



Mainstreaming disaster resilience: Caracas Case Study

Arthur Lerner-Lam
Center for Hazards and Risk Research
Lamont-Doherty Earth Observatory
The Earth Institute at Columbia University

VII Reunión Hemisférica de la Red de Desastres Naturales
Banco Interamericano de Desarrollo
23 April 2007



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Quake triggers waves that leave 3 dead, 7 missing in Chile

- Saturday's 6.2-magnitude earthquake led to waves
- Masses of rock and earth plunged into the narrow inlet creating 26-foot waves
- President Michele Bachelet arrived in the area Sunday
- Angry residents met president, say the government has been slow to help

SANTIAGO, Chile (AP) — Rescuers found the bodies Sunday of three people who were swept out to sea by huge waves triggered by a powerful earthquake that sent avalanches crashing into a fjord in southern Chile. Seven others were missing.

While there was no tsunami, Saturday's 6.2-magnitude earthquake caused masses of rock and earth to plunge from surrounding hills into the narrow inlet, creating 26-foot (8-meter) waves.

The roaring, white-capped water destroyed boats, uprooted trees and overwhelmed beachgoers. Police Maj. Claudio Escobar said the search would continue until the seven missing people had been located.

A correspondent for Chilevision television, who was at the beach to install an antenna, said he saw a man and his young daughter dragged into the water by a large wave.

"There were some boats in the area and waves destroyed them," Orlando Adriaola said. "The boat we arrived in was thrown on top of a tree, partly destroyed."

The government's Emergency Bureau identified the three bodies as Ernesto Contreras, 65; his wife, Elsa Poblete, 54; and their 2-year-old grandson Genaro Linay. They were found in Aysen Fjord, near the epicenter of the quake. The seven missing people weren't identified.

Meanwhile, Chilean President Michele Bachelet arrived Sunday and was met by protests from angry residents who say the government has been slow to offer assistance following several months of seismic activity in the region.

After touring the area, Bachelet said the government would reinforce the area's health services with more doctors and ambulances, as well as a helicopter and a power generator in case of a new emergency.

Public Works Minister Eduardo Bitran and a team of engineers will fly to the area on Monday to check a local bridge that was damaged by the quake, she said.

Bachelet also was considering releasing emergency funds to the area, located about 1,700 miles (2,050 kilometers) south of the Chilean capital, Santiago.

Juan Cayupli, a volcanologist investigating the earthquake for the government, said it "triggered several landslides from neighboring hills into the sea, causing the level of water to rise steeply, violently, in the form of huge waves."

Cayupli, who was at the fjord at the time of the quake, told The Associated Press by telephone that the waters were calm on Sunday.

Saturday's early afternoon quake sent people into the streets in a panic at Puerto Aysen and Puerto Chacabuco, the closest cities to the fjord, with a combined population of 35,000.

Puerto Aysen Mayor Oscar Catalan was at the beach and saw six people being pulled away by the current, according to the Chilean newspaper El Mercurio.

The quake was the strongest of hundreds of quakes that have shaken the area since January 22.

Meanwhile on Sunday, a moderate earthquake shook Santiago in central Chile, with no immediate reports of damages or injuries. The 5.2-magnitude quake hit at 6:22 a.m. ET and was centered about 80 miles (130 kilometers) northwest of Santiago.

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Find this article at:
<http://www.cnn.com/2007/WORLD/americas/04/22/chile.quake.ap/index.html>

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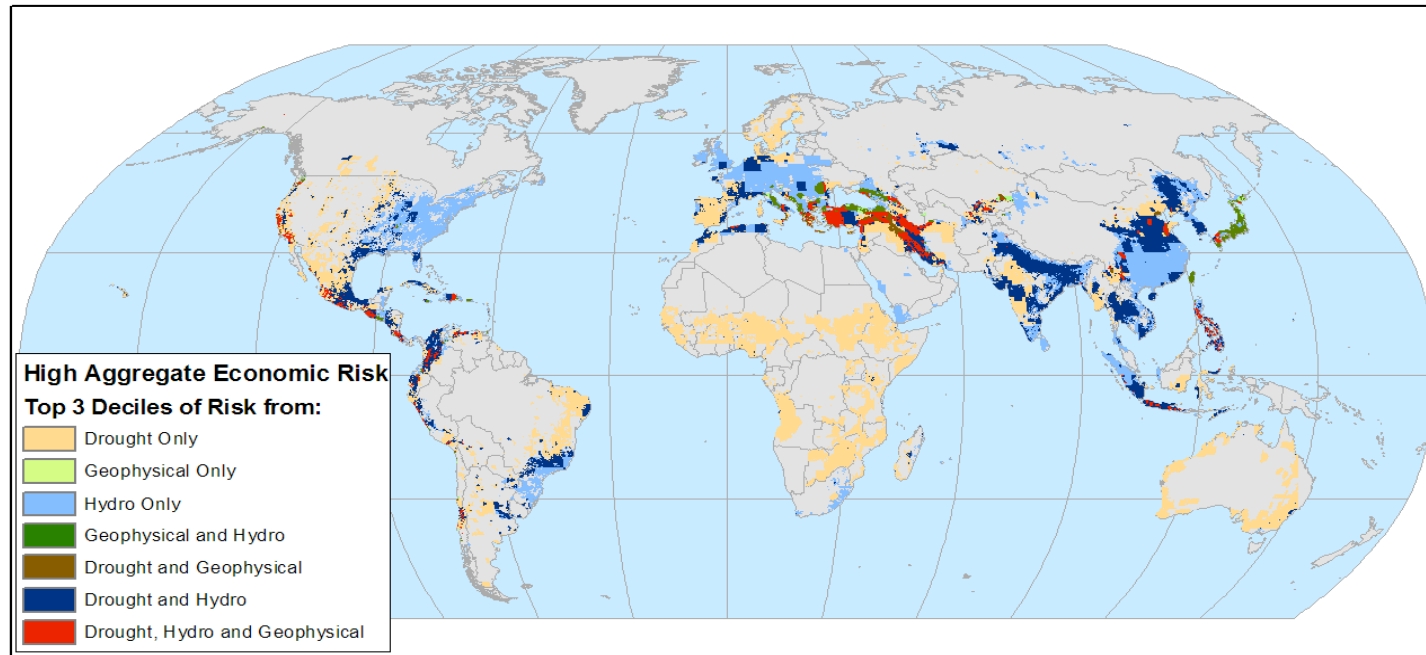


INDICATORS OF DISASTER RISK AND RISK MANAGEMENT

Summary Report



Inter-American Development Bank
Sustainable Development Department
Environment Division



Natural Disaster Hotspots Aggregate Economic Risk

Dilley et al., 2005

Why do case studies?

- Illustrate development of fine-scale evidence base: what can be done with local data?
- Begin to understand local causal factors
- Link evidence to policy
- Plausible mainstreamed implementation strategies
- Demonstrate importance of local capacity and partnerships

Caracas Case Study: Disciplinary contributions

- Geomorphology
- Climate
- Seismology
- Urban Planning
- Civil Engineering, Hydrology
- Remote Sensing
- **Partnerships**
 - Instituto Regional de Estudios Urbanos, Caracas
 - FUNVISIS

The Caracas Case Study Studio

- Disaster Resistant Caracas Studio
 - Development of methodological approach to multi-disciplinary planning and design
 - A **prototype training activity** executed by Master and Doctoral Students in Urban Planning and Geosciences lead by Geoscience and Urban Planning Faculty teams from both countries.
- Three-month probe highlighted critical issues for disaster resiliency.
- Preliminary planning study, **not a plan**.

Context

- Latin America is experiencing rapid and unplanned urban growth. Proper growth can be channeled to increase prosperity and sustainability.
- Latin American cities are centers of education and culture, fueling innovation and creativity. But they are exposed to natural hazards.
- Greater Caracas is an example of a regional center where linkages in culture, finance, telecom, media, technology, and natural resource distribution are integrated.
- Caracas is exposed to risk from earthquakes, landslides, and extreme weather.

Mainstreaming Urban Disaster Resilience

- 1) Rational planning process that includes hazard mitigation.
- 2) Risk management strategies, including financial, regulatory, market incentives, and central/local government initiatives.
- 3) Emergency preparedness and response.



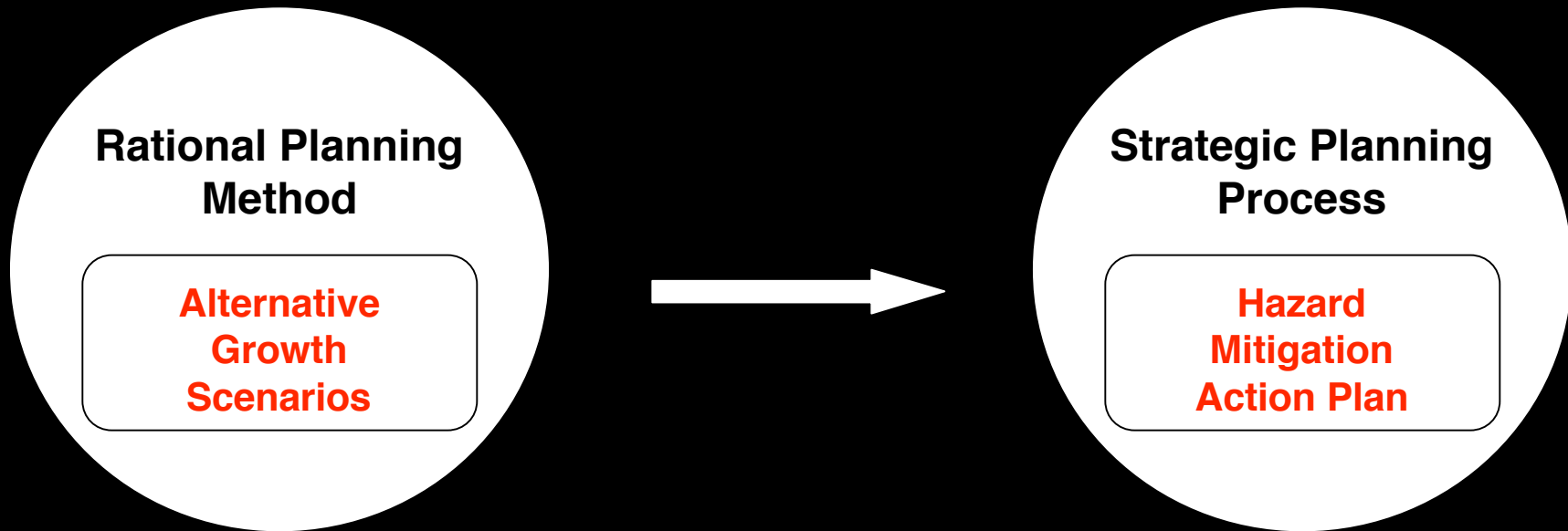


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HAZARDS
RESEARCH

Process



Elements of Rational Planning Model:

- Define Assumptions & Values
- Goals & Objectives (mainstreaming)
 - Guide Rational growth and spatial development
 - Strengthen economic base
 - Protect life and property from hazards
 - Ensure environmental sustainability
 - Provide decent housing
 - Supply sufficient public facilities
 - Enhance accessibility and mobility
 - Improve governmental administration
- Examine Alternatives
 - **Regionalization,**
 - **Satellite Cities**
 - **Densification**
- Develop Programs

