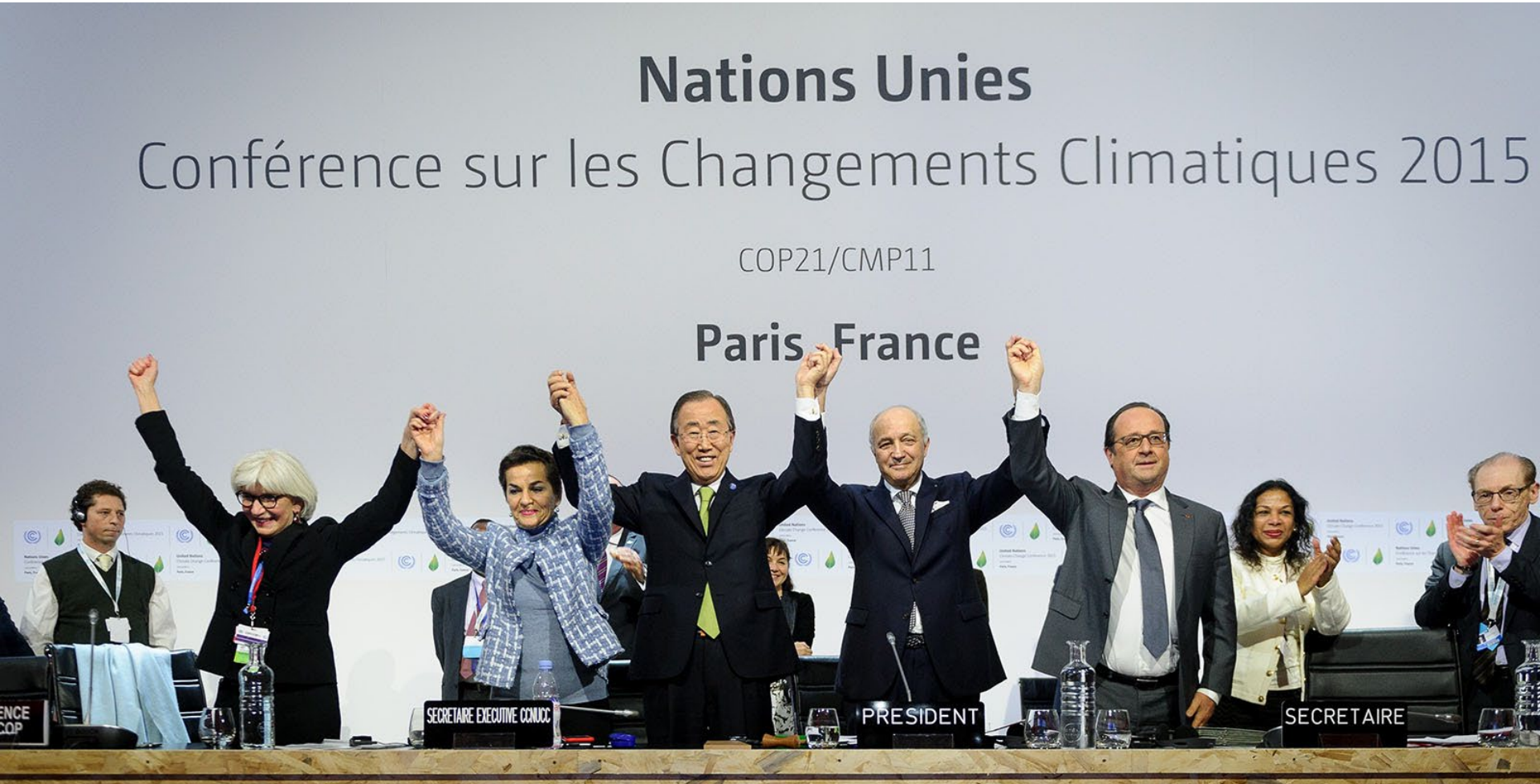
Paris Agreement, 2015

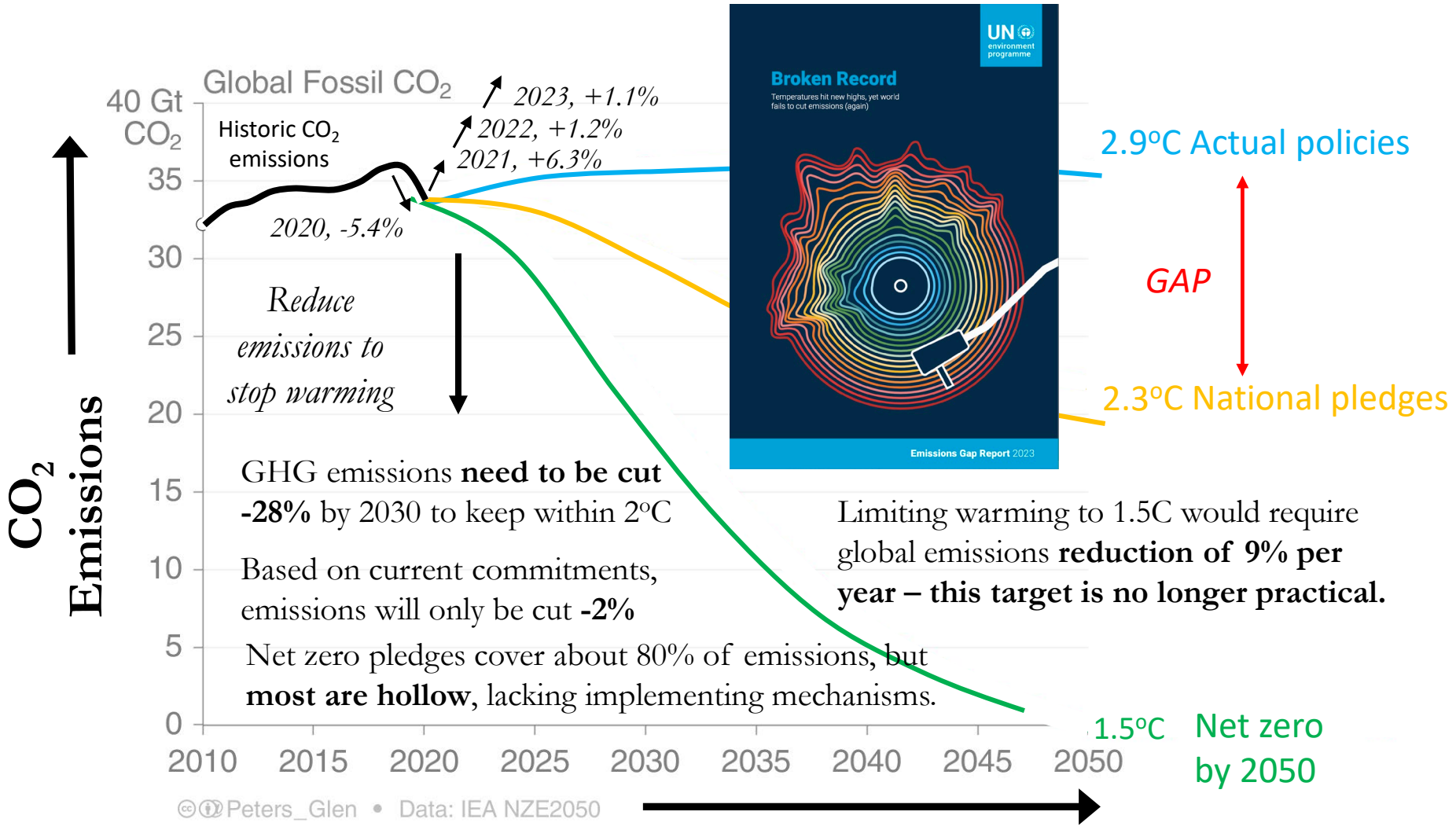
United Nations Framework Convention on Climate Change

Stop global warming before *2°C (3.6°F)*

Pursue efforts to end warming before *1.5°C (2.7°F)*



Progress on Stopping Warming at 1.5°C



GHG emissions **need to be cut -28%** by 2030 to keep within 2°C

Based on current commitments, emissions will only be cut **-2%**

Net zero pledges cover about 80% of emissions, but **most are hollow**, lacking implementing mechanisms.

Limiting warming to 1.5C would require global emissions **reduction of 9% per year – this target is no longer practical.**

Climate Action Tracker (2022) https://climateactiontracker.org/documents/1055/CAT_2022-06-08_Briefing_EnergyCrisisReaction.pdf

Grant, N. (2022) The Paris Agreement's ratcheting mechanism needs strengthening 4-fold to keep 1.5°C alive, Joule, v. 6, p. 703-708, ISSN 2542-4351, https://doi.org/10.1016/j.joule.2022.02.017

Meinshausen, M., Lewis, J., McGlade, C. *et al.* (2022) Realization of Paris Agreement pledges may limit warming just below 2 °C. *Nature* 604, 304–309 https://doi.org/10.1038/s41586-022-04553-z

United Nations Environment Programme (2023). Emissions Gap Report 2023: Broken Record – Temperatures hit new highs, yet world fails to cut emissions (again). Nairobi. https://doi.org/10.59117/20.500.11822/43922.

The problem in a nutshell…

Even as renewables accelerate, so does oil and gas.

