resilientSEE™

OUR GLOBAL ALLIANCE

Academic / Private Industry / Non-Profit Orgs

MULTIDISCIPLINARY TEAM

Community Organization

Sociology

Policy / Urban Affairs / Climate Justice

Architecture / Landscape Design

Urban Design / Planning

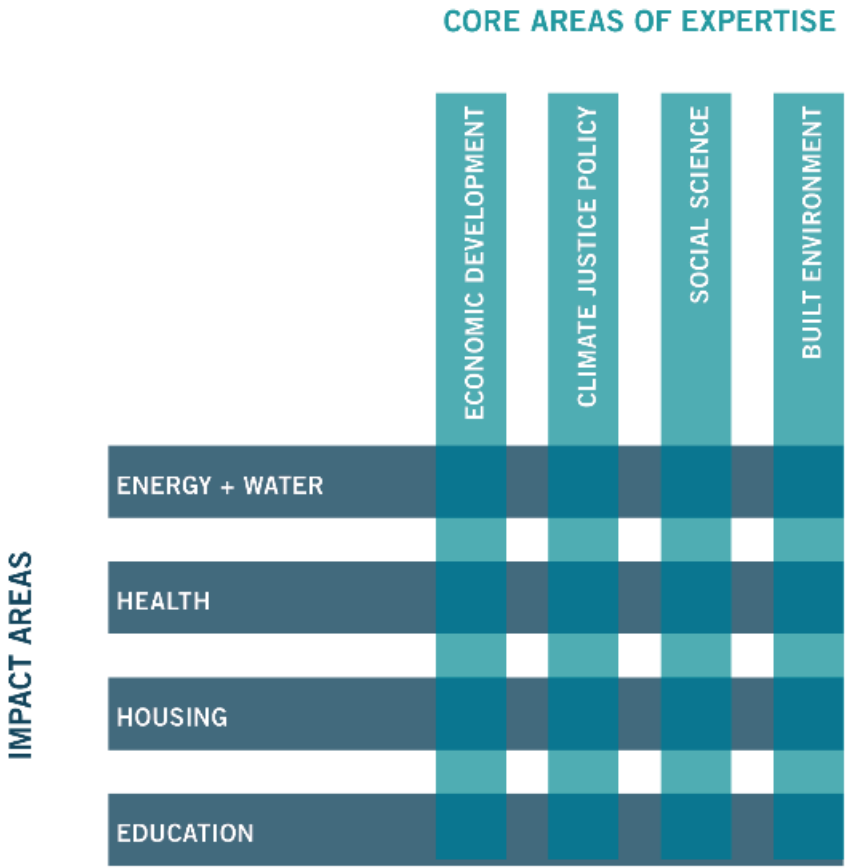
Infrastructure / Energy + Water

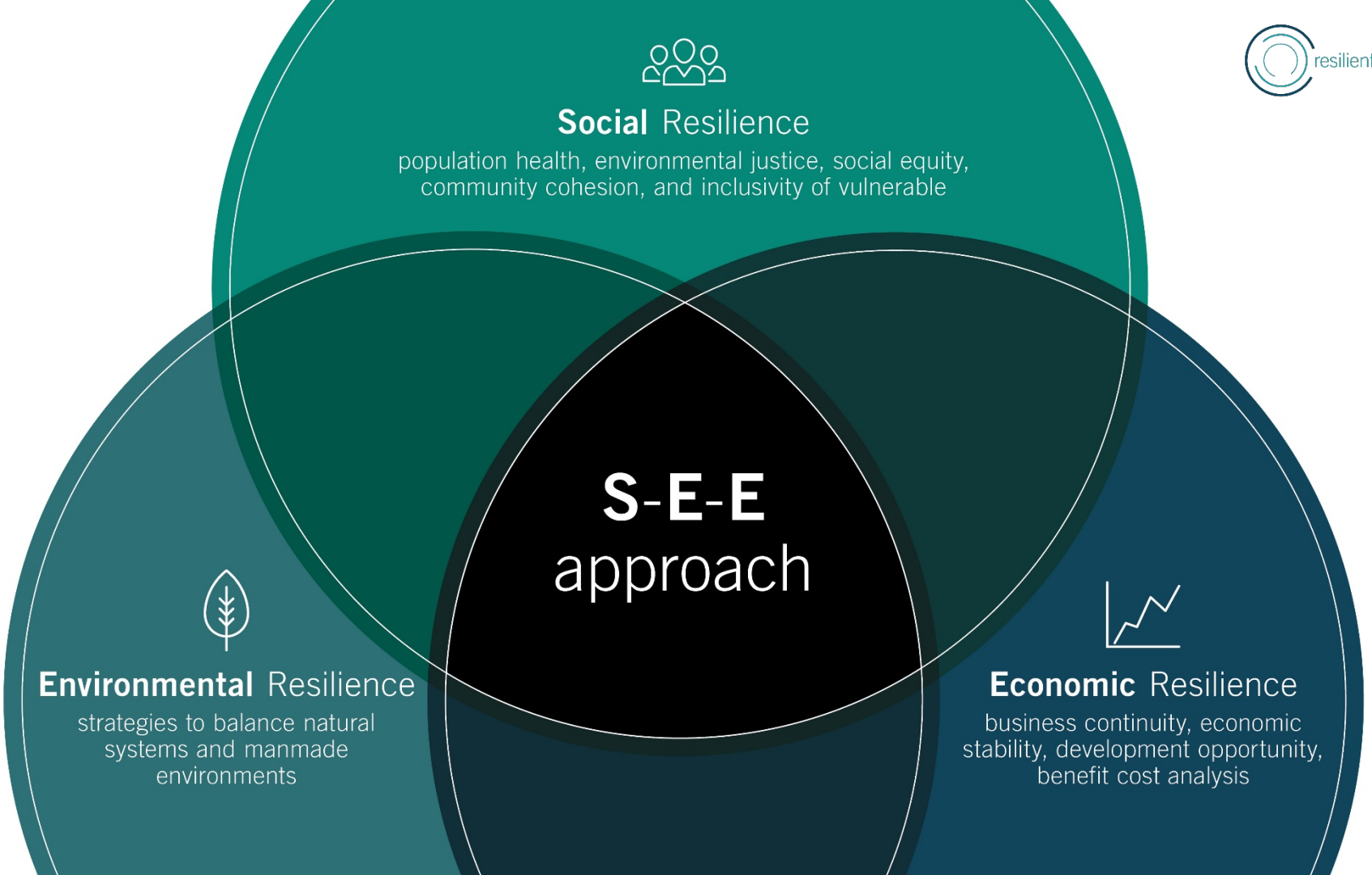
Coastal / Landslide Engineering

Healthcare / Mission Critical

Agriculture & Nutrition

Economic Development




resilientSEE™
Social Resilience
population health, environmental justice, social equity, community cohesion, and inclusivity of vulnerable
S-E-E approach
Environmental Resilience
strategies to balance natural systems and manmade environments
Economic Resilience
business continuity, economic stability, development opportunity, benefit cost analysis

TRUE RESILIENCE REQUIRES…

A MULTIDISCIPLINARY LENS WITH A “SEE” APPROACH

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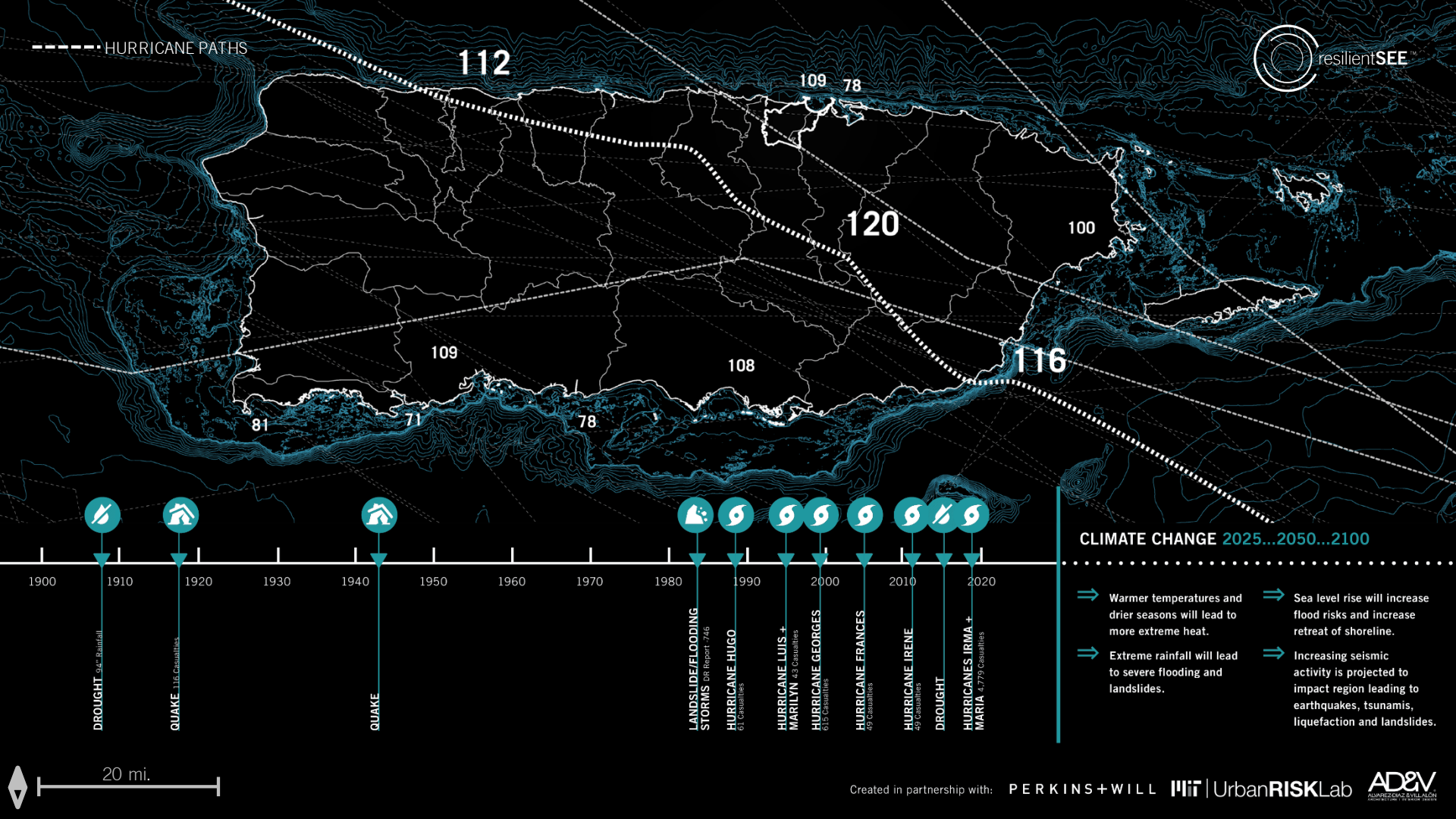
		1 UNDERSTANDING AND AWARENESS	2 ANALYSIS AND ENGAGEMENT	3 PRINCIPLES AND FRAMEWORK
S SOCIAL	• Understand demographics + root causes of inequity. Review of vulnerable populations and public health impacts. • Identify stakeholders + champions, create an inclusive framework. Analyze data to determine alignment with social equity outcomes. • Raise awareness, develop strategies, and track success indicators for Health, Wellbeing, Environment, and Economic.	VULNERABLE POPULATIONS	LOCAL PRESENCE	RESILIENT DESIGN GUIDELINES
E ENVIRONMENTAL	• Analyze disaster + hazards to understand vulnerabilities and risks. Map environmental degradation to natural resources and establish climate projections. • Engage community to develop a design with nature process. Create awareness on benefits of environmental stewardship, enhance regional economy. Focus on pilot projects to demonstrate successes and opportunities.	POOR INFRASTRUCTURE	COLLABORATIVE ANALYSIS	DEVELOPMENT OPPORTUNITIES
E ECONOMIC	• Understand local economic drivers, existing land uses and future drivers. • Analyze cost + financial proforma to evaluate and propose policy + programs that promote small businesses, local industry and public participation. Find opportunities to foster alliances between public and private sector. • Develop an Action Plan that promotes diversity, inclusion and culture.	BUSINESS CONTINUITY	ENGAGE POLICY MAKERS	ECONOMIC TOOLS

