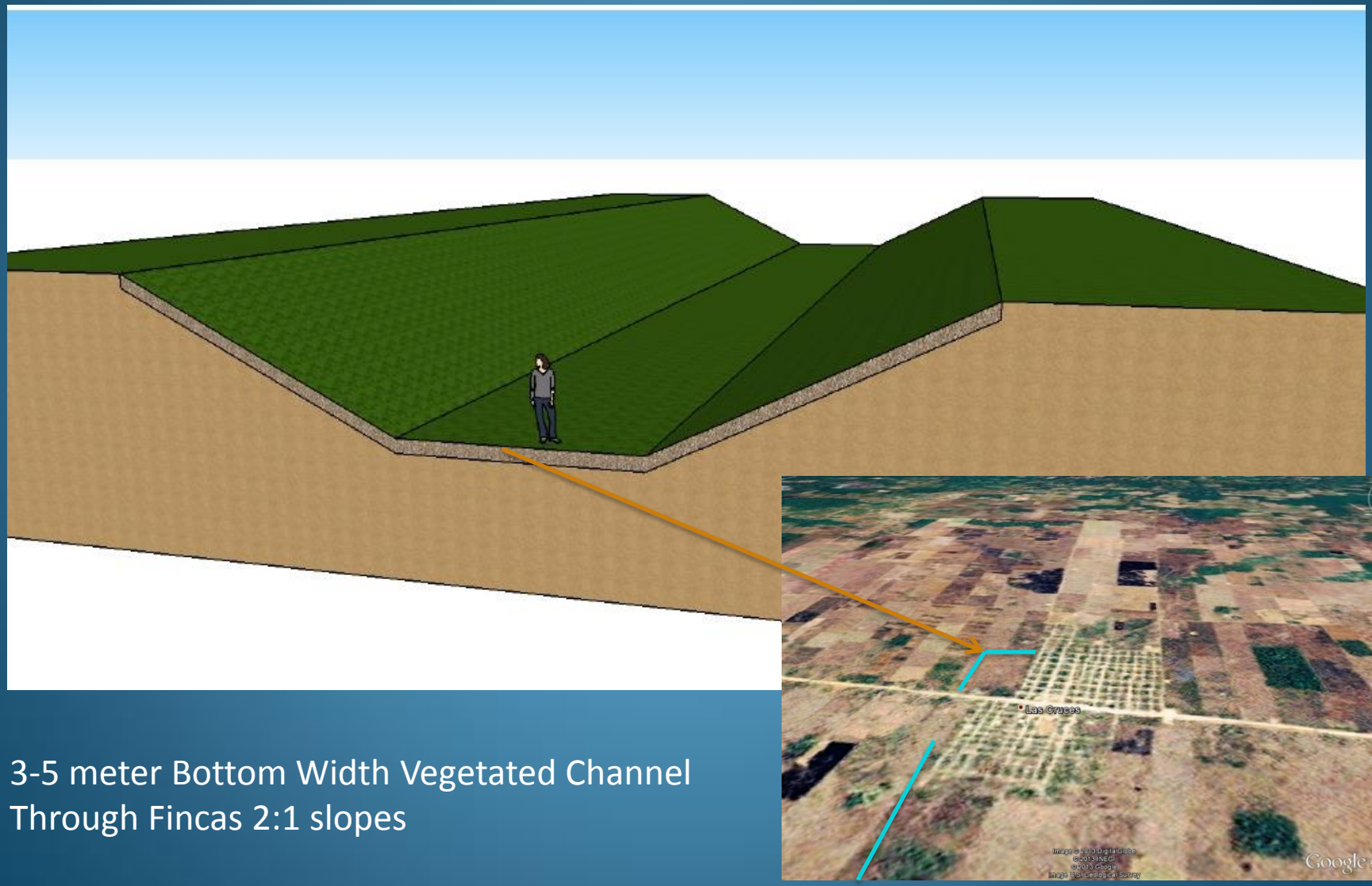
Final Design - Diversion Channel

Proposed – North Side of Town



