The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRANSPORTATION RESEARCH BOARD

Transportation Impacts in Managing Retreat from High-Risk Areas

March 4, 2021

2:00-4:00 PM Eastern

@NASEMTRB
#TRBwebinar

PDH Certification Information:

- 2 Professional Development Hours (PDH) – see follow-up email for instructions
- You must attend the entire webinar to be eligible to receive PDH credits
- Questions? Contact Reggie Gillum at RGillum@nas.edu

#TRBwebinar

The Transportation Research Board has met the standards and requirements of the Registered Continuing Education Providers Program. Credit earned on completion of this program will be reported to RCEP. A certificate of completion will be issued to participants that have registered and attended the entire session. As such, it does not include content that may be deemed or construed to be an approval or endorsement by RCEP.

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REGISTERED CONTINUING EDUCATION PROGRAM

AICP Certification Information:

- The American Institute for Certified Planners has approved this webinar for 2 Certification Maintenance Credits.

- Visit: www.planning.org/cm to report your credits.

- Questions? Contact Reggie Gillum at RGillum@nas.edu

#TRBwebinar

Learning Objectives

1. Identify state-of-the practice in managed retreat and impacts on the transportation sector
2. Locate resources and data for determining whether transportation facilities are located in high-risk areas
3. Identify solutions planning and design to advance sustainable and resilient transportation systems in high hazard areas
4. Discuss policies and standards to advance transportation resilience for adapting to extreme weather and climate change

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Transportation Issues in Managing Retreat from High-Risk Areas

When, Whether and How?

Mark Abkowitz
Vanderbilt University
Chair, TRB Committee on Extreme Weather and Climate Change Adaptation

TRB Webinar
March 4, 2021

Why Are We Here?

Managed Retreat (managed relocation) - the transition of people, communities, infrastructure, and ecosystems away from areas vulnerable to frequent extreme weather and climate change impacts.

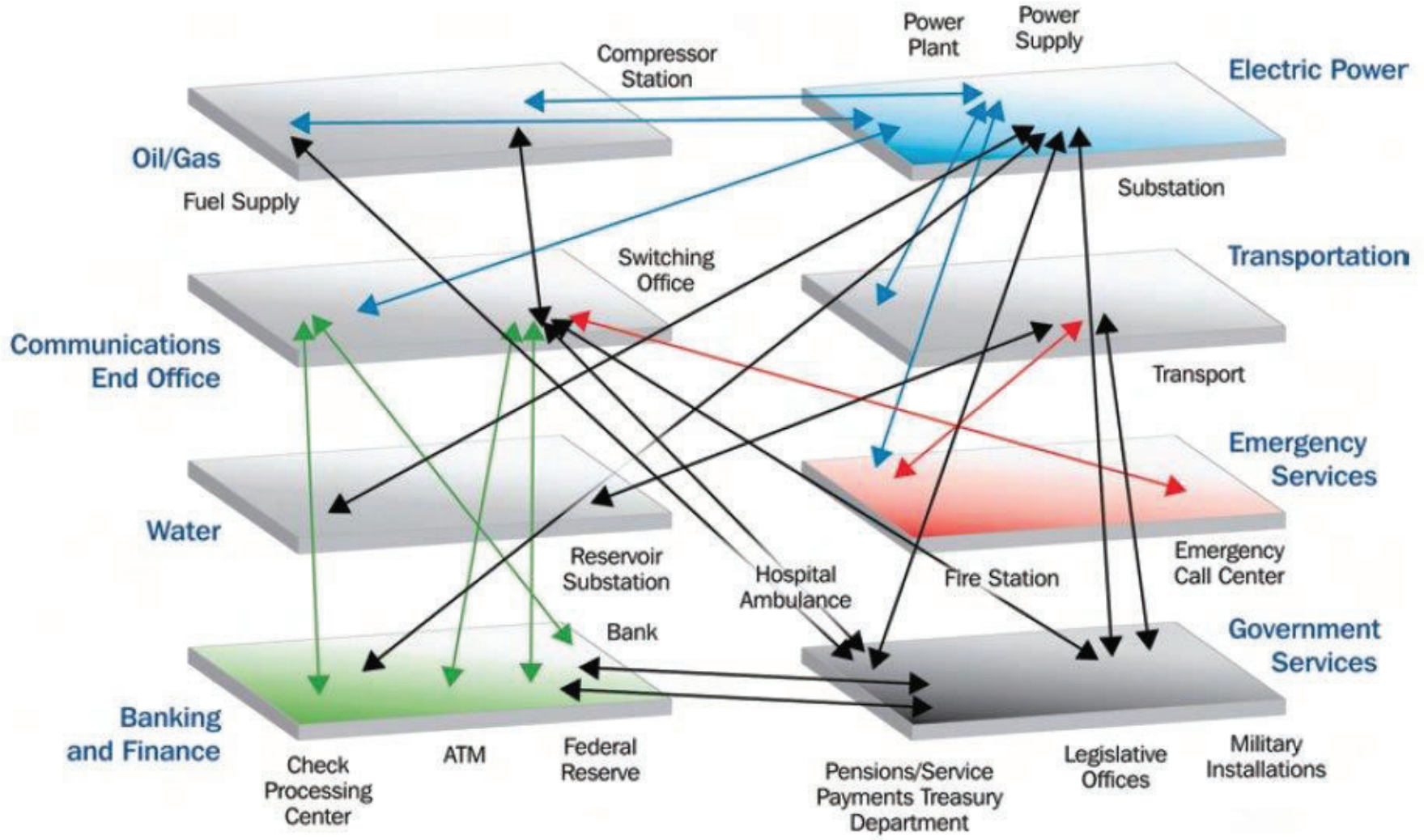
Webinar Objectives:

- Understand managed retreat concepts and applications
- Become familiar with environmental, social, economic, and legal considerations involved in managed retreat decisions
- Recognize managed retreat considerations specific to transportation
- Acknowledge the role of transportation in a comprehensive, holistic approach to managed retreat

Why Do We Care?

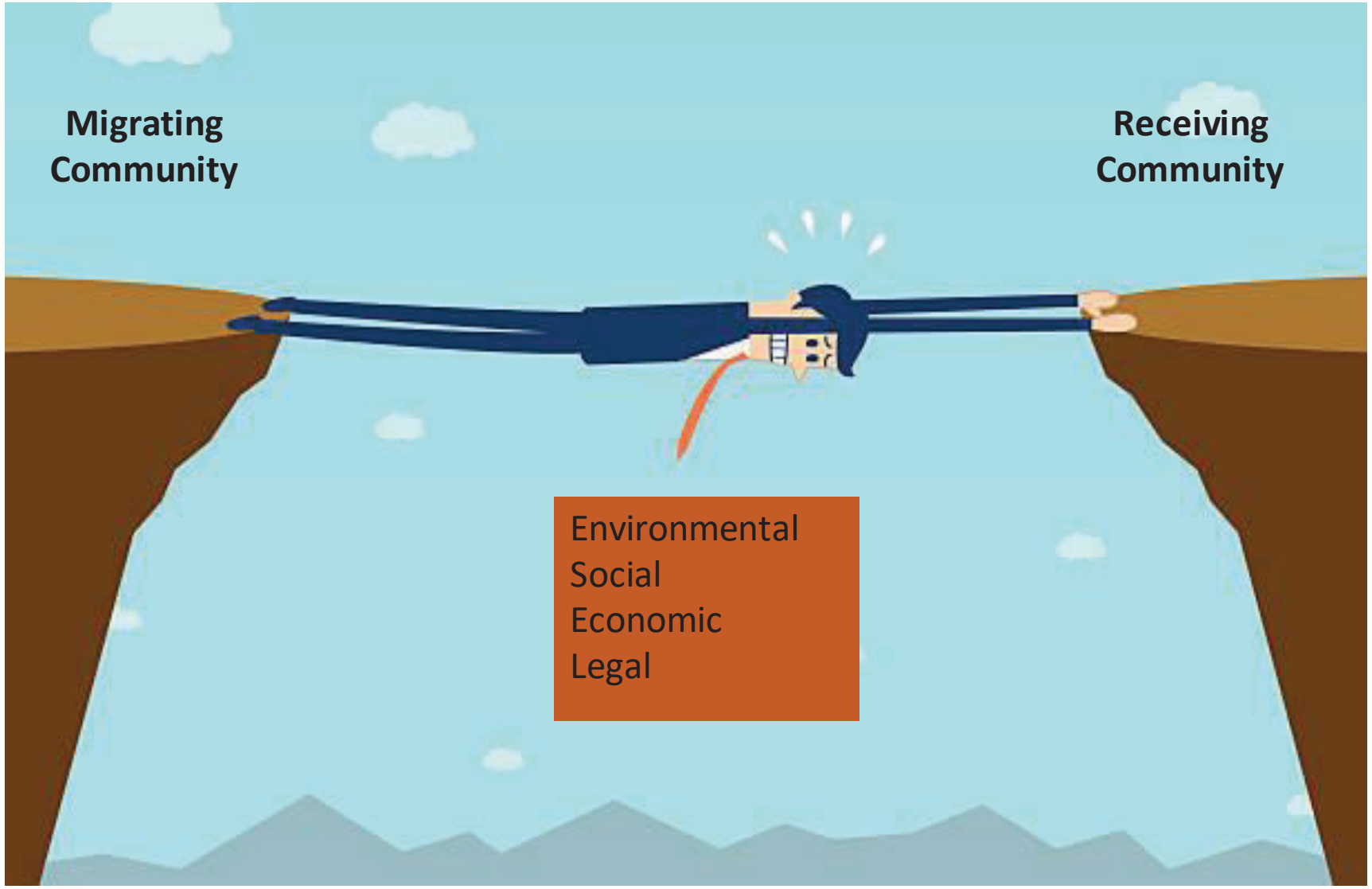
- Netherlands – Protective dikes in farming community of De Noordwaard lowered and land allowed to flood.
- Indonesia: New capital city to be built in Borneo as Jakarta sinks into the sea.
- U.S.: From 1989-2017, FEMA funded 43,633 voluntary buyouts of flood-prone properties, located in 49 U.S. states and 3 territories, across 1,148 counties.
- More than 100 million people residing in U.S. expected to face displacement by rising seas before the end of the century.