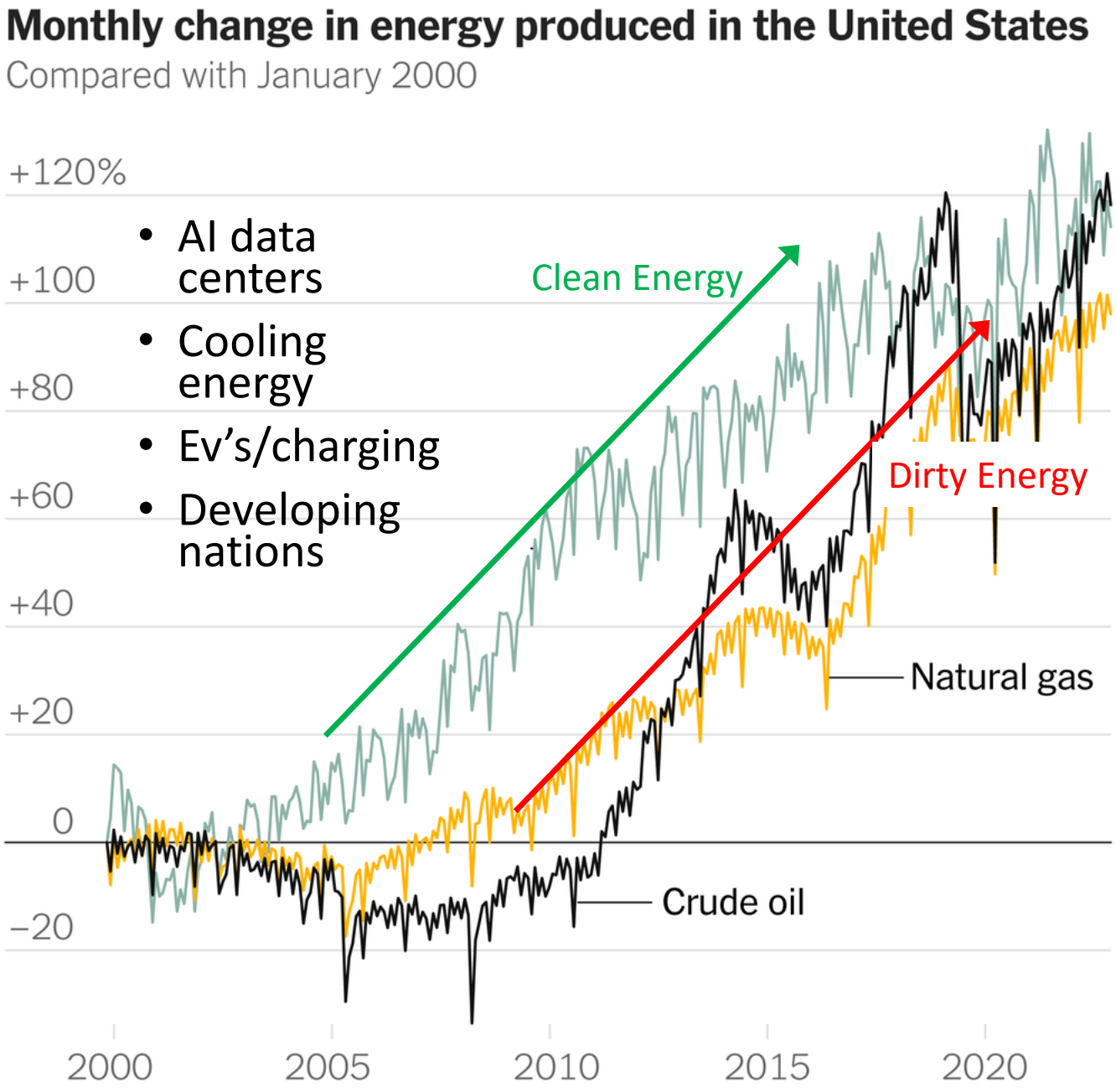
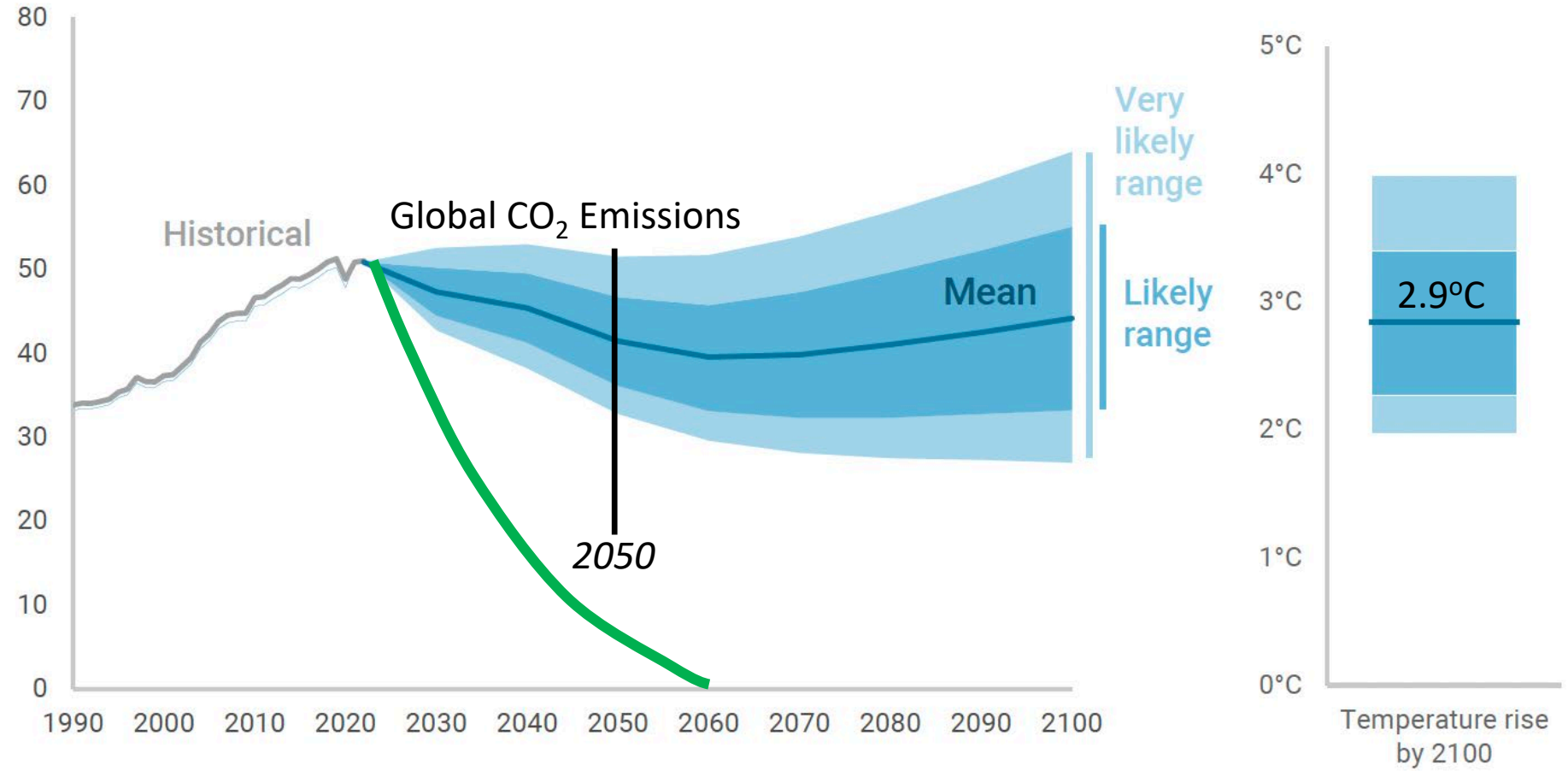


FIGURE 1

Global greenhouse gas emissions and temperature rise

Net emissions including removals (billion metric tons of CO_2-equivalent)



Source: Rhodium Climate Outlook, AR5 100-year GWP values. Following IPCC conventions, this report uses *very likely* to indicate a 90% probability of occurring and *likely* to indicate a 67% probability.

IPCC, 2021 Assessment Report 6

Sea level is **committed to rise** for centuries to millennia due to continuing deep-ocean warming and ice-sheet melt and will **remain elevated** for thousands of years (high confidence). *[AR6 WGI SPM p.21 B.5.4]*

Global mean sea level will rise by about
- 6.5 to 10 ft at 1.5°C
- 6.5 to 20 ft at 2°C

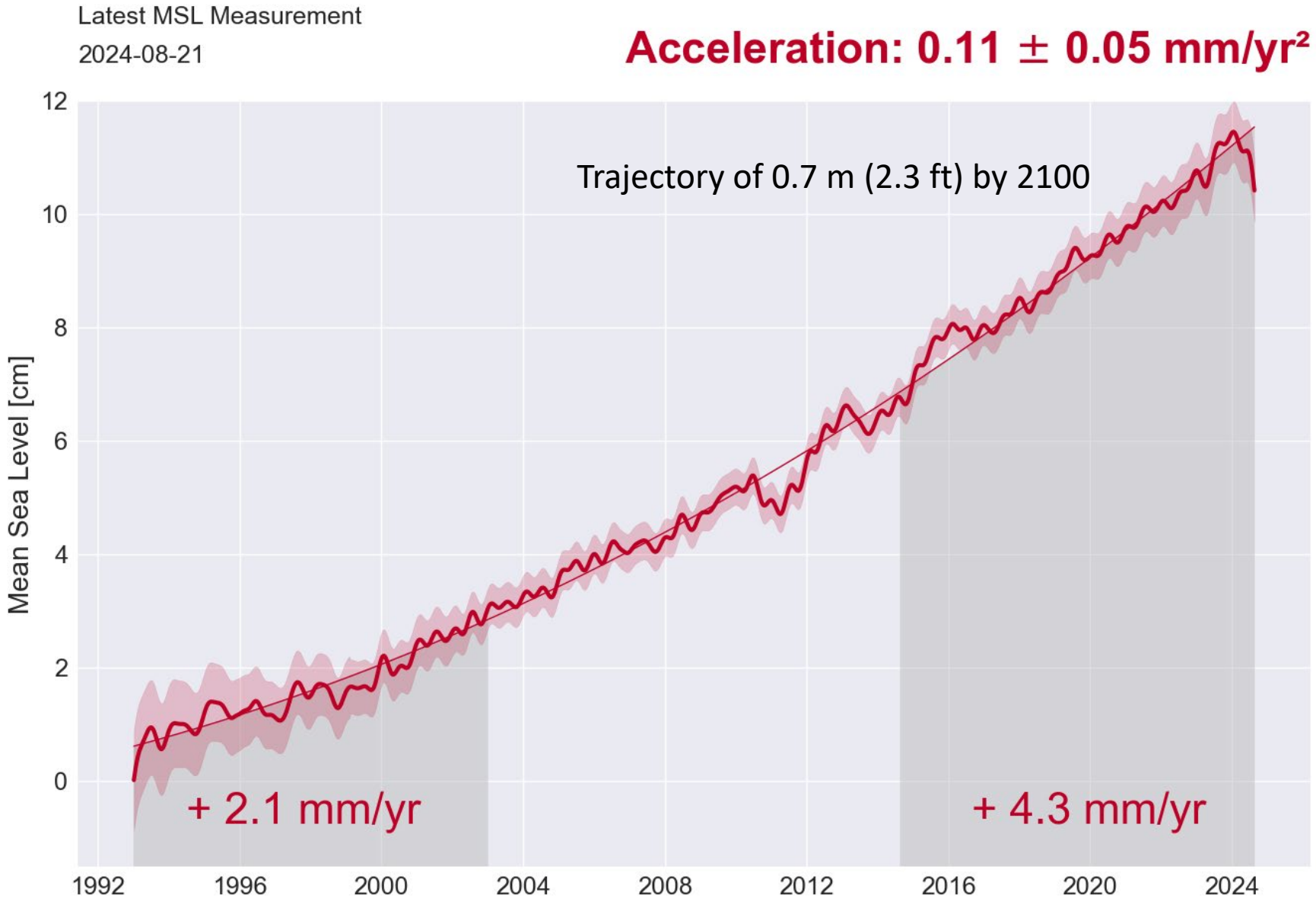
…and will continue to rise over subsequent millennia

IPCC, 2021: Summary for Policymakers. In: *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Masson-Delmotte, V., *et al.* (eds.)]. In Press.