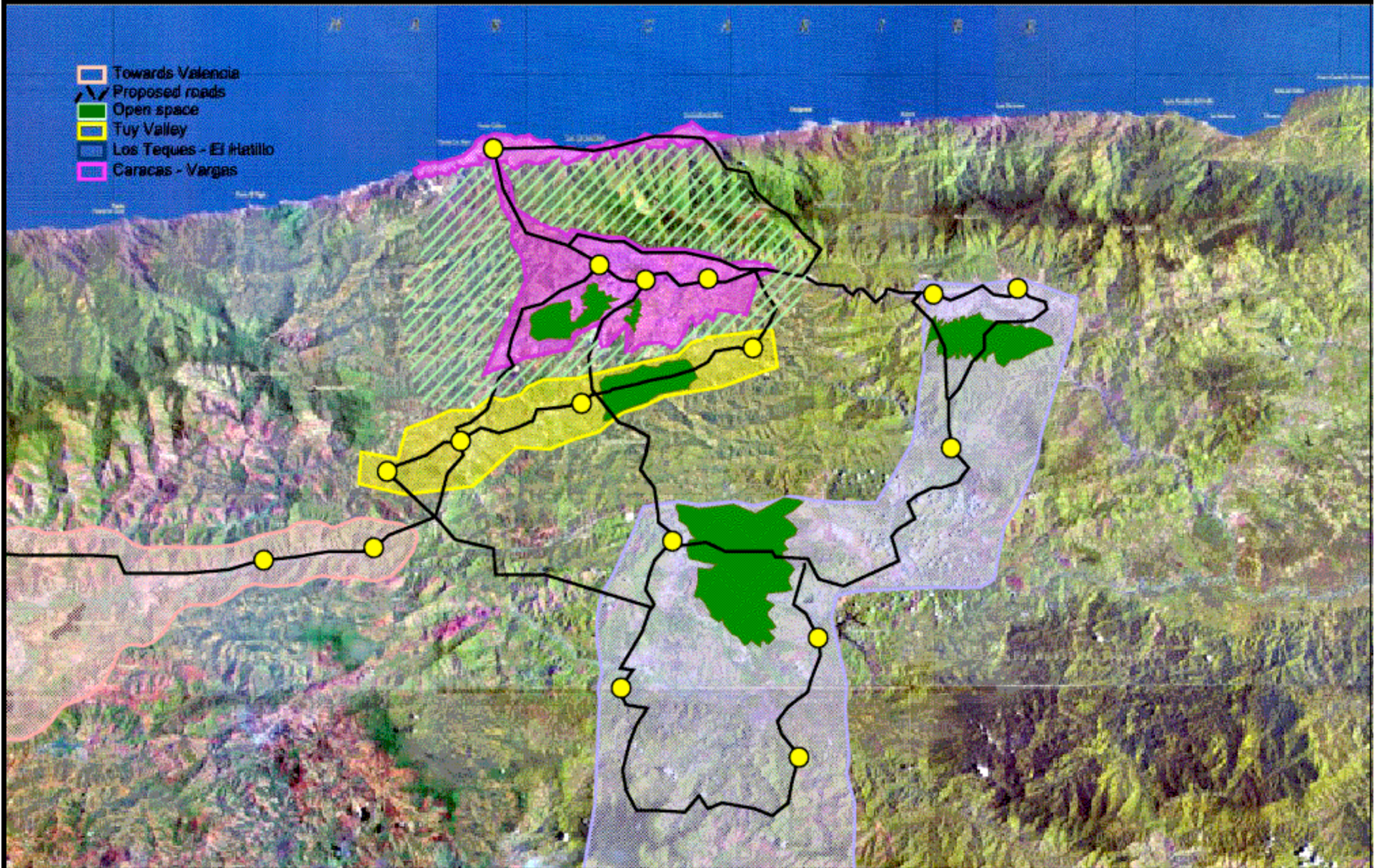
FUTURE SHAPE

regionalization

1:500,000
4 0 4 8 Kilometers



- Towards Valencia
- Proposed roads
- Open space
- Tuy Valley
- Los Teques - El Hatillo
- Caracas - Vargas



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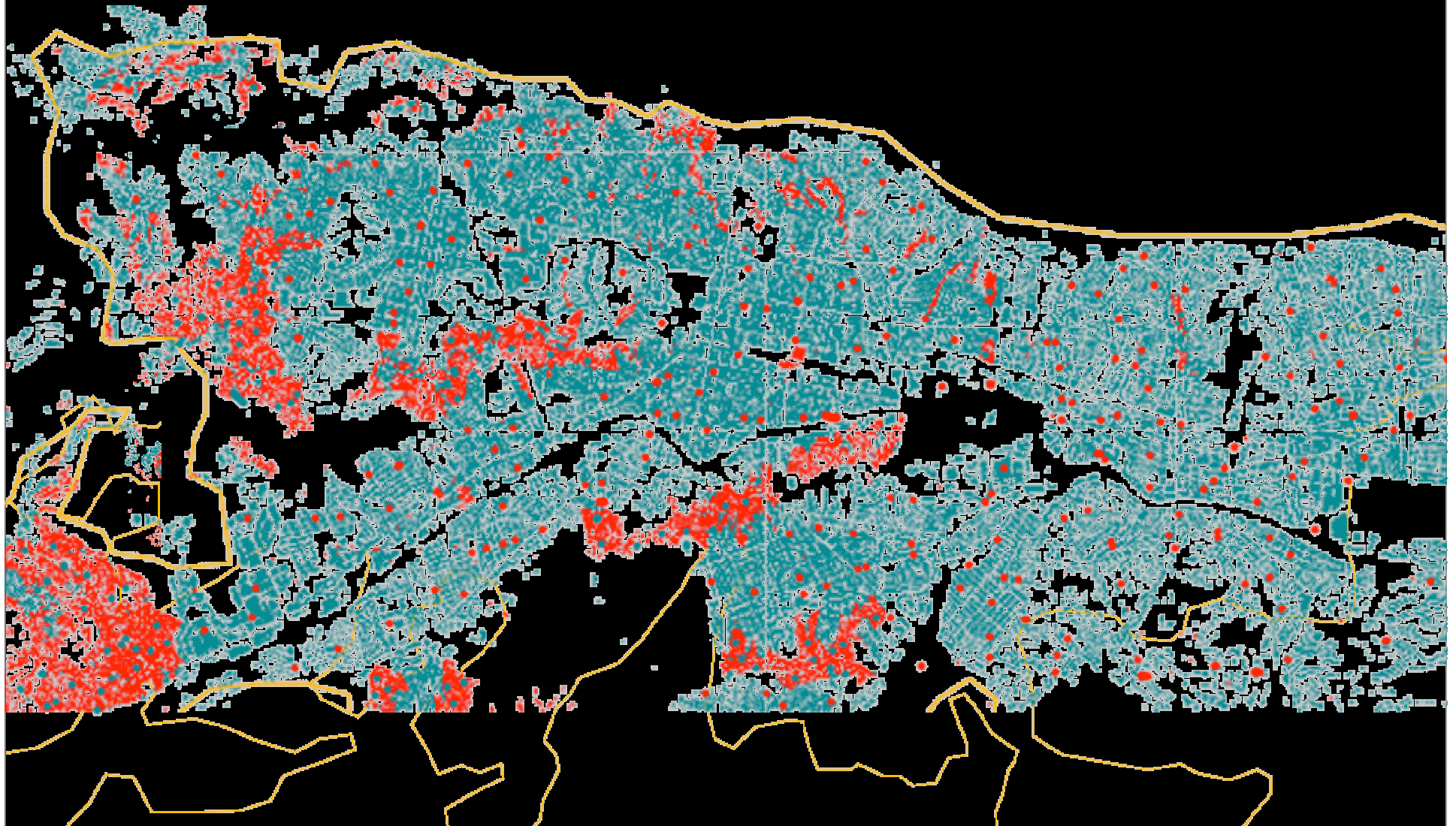
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FUTURE SHAPE

densification - barrio integration

1:75,000

1 0 1 2 Kilometers



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PLANNING**

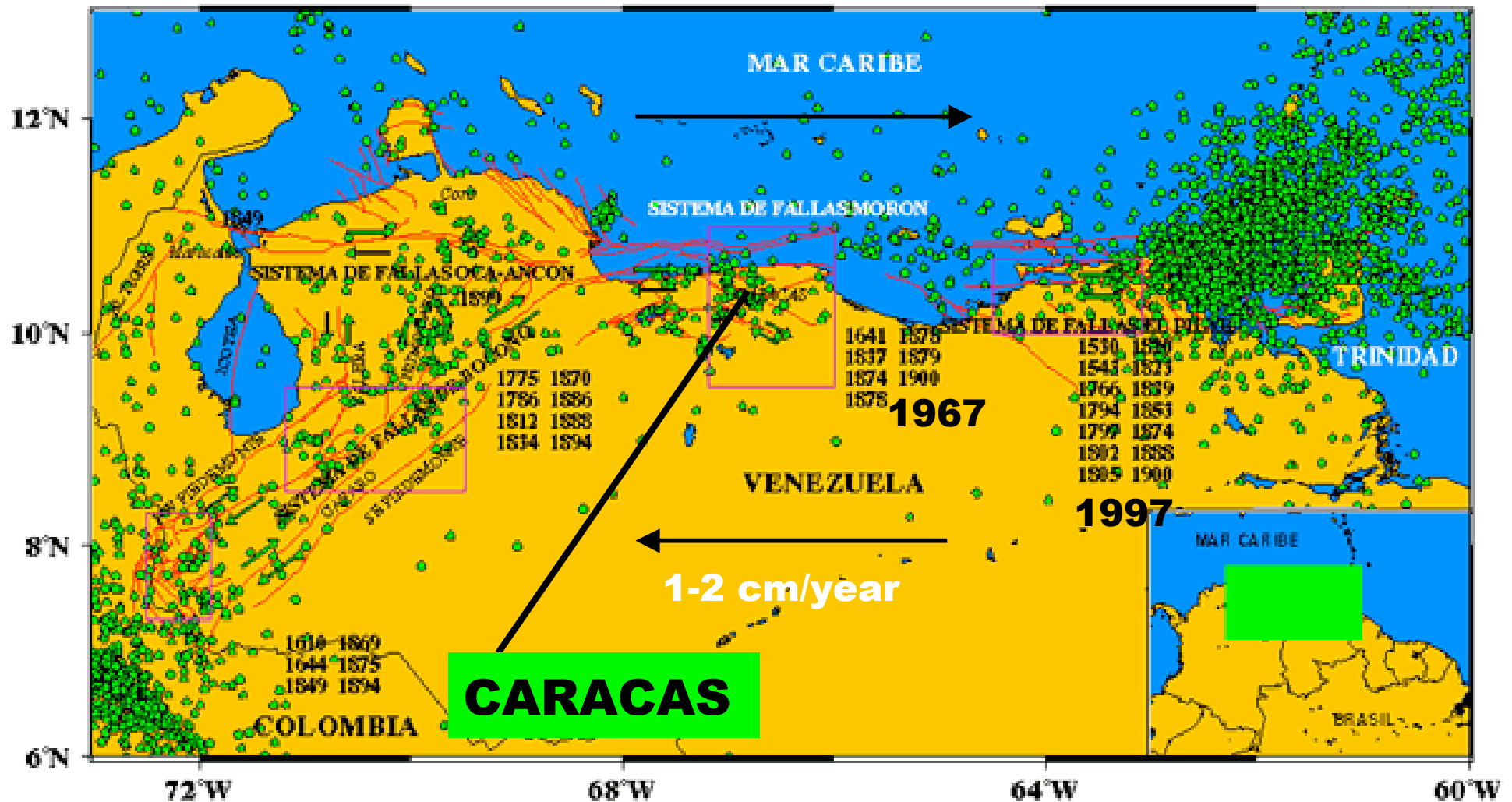
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Risk Assessment