Critical Infrastructure Interdependencies



Source: Department of Homeland Security, National Infrastructure Protection Plan

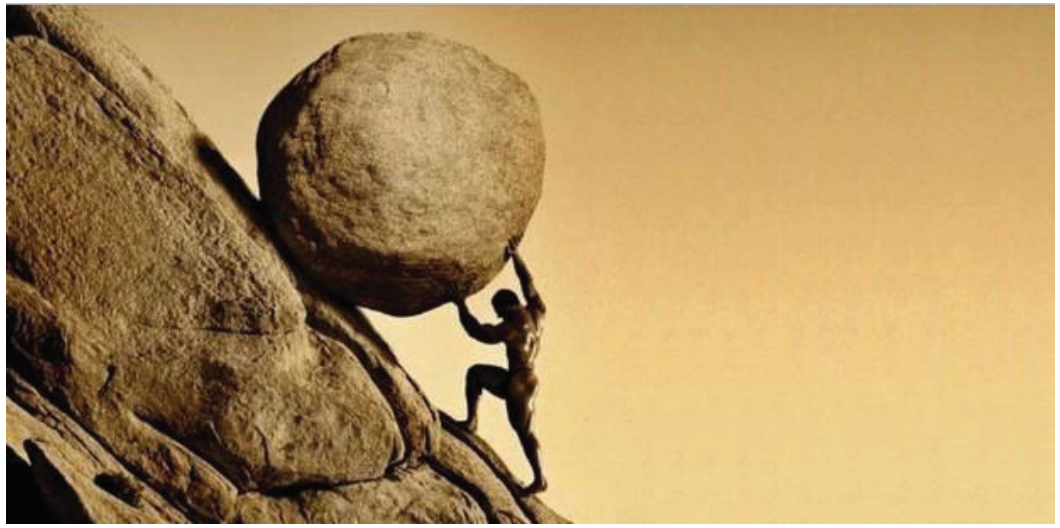
Barriers to Change



Charting A Path Forward

We're going to have to think really hard about how and where it happens, who moves and who stays, and whose values matter most. In so many ways, it's a perfect unfolding of both the tensions and the opportunities …

– Katharine Mach, Stanford University



Key Themes

- Managed retreat takes time and planning.
- Managed retreat is interdisciplinary and proactive.
- Managed retreat must be community-driven and inclusive.

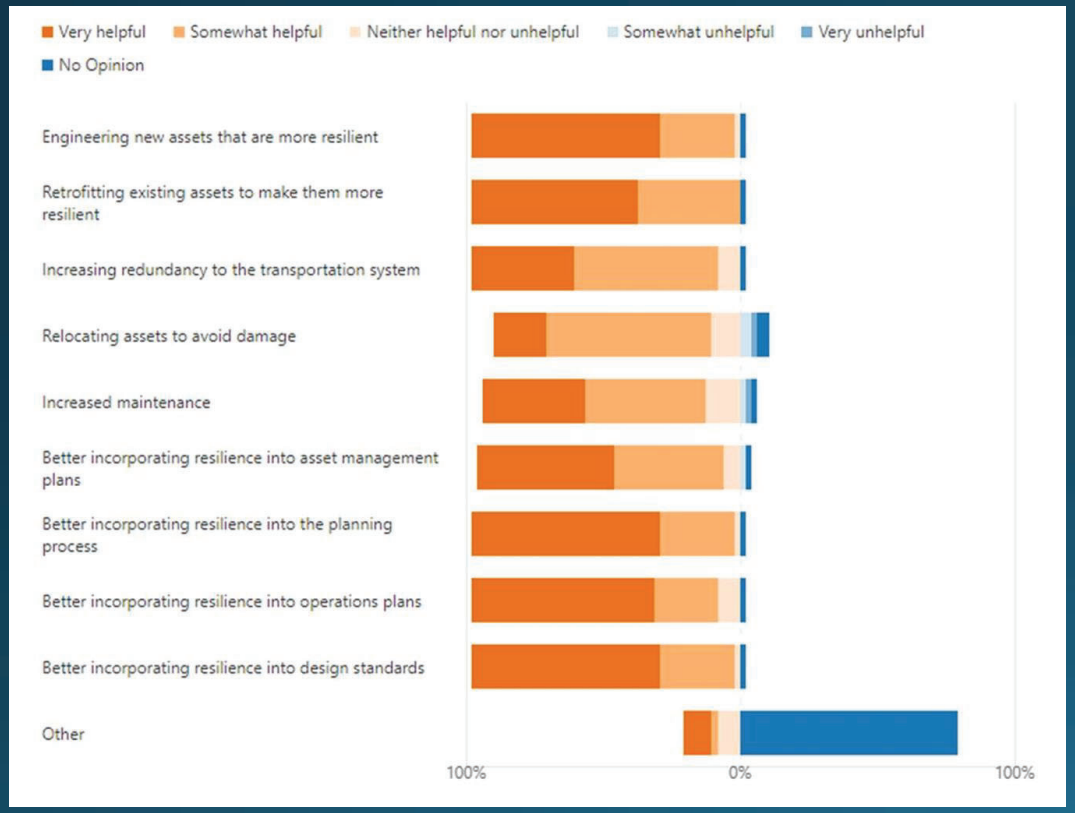
Source: Georgetown Climate Center

PROTECTING HAWAII COASTAL HIGHWAYS

TRB Webinar: Transportation Impacts in Managing Retreat from High Risk Areas

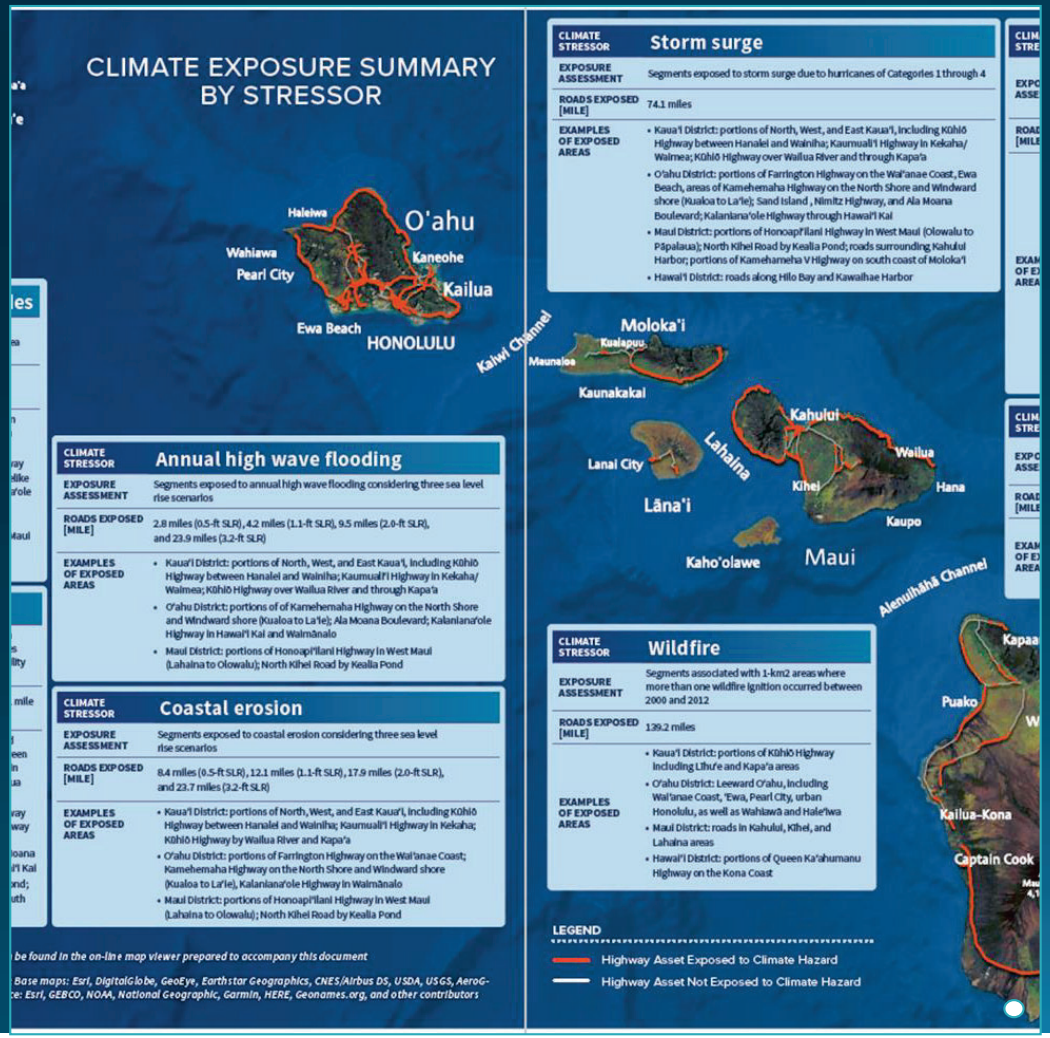

PLAN
DESIGN
BUILD
OPERATE
MAINTAIN

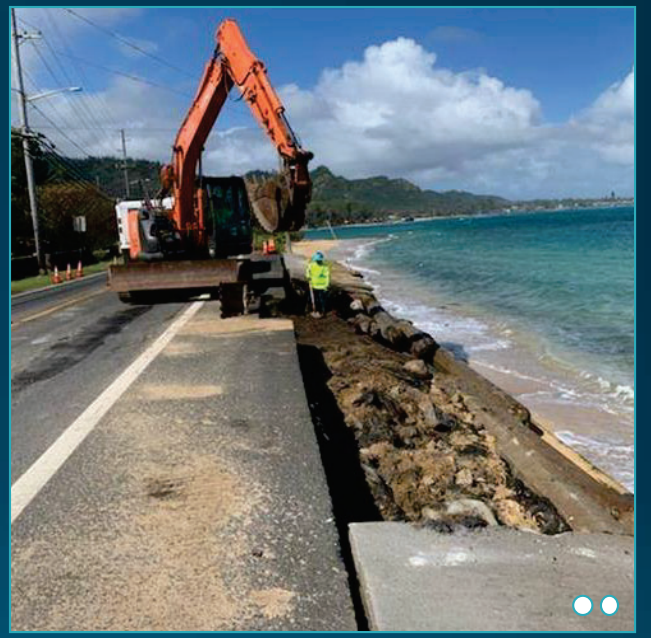
CTSSR Member Adaptation Strategies

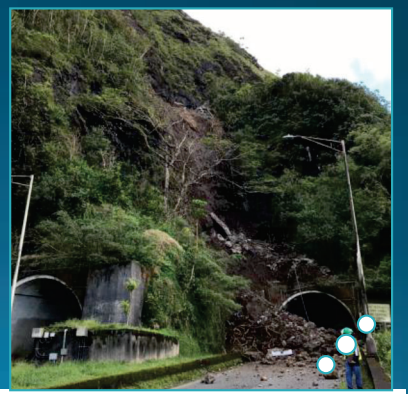


- Survey sent January 2021.
- Relocating assets is one of many strategies transportation departments are considering to improve resilience of their systems.