TRUE RESILIENCE REQUIRES…

COMMUNITY CO-AUTHORED SOLUTIONS


HURRICANE PATHS
112
109
78
120
100
109
108
116
81
71
78
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
2020
DROUGHT 94" Rainfall
QUAKE 116 Casualties
QUAKE
LANDSLIDE/FLOODING STORMS DR Report 746
HURRICANE HUGO 61 Casualties
HURRICANE LUIS + MARILYN 43 Casualties
HURRICANE GEORGES 615 Casualties
HURRICANE FRANCES 49 Casualties
HURRICANE IRENE 49 Casualties
DROUGHT
HURRICANES IRMA + MARIA 4,779 Casualties
CLIMATE CHANGE 2025...2050...2100
Warmer temperatures and drier seasons will lead to more extreme heat.
Extreme rainfall will lead to severe flooding and landslides.
Sea level rise will increase flood risks and increase retreat of shoreline.
Increasing seismic activity is projected to impact region leading to earthquakes, tsunamis, liquefaction and landslides.
20 mi.
Created in partnership with:
PERKINS+WILL
MIT | UrbanRISKLab
AD&V

TRUE RESILIENCE REQUIRES…

A DATA DRIVEN PROCESS

ENVIRONMENT: TOPOGRAPHY

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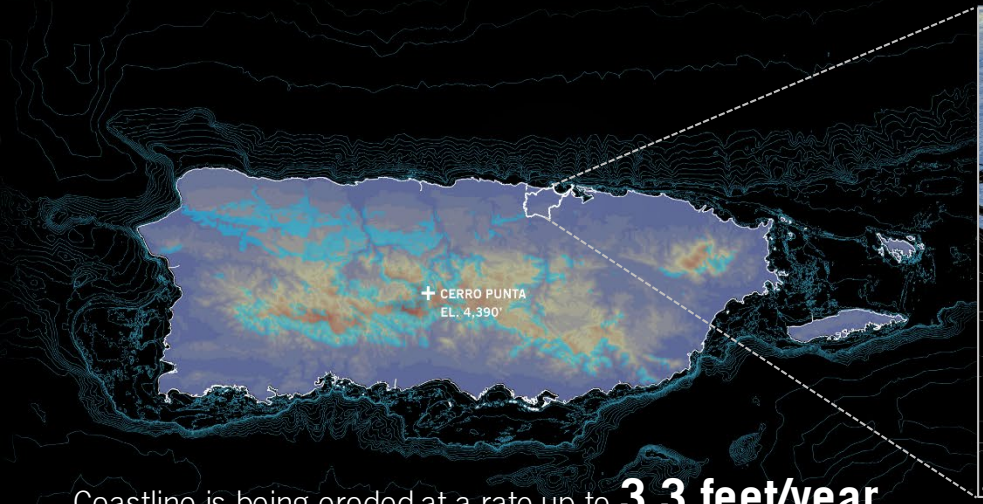
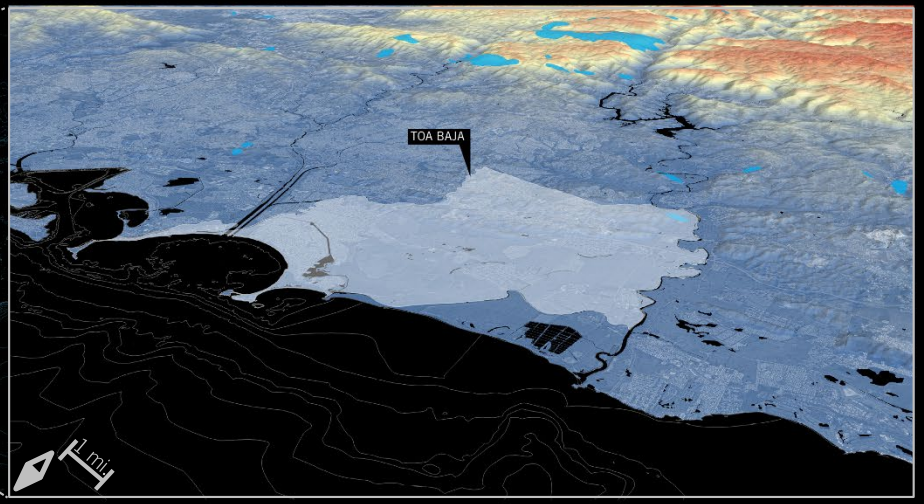
HIGHEST LANDSLIDE RISK

+0' +4400'
ELEVATION
+0' +490'





Coastline is being eroded at a rate up to **3.3 feet/year**

49% of population lives in areas ranging from moderate to high susceptibility for landslides

Growing population density **higher than Japan**, resulting in more construction on vulnerable slopes