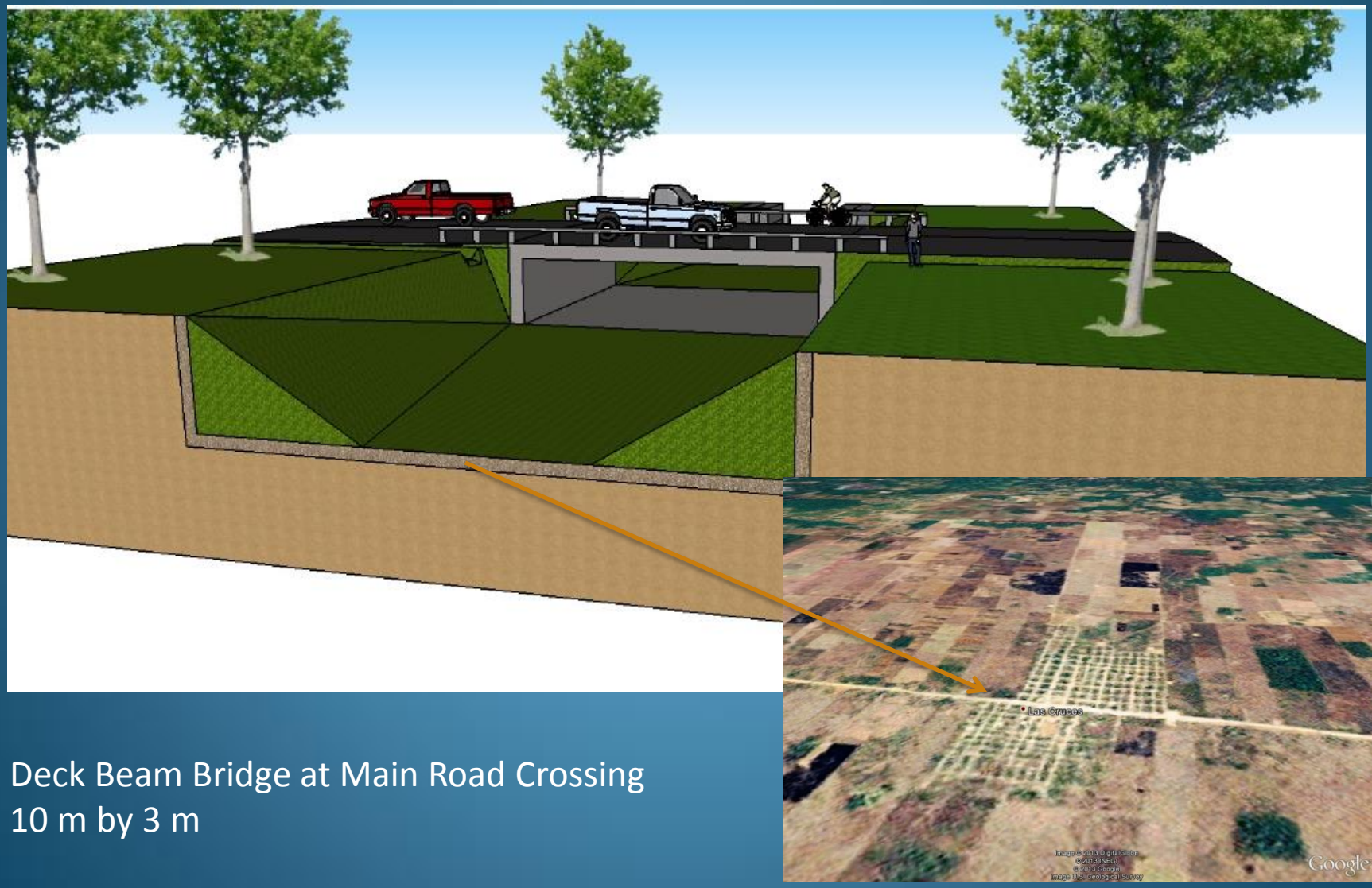
10 m Wide, Gabion/Concrete Channel
Through North End of Town