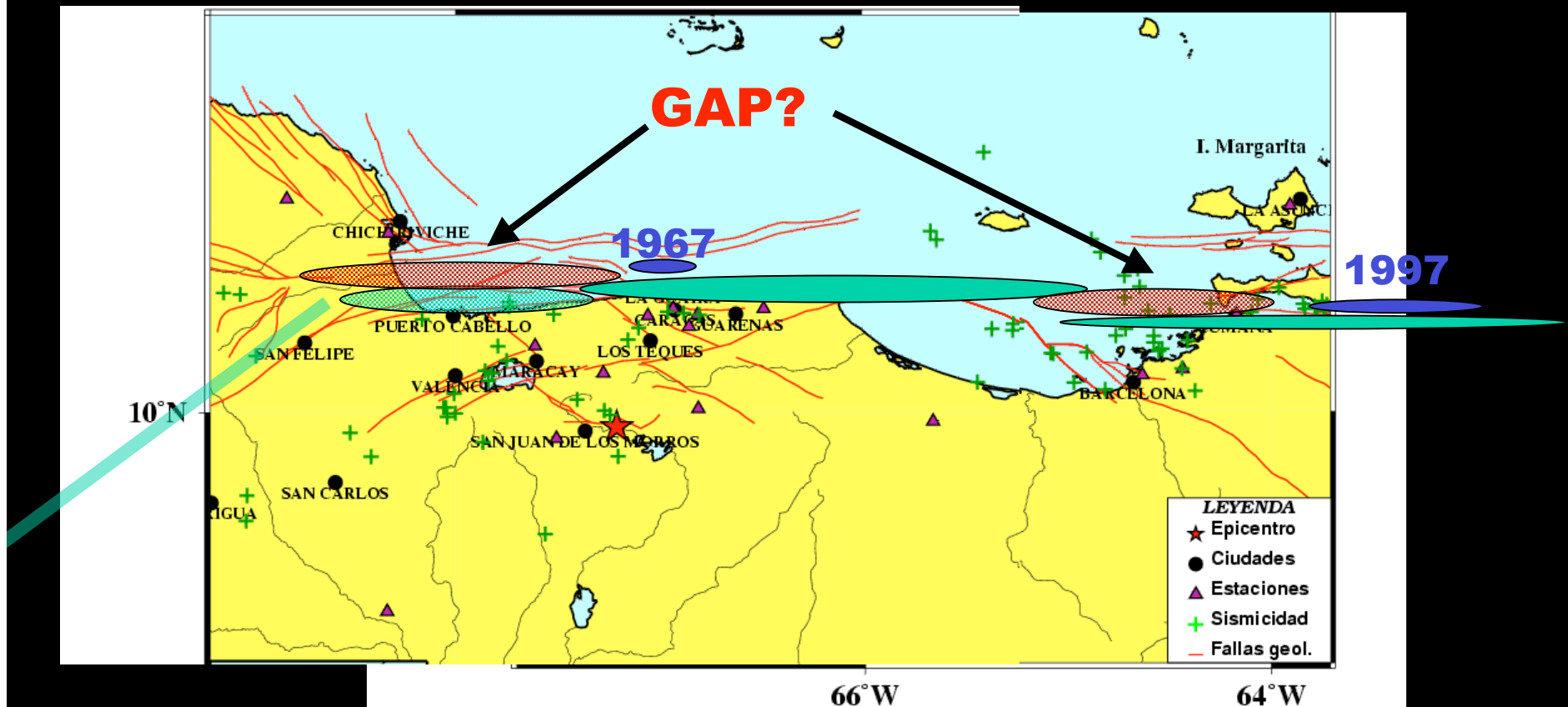
Caracas Faces Two Main Hazards:

- **Earthquakes - The Plate Boundary**
 - Ground shaking
 - Soil failure
 - Landslides
- **Extreme Rainfall Events**
 - Flooding
 - Mud and debris flows

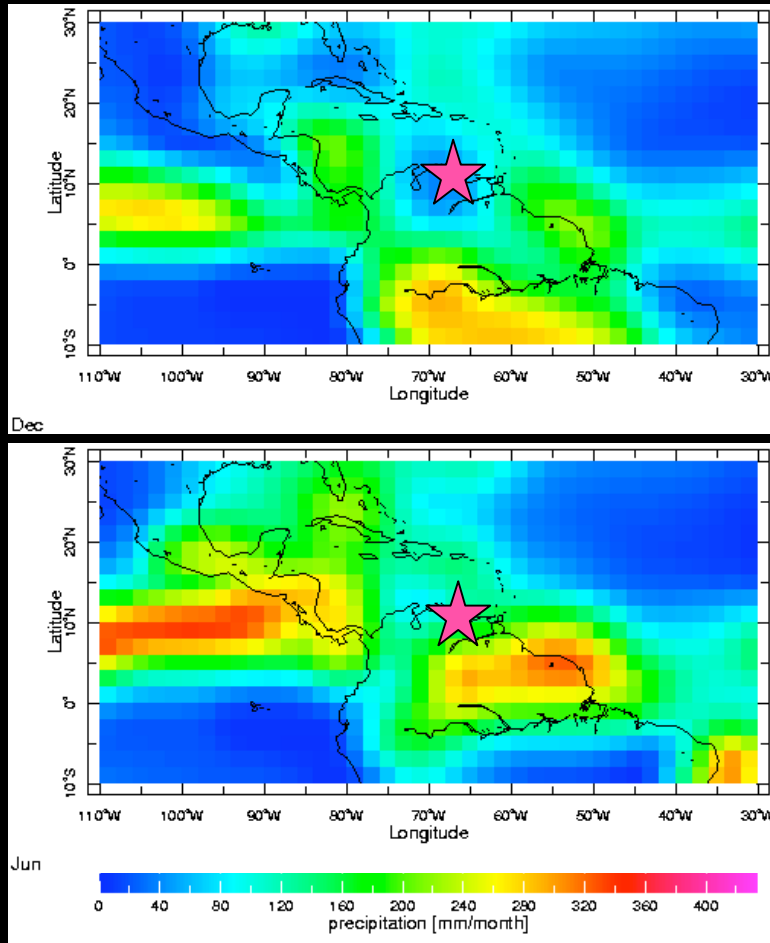




http://www.funvisis.org.ve/htmls/fallas_venezuela.html



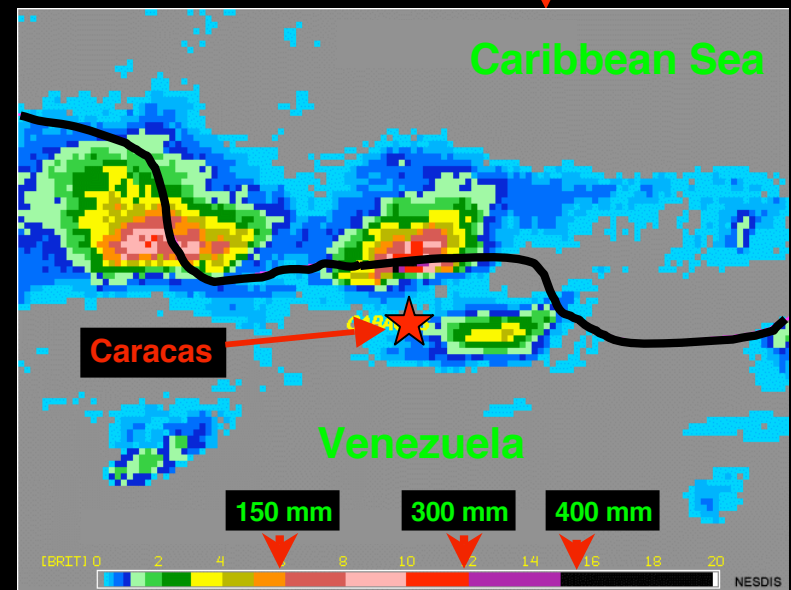
<http://www.funvisis.org.ve>



December

15-17, 1999

June



(Oberhuber, J.M., An atlas based on 'COADS' dataset, Tech. Rep. #15, Max-Planck-Institute für Meteorologie, 1988.)

(source: http://www.comet.ucar.edu/resources/cases/venezuela/images/ven_satacc.gif)

Normal December Rainfall:

100 mm

December 15-17, 1999:

912 mm

December 1999 Total:

1207 mm

Major flooding events have also occurred in the following years:

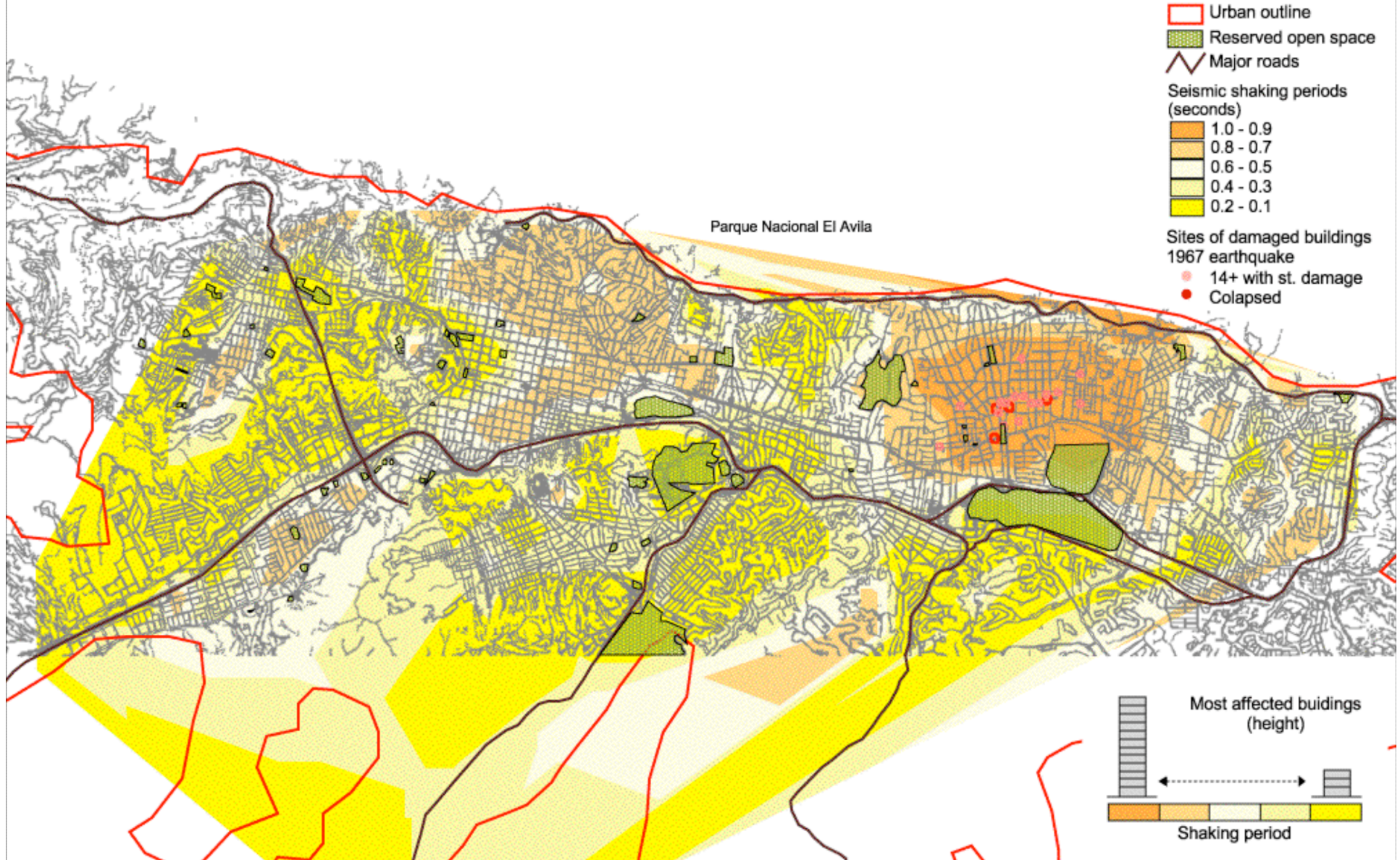
- 1740
- 1780
- 1789
- 1798
- 1938
- 1944
- 1948
- 1951
- 1972
- 1999