Hawaii Highways
Climate Adaptation Action Plan



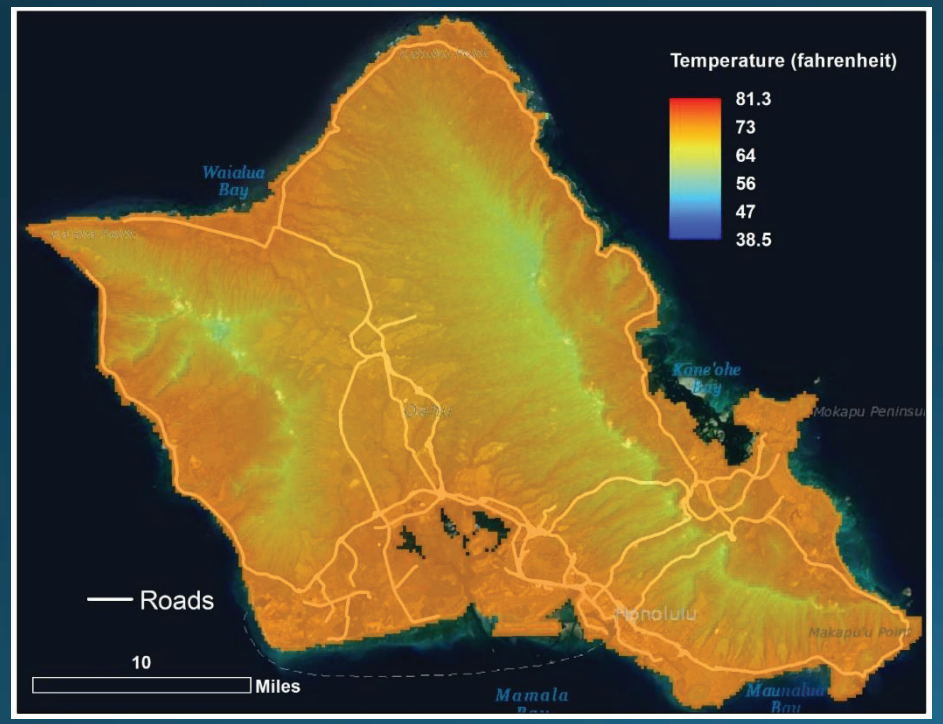




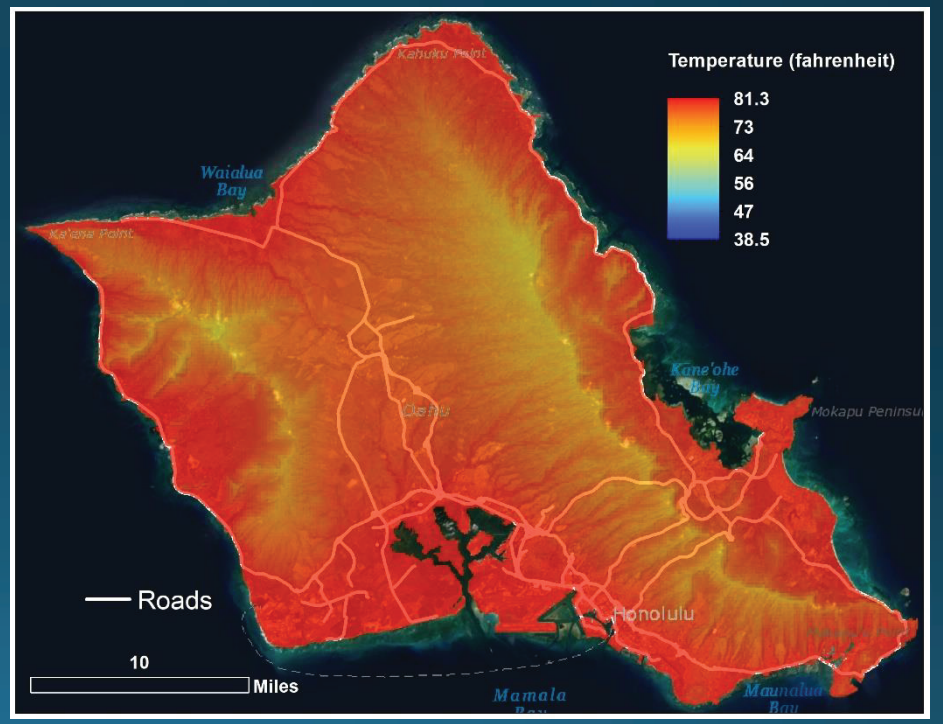
HDOTHighways

Climate projections

Historical Annual Mean Temp

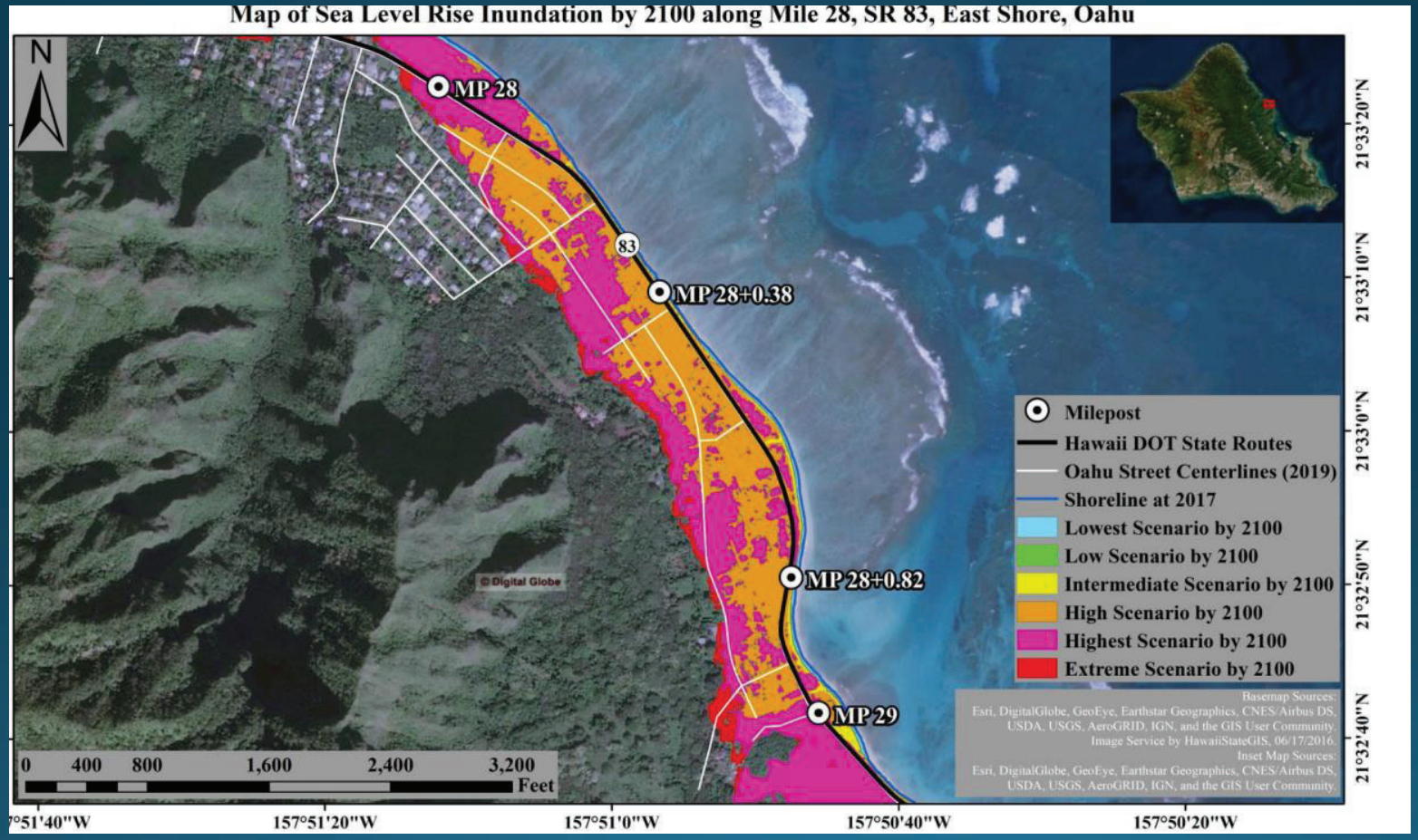


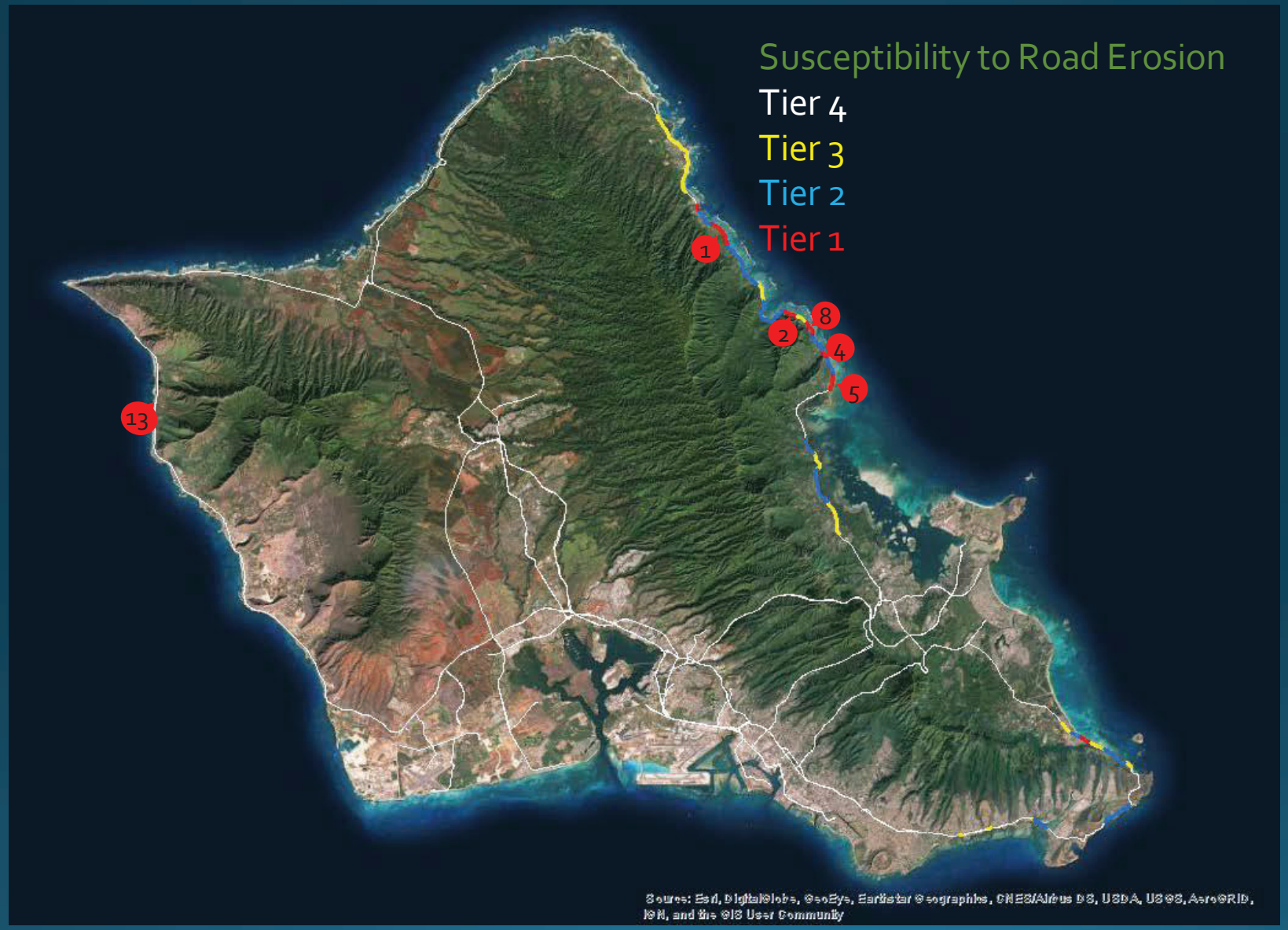
Annual Mean Temp by 2100



HDOT Highways

Forecasted Coastal Erosion




Susceptibility to Road Erosion
Tier 4
Tier 3
Tier 2
Tier 1
1
8
2
4
5
13
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Route 83 (Hauula/Pokiwai Road)

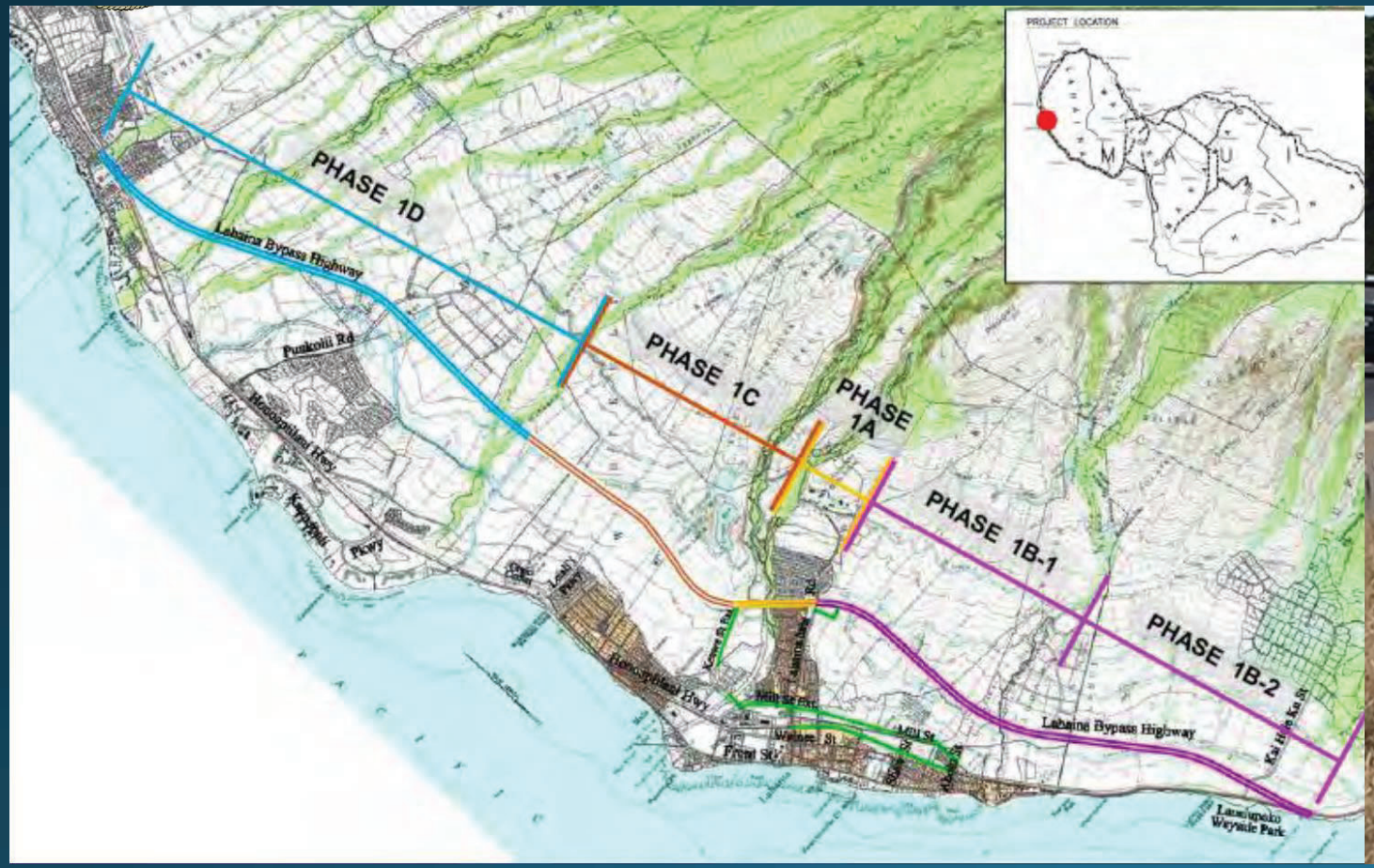
Before (KITV Photo)

After (HDOT Photo)

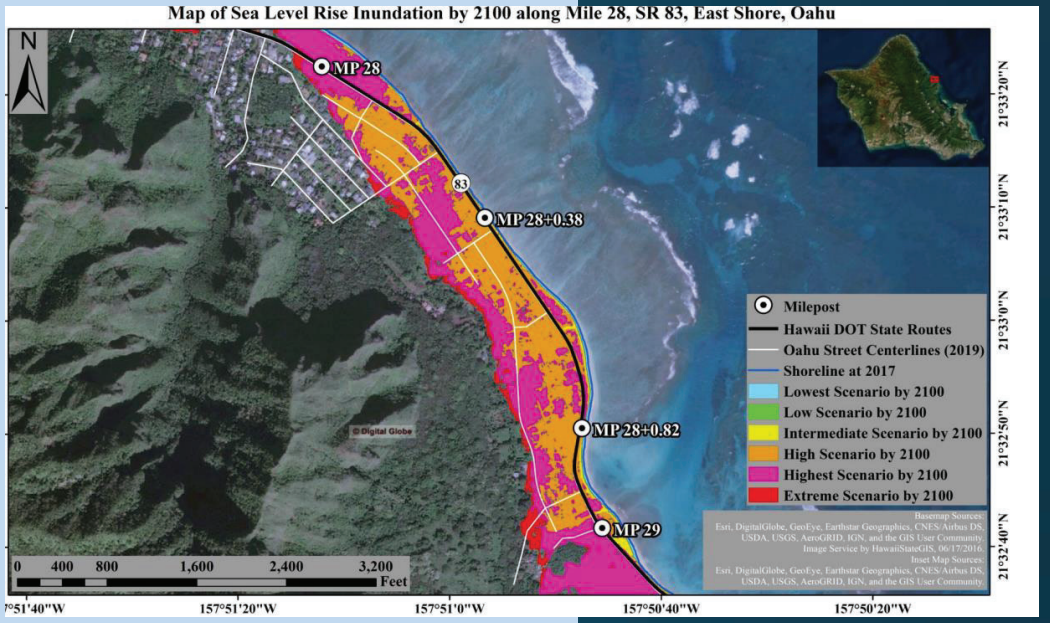
HDOTHighways

Kuhio Highway at Wainiha Bay

Realignment/Managed Retreat




Kahuku
Kahuku Training Area
Laie
Oahu
Ahupuaa O Kahana State Park
Schofield Barracks
Schofield Barracks East Range
Waniawa
Oahu Forest Nat'l Wildlife Ref
Kaneohe Bay
Kahaluu
Lualualei Naval Magazine
Waianae
Pearl City
Waipahu
Waipanu
Ewa Beach
Mamala Bay
Maunalua Bay
Kaukonahua Rd
Farrington Hwy
Kamehameha Hwy
Moanalua Fwy
Manoa Rd


Map of Sea Level Rise Inundation by 2100 along Mile 28, SR 83, East Shore, Oahu
N
MP 28
MP 28+0.38
MP 28+0.82
MP 29
Milepost
Hawaii DOT State Routes
Oahu Street Centerlines (2019)
Shoreline at 2017
Lowest Scenario by 2100
Low Scenario by 2100
Intermediate Scenario by 2100
High Scenario by 2100
Highest Scenario by 2100
Extreme Scenario by 2100
0 400 800 1,600 2,400 3,200
Feet
21°33'20"N
21°33'10"N
21°33'0"N
21°32'50"N
21°32'40"N
157°51'40"W
157°51'20"W
157°51'0"W
157°50'40"W
157°50'20"W