Proposed – Pasture Area



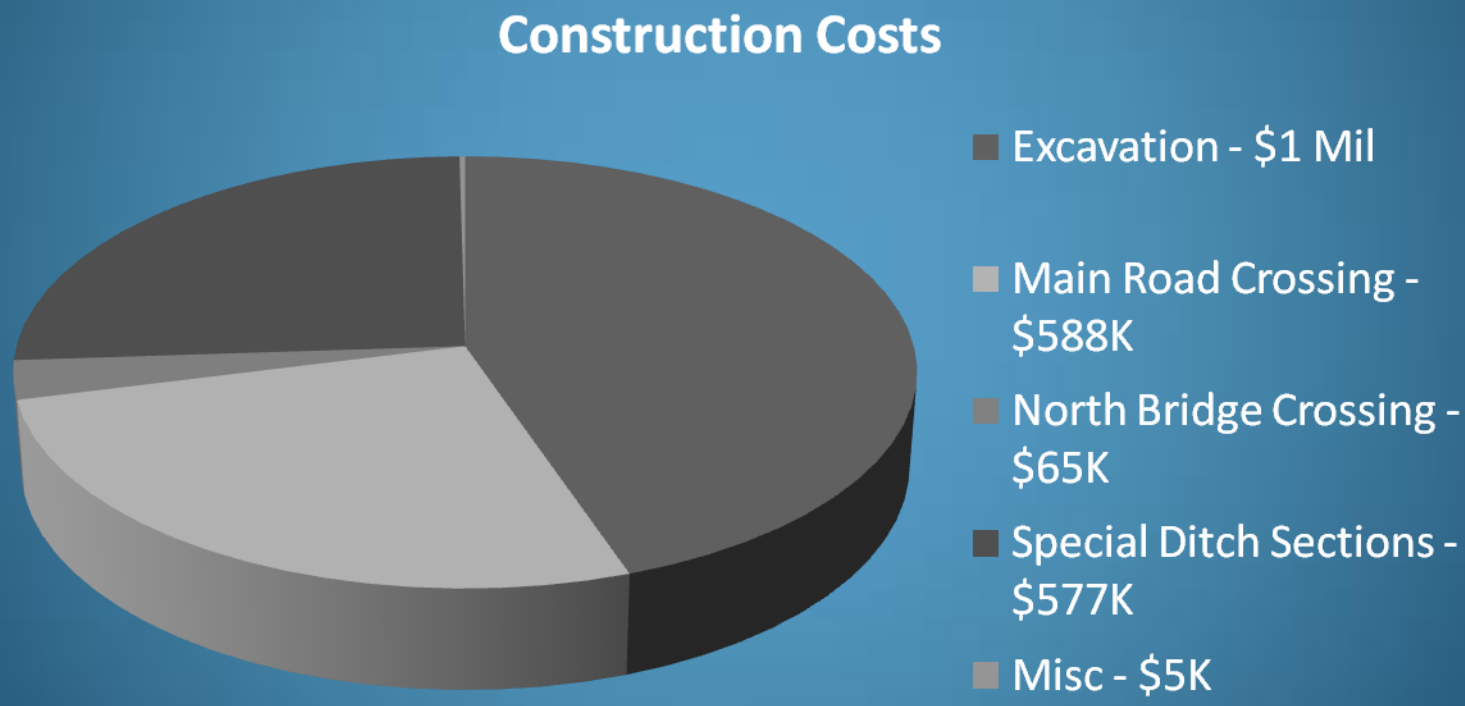
3-5 meter Bottom Width Vegetated Channel
Through Fincas 2:1 slopes