Average recurrence:
25 years

Events of extreme
magnitude

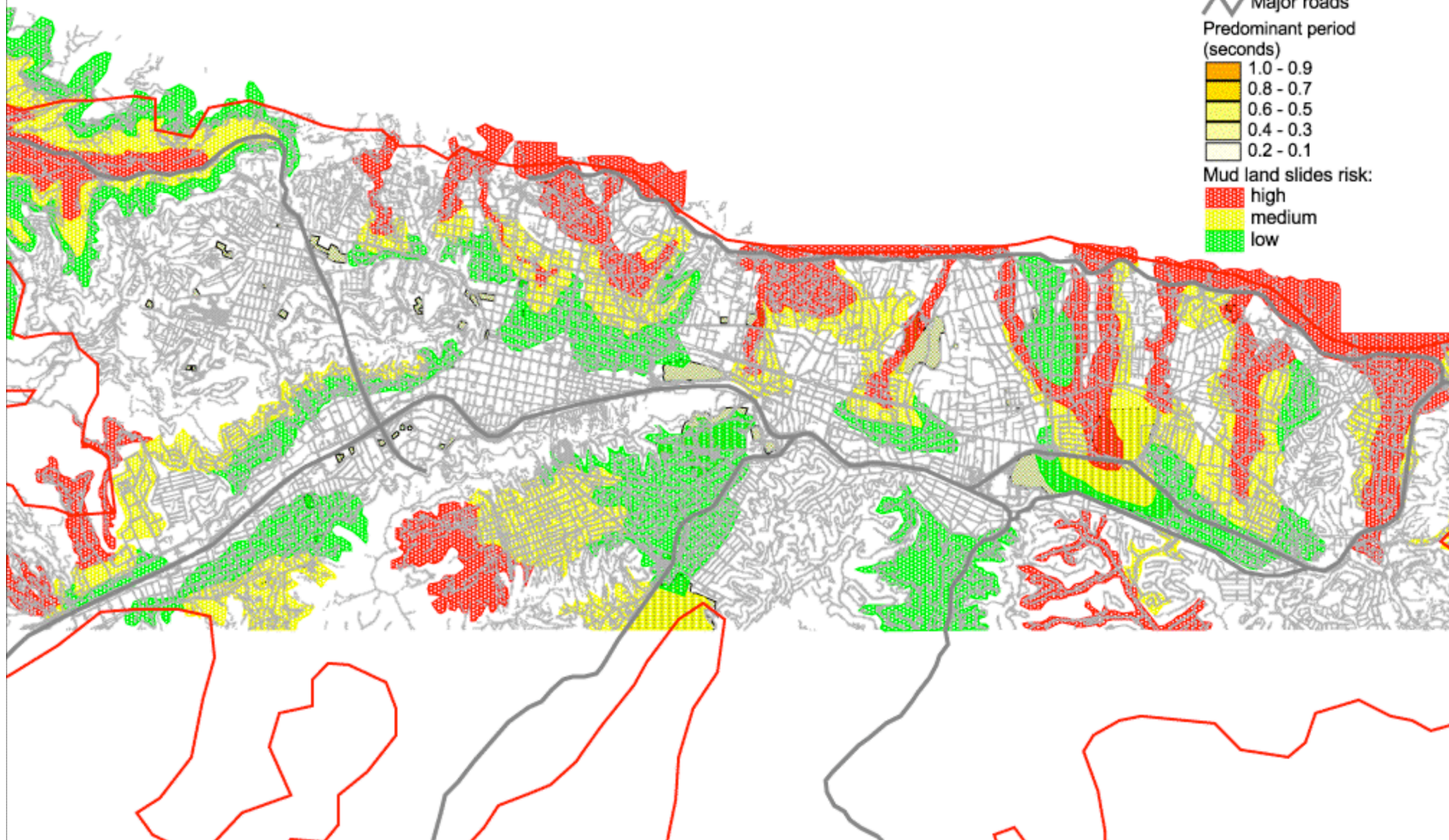


Geoscience & Urban Planning





- Urban outline
- Reserved open space
- Major roads
- Predominant period (seconds)
 - 1.0 - 0.9
 - 0.8 - 0.7
 - 0.6 - 0.5
 - 0.4 - 0.3
 - 0.2 - 0.1
- Mud land slides risk:
 - high
 - medium
 - low



HAZARDS

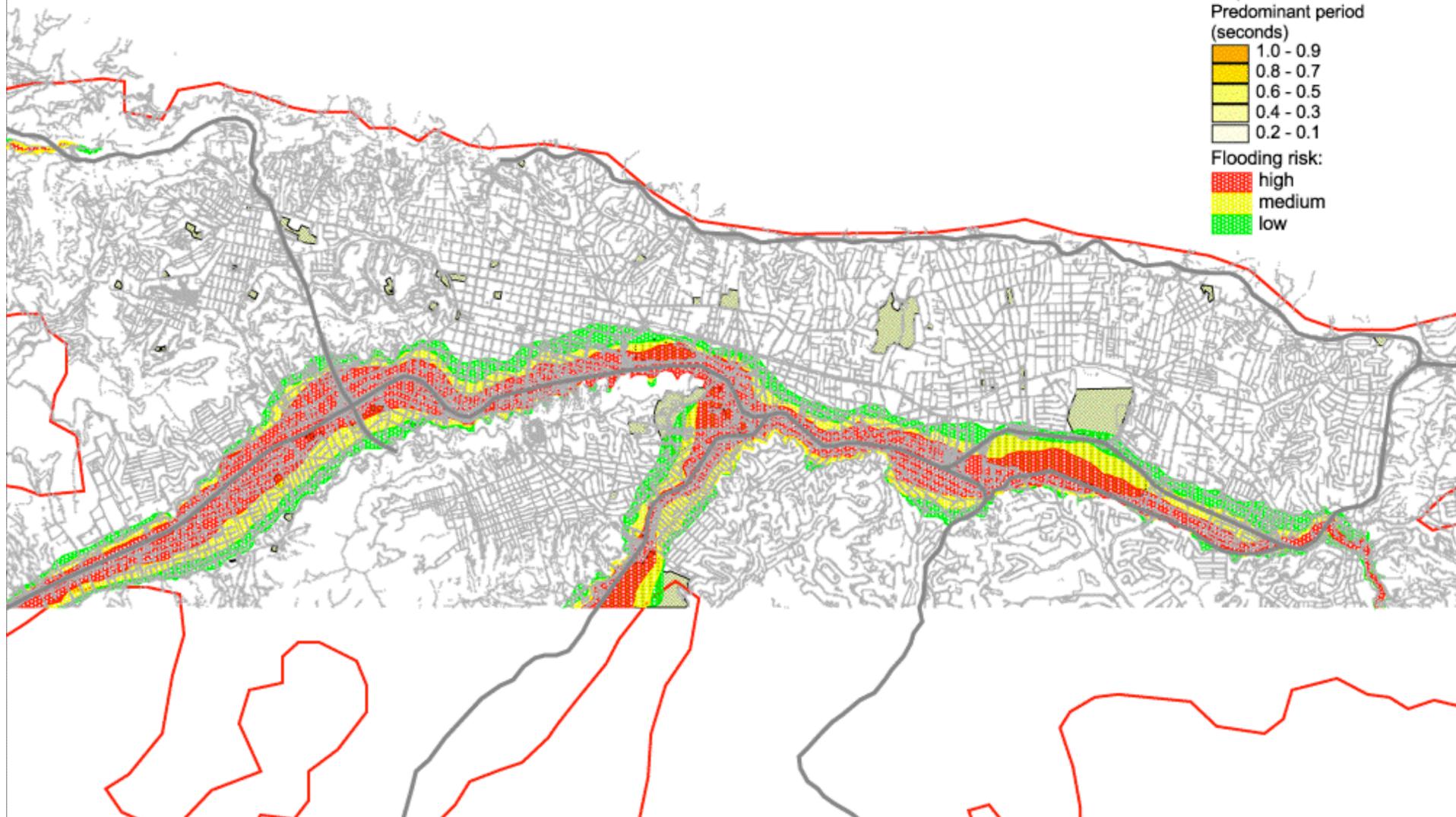
river flooding

1:75,000

1 0 1 Kilometers



- Urban outline
- Reserved open space
- Major roads
- Predominant period (seconds)
 - 1.0 - 0.9
 - 0.8 - 0.7
 - 0.6 - 0.5
 - 0.4 - 0.3
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HAZARDS seismic + debris flows/landslides + floods

1:75,000
1 0 1 Kilometers



- Urban outline
- Reserved open space
- Major roads

Seismic shaking periods (seconds)