Low lying areas of Toa Baja are subject to **Subsidence** and **Liquefaction**

ENVIRONMENT: HYDROLOGY

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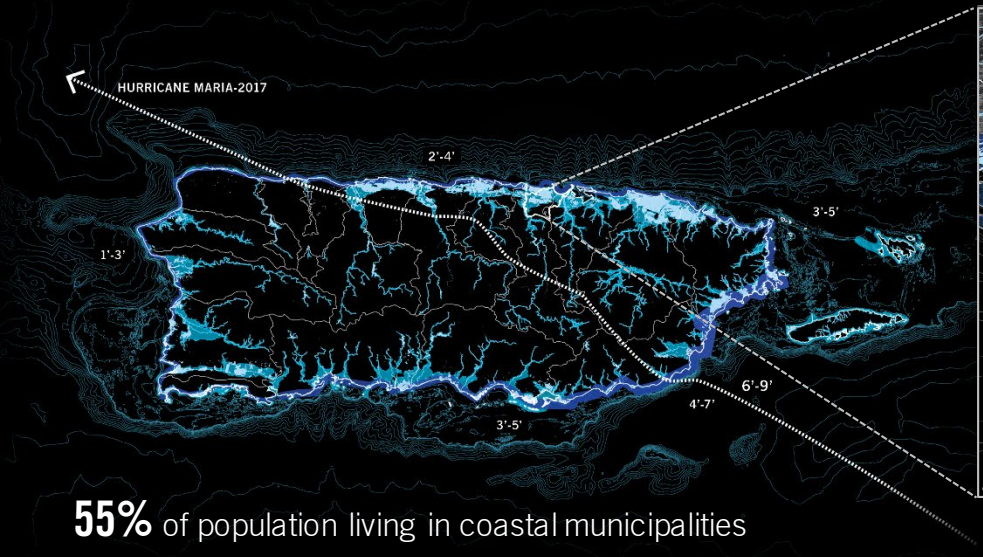
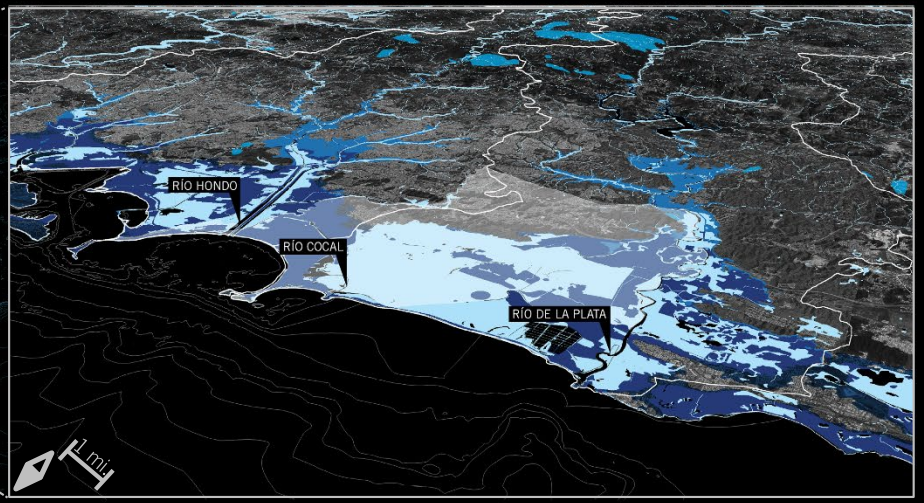
STREAMS | WATERSHED | WETLANDS | 1% STORM FLOOD ZONE | 1'-3" 6'-9" MARIA STORM SURGE INUNDATION





55% of population living in coastal municipalities

500,000 people (15% of the population) live in areas prone to flooding

252,748 structures at risk of flooding

La Plata River floods Toa Baja every **6-10 years**

$500 Million investment for flood control project in Rio de la Plata

ENVIRONMENT: ECOLOGY

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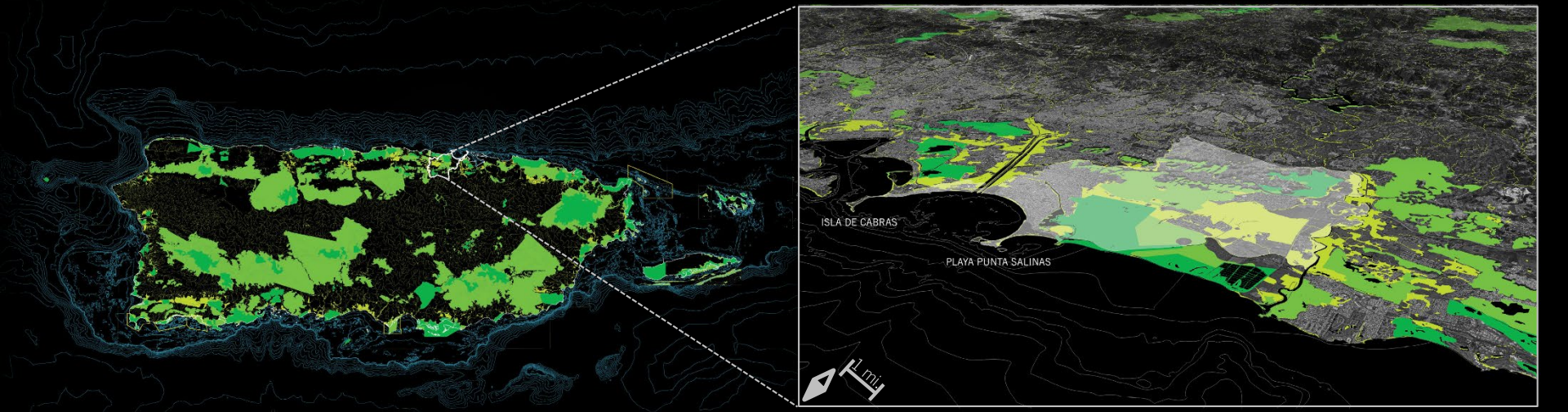
CRITICAL WILDLIFE AREA | CONSERVATION PRIORITY | WETLAND



60 years of natural tree fall happened in one day after Hurricane Maria

20% of the island is karst zone, consists of alluvial & claylike surface. Susceptible to landslides and liquefaction

20 mi.