SUSTAINABLE HAWAI'I INITIATIVE

COMMITMENTS

Clean Energy Transformation

Electricity: Renewable/Efficiency

29.79%

Percent Renewable Energy Statewide in 2019

✔ On track

Average Fuel Use Per Person Annually

$2,638.20

Dollars Spent Per Person on Imported Fuel in 2017

✔ On track

Statewide Net Greenhouse Gas Emissions

9.2

Million Metric Tons of Carbon Dioxide Equivalent Emissions in 2016

▶ Near target

Total Energy Use

42,800

Thousand Barrels of Oil Consumed in 2017

Measuring

Transportation

516 M

Gallons of Petroleum Used for Ground Transportation in 2017

✖ Needs improvement

Business Sector Energy Efficiency

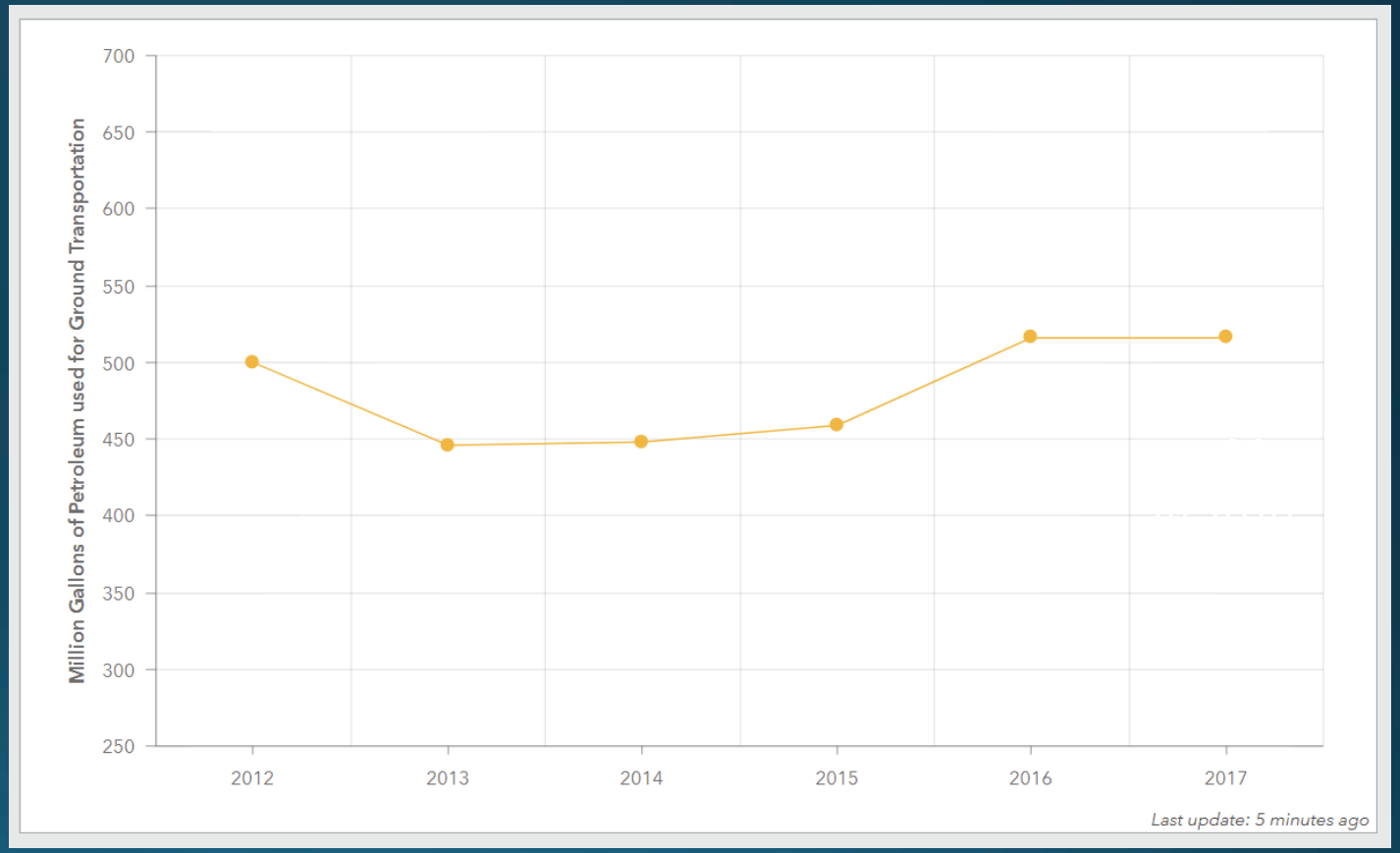
11.8%

Percent Reduction in Energy Use in the Business Sector in 2018

Measuring

Hawaii's Clean Energy Goals - Transportation

- Goal is to reduce use of petroleum in ground transportation by 70% (~385 M gallons/year by 2030)
- Strategies:
  - Improving the efficiency of the standard vehicle fleet
  - Reducing the overall number of vehicle miles traveled (VMT)
  - Expanding the use of renewable fuels for transportation
  - Accelerating the deployment of electric vehicles and related infrastructure




SAFETY


SB-2500C


PROTERRA CATALYST
BATTERY ELECTRIC


350+
TOTAL CHARGING STALLS
O'AHU
1
TOTAL CHARGING STALL
MOLOKA'I
LĀNA'I
1
TOTAL CHARGING STALL
MAUI
100+
TOTAL CHARGING STALLS
50+
TOTAL CHARGING STALLS
HAWAI'I
LEVEL 2 CHARGE
1 hour = At least 12 miles of range
FAST CHARGE
15 minutes = About 43 miles of range
HAWAIIAN ELECTRIC
FAST CHARGE
Hawaiian Electric fast charging locations
updated as of July 2020

Broadband Initiative

- Embarking on initiative to expand broadband connectivity to roadways and underserved communities.
- Transportation benefit will be increased capabilities in ITS, VMT reduction due to increased access to remote work and schooling, and preparations for CAV.