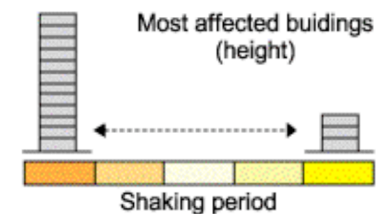
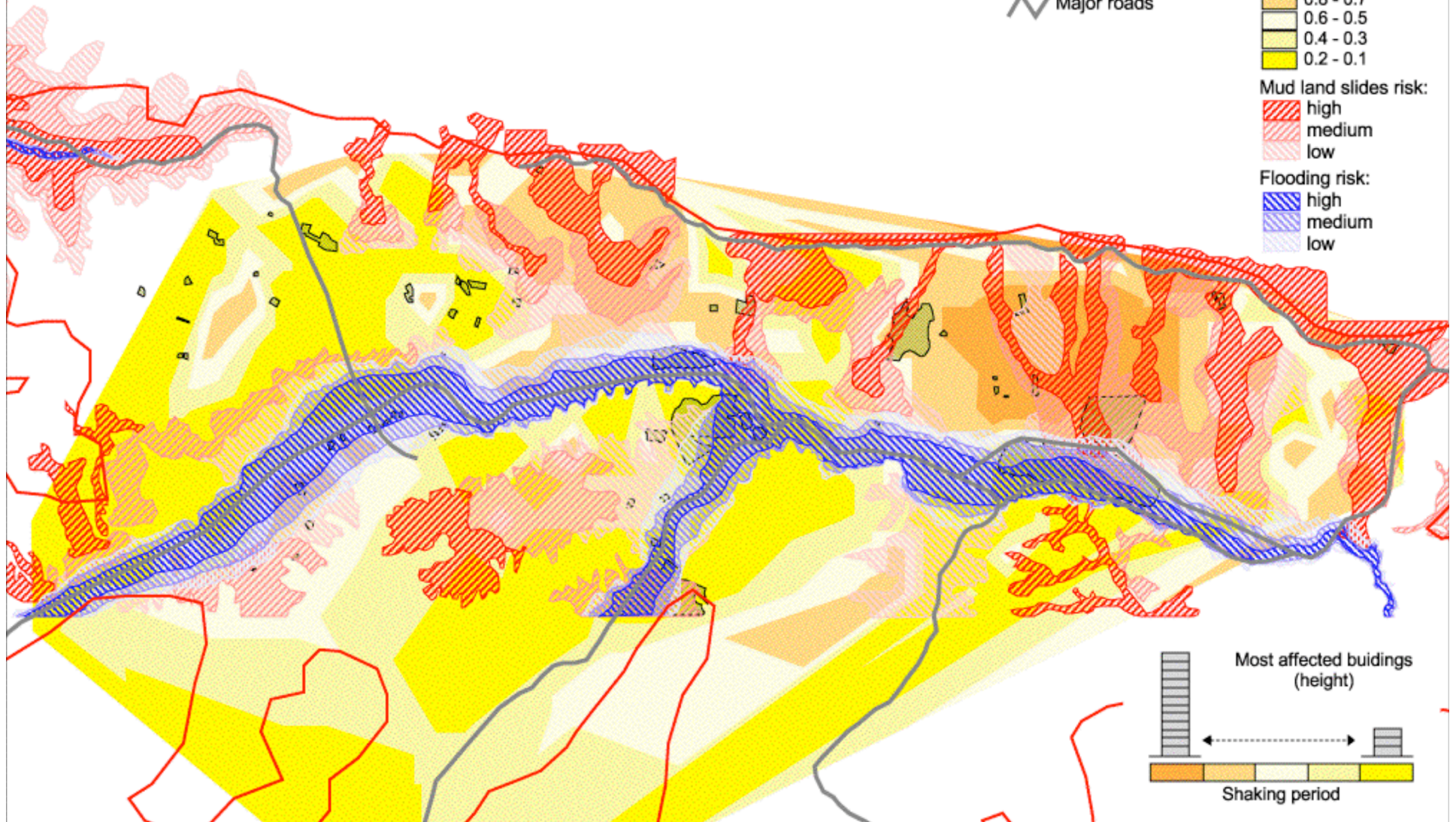
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- 0.8 - 0.7
- 0.6 - 0.5
- 0.4 - 0.3
- 0.2 - 0.1

Mud land slides risk:

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Flooding risk:

- high
- medium
- low



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Action Plan

Tier 1

Medical - Hospitals, ambulances, clinics, Red Cross, field hospitals & equipment
Water - Supply infrastructure, aqueducts, storage tanks , treatment tanks
Transportation - All roads, rail lines, airports, heliports, seaports, evacuation routes
Shelter / Housing - Existing structures, tents, cots, community centers
Communications - Emergency broadcast systems, cell phone, radio/TV transmission

Tier 2

Fuel - Storage Tanks, delivery mechanisms, pipelines
Fire/HAZMAT - Fire stations, equipment, response systems
Electricity - Power generators, Transmission stations, back-up generators
Food - storage warehouses, distribution points, refrigeration

Tier 3

Reserved Spaces - Stadiums, parks, fields, tent cities
Sanitary Facilities - Treatment facilities, temporary sanitation

Systems

Management System Search & Rescue Law enforcement & Security

- Hazard Mitigation Plan
 - Reserved Open Space
 - Evacuation Routes
 - Storage Warehouses
- Emergency Response System
 - Search and Rescue Teams
 - Field Hospitals
 - Power Generation Stations

Tier 1 and 2 Systems

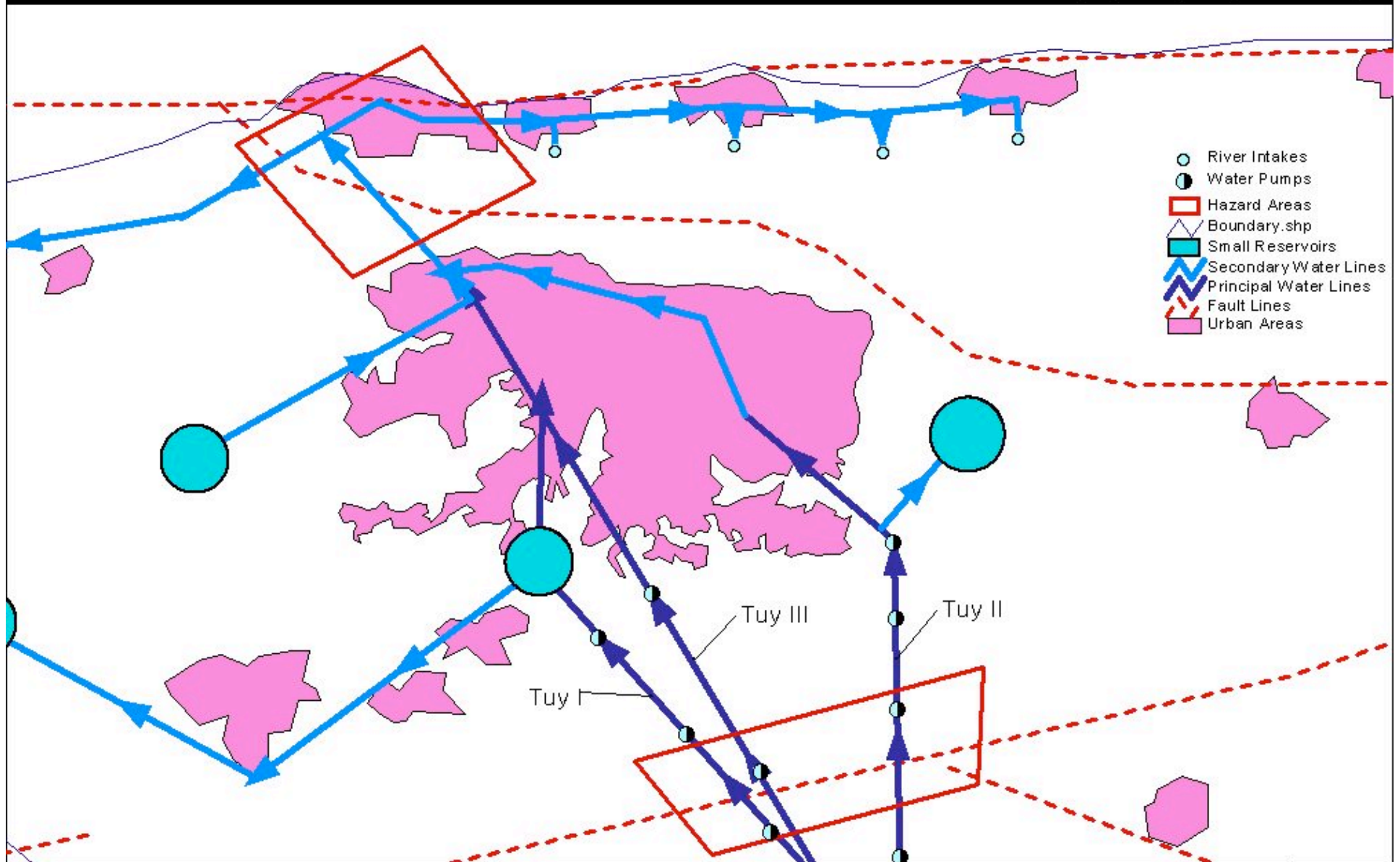
- Water
- Transportation
- Communications
- Electricity
- Fuel and Natural Gas
- Sewage

ACTION PLAN

water supply infrastructure

1:200,000

1 2 Kilometers



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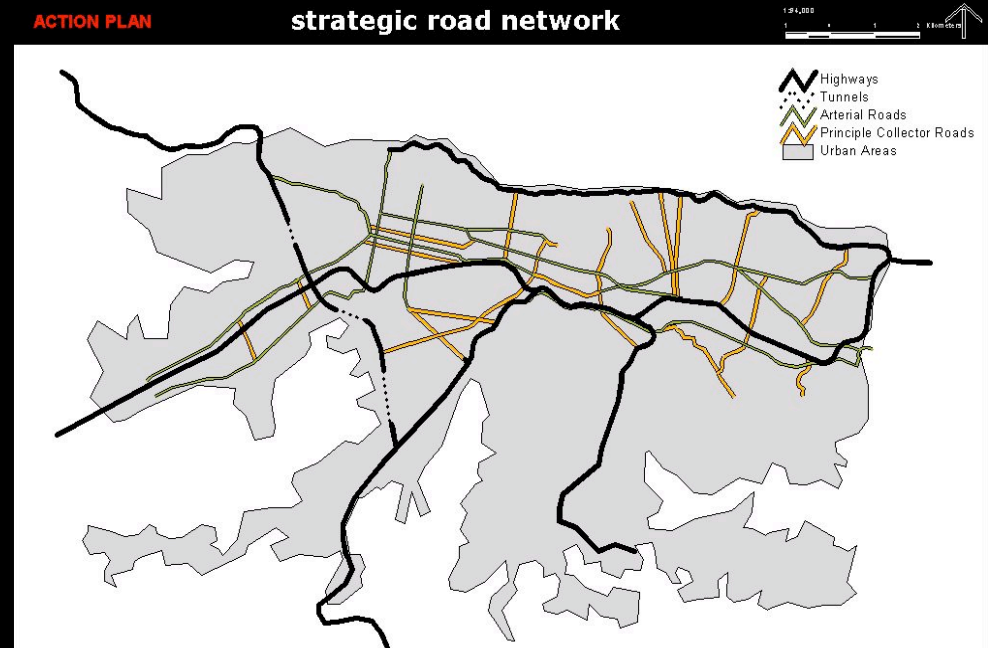
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- Robust and Reliable Water Supply System
- Need for Water Storage Inside the City
- Backup Power for Pumping Stations
- Backup Water Distribution Network



- Robust and Redundant System
- System to Remain Intact and Operable
 - Reinforcement and Retrofitting Existing System
- Creation of Strategic Network
 - Network to Include Emergency Routes
 - Improved Access to the Valley and Coast