16.25% developed land

Loss of coastline due to erosion and sea level rise limits public access

Fragmented natural reserves

SOCIAL: INFORMAL HOUSING

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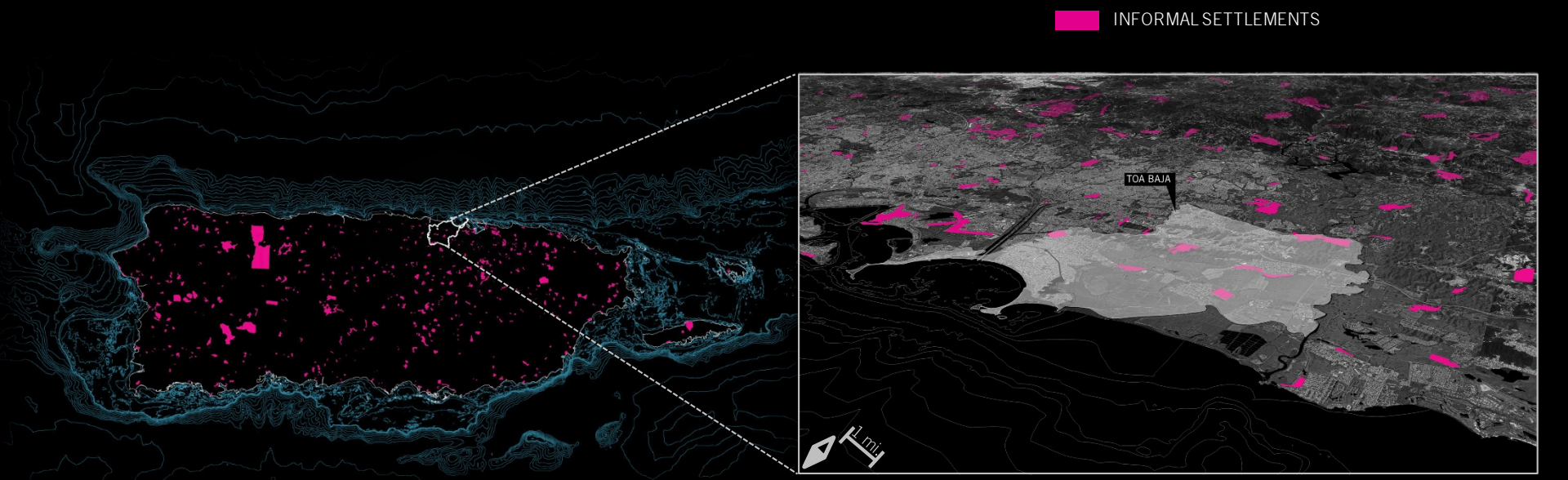

500,000 people (15% of the population) live in areas prone to flooding

250,000 homes severely damaged

Toa Baja has the highest unmet housing needs

4,000 housing units needed

14K + flooded homes

SOCIAL: EMERGENCY SERVICES

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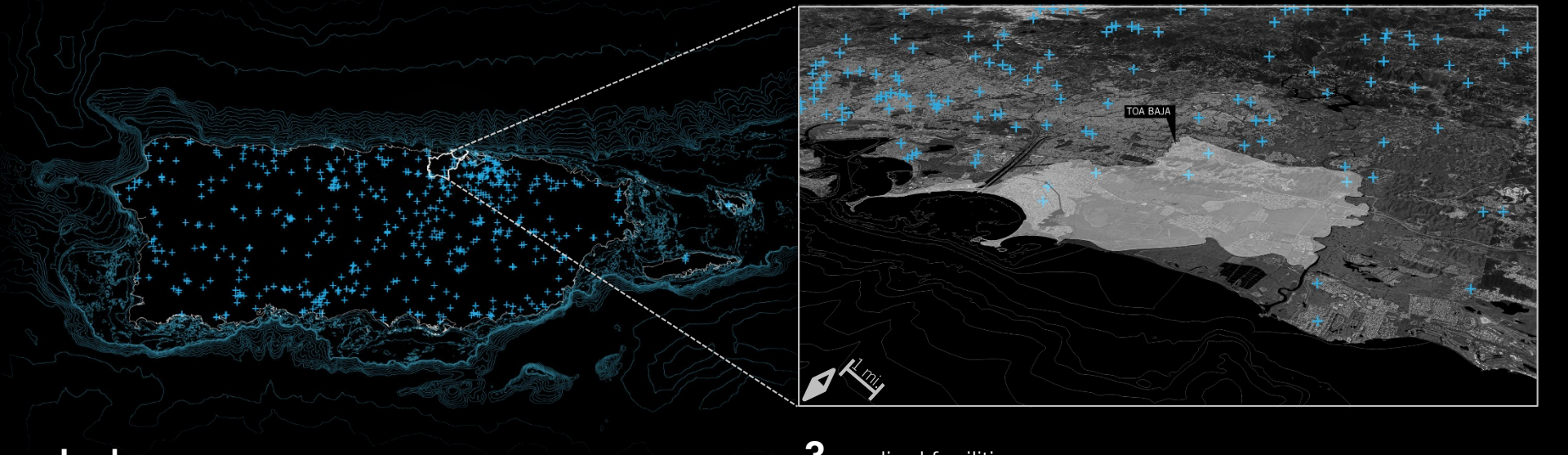
+ HOSPITALS + EMERGENCY SHELTERS



Lack of emergency and medical facilities

3 medical facilities

Social Vulnerability to anticipate, prepare, respond, and recover

20 mi.

ECONOMIC: INFRASTRUCTURE AND DEVELOPMENT

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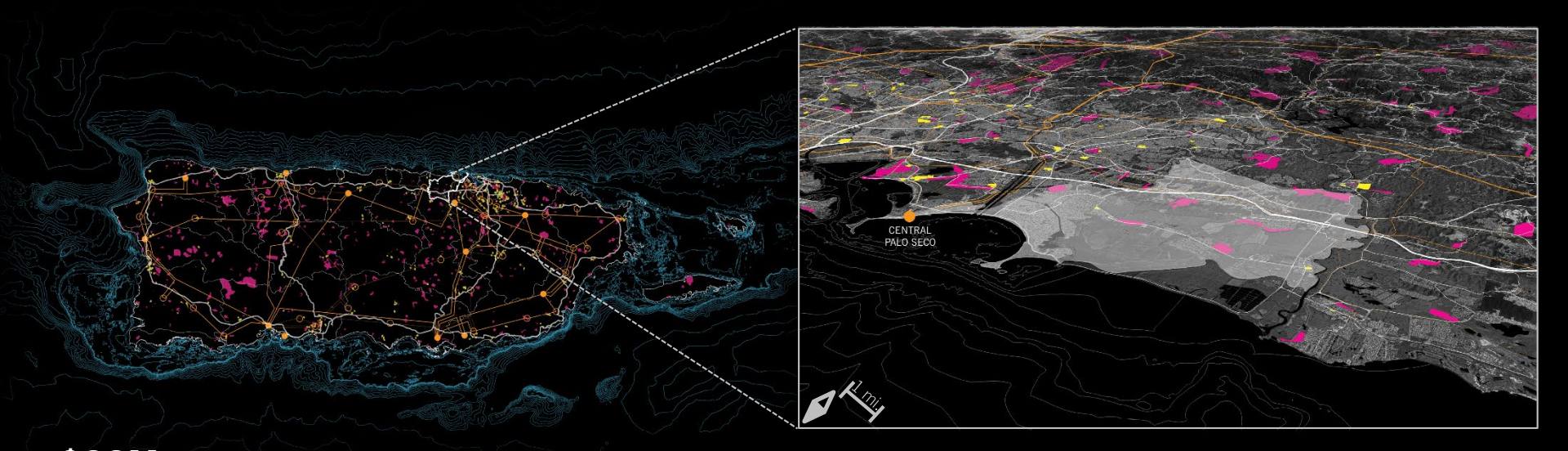
ELECTRICAL INFRASTRUCTURE | INFORMAL SETTLEMENTS | PUBLIC HOUSING