Sea level rise, an unstoppable and irreversible reality

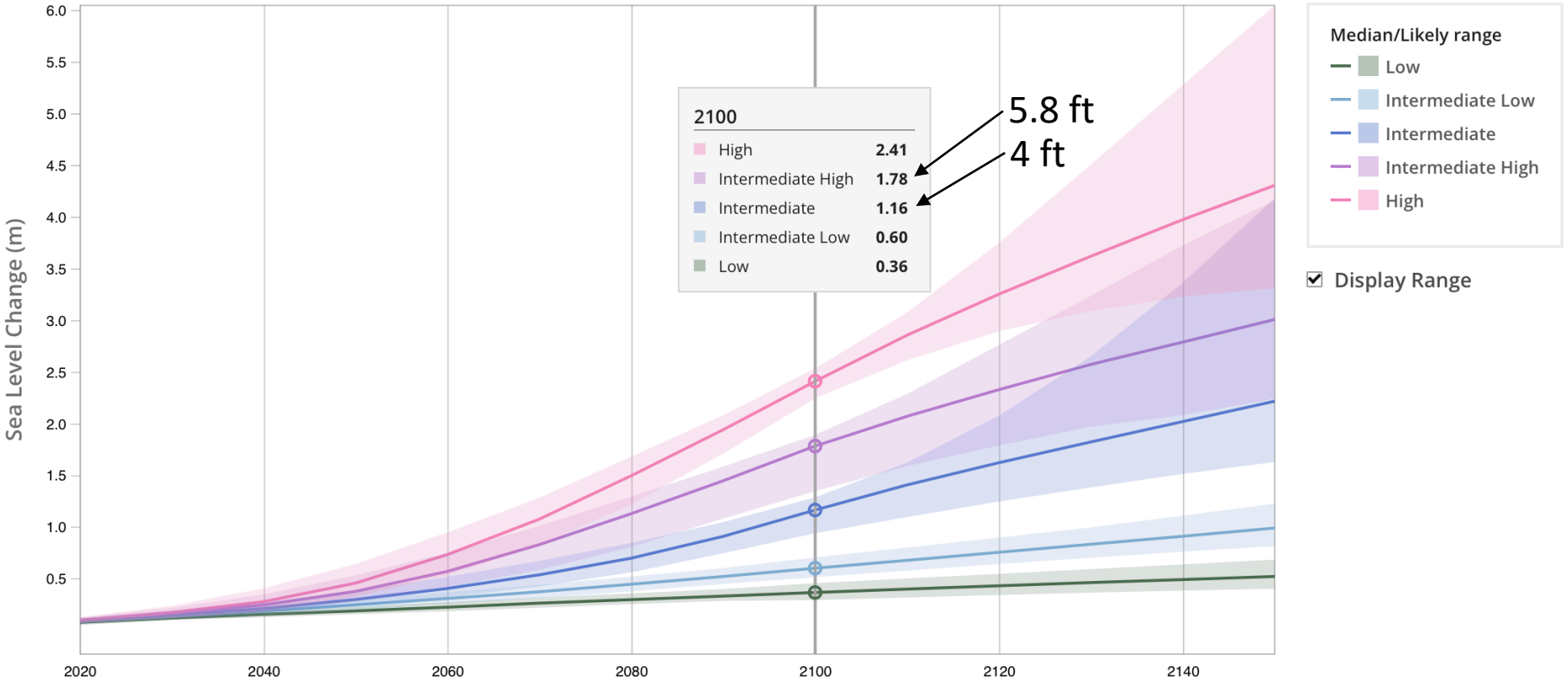
Photo, S. Habel

Global Mean Sea Level Rise



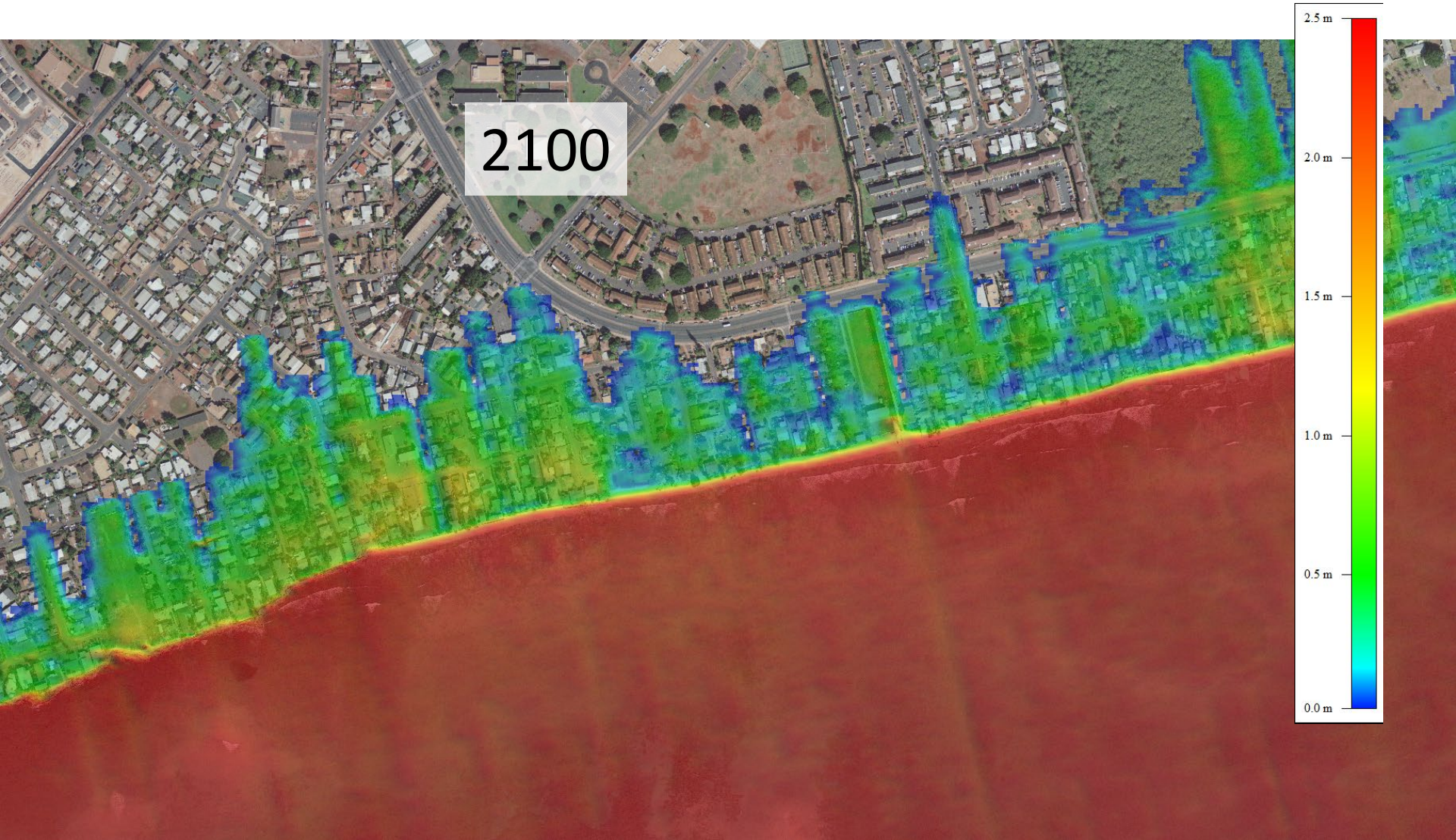
https://www.aviso.altimetry.fr/en/data/products/ocean-indicators-products/mean-sea-level.html#c15723

NOAA/NASA/USGS/ARCE
SLR Planning Scenarios
Honolulu, Oahu



https://sealevel.nasa.gov/task-force-scenario-tool

Ewa Beach – Annual Wave Flooding, 4ft




As sea level rises, so does
the water table

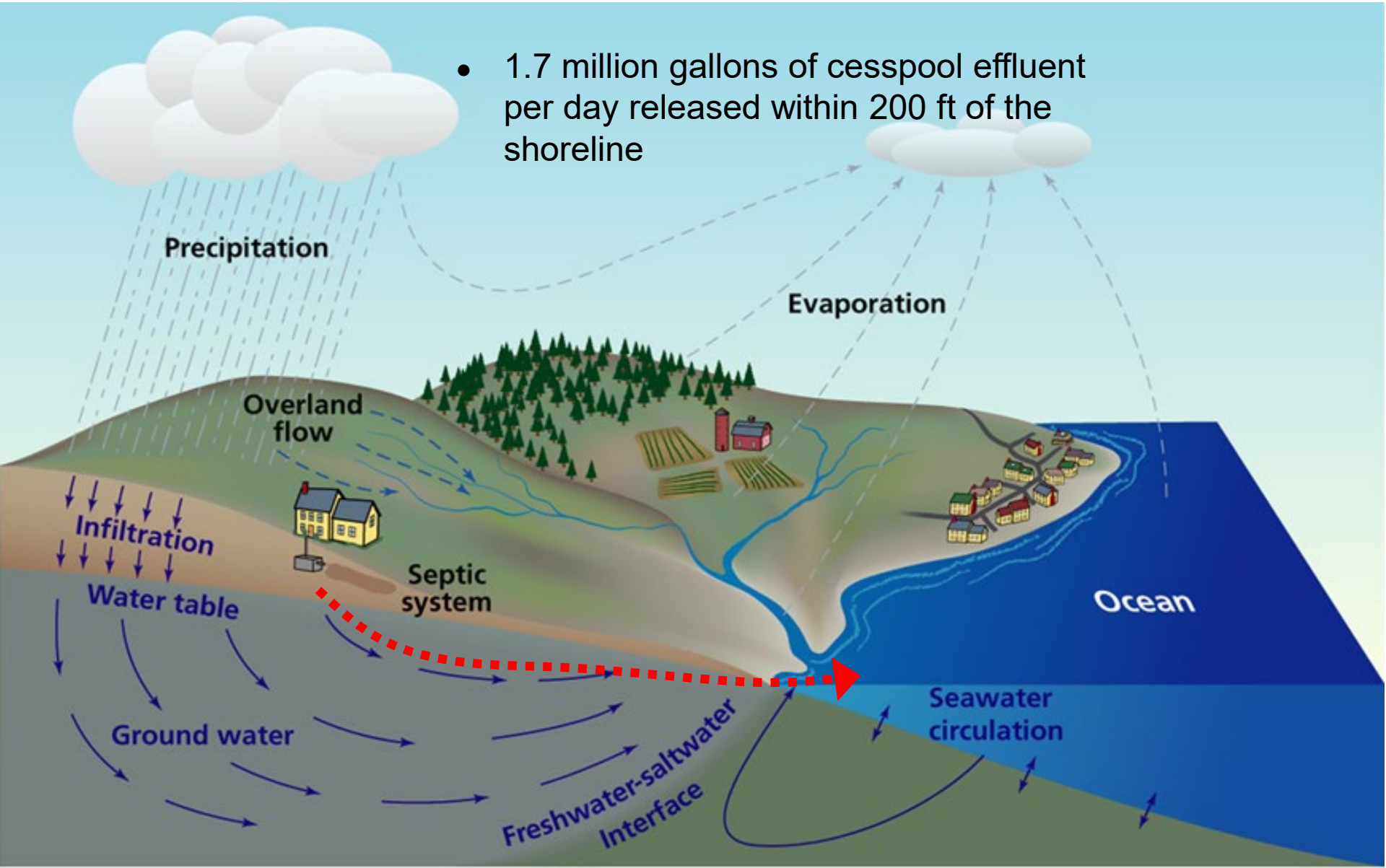
Storm drain backflow

Rain + High Tide = Compound Flooding

Sunset Beach – Coastal Erosion, 4 ft

Subterranean Estuary

- 1.7 million gallons of cesspool effluent per day released within 200 ft of the shoreline



