

# Coastal Inundation on Oahu

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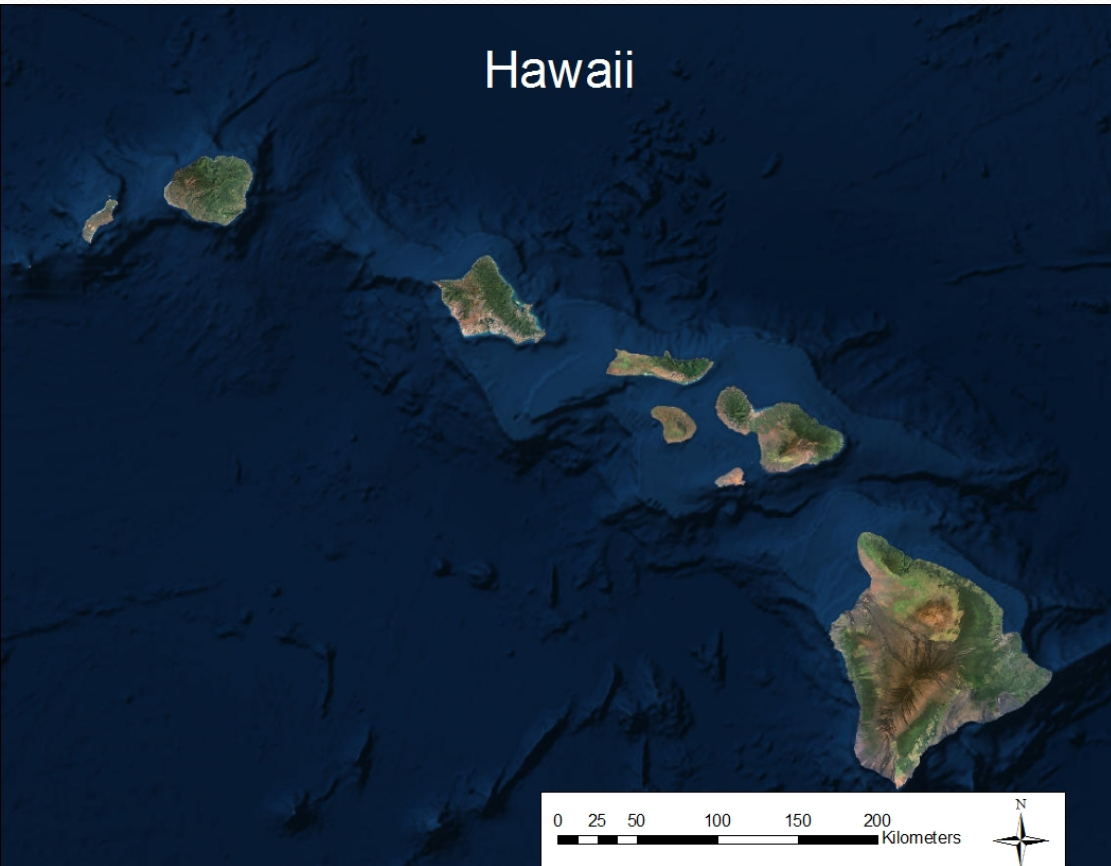
Kapiolani Community College

## NASA Summer Research Experience for Undergraduates (REU)

NASA Cooperative Agreement  
NNX14AKA



# Background



- Hawaii's biggest export is Tourism

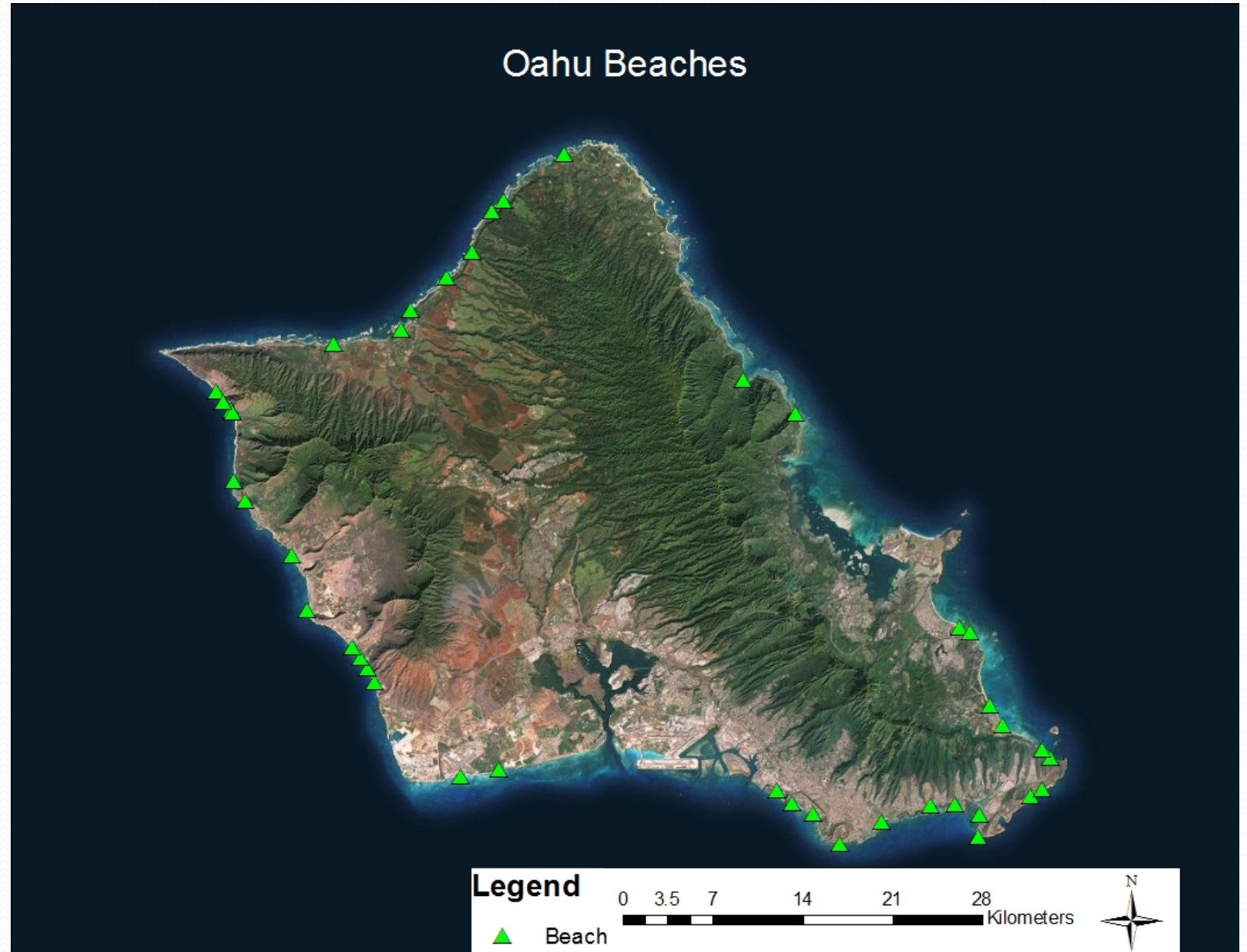
- The State of Hawaii is in the middle of the Pacific Ocean





# Objective

The objective of my project is to determine the impact of climate change induced sea level rise on coastal inundation for the island of Oahu.