MAHALO

Ed Sniffen

Deputy Director for Highways

Hawaii Department of Transportation

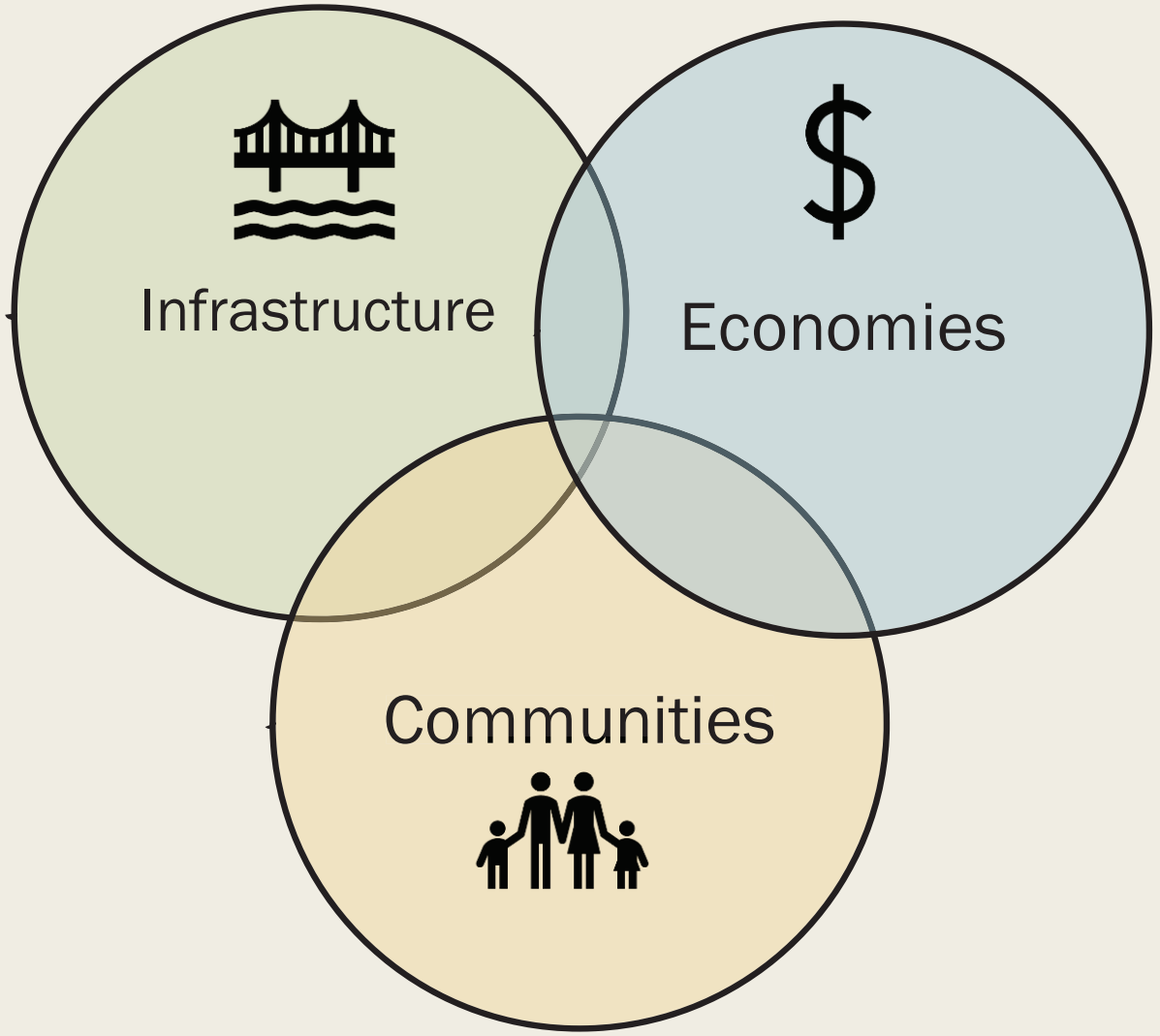
http://hidot.hawaii.gov

COORDINATING CROSS-SECTOR RETREAT AND RELOCATION TO IMPROVE RESILIENCE

TRB Webinar March 4, 2021

Sandra Knight, WaterWonks LLC

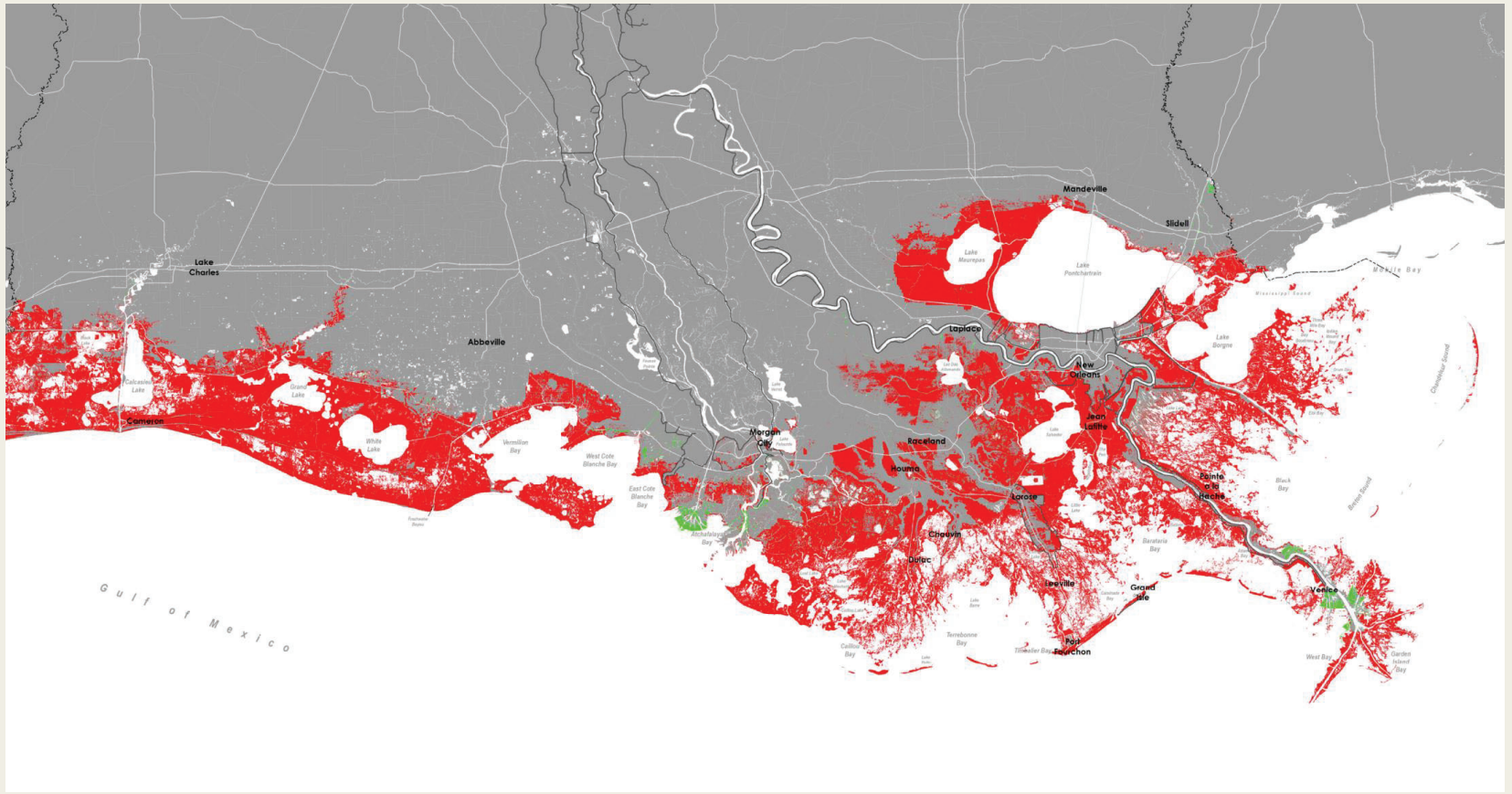
Cross-sector Dependence



Challenges to “Managing” Retreat

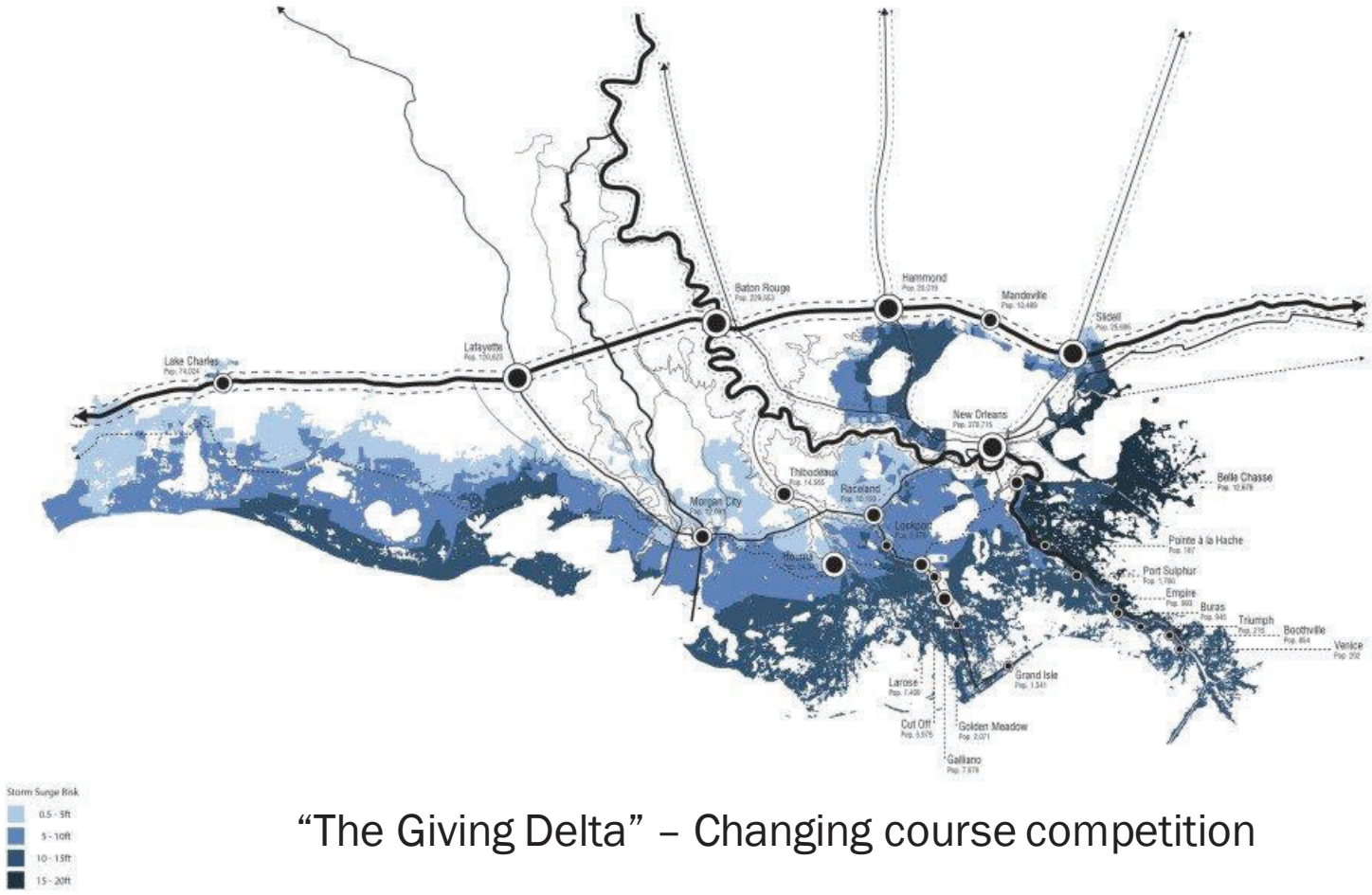
- Can we predict and manage flood risk and land loss?
- What becomes of vacant property?
- What are the impacts to individuals and neighborhoods for those that move and those that stay behind?
- How can we preserve socio-cultural assets?
- What are the impacts to local and economic livelihood? Tax base?
- How does transportation and critical infrastructure play a role?

Can we really manage land loss?



Louisiana 2017 Coastal Master Plan- Future w/o Action Year 50, 2.5 ft SLR- 4123 Sq.Mi.

Can we “advance the line” to safe areas for redevelopment?

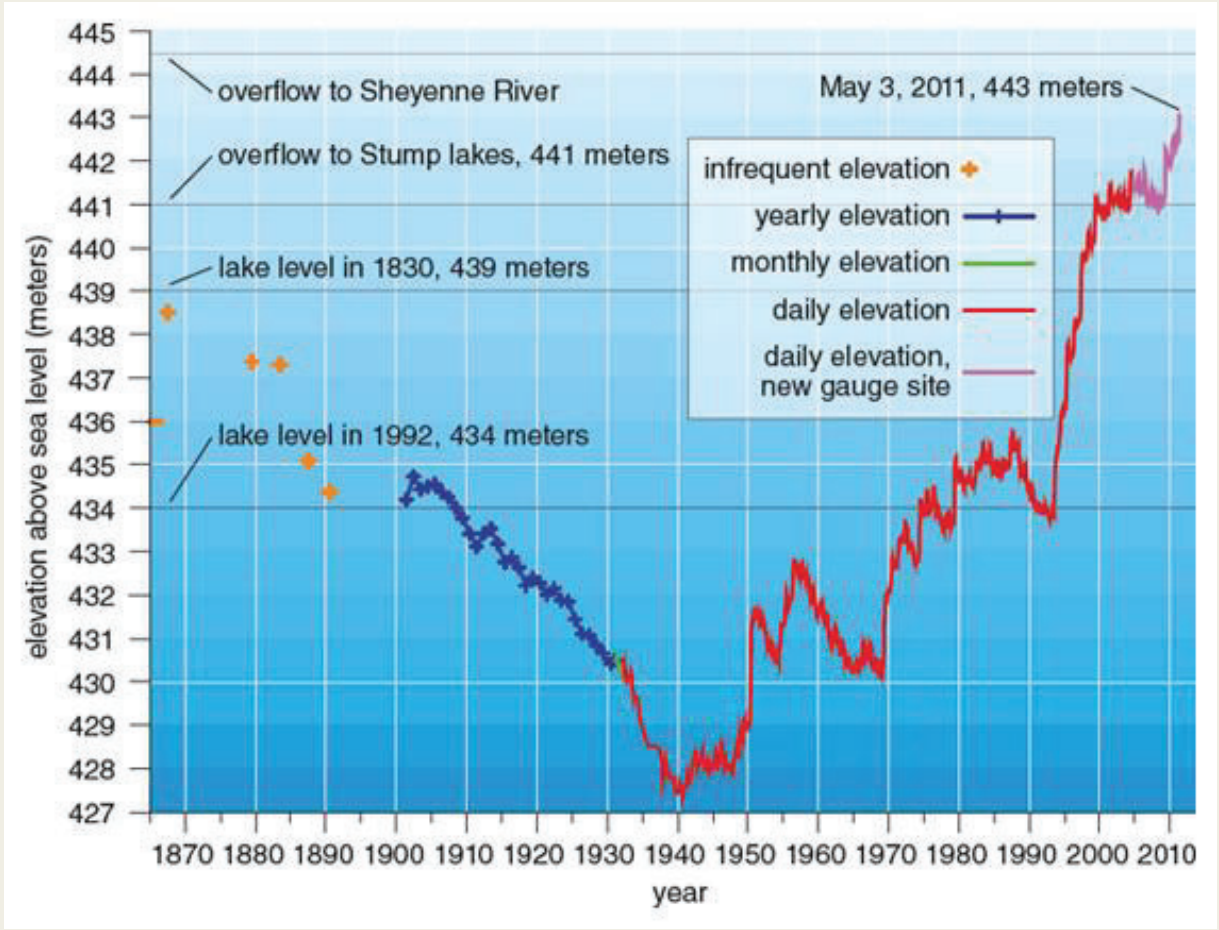


“The Giving Delta” – Changing course competition

How does vacant property impact communities? Roads and access?