Chronic Coastal Erosion

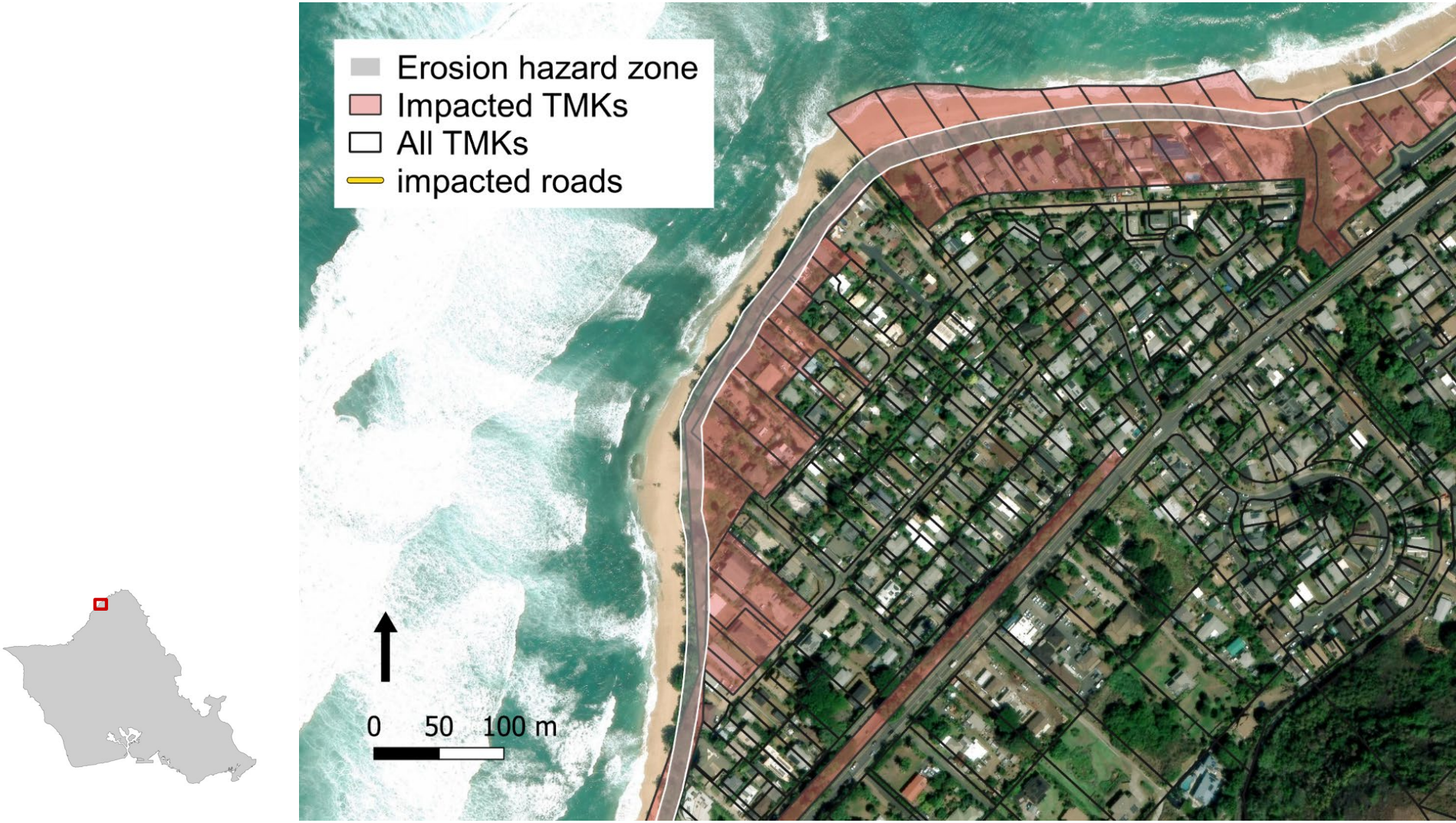
Cess Pool

SLR will bring polluted groundwater to the surface

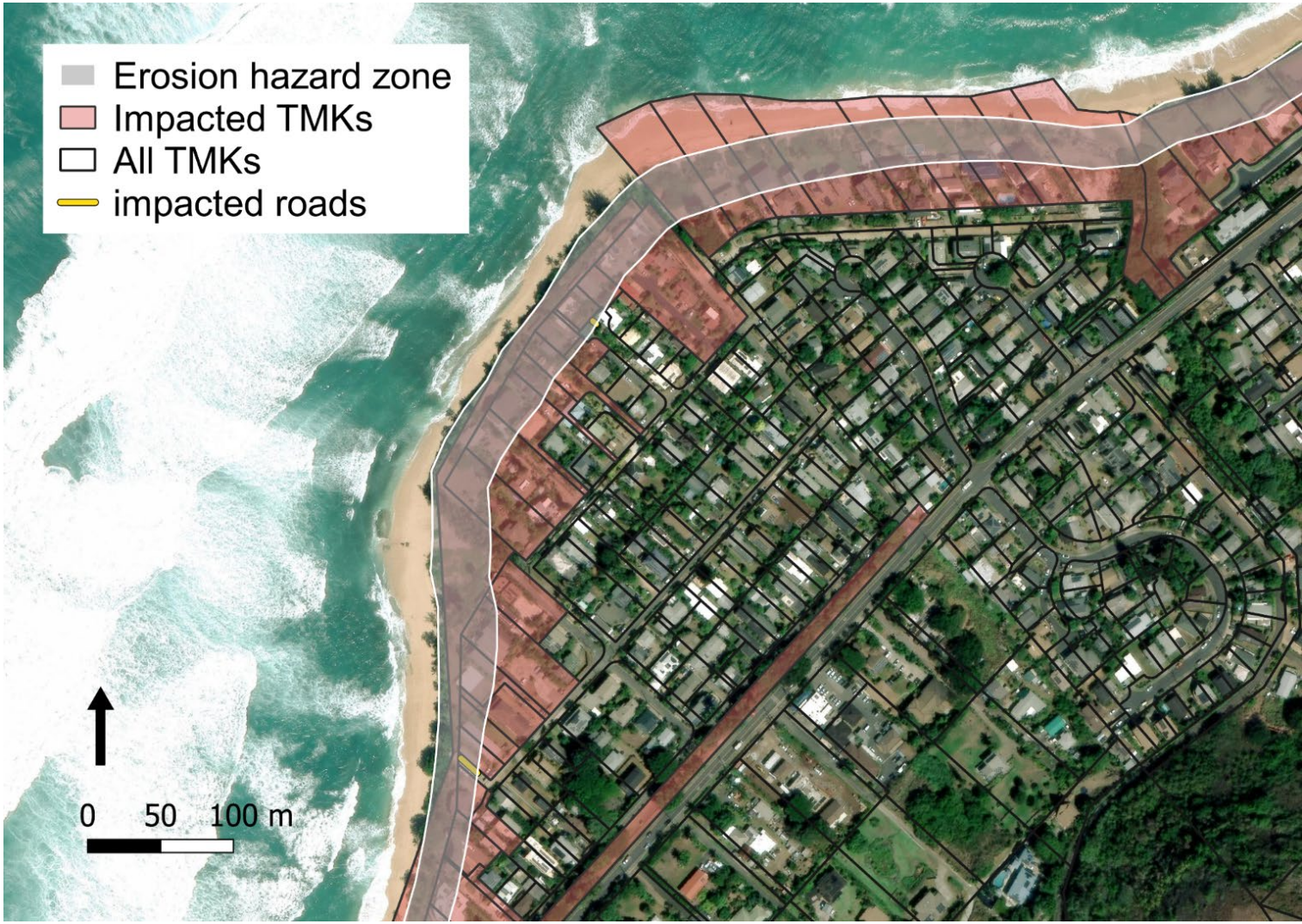
Groundwater Pollution

Sunset Beach – Coastal Erosion, 0 ft

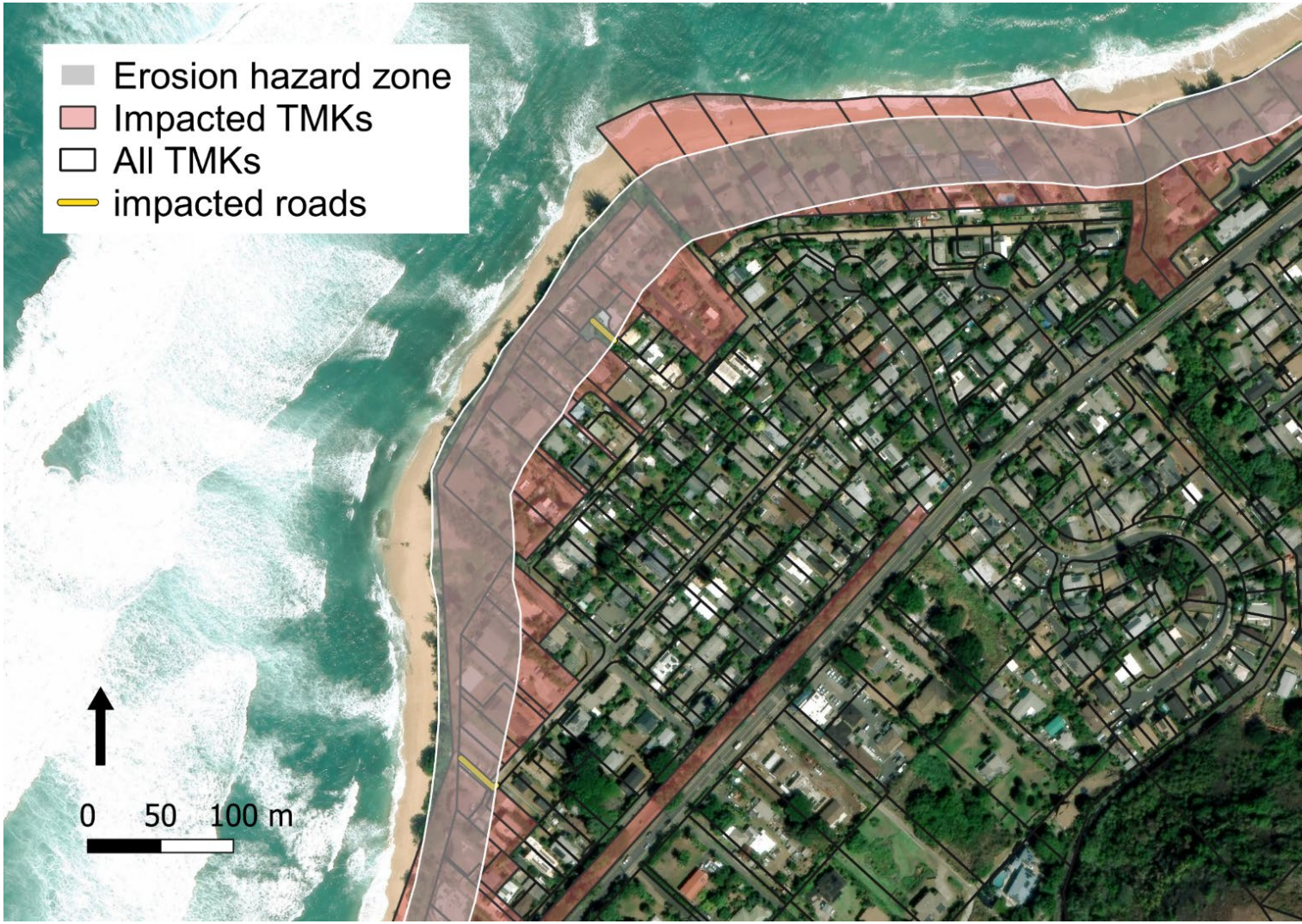