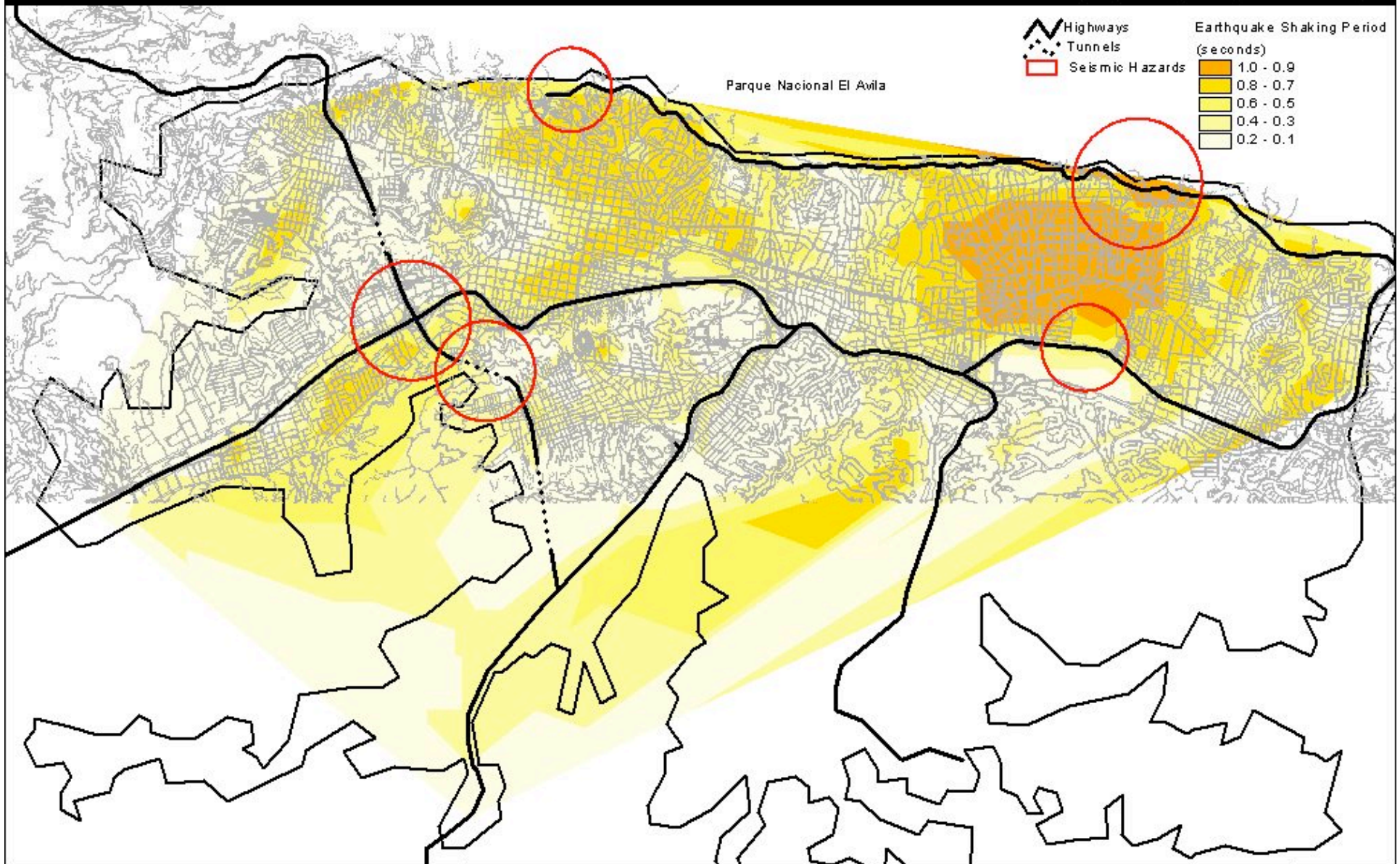


ACTION PLAN

seismic risk- transportation

1:75,000

1 2 Kilometers



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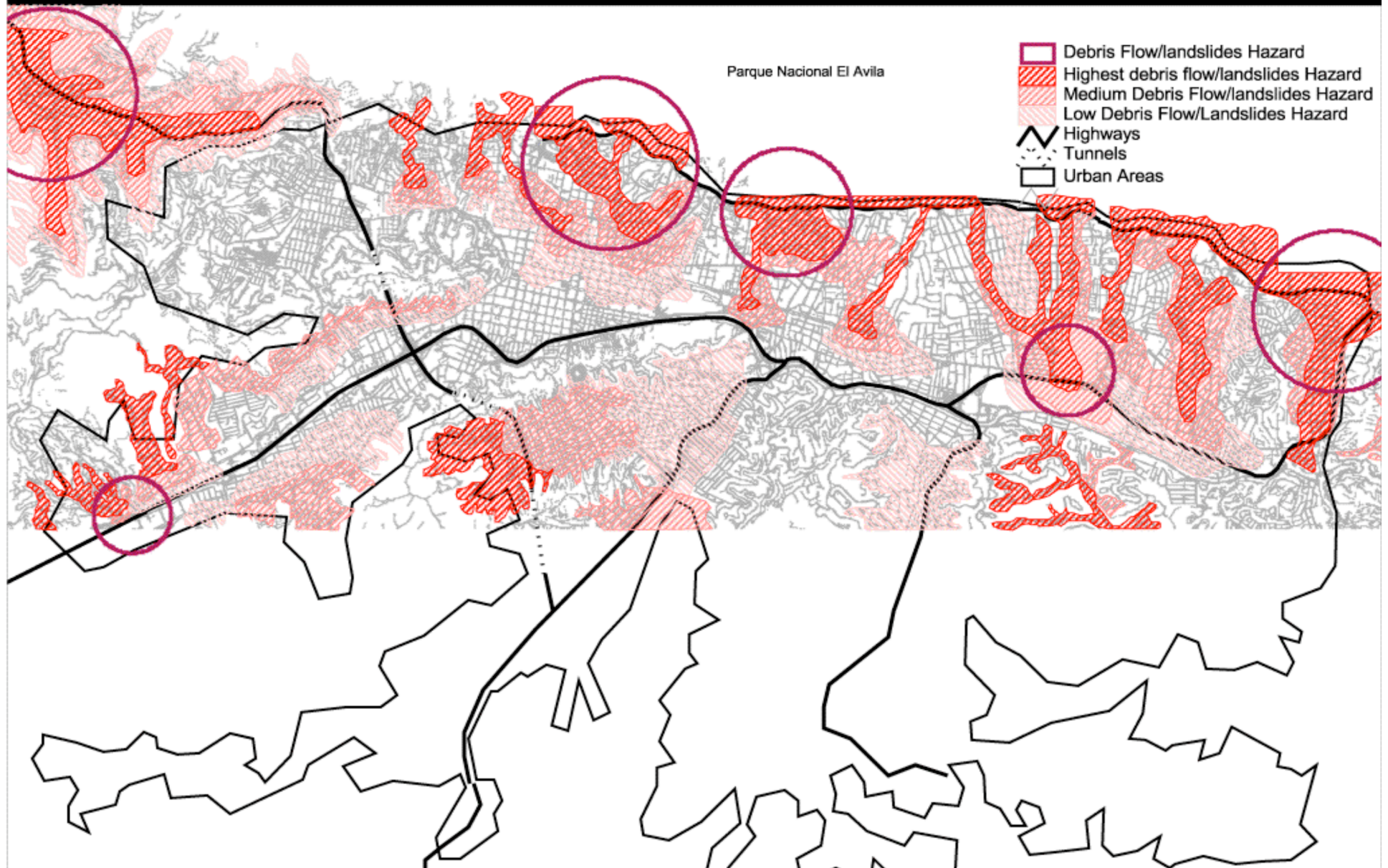
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ACTION PLAN

debris flow/landslides - transportation

1:75,000

1 0 1 2 Kilometers



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ACTION PLAN

flood hazard - transportation

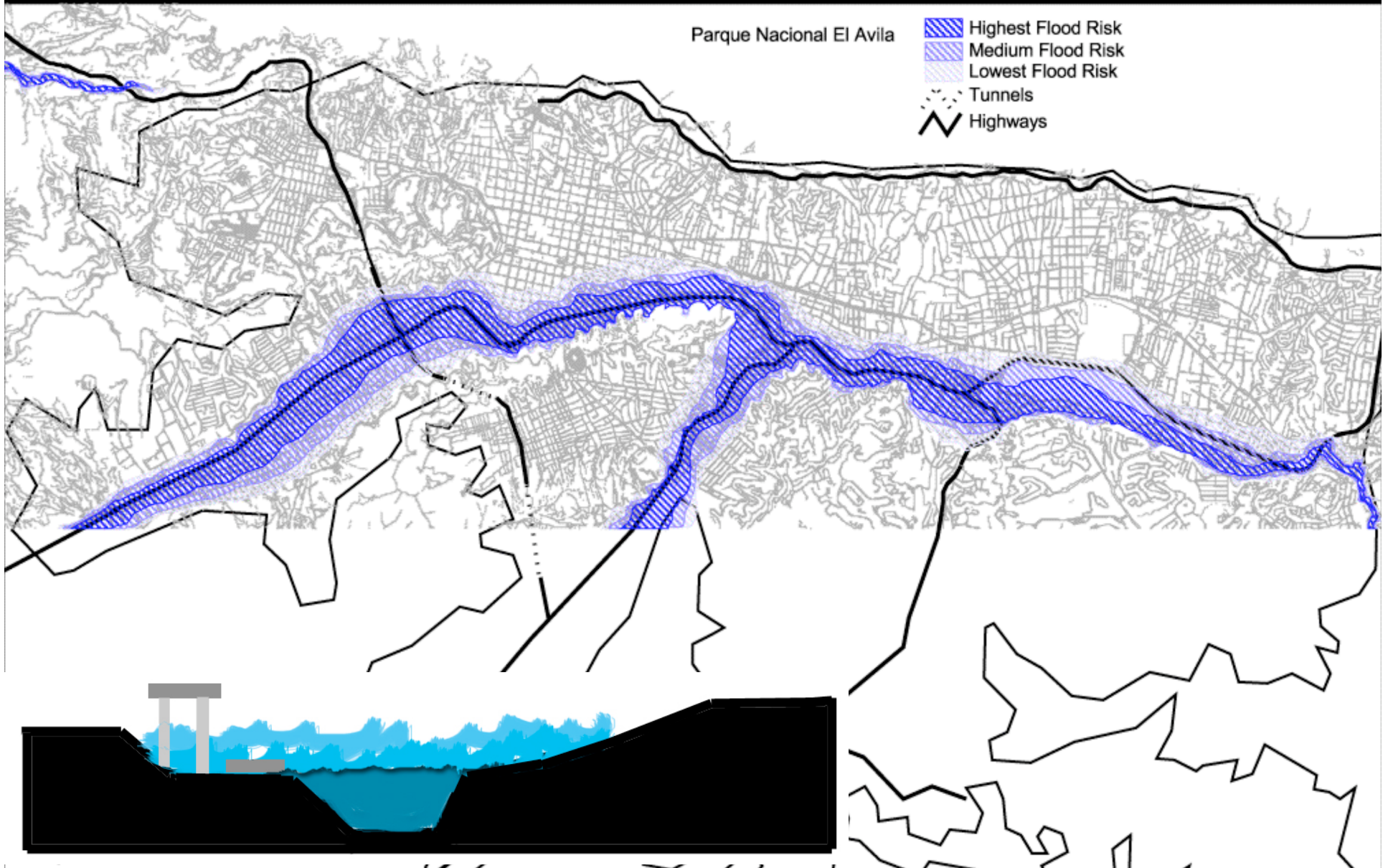
1:75,000

1 0 1 2 Kilometers



Parque Nacional El Avila

- Highest Flood Risk
- Medium Flood Risk
- Lowest Flood Risk
- Tunnels
- Highways