$80M Total economic damages

2nd Largest Blackout in US history

$60M electric infrastructure damage

3 hospitals

4,000 housing units needed

Palo Seco 1 of 2 plants that supply energy to PR is in Toa Baja

RESILIENTSEE VULNERABILITIES

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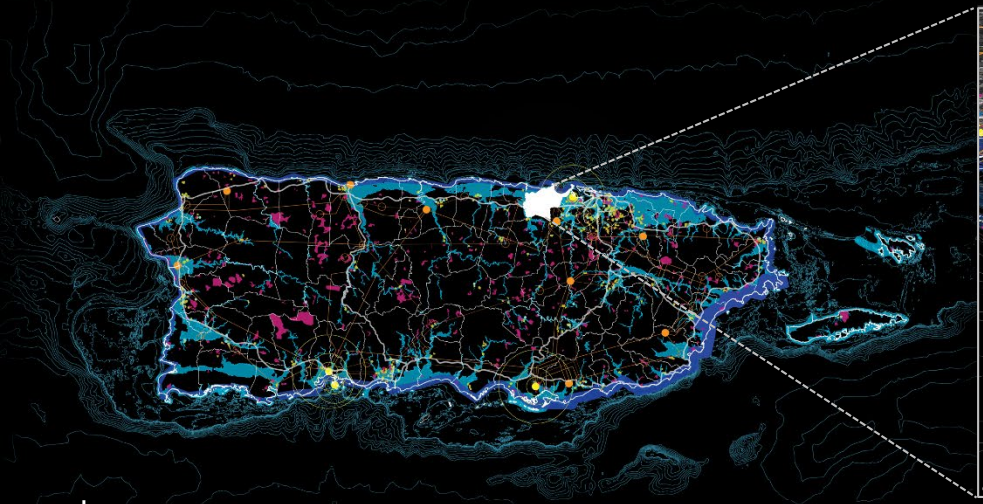
INFORMAL SETTLEMENTS
HOSPITALS
1% STORM FLOOD ZONE
1'-3" 6'-9"
MARIA STORM SURGE INUNDATION
PUBLIC HOUSING
ELECTRICAL SUBSTATIONS
ELECTRICAL INFRASTRUCTURE