# Data Sources

- ArcMap
- DEMs
- Sea Level Rise Data (SLR)
- Open Street Map Data (OSM)
- Ice Sheet Data





# Methodology

- Work on digitizing the island of Oahu to create an OSM file which labels everything on the island
- Study the future scenarios for potential SLR
- Using formulas obtained from a DoD report on SLR, calculate the various levels of potential SLR for several different scenarios
- Using the DEM of Oahu, create visuals which represent SLR across the island
- Show coastal inundation around several spots around the island, primarily focusing around our major industries
- Create a map showing the potential SLR of the melting of the major ice sheets

# Results and Discussion

$$a \cdot (t - 1992) + b \cdot (t - 1992)^2$$

$$a = 1.7 \cdot 10^{-3}$$

$$t = \text{Year}$$

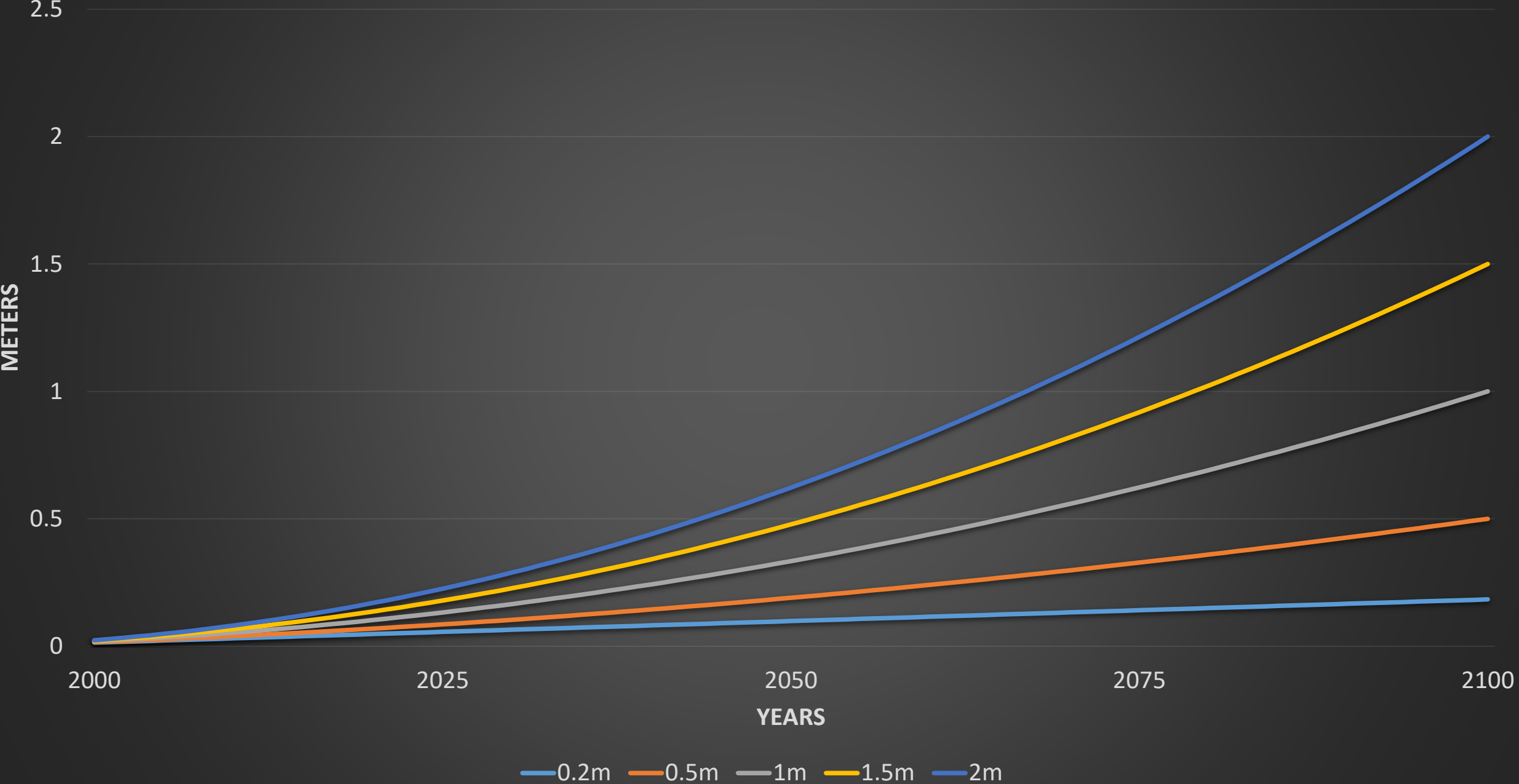
b	End Scenario at 2100 in Meters
$2.7126200 \times 10^{-5}$	0.5m
$6.9993141 \times 10^{-5}$	1.0m
$1.12860082 \times 10^{-4}$	1.5m
$1.55727023 \times 10^{-4}$	2.0m



# SLR Scenarios

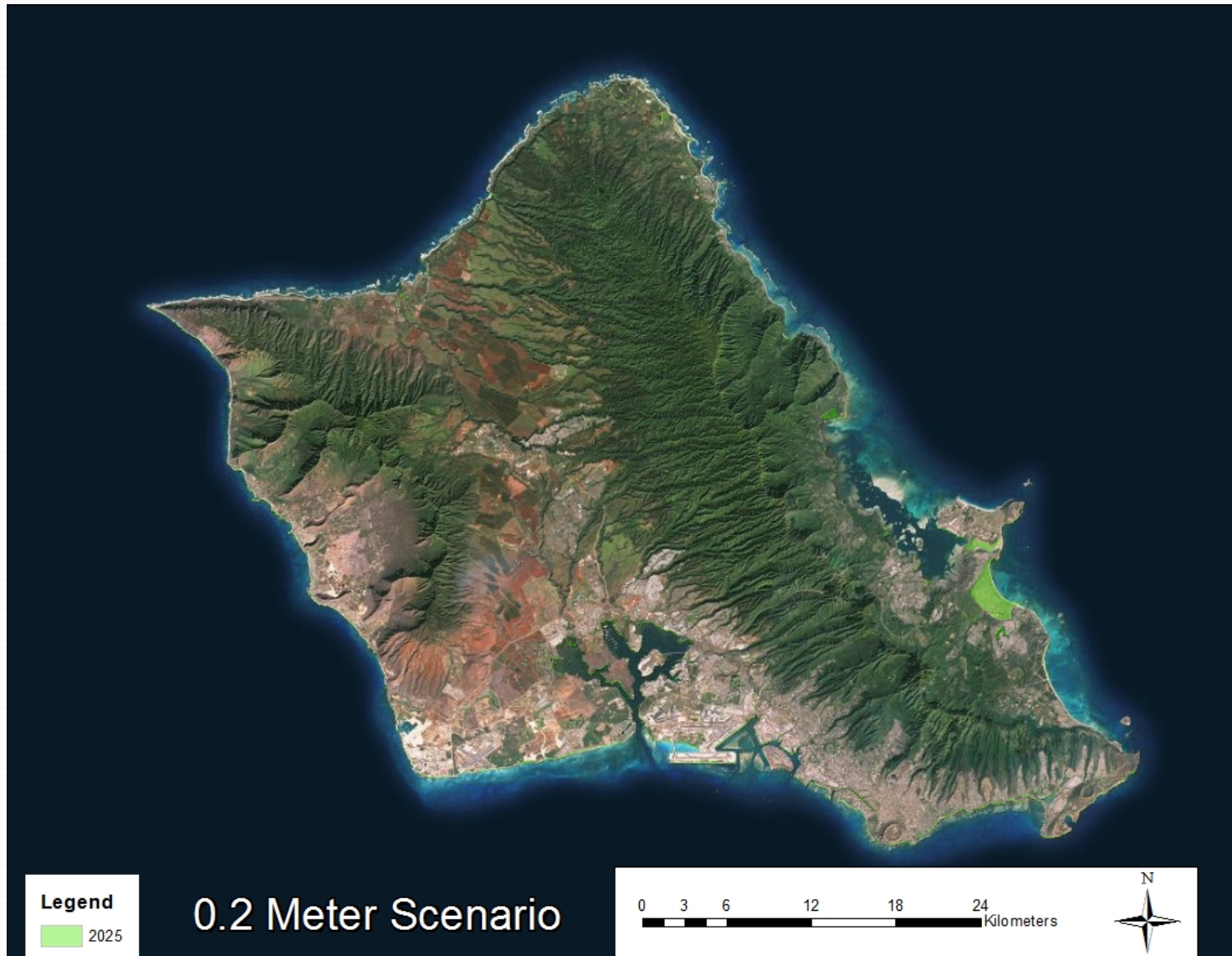
1992	2025	2050	2075	2100
0m	0.0561m	0.0986m	0.1411m	0.1836m
0m	0.08564m	0.18985m	0.32797m	0.5m
0m	0.13232m	0.33406m	0.62328	1.0m
0m	0.179m	0.47826m	0.91859m	1.5m
0m	0.22569m	0.62247m	1.2139m	2.0m