Proposed – Main Road Crossing



Deck Beam Bridge at Main Road Crossing
10 m by 3 m

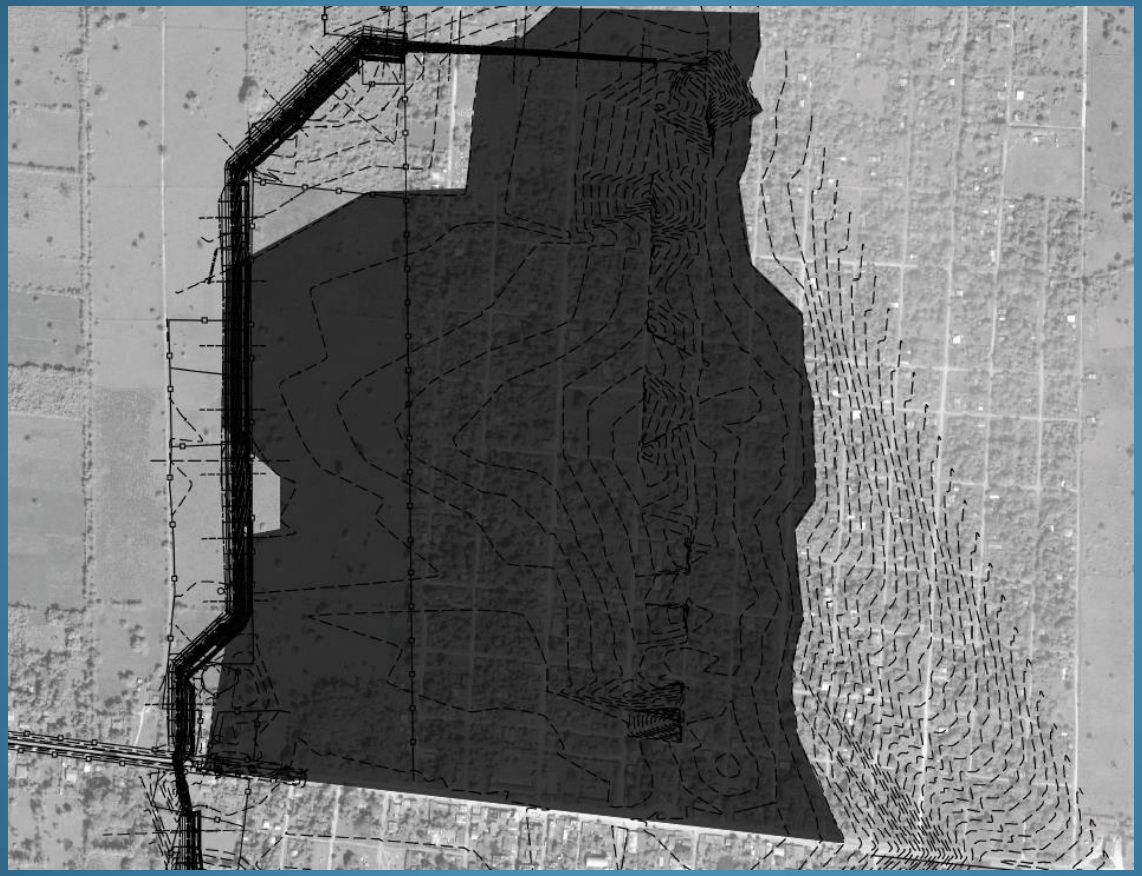
Cost Estimate: $2.1 Million



Results

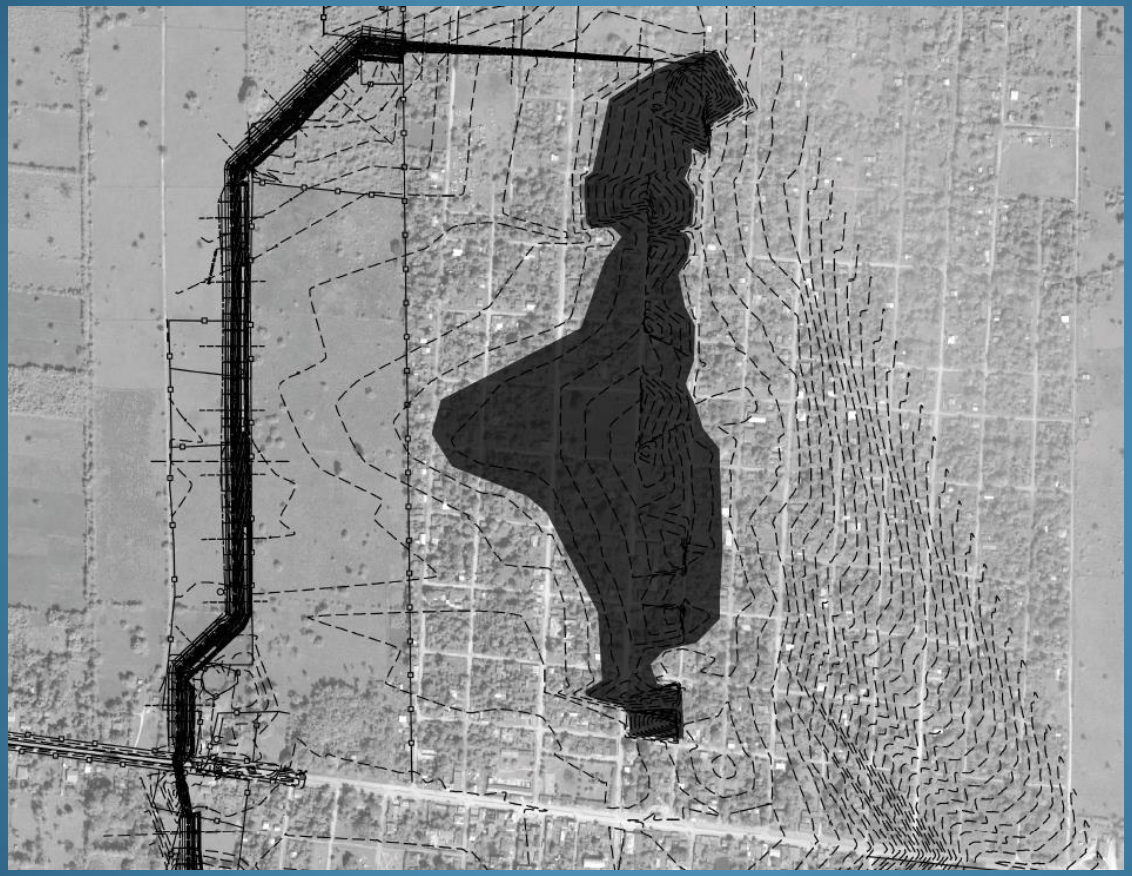
- Is this an effective design?
- How will it perform for severe events?
- How will it perform for smaller events?