$65B total economic cost

500,000 people (15% of the population) live in areas prone to flooding

250,000 homes severely damaged

$400M property damage

$1.3B economic damage

$60M electrical damage

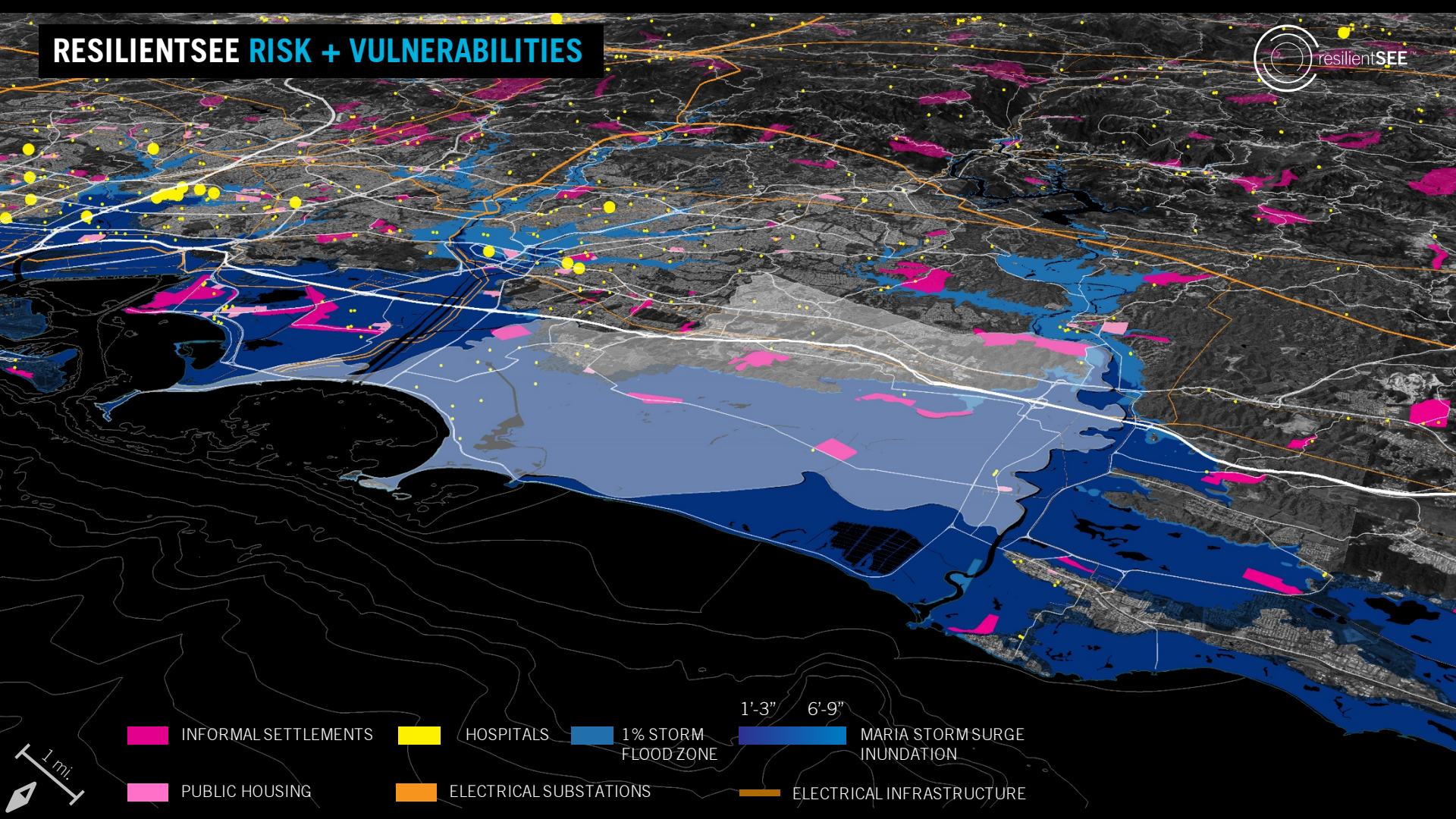
36 % below poverty level

13K + damaged properties

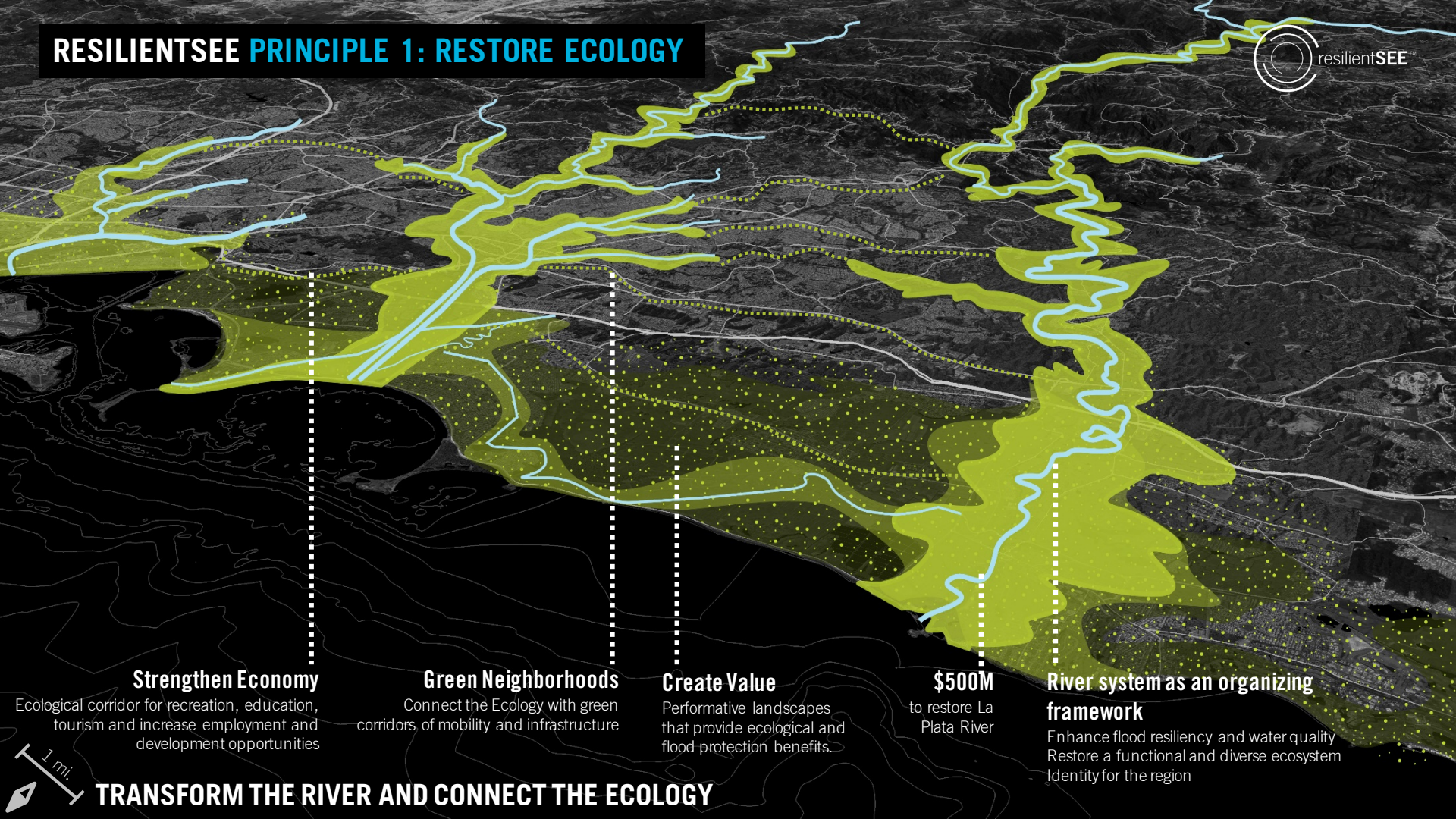
14K + flooded homes

MUNICIPALITY TOA BAJA

RESILIENTSEE RISK + VULNERABILITIES

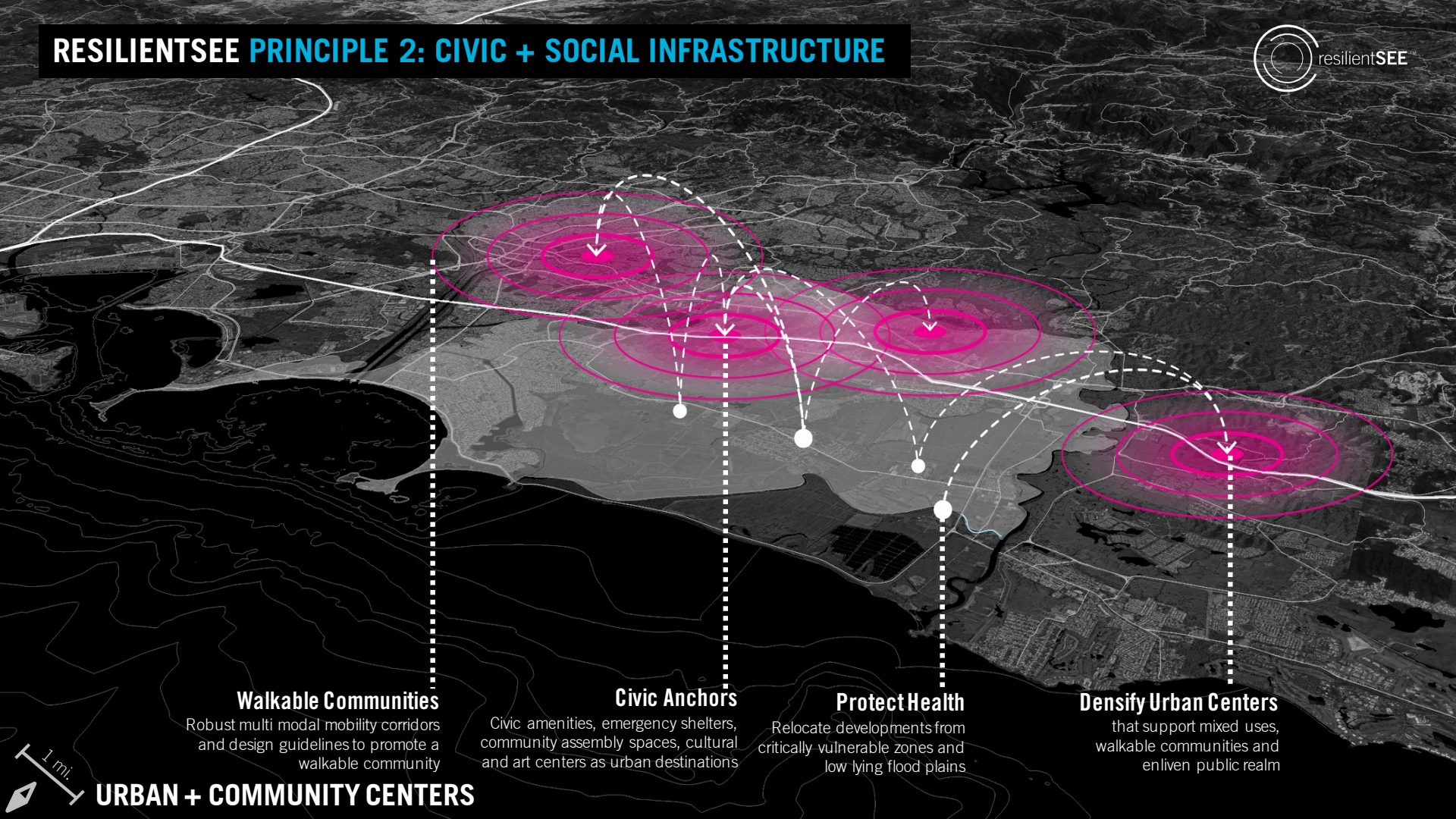


RESILIENTSEE PRINCIPLE 1: RESTORE ECOLOGY



TRANSFORM THE RIVER AND CONNECT THE ECOLOGY

RESILIENTSEE PRINCIPLE 2: CIVIC + SOCIAL INFRASTRUCTURE



RESILIENTSEE PRINCIPLE 3: RESILIENT BUILDING SYSTEMS

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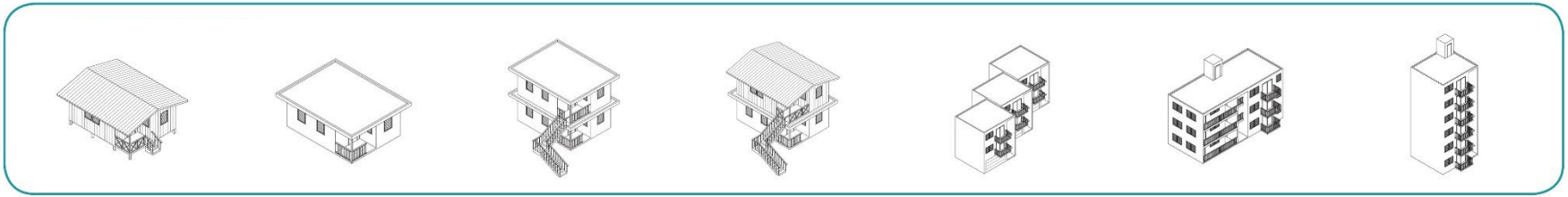