# Sea Level Rise in Meters

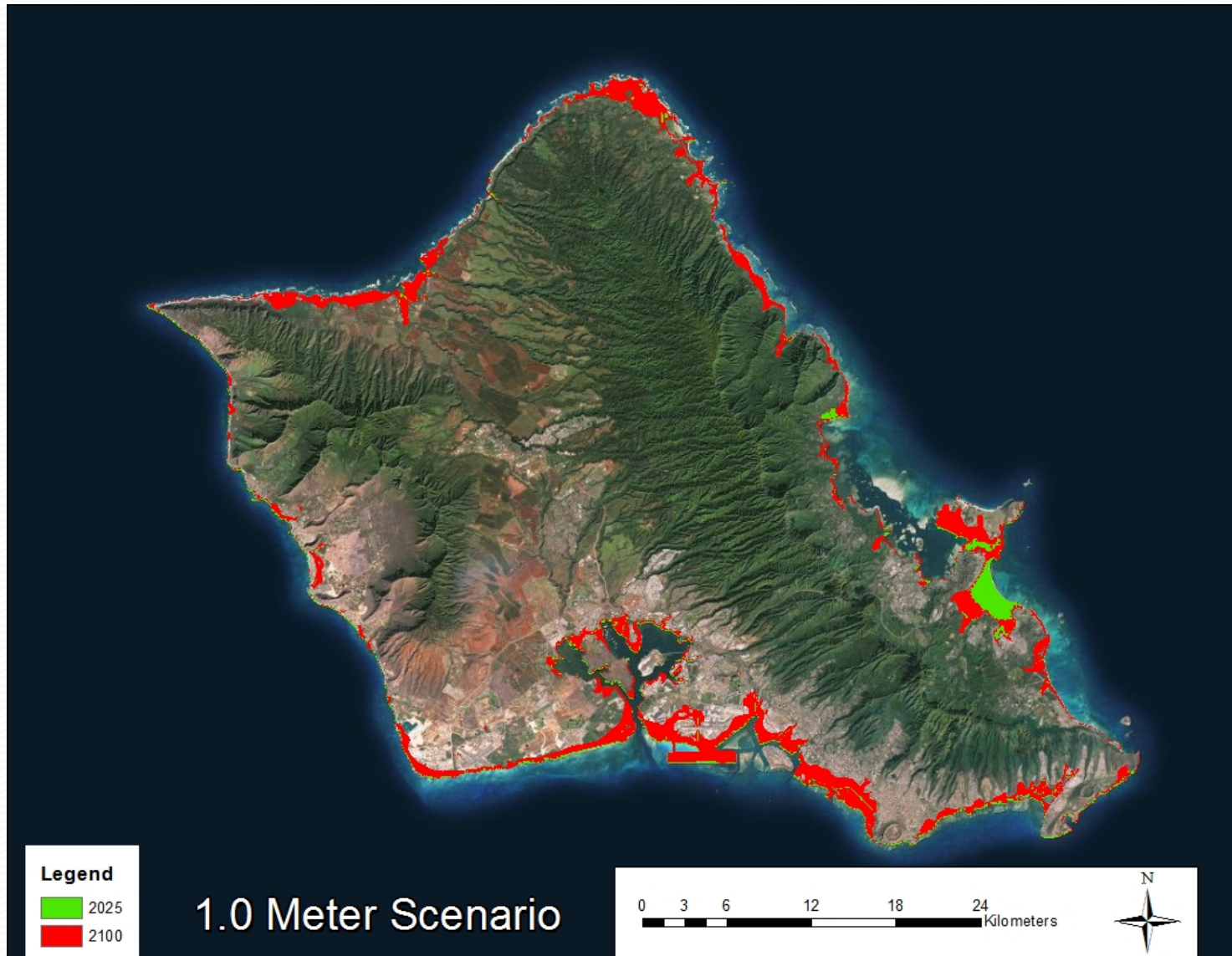




# Island Wide Inundation Maps

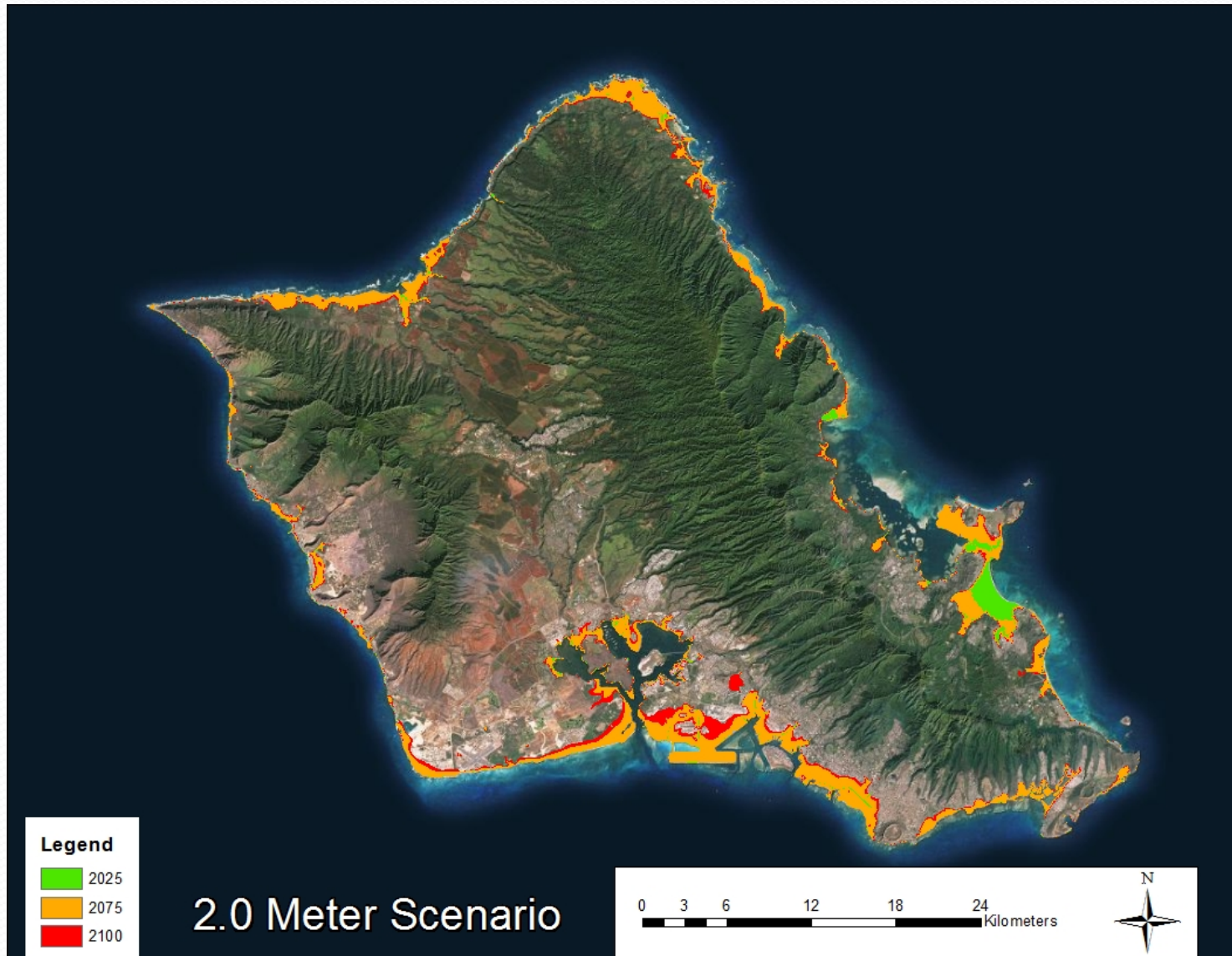