Sunset Beach – Coastal Erosion, 1 ft



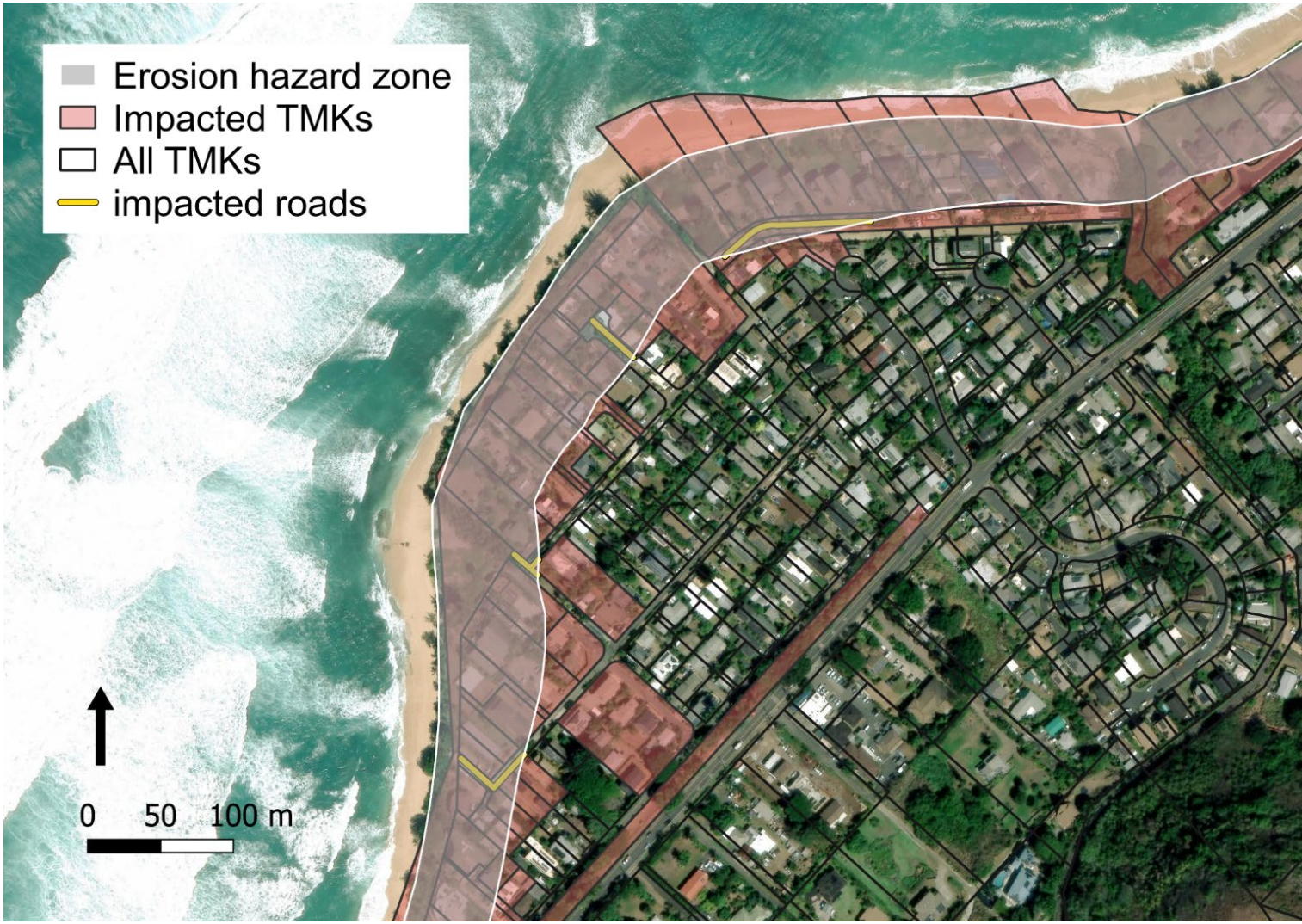
Sunset Beach – Coastal Erosion, 2 ft



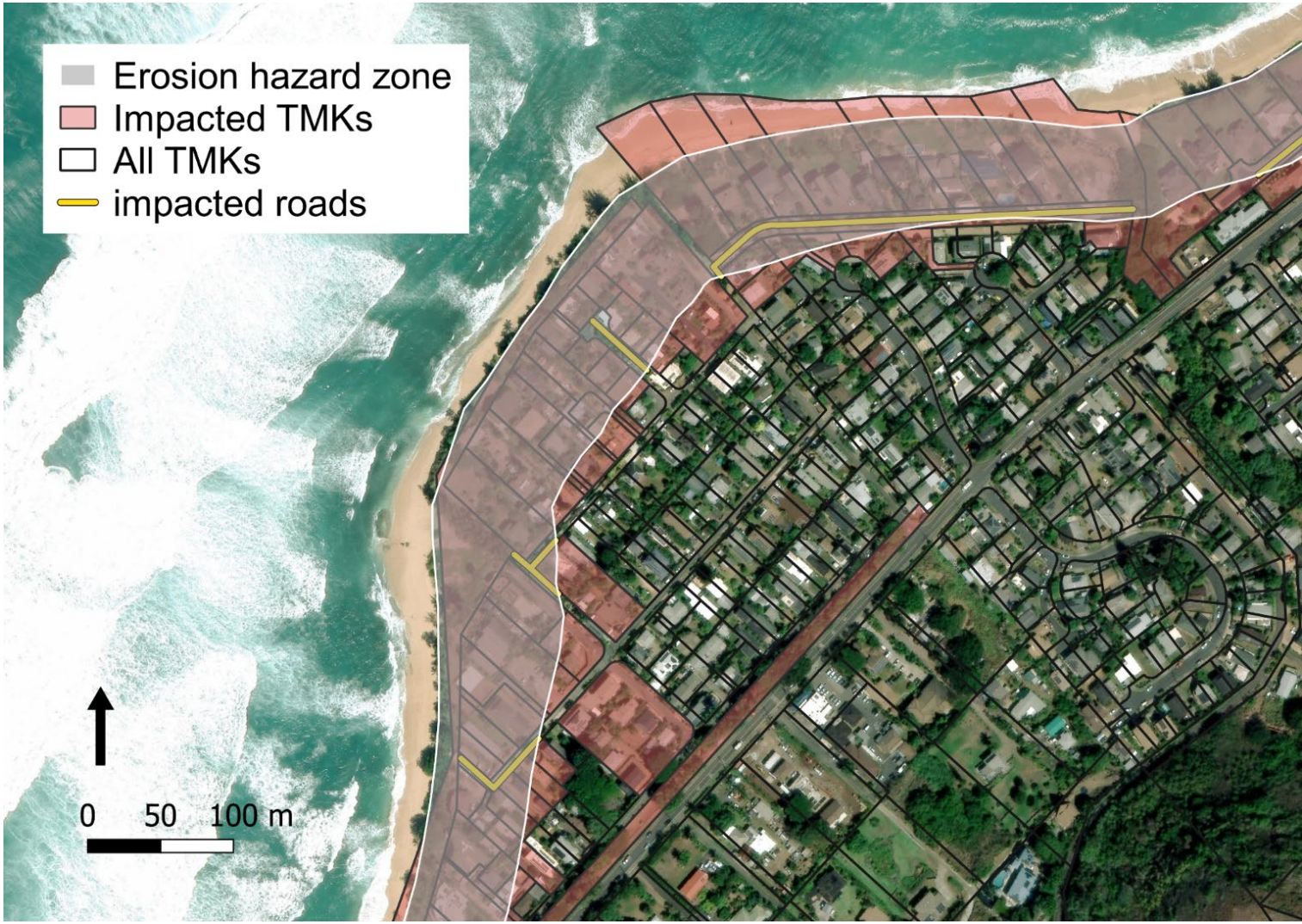
Sunset Beach – Coastal Erosion, 3 ft



Sunset Beach – Coastal Erosion, 4 ft

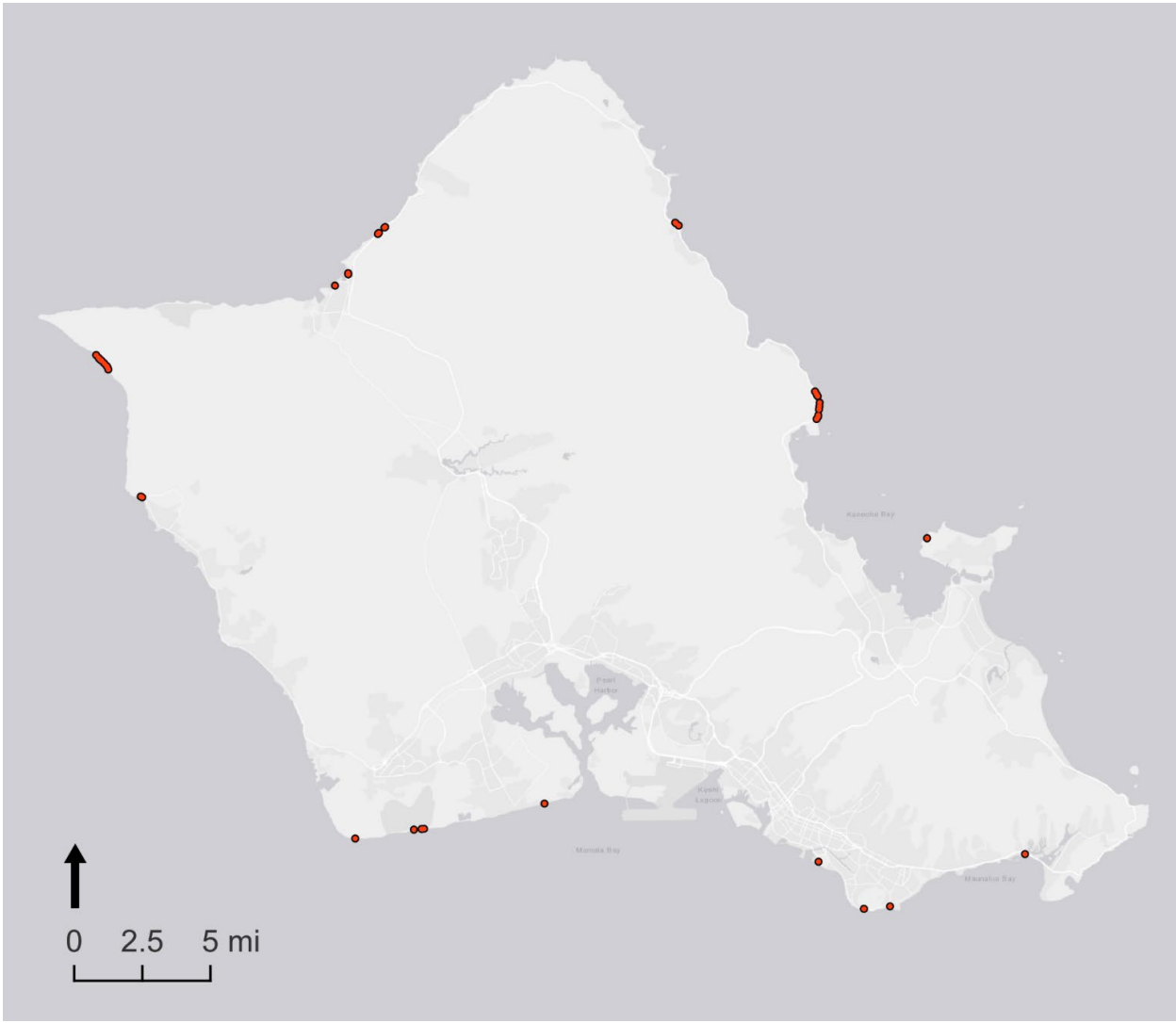


Sunset Beach – Coastal Erosion, 5 ft