Aerial view Lower Ninth Ward, August 1, 2015. Photo by Rick Carioli/The Washington Post

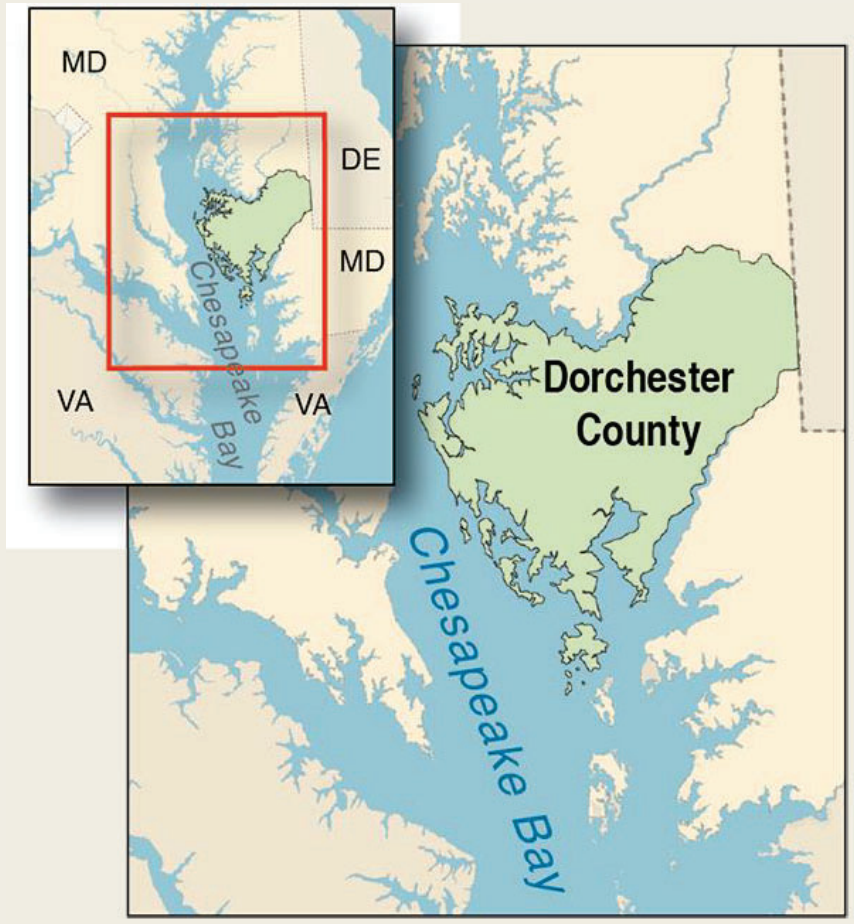
Where can we gather lessons-learned? Devil's Lake, ND



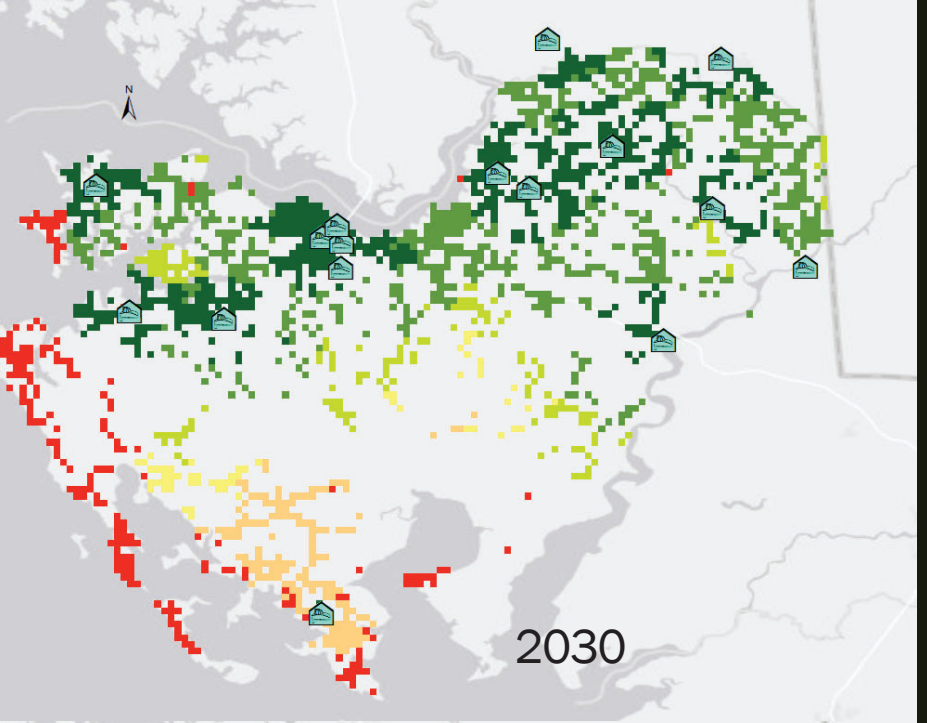
Krueger, *American Scientist*, February 2012. Graph adapted by Tom Dunne from a USGS chart. America

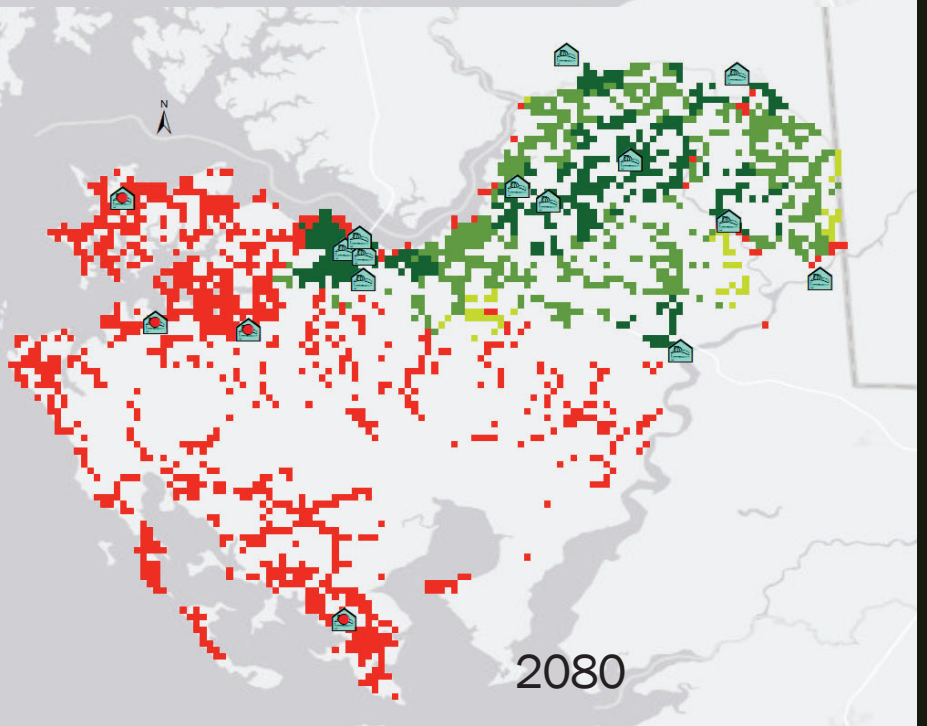
Eric Hylden / Forum Communications. Shoreline of Devils Lake and ND Highway 20 near the Spirit Lake Casino

Is raising the road a resilient way to manage the problem?

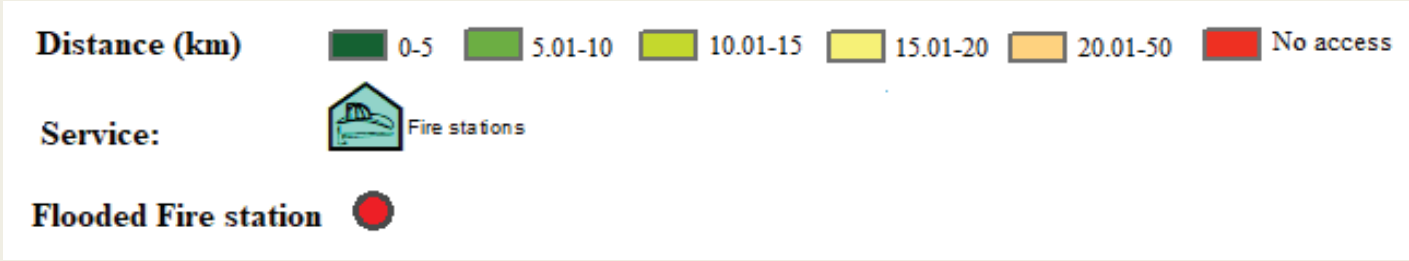


RISING SEAS: ROADS AND COMMUNITIES: DORCHESTER COUNTY MD





Emergency Services: Fire Stations, Dorchester County



Miami – Sunny Day Flooding

Houston – Hurricane Harvey

How Viable Is Urban Retreat?