# Island Wide Inundation Maps





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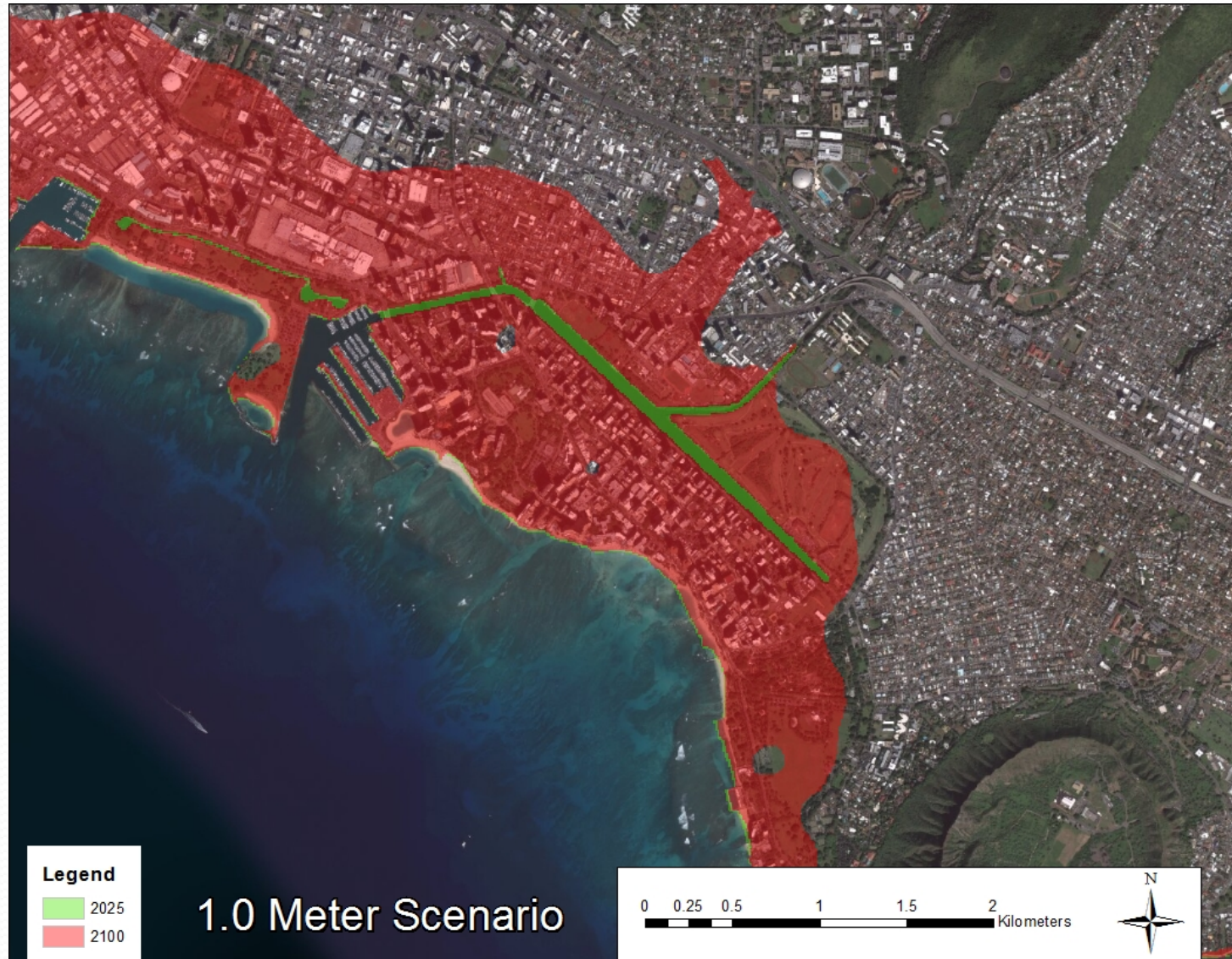