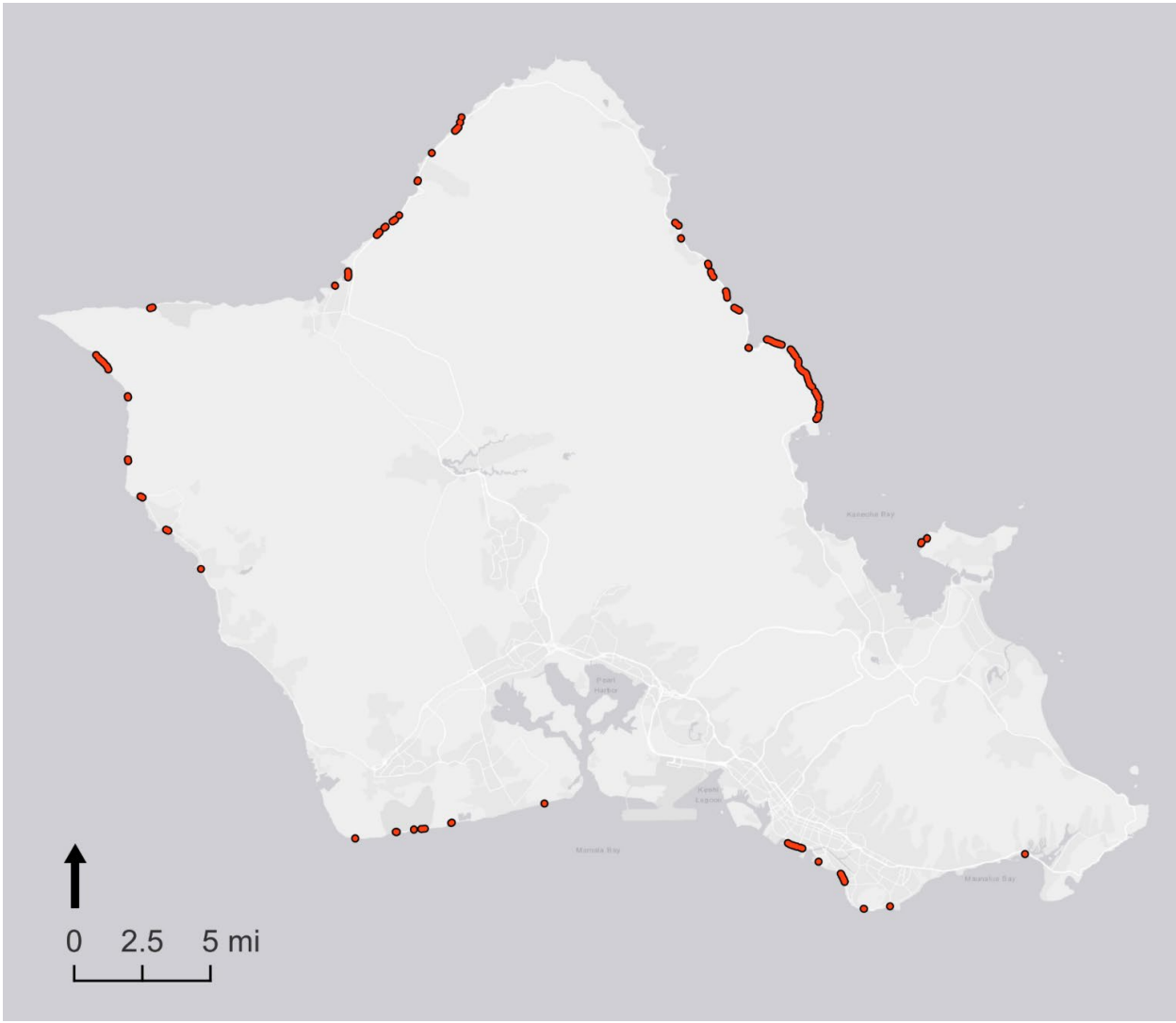


Sunset Beach – Coastal Erosion, 6 ft

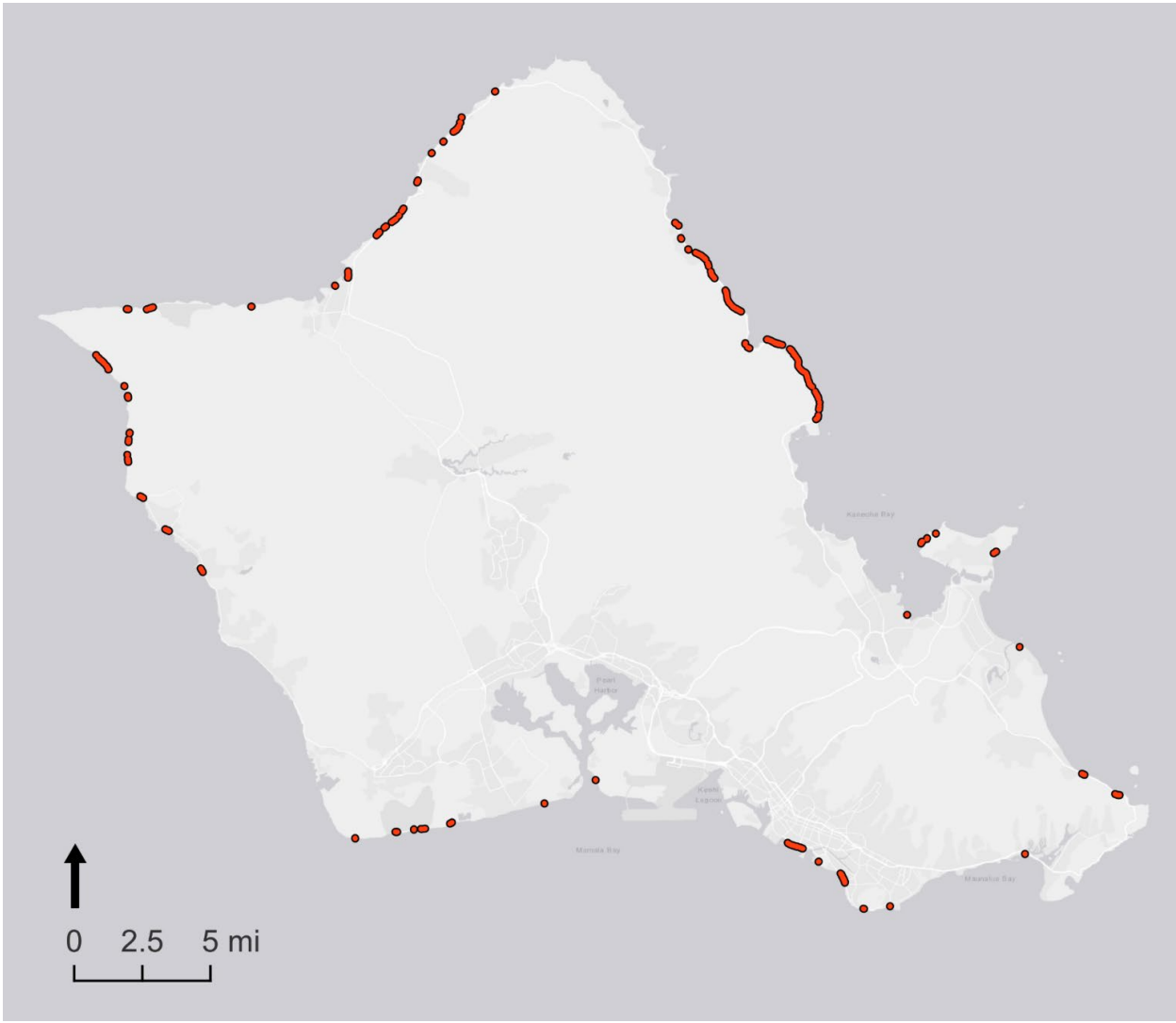
Miles of road in erosion hazard zones - 1ft 0.53 mi



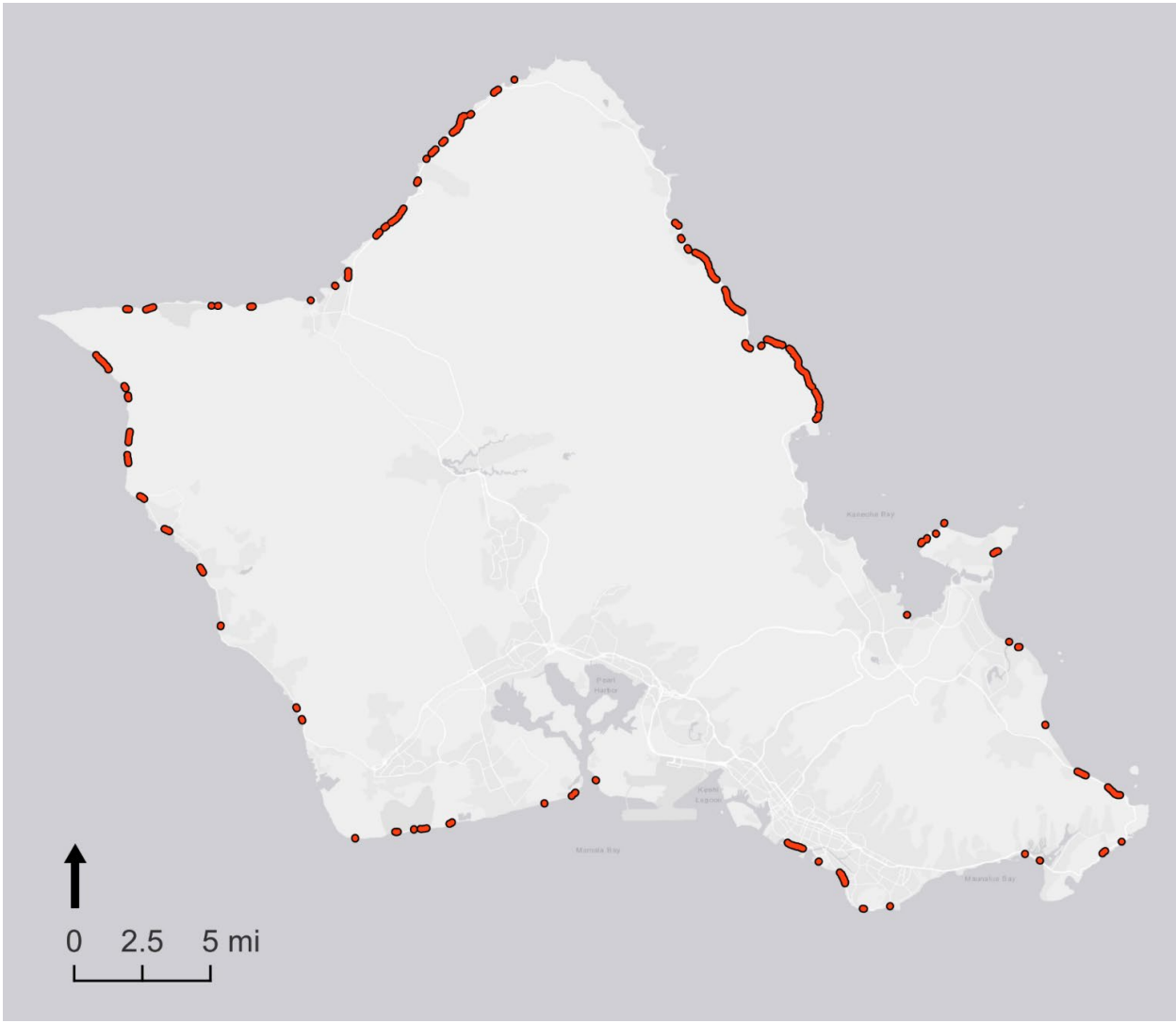
Miles of road in erosion hazard zones - 2ft 4.38 mi