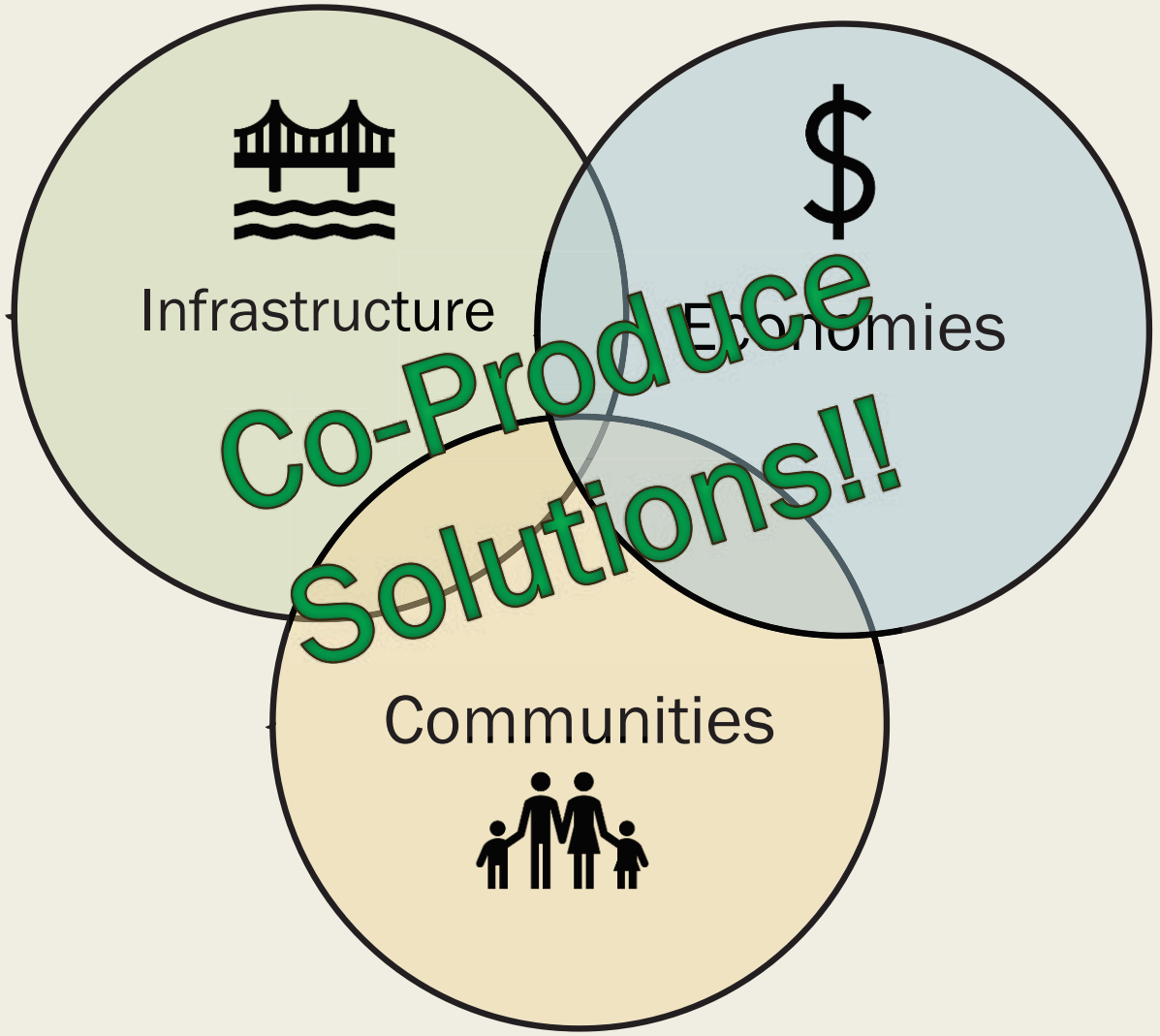
Key policy and legal areas that impact effective relocation projects

- Real Estate: Who owns it and what is it worth?
- Finance: Who pays and who benefits?
- Authorities: What governing authorities are in place and who is responsible?

How can the transportation sector improve resilience and support retreat/relocation of communities?

- Engage community
- Leverage and expand funding pathways and opportunities
- Bring federal, state and local partners to the table for support
- Enhance/replace existing economies with viable blue-green economies
- Utilize natural systems and enhance environmental stewardship

Cross-sector Solutions



GEORGETOWN CLIMATE CENTER

Tools and Best Practices for Developing Managed Retreat Strategies

TRB Webinar

March 4, 2021

What is in the Managed Retreat Toolkit?

- About managed retreat
- Legal and policy tools
- Crosscutting legal and policy considerations
- Case studies

Legal and Policy Tools

Planning

Infrastructure

Acquisition

Regulatory

Market-Based

- Design Modifications and Asset Protection
- Asset Relocation and Realignment
- Disinvestment Strategies

Image Credit: DNREC

Infrastructure Decisions in a Managed Retreat Context

Image Credit: DNREC

- Flooding, erosion, saltwater intrusion, coastal storms
- Increasing maintenance needs & costs
- Transportation + land use
- Multiple agencies/authorities
- Long-range planning; asset management
- Community engagement

Asset Relocation & Realignment

- Adaptive management; phasing and planning of realignment solutions
  - Investment cycles
  - Asset criticality and use
  - Data and projections to inform decisions
  - 23 C.F.R. Part 667 evaluations
- Economic, environmental, administrative/legal, social considerations

Image Credit: Caltrans

Case Study: Piedras Blancas Highway Realignment

Image Credit: Caltrans

Image Credit: Caltrans

- Caltrans realigned a 2.8-mile section of Highway 1 nearly 500 feet inland
- Expected to protect from bluff retreat beyond the year 2100
- Old alignment repurposed for habitat and recreational uses

Disinvestment Strategies

- Approaches
  - Abandonment/closure through formal proceedings
  - Reclassification
  - Environmental thresholds
- Legal considerations
  - Authority
  - Road condition & maintenance
  - Loss of access
- Economic analyses (cost to maintain, user costs, potential for liability, etc.)
- Asset criticality and use

Image Credit: Lieut. Cmdr. Mark Moran / NOAA Corps

Case Study: St. Johns County Ordinance 2012-35

Image Credit: FEMA

- Provides for modified design criteria and standards in “environmentally challenging locations” where typical road design standards are not feasible due to naturally occurring conditions

Plans

- Hazard Mitigation Plans
- Coastal Management Plans
- Local Comprehensive Plans
- Climate Adaptation Plans
- Long-Term or Visioning Plans
- Post-Disaster Recovery and Redevelopment Plans
- Managed Retreat or Relocation-Specific Plans
- Wetlands Migration or Ecosystem-Specific Plans
- Long-Range Transportation Plans

Image Credit: LA SAFE

Case Study: Hawaii

Scenario Profile Four: Scenario for Critical Infrastructure (O'ahu)

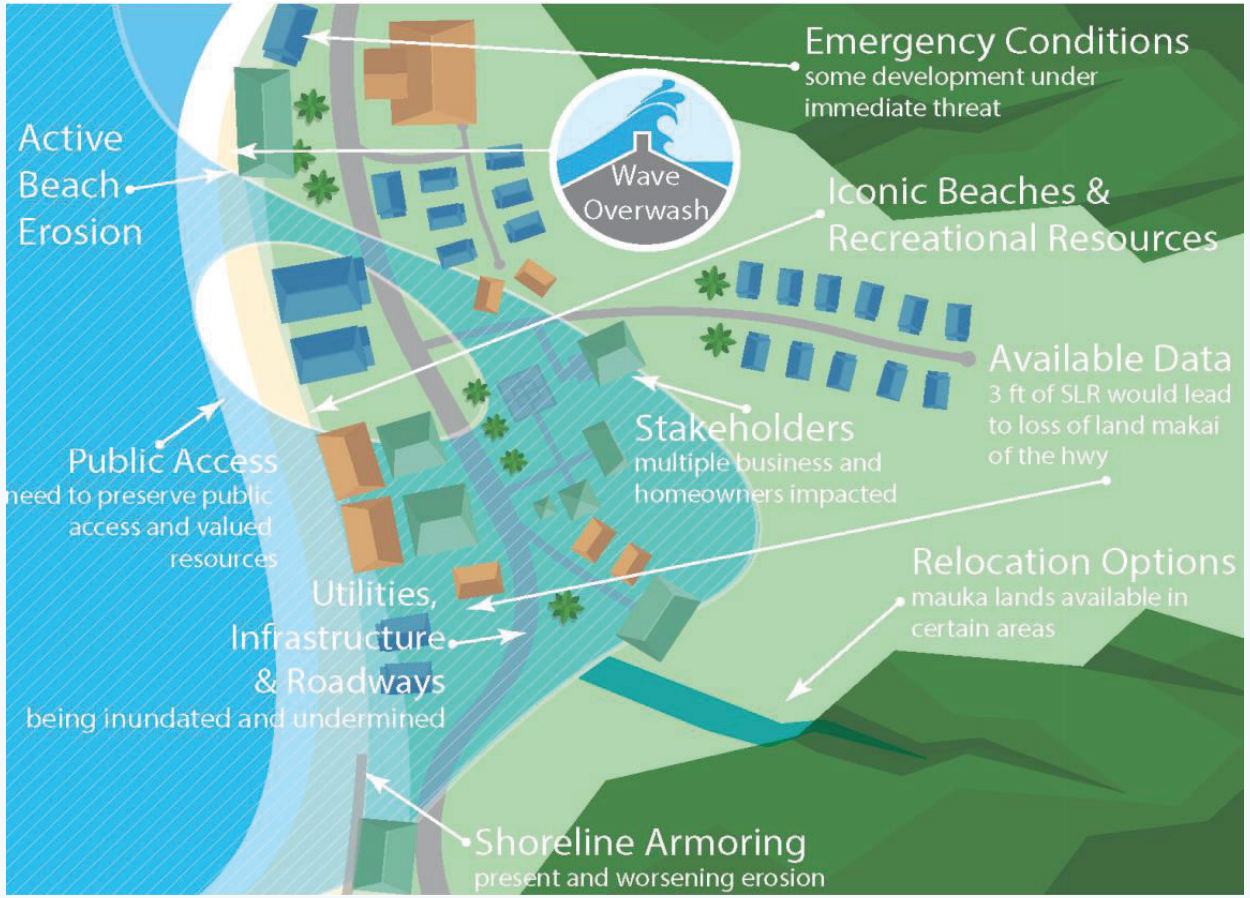


Image Credit: State of Hawaii

Acquisition Tools

- Voluntary Buyouts
- Open Space Acquisitions
- Conservation Land Trusts
- Land Swaps
- Leasebacks
- Life Estates and Future Interests

Image Credit: Matt Green, Staten Island, New York

Acquisition Tool: Buyouts

Image Credit: Township of Woodbridge, New Jersey

- Looking for sustainable, non-disaster funding
- Moving beyond property transfers and structural demolitions
- Converting bought-out properties into community assets
- Engaging communities

Case Study: Woodbridge, New Jersey Overlay Zone

Image Credit: GCC

Image Credit: GCC

Crosscutting Policy Considerations

- Funding
- Wetlands Migration
- Community Engagement and Equity
- Receiving Communities

Crosscutting Policy Considerations: Receiving Communities

Image Credit: LA SAFE

- Identifying receiving areas
- Planning for affordable housing, supporting infrastructure, and critical services (such as schools)
- Facilitating transitions
- Funding sources

Case Study: LA SAFE

Louisiana Strategic Adaptations for Future Environments

- Public-private partnership
- Community-led and -driven process
- State is funding 10 total parish-supported adaptation projects
- Developed six parish and one regional adaptation plans or “strategies”

Image Credit: LA SAFE

Thank you!

Explore the Managed Retreat Toolkit online:
bit.ly/GCCMRT

Connect with us on social media:

@Climate_Center

@GeorgetownClimate

#GCCMRT

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Image Credits: LA SAFE and GCC

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Other TRB events for you

- *March 18*: **TRB Webinar: Measuring Resiliency – Tools for Analyzing Resilient Transportation Systems**
- *April 6-8*: **Measuring and Managing Freight System Resilience Workshop**
- *June 29 – July 1*: **2021 Conference on Sustainability and Emerging Transportation Technology**

https://www.nationalacademies.org/trb/events