# South Shore Inundation Maps



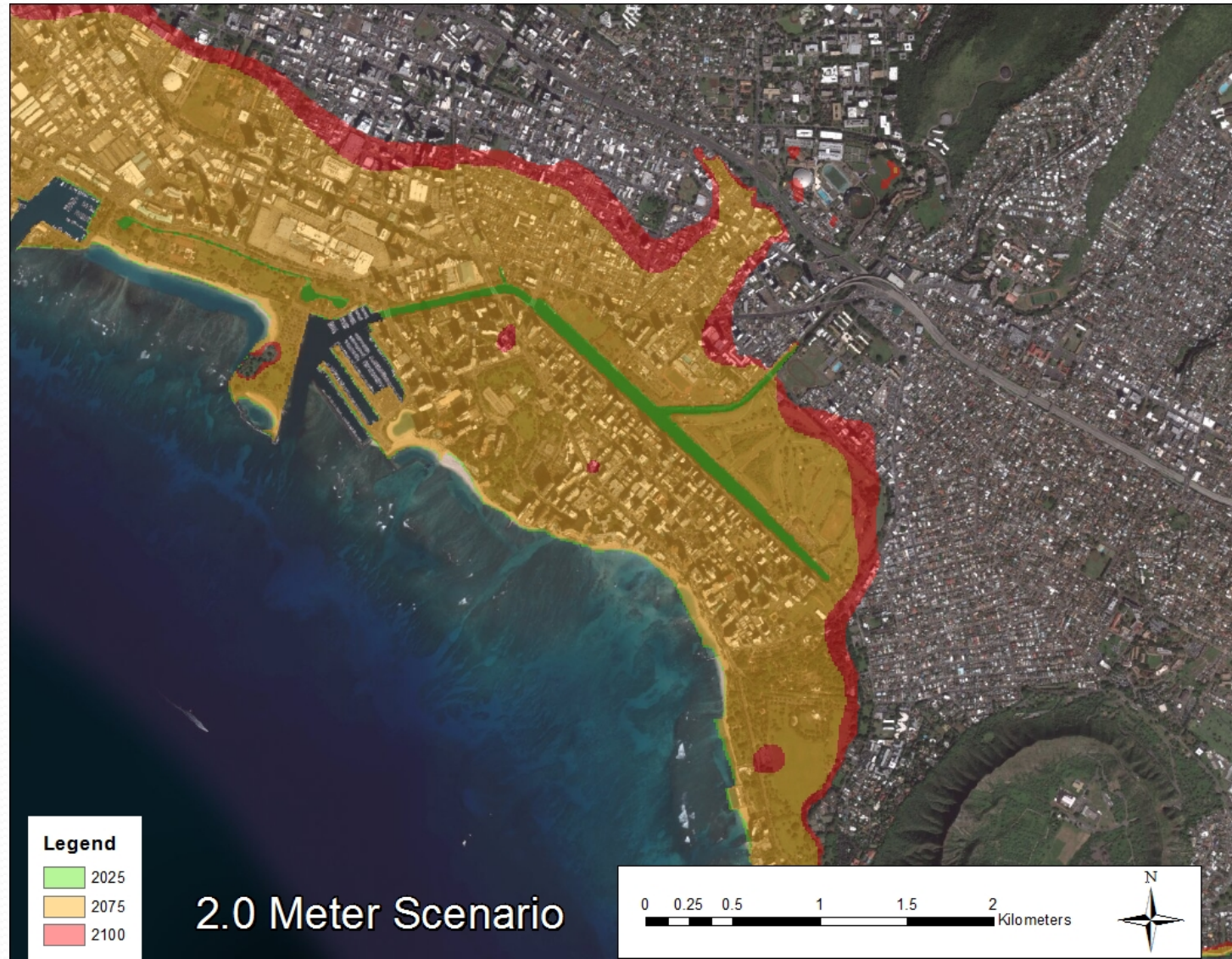


# South Shore Inundation Maps





# South Shore Inundation Maps



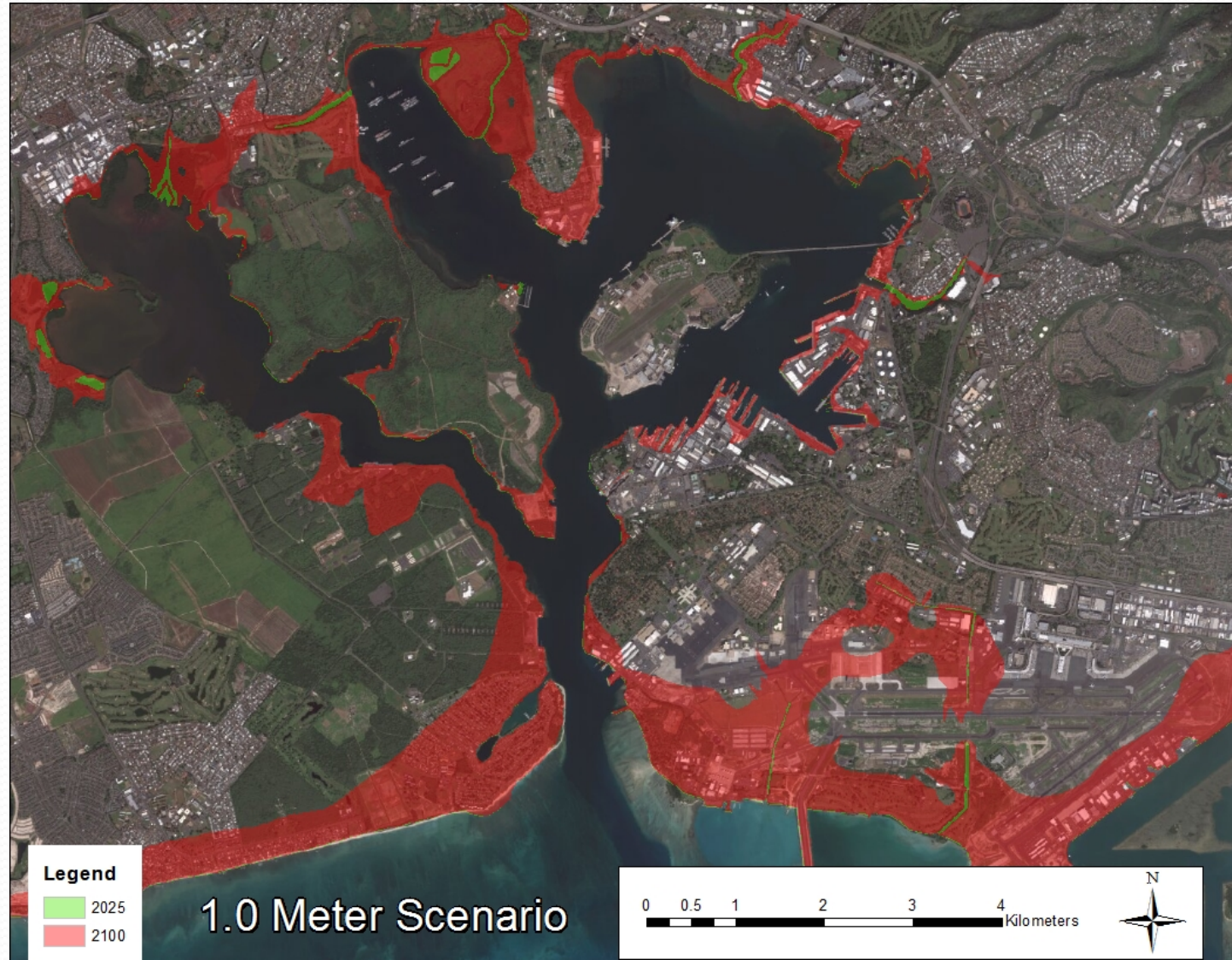