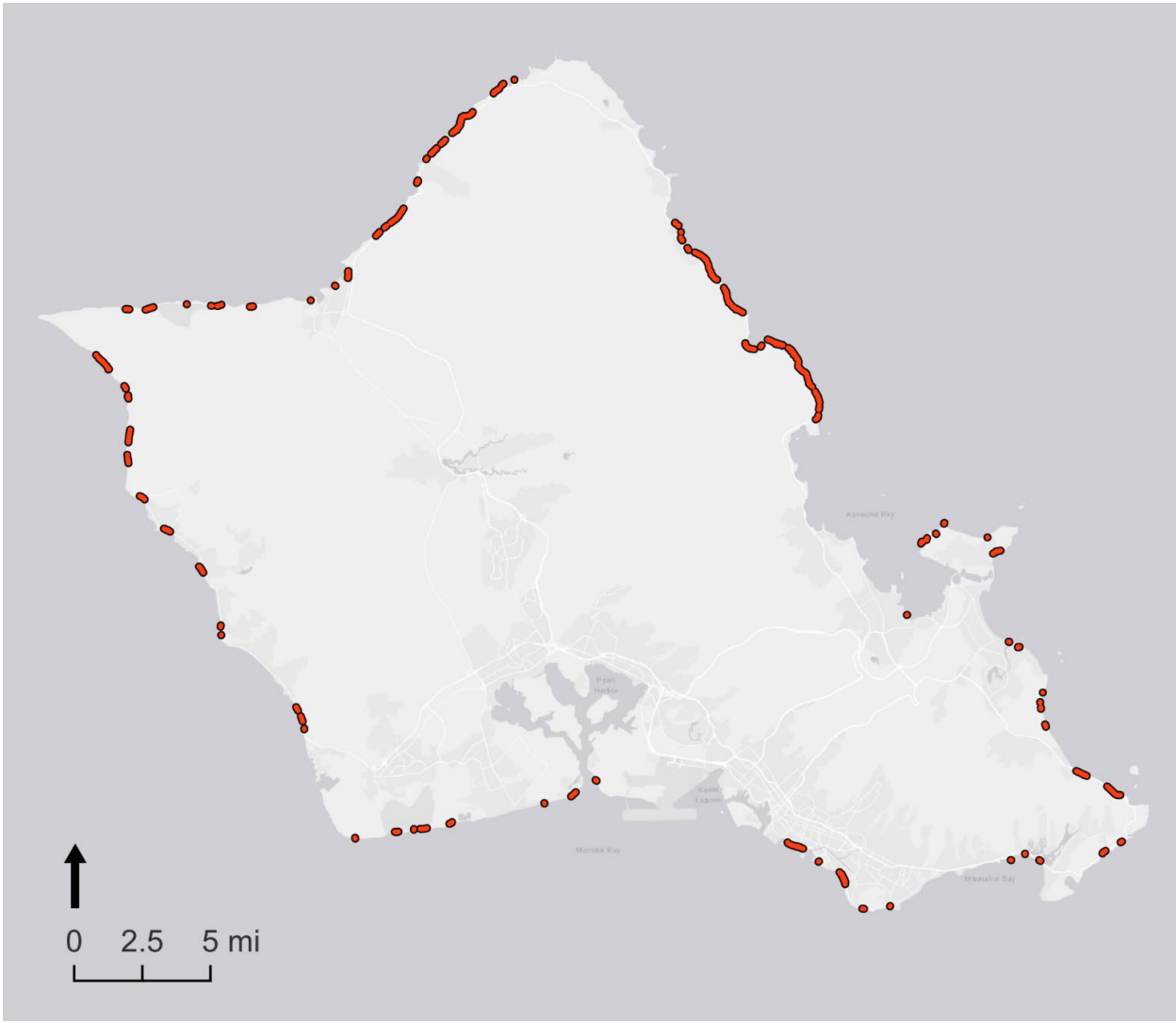
Miles of road in erosion hazard zones - 3ft 7.05 mi



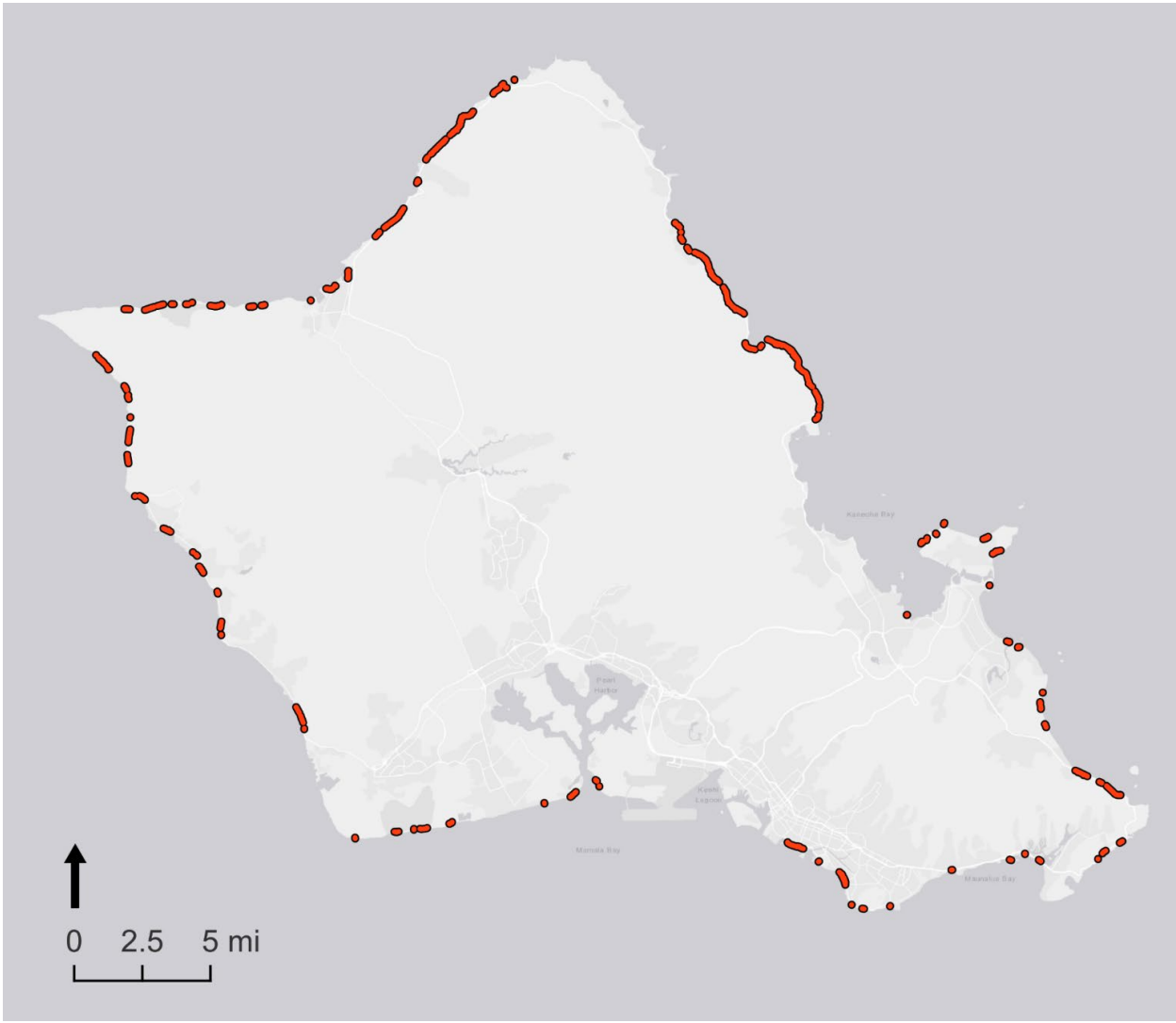
Miles of road in erosion hazard zones - 4ft 9.64 mi