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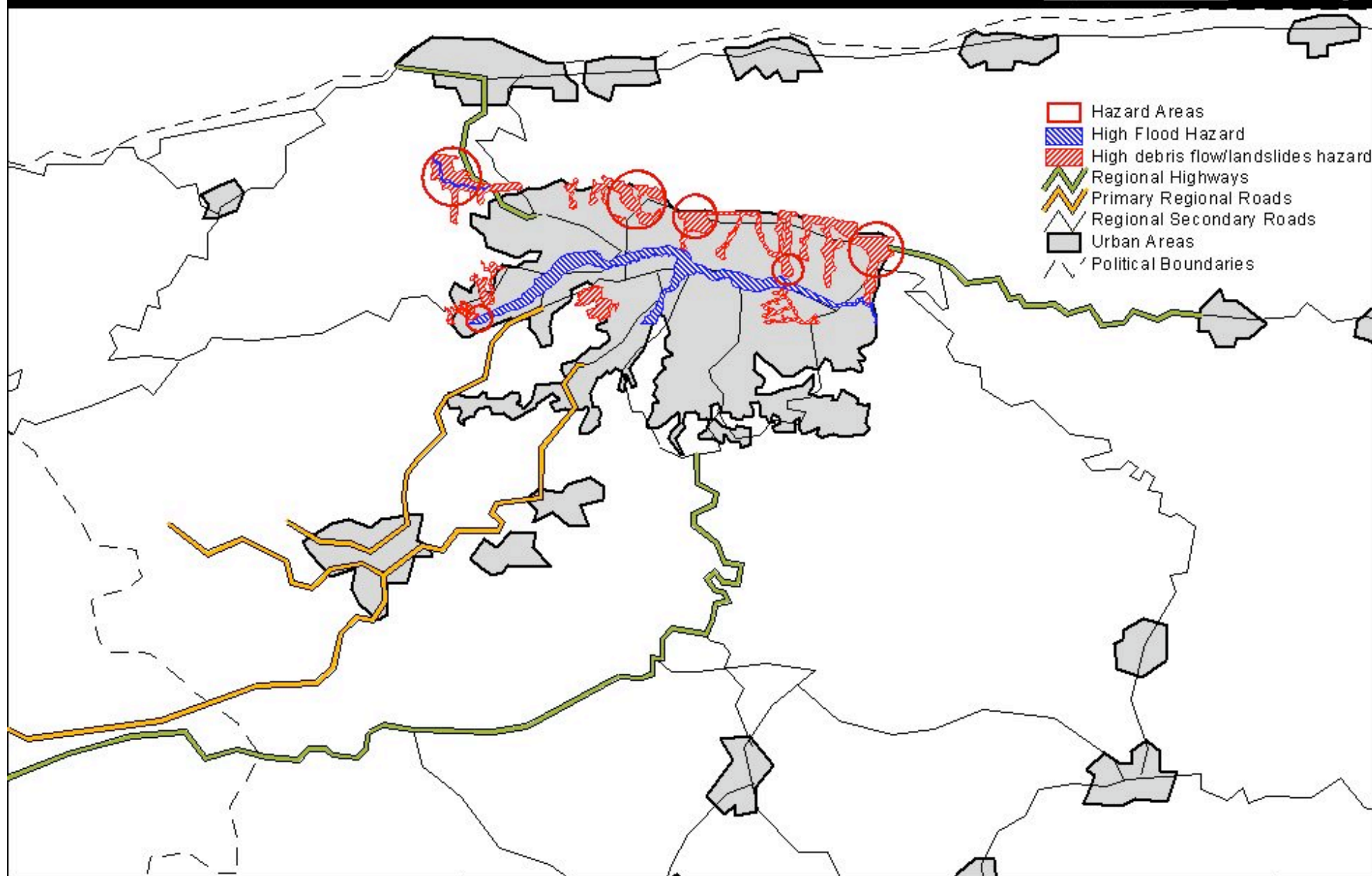
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ACTION PLAN

regional transport/hydro hazard

1:200,000

1 2 Kilometers



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- Robust and Reliable Communications System
- Emergency Broadcast System
- Unified Emergency communications center
- Prevent gridlock



Hospitals, Fire and Police Stations

- Access to these facilities must be improved
- New facilities must be built in under-served areas
- Existing facilities must be strengthened and made self-sufficient

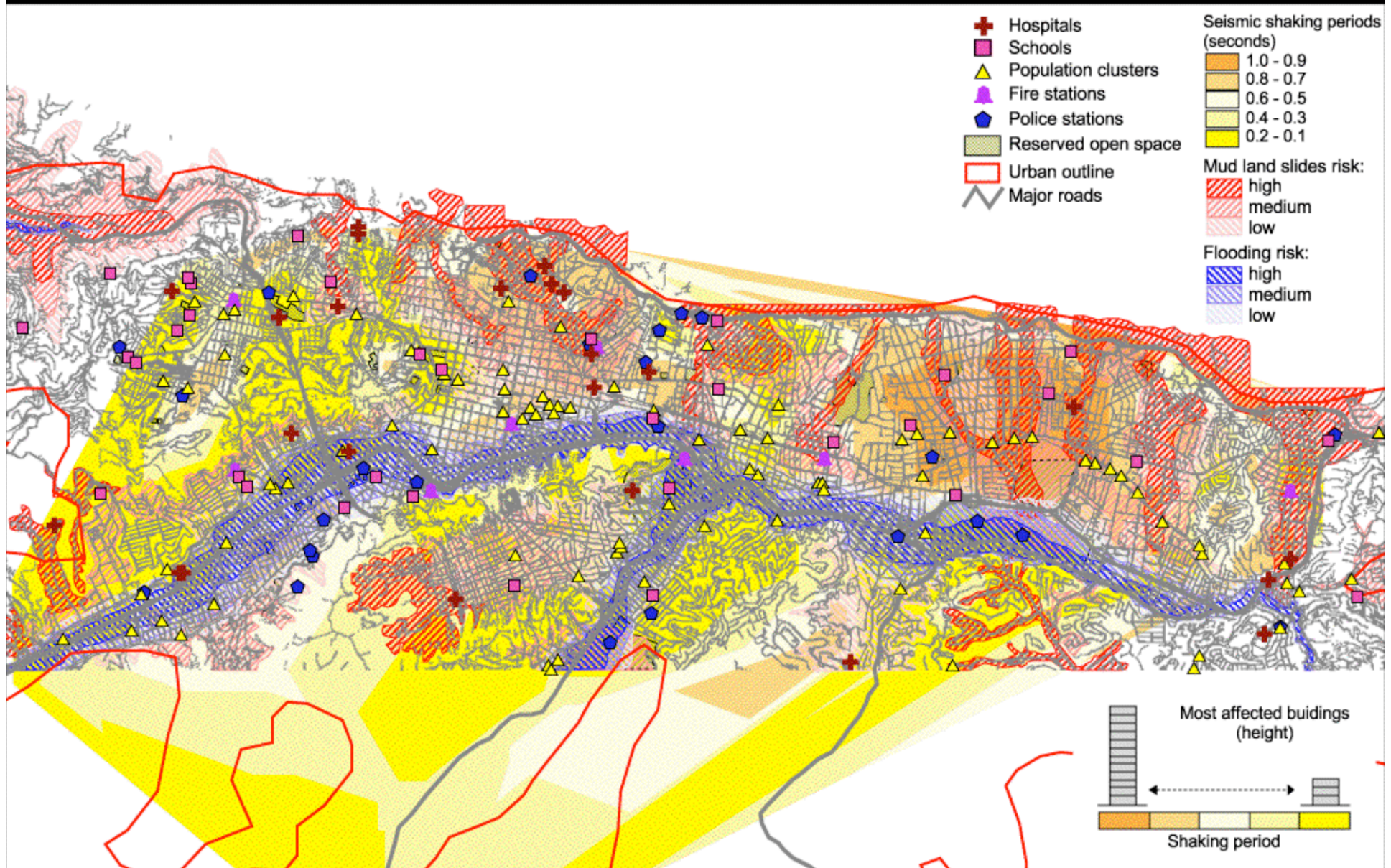
HAZARDS critical facilities & hazards

1:75,000

1 0 1 Kilometers



- Hospitals
 - Schools
 - Population clusters
 - Fire stations
 - Police stations
 - Reserved open space
 - Urban outline
 - Major roads
- Seismic shaking periods (seconds)
- 1.0 - 0.9
 - 0.8 - 0.7
 - 0.6 - 0.5
 - 0.4 - 0.3
 - 0.2 - 0.1
- Mud land slides risk:
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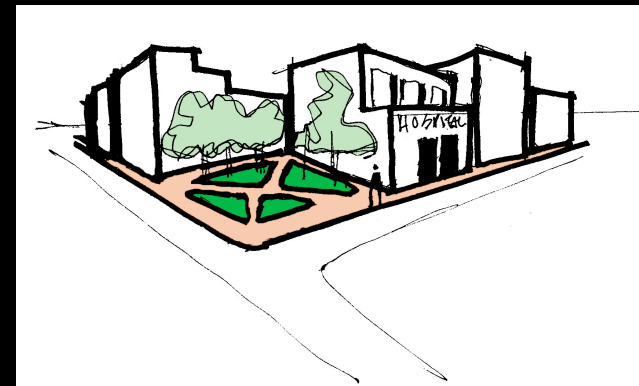
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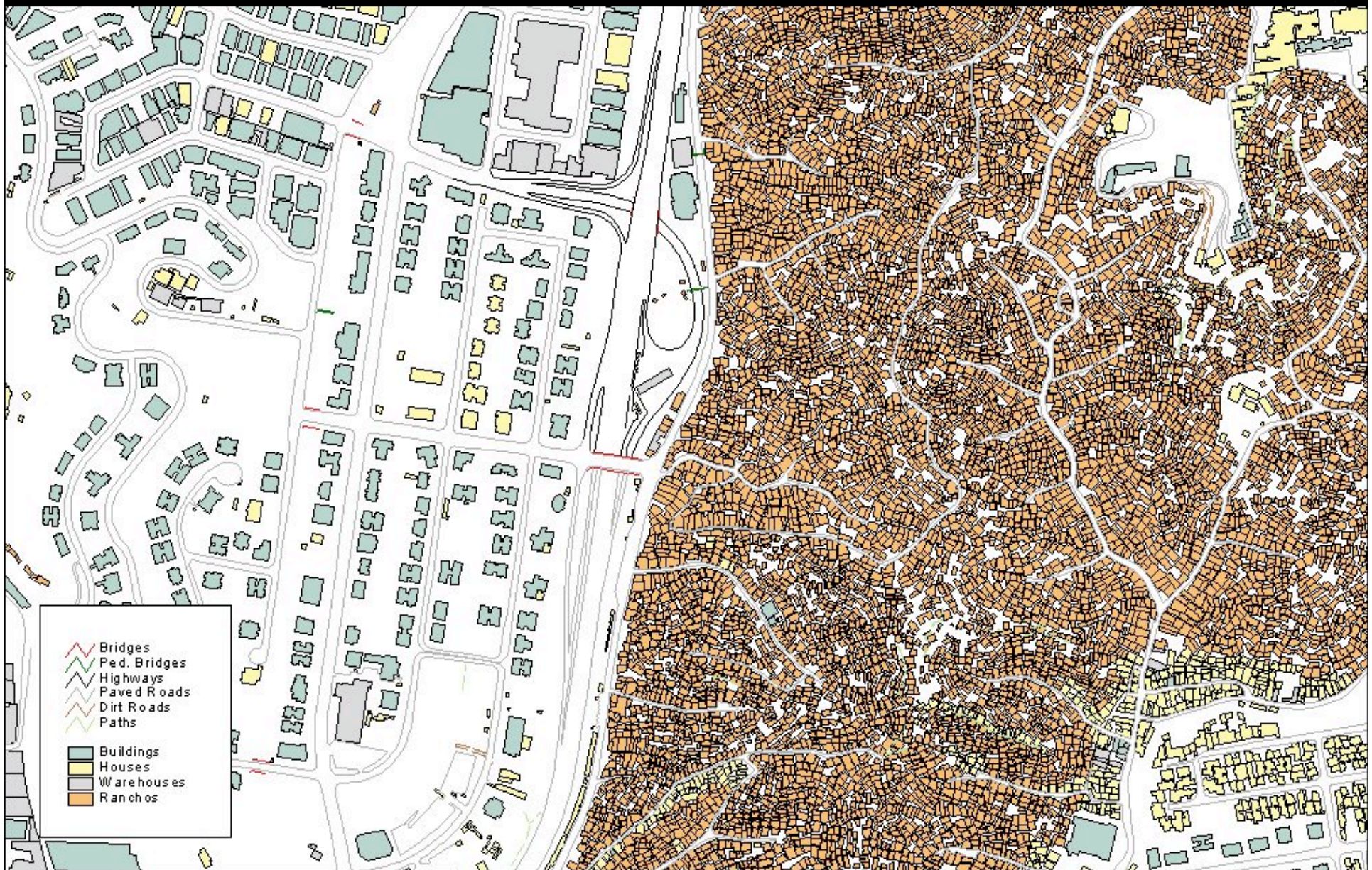
Reserved Spaces - Parroquias