# Pearl Harbor Inundation Maps



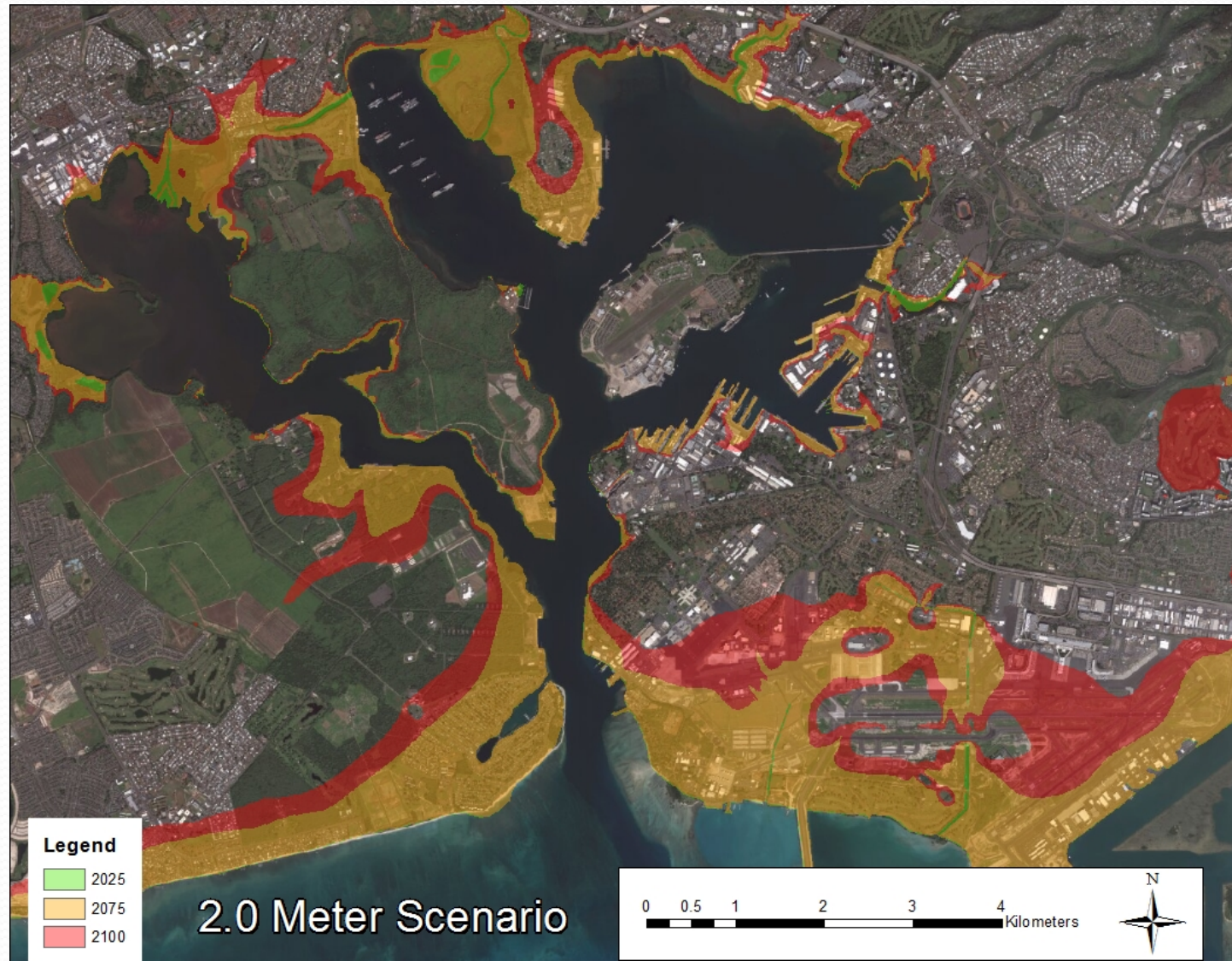


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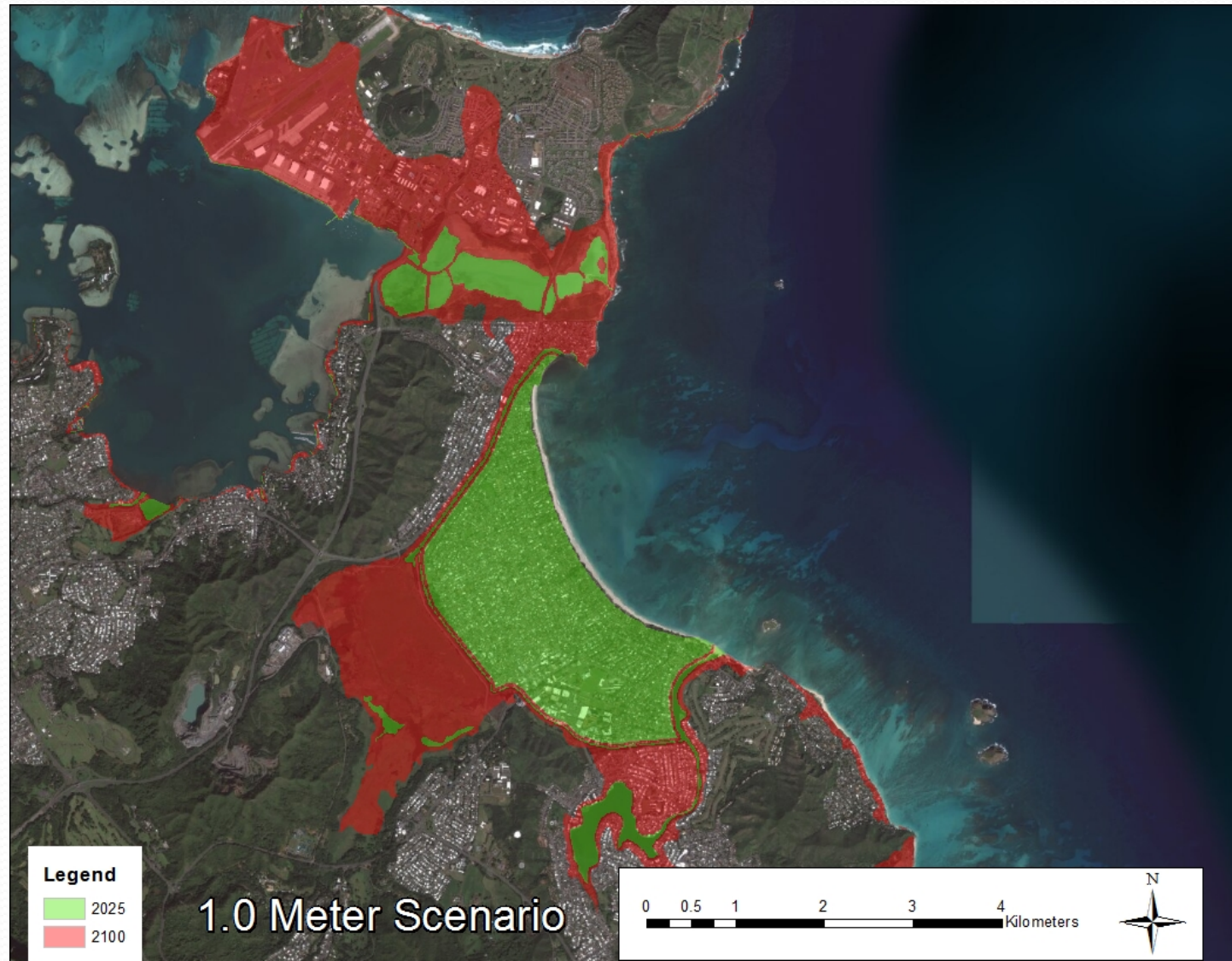