Miles of road in erosion hazard zones - 5ft 11.49 mi

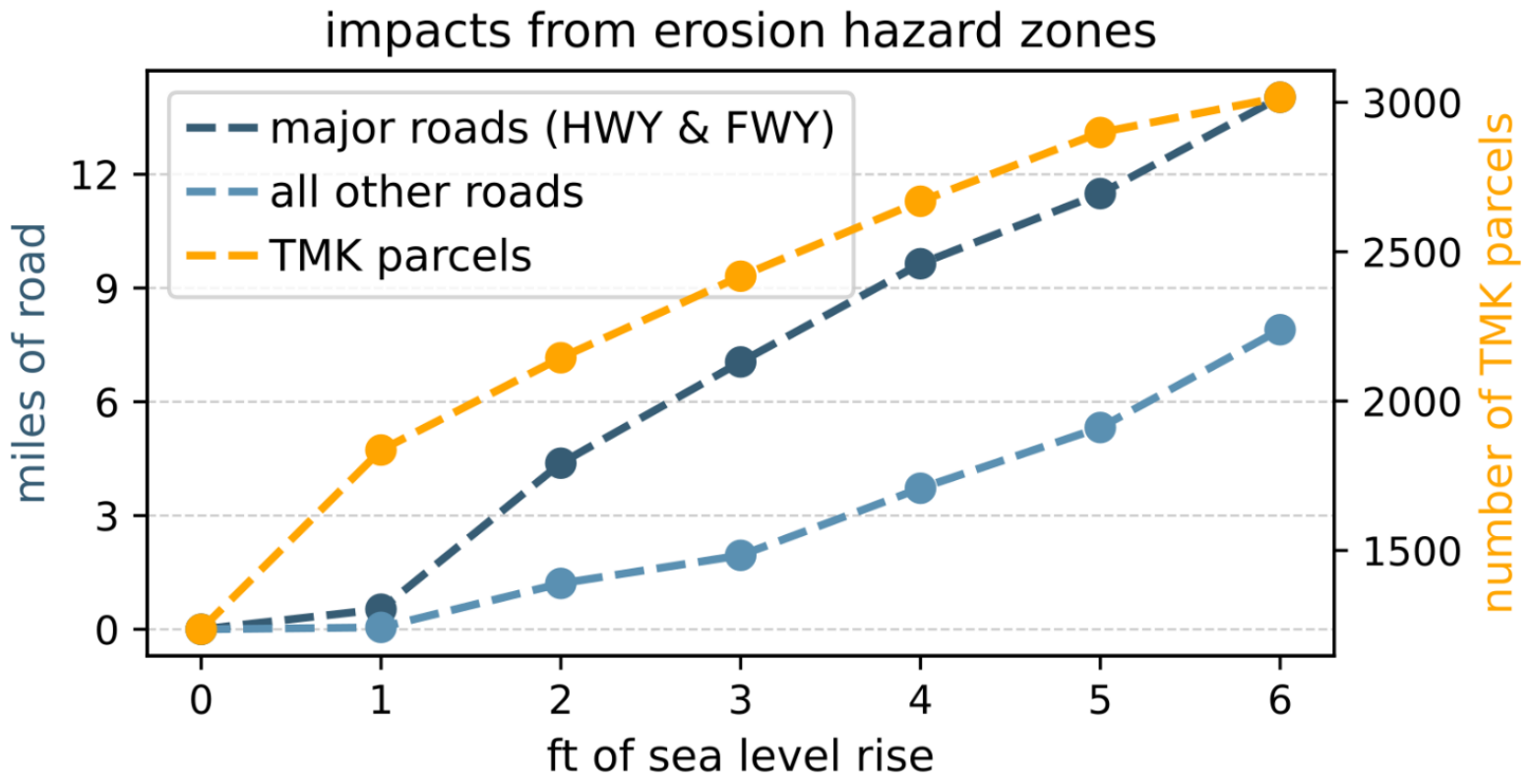


Miles of road in erosion hazard zones - 6ft 14.03 mi

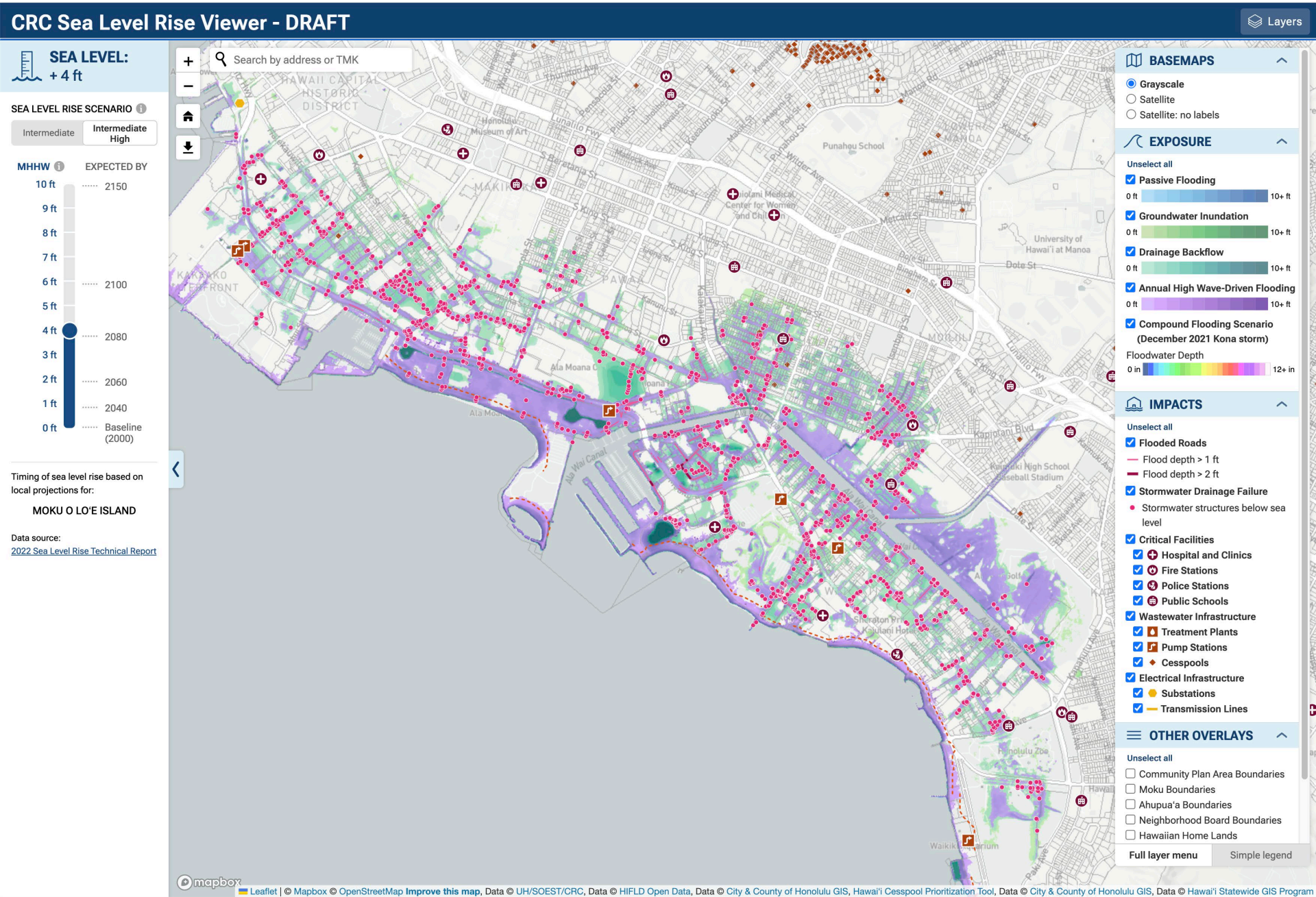


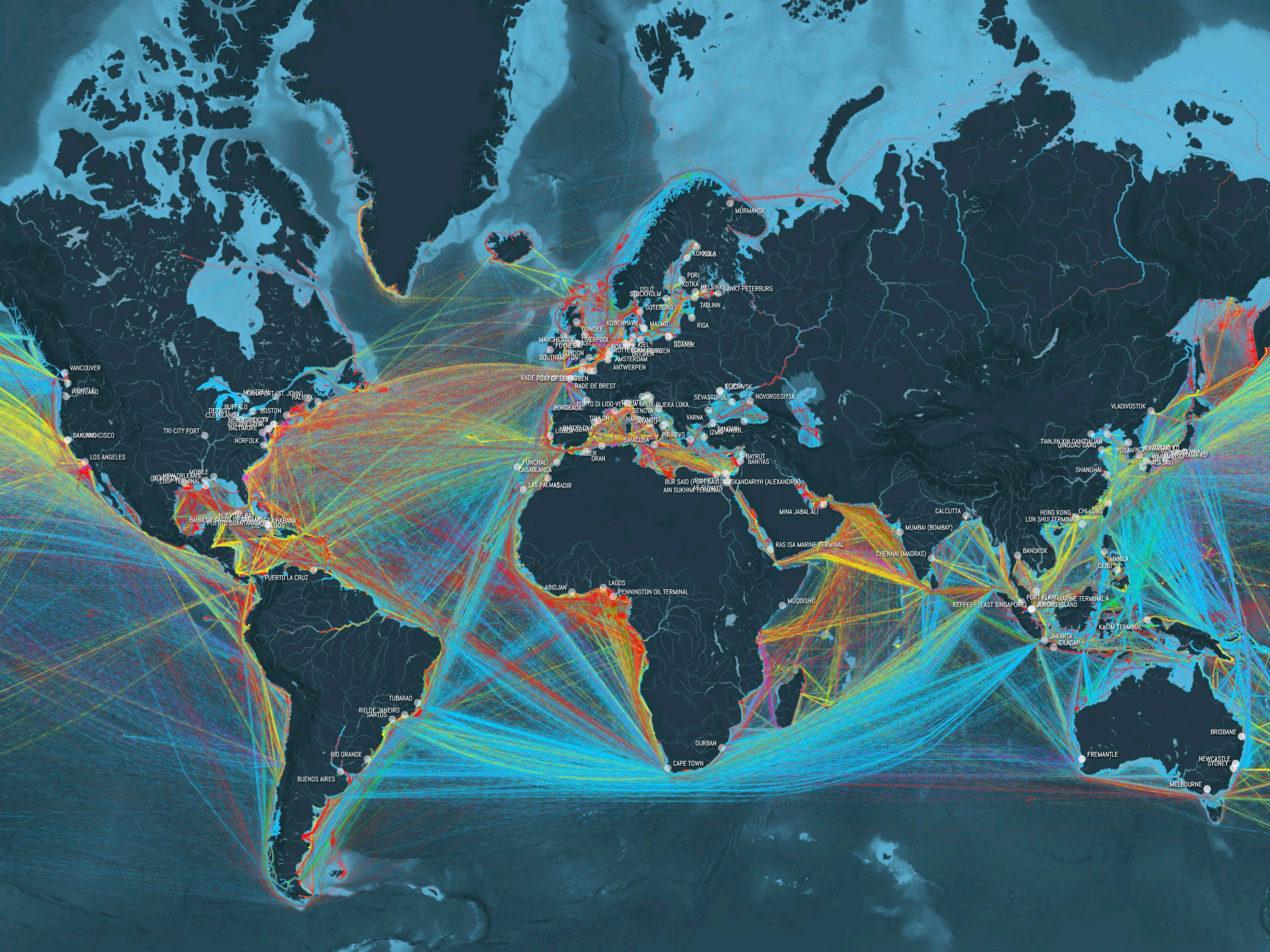
Both TMK and roads in Erosion hazard zones on O‘ahu

3017 parcels + 22 miles of road



SOEST Climate Viewer - https://www.soest.hawaii.edu/crc/slr-viewer/




MURMANSK
KOKKOLA
PORI
KOTKA
HELSINKI
SANKT-PETERBURG
OSLO
STOCKHOLM
TALLINN
GOTEBORG
RIGA
KOBENHAVN
MALMO
DUNDEE
MANCHESTER
LIVERPOOL
GDANSK
LONDON
SOUTHAMPTON
AMSTERDAM
ANTWERPEN
RADE DE BREST
SEVASTOPOL
NOVOROSSIYSK
BORDEAUX
RIJEKA LUKA
GENOVA
VARNA
TOULON
SIRACUSA
PIRAIEVS
BAYRUT
BANIYAS
ALGER
ORAN
FUNCHAL
CASABLANCA
LAS PALMAS
AIN SUKHNA TERMINAL
MINA JABAL ALI
RAS ISA MARINE TERMINAL
CALCUTTA
MUMBAI (BOMBAY)
CHENNAI (MADRAS)
VANCOUVER
PORTLAND
LOS ANGELES
TRI-CITY PORT
BUFFALO
BOSTON
HALIFAX
BALTIMORE
NORFOLK
MOBILE
PUERTO LA CRUZ
ABIDJAN
LAGOS
PENNINGTON OIL TERMINAL
MUQDISHO
KEPPEL - (EAST SINGAPORE)
PORT KLANG
JURONG ISLAND
JAKARTA
CILACAP
KASIM TERMINAL
BANGKOK
MANILA
CEBU
HONG KONG
CHI-LUNG
LON SHUI TERMINAL
SHANGHAI
QINGDAO GANG
VLADIVOSTOK
NAGASAKI
TUBARAO
RIO DE JANEIRO
SANTOS
RIO GRANDE
BUENOS AIRES
DURBAN
CAPE TOWN
FREMANTLE
BRISBANE
NEWCASTLE
SYDNEY
MELBOURNE

The Sea Level Rise Problem

- An unstoppable, accelerating problem
- 1 billion displaced world wide
- 90% of global goods and raw materials
- Pollution, land loss, multiple types of flooding, wave forces, large-scale public infrastructure losses
- Adaptation to SLR will cost coastal cities $1 trillion by the end of the century
- Globally, nationally, and locally we are still stuck on defining the problem and have not made meaningful progress on solutions.