CLIMATE CHANGE COMMISSION
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December 30, 2022

Josephine Briones
Climate Change Mitigation and Adaptation Research Specialist
Environmental Research and Design Lab (ERDL)
University of Hawaiʻi at Mānoa
Sent via E-mail

Dear Ms. Briones:

SUBJECT: Sea Level Rise Guidance and Freeboard

Thank you for your inquiry dated November 28, 2022, regarding the City and County of Honolulu ("City") Climate Change Commission's ("Commission") updated Sea Level Rise Guidance Document ("SLR Guidance") adopted July 29, 2022. In addition to the discussion during the Commission's December 16, 2022 meeting[1], the Commission offers the following information.

> **Question:** *Our team wants to know where the freeboard recommendation from the most recent SLR Guidance document, particularly the statement on page 10, applies and doesn't apply? Is it buildings within the SLR-XA only or does it apply to buildings in particular floodzones? Your guidance is greatly appreciated.*
>
> **Updated SLR Guidance** (adopted July 29, 2022; page 10, emphasis added): *Other communities across the U.S. have adopted the NOAA[2] sea level rise scenarios for their planning strategies. Given that community planning is risk averse, and that investments in public infrastructure projects are expensive and typically designed to last a long-time, planning on the basis of Intermediate or higher scenarios is appropriate. Using the Intermediate or higher level sea level rise scenario as a benchmark, adding 1 ft of freeboard[3] to accommodate a King Tide,*

1 Recording available at https://www.resilientoahu.org/climate-change-commission-meetings.
2 Sweet, W.V., et al. (2022) Global and Regional Sea Level Rise Scenarios for the United States: Updated Mean Projections and Extreme Water Level Probabilities Along U.S. Coastlines. NOAA Technical Report NOS 01. National Oceanic and Atmospheric Administration, National Ocean Service, Silver Spring, MD, 111 pp. https://oceanservice.noaa.gov/hazards/sealevelrise/noaa-nos- techrpt01-global-regional-SLR-scenarios-US.pdf
3 Definition of Freeboard from FEMA (https://www.fema.gov/glossary/freeboard): (a) An additional amount of height above the Base Flood Elevation used as a factor of safety (e.g., 2 feet above the Base Flood) in determining the level at which a

and adding an additional 1 ft of freeboard to accommodate heavy rainfall at high tide when there is no drainage capacity in the coastal zone, would provide an even greater buffer against flood damage.

The Commission provides this clarification and discussion regarding the intent of this recommendation in the SLR Guidance. Your question highlights a crucial need for more research and planning to integrate SLR considerations in building design and floodplain management in low-lying coastal plains in Honolulu and statewide.

The recommendation simply advises an additional two feet of building elevation (freeboard) when using a particular SLR scenario for planning, such as the updated recommendation from the Commission of 3.8 feet of SLR as modeled for the Honolulu Tide Station from NOAA as the minimum scenario for planning and design. In other words, it recommends a minimum elevation of a structure's lowest floor to the SLR planning scenario (e.g., 3.8 feet) plus one foot for extreme tides and plus another one foot for rainfall flooding (e.g., total of 5.8 feet) relative to Mean Higher High Water (MHHW) as the vertical datum. It does not provide a spatial extent for applying this additional freeboard. However, in the example above, the area for applying this recommendation might be approximated by the Passive Flooding area with six feet of sea level rise in the NOAA Sea Level Rise Viewer (coast.noaa.gov/slr) and also available in the Hawai'i Sea Level Rise Viewer, under "Other Overlays" (hawaiisealevelriseviewer.com). Higher SLR scenarios are recommended for critical public infrastructure.

Less clear is how this additional freeboard might be applied for buildings within an existing Special Flood Hazard Area (SFHA) of the FEMA Flood Insurance Rate Maps (FIRMs) such as in the VE and AE Zones. These "Flood Hazard Zones are also available in the Hawai'i Sea Level Rise Viewer under "Other Overlays", however, for actual base flood elevations see the state Flood Hazard Assessment Tool (FHAT; gis.hawaiinfip.org/FHAT/). The additional freeboard might be applied as described above, two feet might be added to the Base Flood Elevation (BFE)[4] in the SFHA, or, ideally, the greater of the two. Considering the FEMA FIRMs in implementing the recommended additional freeboard would help to utilize existing regulatory pathways within City

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structure's lowest floor must be elevated or floodproofed to be in accordance with state or community floodplain management regulations. (b) Freeboard is a factor of safety usually expressed in feet above a flood level for purposes of floodplain management. "Freeboard" tends to compensate for the many unknown factors that could contribute to flood heights greater than the height calculated for a selected size flood and floodway conditions, such as wave action, bridge openings, and the hydrological effect of urbanization of the watershed. Freeboard is not required by NFIP standards, but communities are encouraged to adopt at least a one-foot freeboard to account for the one-foot rise built into the concept of designating a floodway and the encroachment requirements where floodways have not been designated. Freeboard results in significantly lower flood insurance rates due to lower flood risk.

4 Base Flood Elevation (BFE) (https://www.fema.gov/node/404233): The elevation of surface water resulting from a flood that has a 1% chance of equaling or exceeding that level in any given year. The BFE is shown on the Flood Insurance Rate Map (FIRM) for zones AE, AH, A1–A30, AR, AR/A, AR/AE, AR/A1– A30, AR/AH, AR/AO, V1–V30 and VE.

ordinances such as the flood hazard areas, special management areas, and/or building code, Revised Ordinances of Honolulu Chapters 21A, 25, and 16, respectively.

Until better map data is available on event-based flooding with SLR, these approaches address a key shortcoming of the FIRMs, which are based on hydraulic modeling of present day flood risk (using historical data) and do not include future increases in flood hazards with SLR. The extent of the SFHAs and depth of the BFEs will increase with SLR in low-lying coastal plains.

This is an area of active research at the Climate Resilience Collaborative at the University of Hawai'i. The Commission expresses its appreciation to Drs. Chip Fletcher and Shellie Habel for their input on this topic. The Commission hopes to continue to support and work the City and the University of Hawai'i to further address challenges related to increasing event-based flooding hazards with SLR.

Should you have any further questions, please do not hesitate to contact the Commission at ccc@honolulu.gov.

Sincerely,

Rosanna 'Anolani Alegado, Ph.D.
Chair

Bradley Romine, Ph.D.,
Commissioner