- Normal Function
 - Parks and Plazas
 - Recreation Fields
 - Community Centers
 - Open-air markets
 - Preserve historic areas
- Disaster Function
 - Evacuation Sites
 - Temporary Shelters
 - Field Hospitals
 - Information Posts
 - Supply Distribution Points



ACTION PLAN

petare



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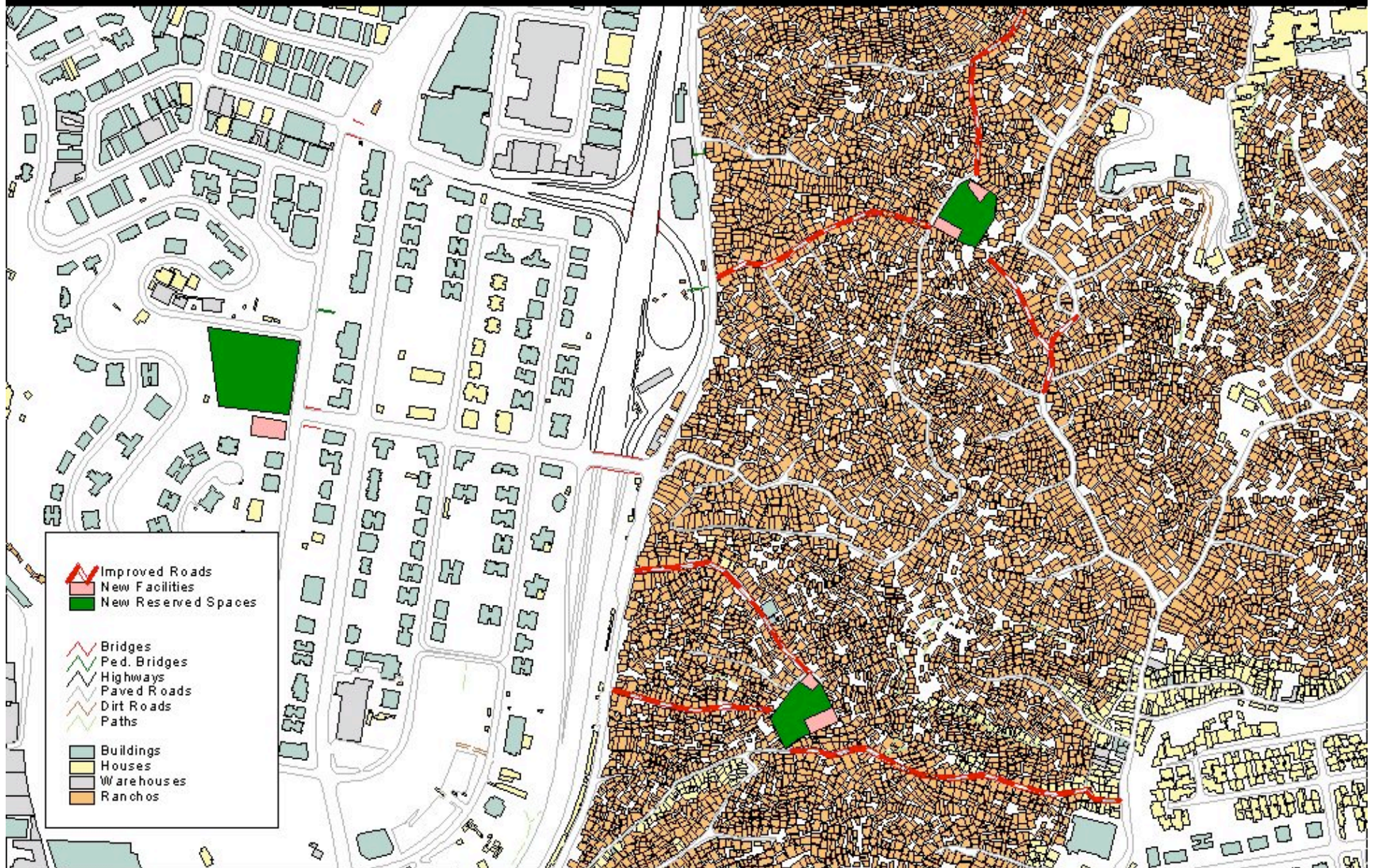
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ACTION PLAN

new reserved spaces



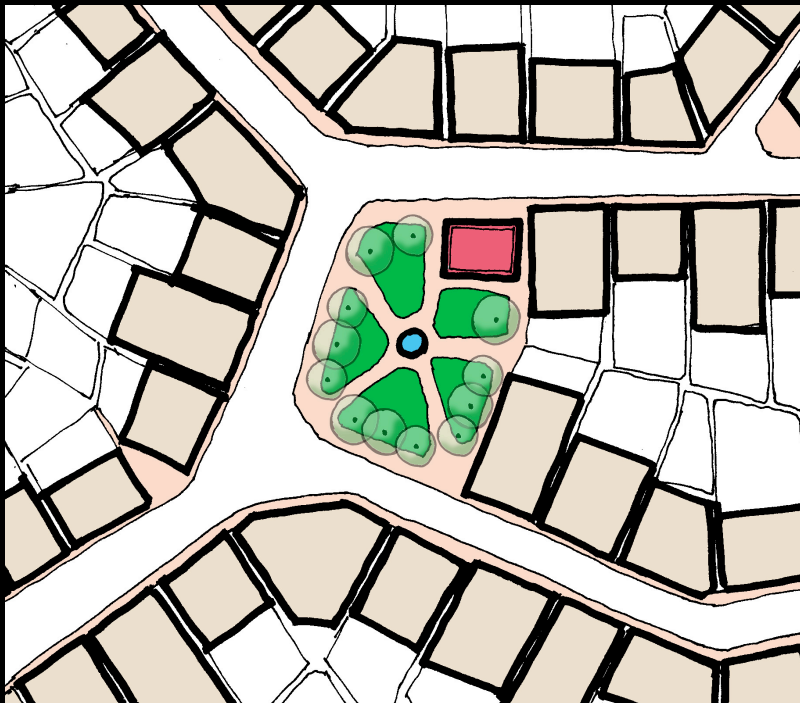
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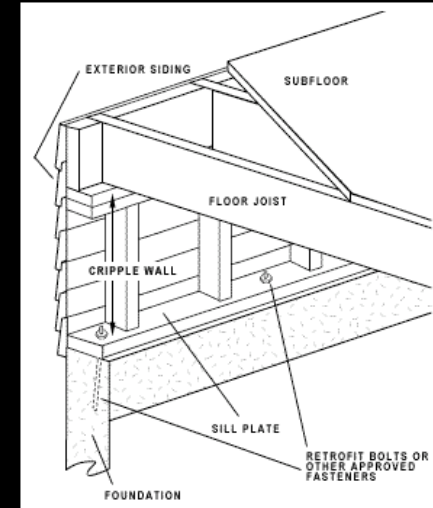
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Structural design

- Retrofitting
- Building Codes
- Construction Training



Economic & planning policy

- Land Title
- Loans & Tax Incentives
- Planning & Provision

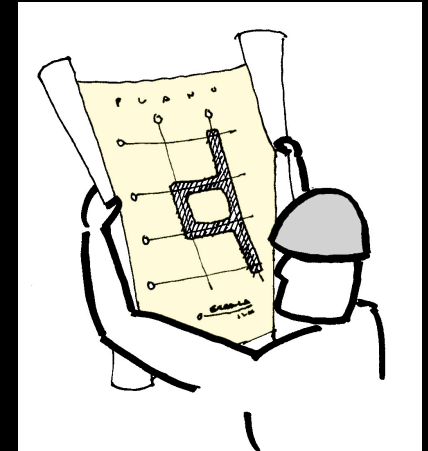


- Requires social policy
 - Community Participation
 - Maintain Social Networks
- Requires land use policy
 - Increase Density via Appropriate Design
 - Enhance access





Technical Assistance



Interactive Training and Educational Exchange



Projections

schematic timeline

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Infrastructure

coastal connector

redundancy

Housing

hardening/
relocation

zoning

land title

Administration

disaster ministry

Science

data mining

hazard mapping

disaster info
clearinghouse

Education

hazard curriculum

volunteer corps

academia

0-5

5-10

10-20

years

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HAZARDS
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Some questions

- Are cost-benefit strategies useful when loss uncertainties are large or expressed over decade time scales?
- The largest uncertainties are associated with the most extreme events. Should there be an emphasis on more persistent hazards to maintain growth?
- What are the barriers to implementing evidence-based risk management policies?
- What are the most useful international or regional frameworks for financing natural hazard risk management, including preparedness, response and reconstruction?

Practical suggestions:

- Make sure there are trained professionals in government and community services, in design/architecture, construction and planning
- Make every decision with an understanding of risk
- Teach the children
- Decentralize - “Safe Neighborhoods” “Safe Villages”
- Commit to regional information sharing, data exchange and knowledge management

Policy options for preparedness: Baselines

- Structure Census
 - Formal and informal residences
 - Commercial enterprises
 - Infrastructure nodes and links
- Assessments of demographic mobility
 - Evacuation
 - Temporary re-location

Policy options for preparedness: Baselines

- Understand supply chains and “economic footprints”
 - Social and business continuity
- Practice information flow
 - Regional -> National -> Local
- Determine decision pathways
 - Responsibility
 - Authority

Disaster continuity: Local buffering capacity

- Build “continuity models”
 - Physical and financial bridges back to normal operations
- Establish contingent credit and grant models
 - Microfinance
 - Small business grants
 - Neighborhood block grants

Sustainability models

- Culture of preparedness depends on political will, public awareness and professional interest
- Link public awareness to economic opportunity in mind of public
- Make Caracas/Venezuela a “case study laboratory” for collaborative research and education and training.

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Gracias
Thank You

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