Inundation – Pre-Construction



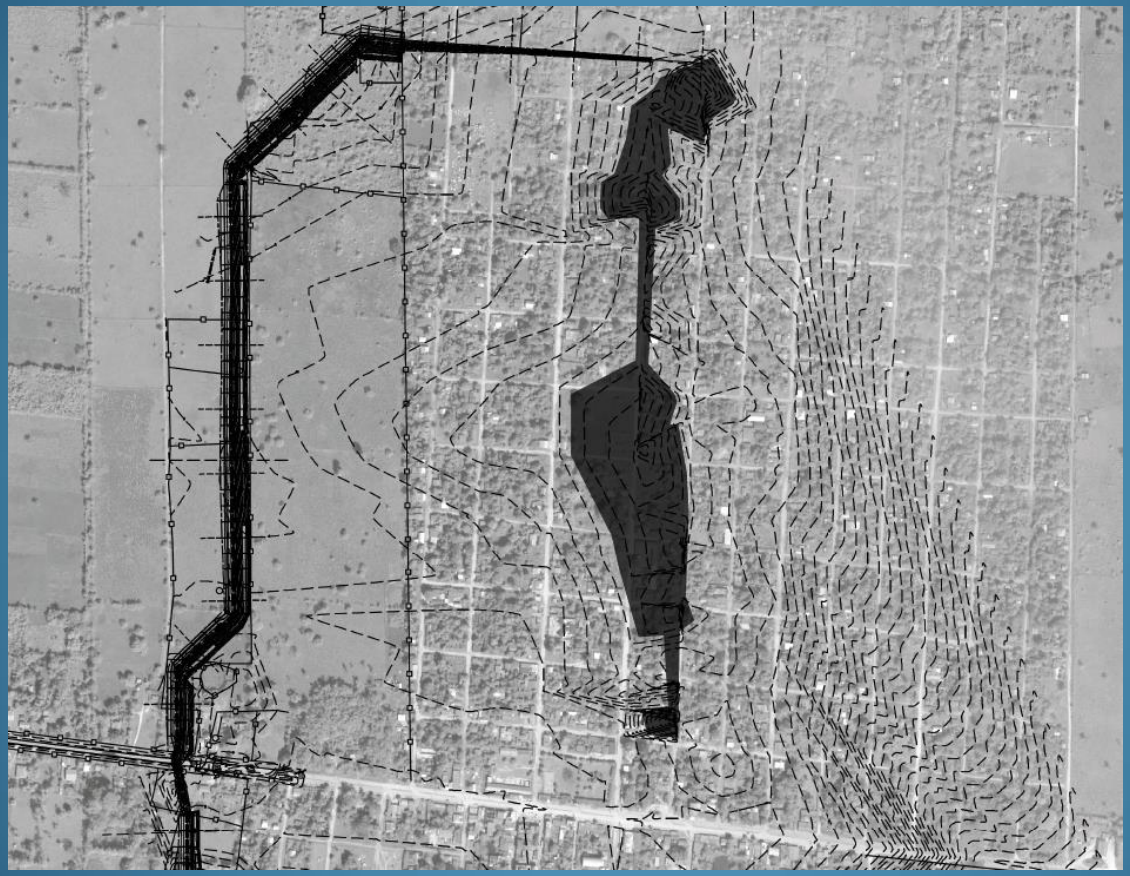
Pre-Construction Flood Limits – 2010 Storm