# Kailua Inundation Maps

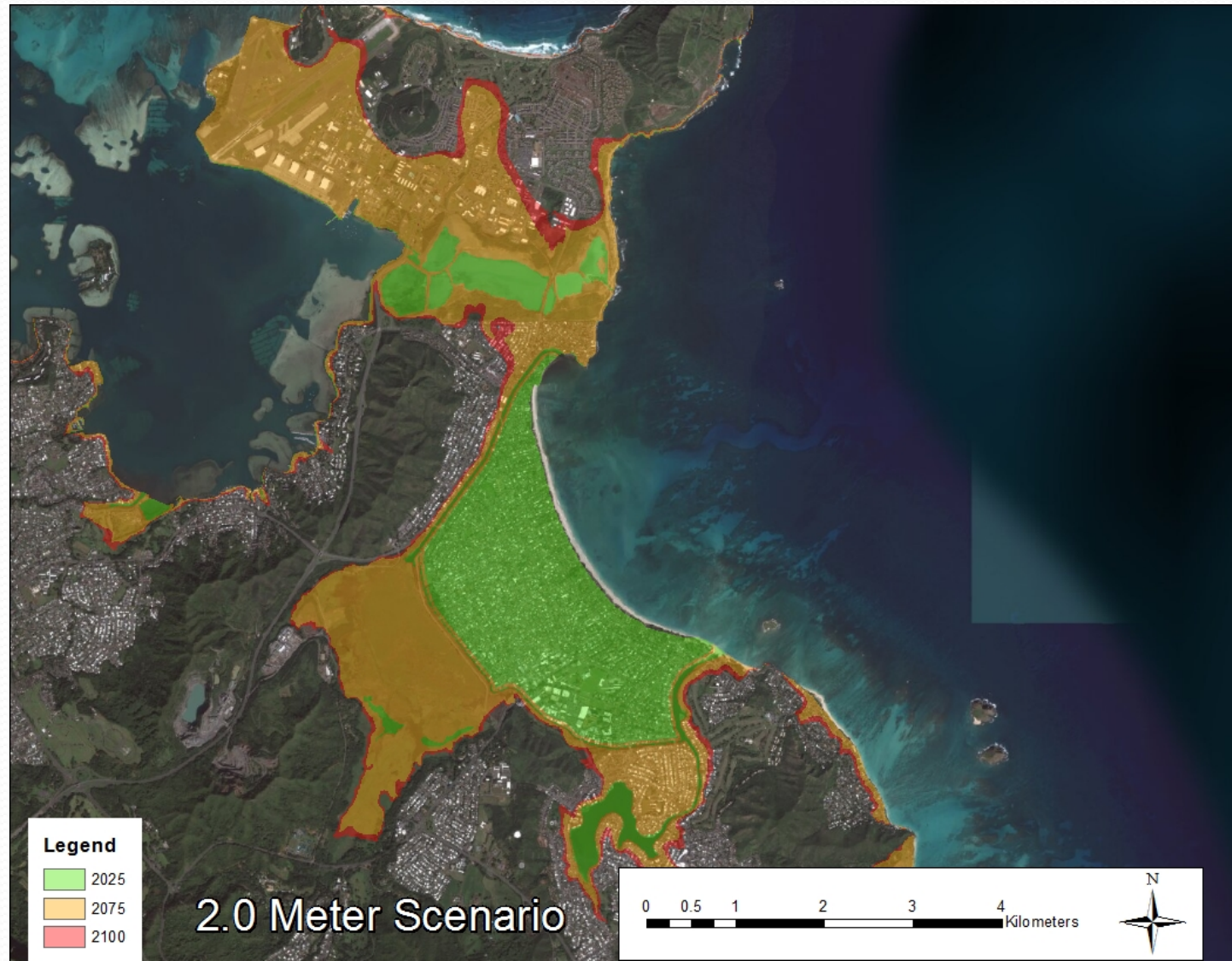




# Kailua Inundation Maps



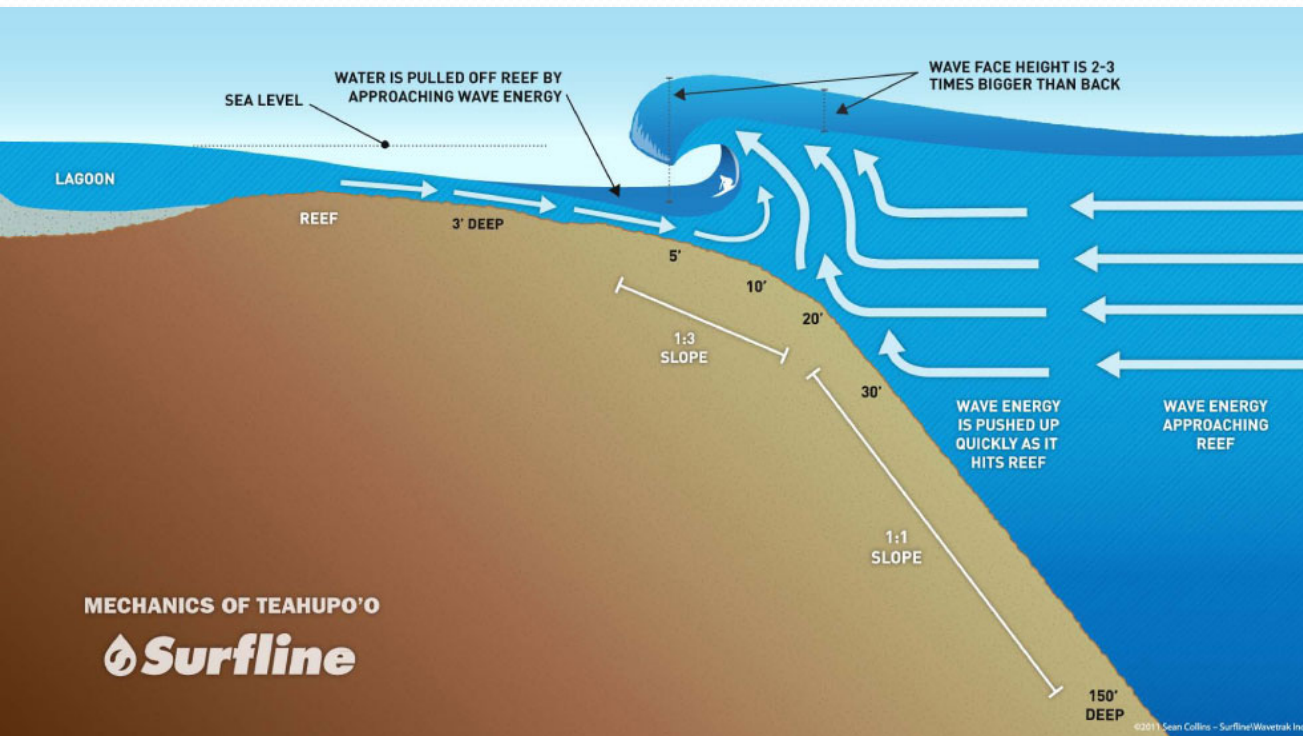
# Kailua Inundation Maps





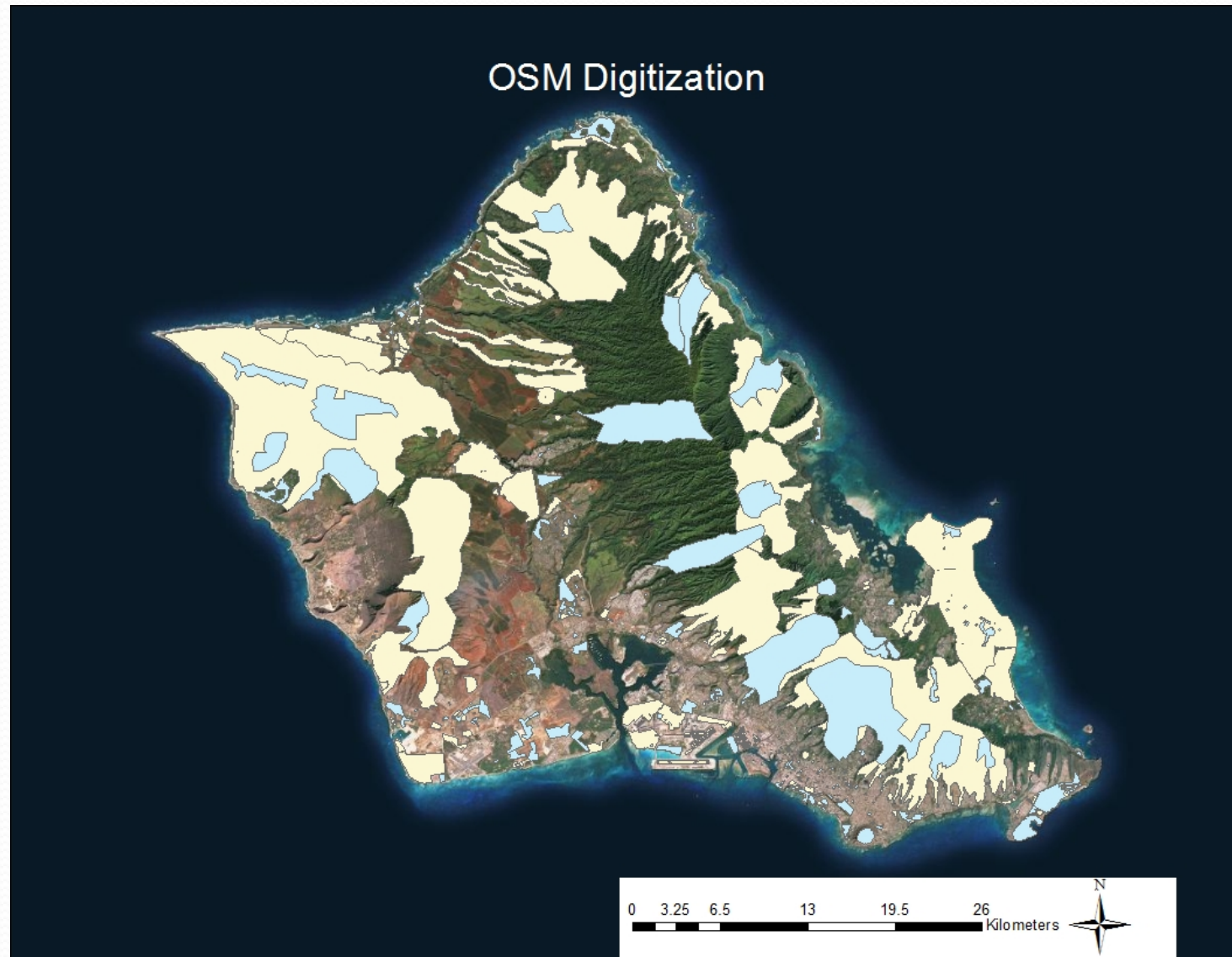
# Recommendations and Future Work

- Examine ocean wave science and surfing
- Examine potential sea level rise and how it impacts various surf spots around the island.
- Use the mobile collector app to plot bowl location and wave line up

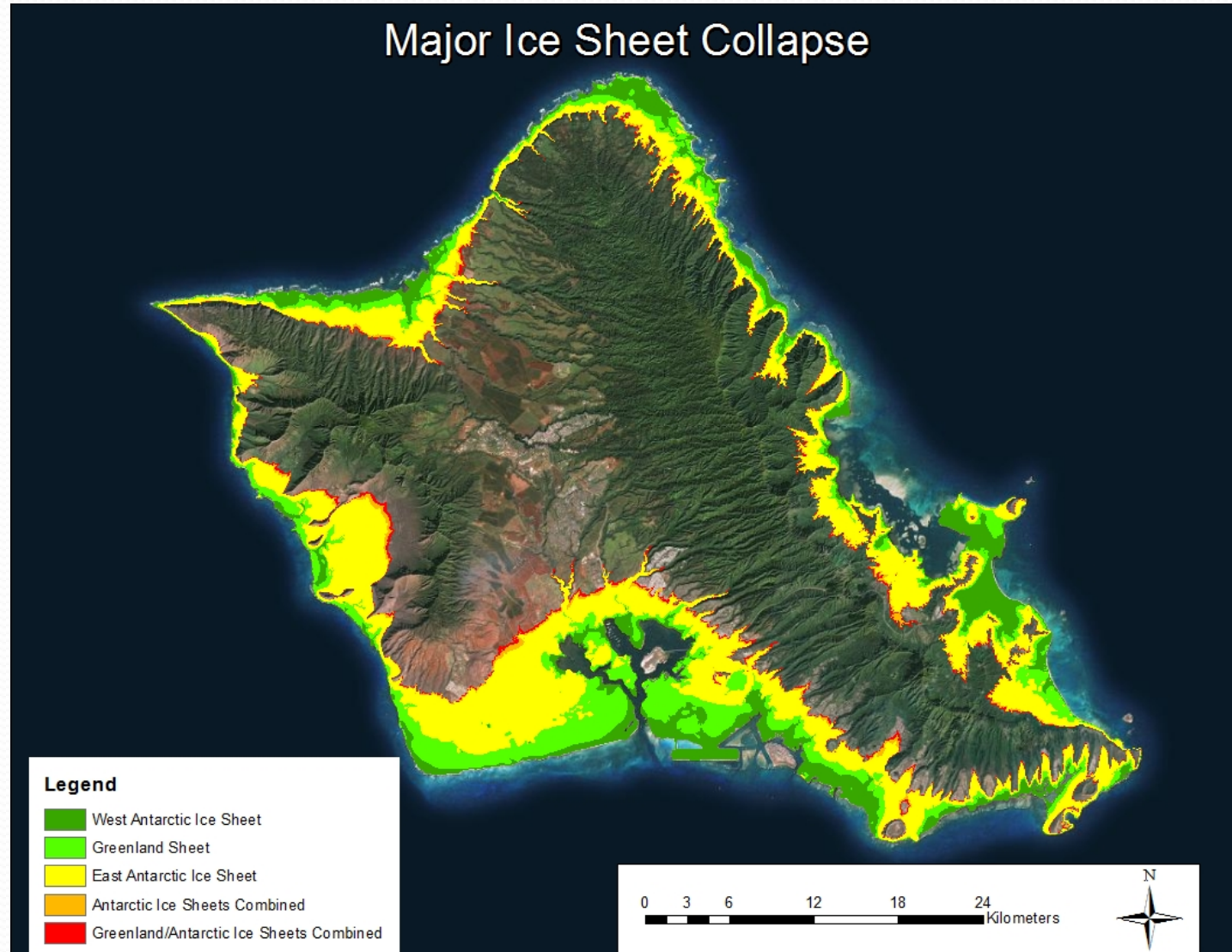




# OSM Work



# Final Thoughts



# Literature Cited

- Doney, S., A. A. Rosenberg, M. Alexander, F. Chavez, C. D. Harvell, G. Hofmann, M. Orbach, and M. Ruckelshaus, 2014: Ch. 24: Oceans and Marine Resources. *Climate Change Impacts in the United States: The Third National Climate Assessment*, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 557-578. doi:10.7930/JORF5RZW.
- Hall, J.A., S. Gill, J. Obeysekera, W. Sweet, K. Knuuti, and J. Marburger. 