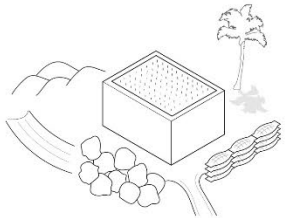
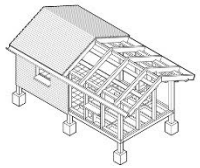
BUILDING TYPOLOGIES

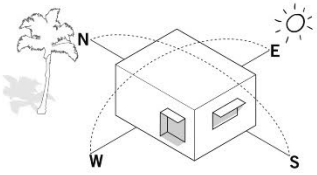




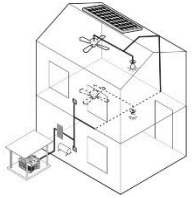
1. A Safer Site



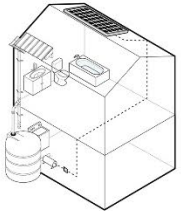
2. Building Protection



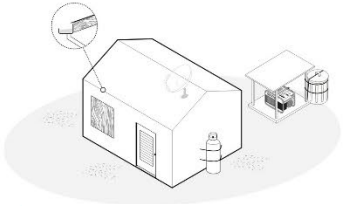
3. Adaptive Design



4. Energy Generation + Back Up



5. Water Management



6. Emergency Preparedness

7. Community Engagement

8. Putting it All Together

Created in partnership with: Enterprise

NEXT STEPS

- COMMUNITY ENGAGEMENT AND DEVELOP SUSTAINABLE PLANNING PRINCIPLES
- DEVELOP A DYNAMIC AND RESILIENT FRAMEWORK THAT SUPPORTS GROWTH AND PROMOTES HEALTHY LIVING
- DEVELOP A PHASED IMPLEMENTATION PLAN