Inundation – Post-Construction



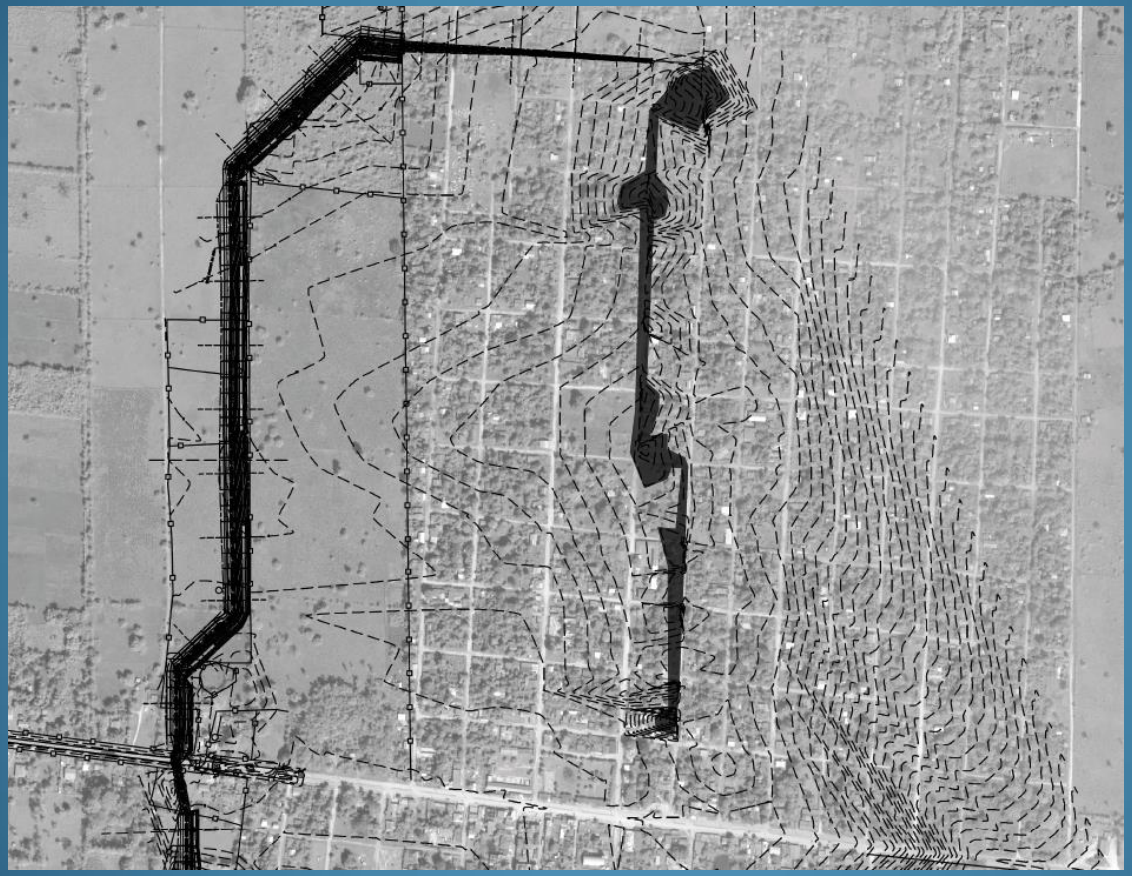
Post-Construction Flood Limits – 2010 Storm

Inundation – Post-Construction



Post-Construction Flood Limits – 75% 2010 Storm

Inundation – Post Construction



Post-Construction Flood Limits – 50% 2010 Storm

Implementation

- Final Plans
  - Delivered in April of 2012
  - Received and no further info has been requested
- Project Funding
  - Guatemalan Oil Revenues and Municipal Status
  - UN and Other Agency Disaster Response Grants
- Construction on Hold
  - Local municipality status has been challenged
  - Holding off on seeking grants at the moment

Conclusion

“All travel has its advantages. If the passenger visits better countries, he may learn to improve his own. And if fortune carries him to worse, he may learn to enjoy it.”

-Samuel Johnson

Questions

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