2016. Regional Sea Level Scenarios for Coastal Risk Management: Managing the Uncertainty of Future Sea Level Change and Extreme Water Levels for Department of Defense Coastal Sites Worldwide. U.S. Department of Defense, Strategic Environmental Research and Development Program. 224 pp.
- Howard, Brian Clark. "West Antarctica Glaciers Collapsing, Adding to Sea-Level Rise." *National Geographic*. National Geographic Society, 13 May 2014. Web. 02 Aug. 2016.
- Parris, Adam, Peter Bromirski, Dan Cayan, Mary Culver, John Hall, Radley Horton, Kevin Knuuti, Richard Moss, Jayantha Obeysekera, Abby Sallenger, and Jeremy Weiss. "Global Sea Level Rise Scenarios for the United States National Climate Assessment." *NOAA Technical Report OAR CPO-1* (2012): 1-29. Web. 22 July 2016.
- "Quick Facts on Ice Sheets." *National Snow & Ice Data Center*. N.p., 13 July 2015. Web. 04 Aug. 2016.
- Walsh, John, and Donald Wuebbles. "Our Changing Climate." *3rd National Climate Report* (2014): n. pag. Web. 26 July 2016.
- "What Are The Major Industries In The State Of Hawaii." *Hawaii.gov*. N.p., n.d. Web. 3 Aug. 2016.



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Questions?