Climate Change Commission

CITY AND COUNTY OF HONOLULU

925 Dillingham Boulevard, Suite 257 • Honolulu, Hawaiʻi 96817

MEETING AGENDA
Amended
Tuesday, December 17, 2019
3:00 p.m.
Honolulu Hale
Council Committee Hearing Room (2nd Floor)
530 South King Street
Honolulu, Hawaiʻi 96813

1. Call to Order
2. Roll Call
3. Approval of the Minutes: October 24, 2019 and November 18, 2019
4. Report on Activities of the Office of Climate Change, Sustainability and Resiliency
    a. Climate Change Polling Results
5. Communications and Correspondence
6. Discussion and Action on Shoreline Setback Guidance and White Paper
7. Discussion of Draft White Paper on Climate Change and Equity
8. Public Input for Matters Not on the Agenda
9. Tentative Next Meeting Date
10. Announcements
11. Adjournment

A mailing list is maintained for interested persons and agencies to receive this commission's agenda and minutes. Additions, corrections, and deletions to the mailing list may be directed to the Office of Climate Change, Sustainability and Resiliency (CCSR) at Kapālama Hale, Suite 257, 925 Dillingham Boulevard, Honolulu, Hawaiʻi 96817; Telephone: (808) 768-2277 Fax: (808) 768-4242. Agendas and minutes are also available online at www.resilientoahu.org.

If you require special assistance, auxiliary aid and/or service to participate in this event (i.e., sign language interpreter, interpreter for language other than English, or wheelchair accessibility), please contact CCSR at (808) 768-2277 or email your request to ccc@honolulu.gov at least three (3) business days prior to the meeting.

All written testimony must be received by CCSR 48 hours prior to the meeting. If within 48 hours, written and/or oral testimony may be submitted directly to the Commission at the meeting. Send to: Climate Change Commission, Kapālama Hale, Suite 257, 925 Dillingham Boulevard, Honolulu, Hawaiʻi 96817. Fax: (808) 768-4242. Email: ccc@honolulu.gov.

PURPOSE

Pursuant to the Revised Charter of Honolulu ("RCH") Section 6-107(h), the City and County of Honolulu ("City") Climate Change Commission is charged with gathering the latest science and information on climate change impacts to Hawaiʻi and providing advice and recommendations to the Mayor, City Council, and executive departments as they look to draft policy and engage in planning for future climate scenarios and reducing Honolulu's contribution to global greenhouse gas emissions.

This white paper provides recommendations for amending ROH 23.

PRINCIPLES AND ACTIONS FOR AMENDING ROH CHAPTER 23

The Hawaiʻi State Legislature has authorized the City and County of Honolulu to establish and revise as appropriate a coastal setback ordinance and rules provided they are aligned with the intent of Hawaii Revised Statutes 205A. Consistent with that authority, the Honolulu Climate Change Commission recommends that Revised Ordinances of Honolulu Chapter 23 be updated to reflect new understanding of climate change impacts using the following principles and actions.

1. **Design ROH23 to be consistent with and reflect learning in a continual and adaptive manner, from the science of climate change.** In general the Hawaiian Islands, and the coastal zone in particular, are experiencing chronic coastal erosion, seasonal wave impacts, degradation of coral reefs and their capacity to buffer wave energy, more extreme rain events, rapid intensification of tropical cyclones and changes in their tracks that bring them closer to the islands, and sea level rise. These and other trends related to climate change increase risk in the coastal zone. The most effective way to reduce risk is to exercise avoidance. Risk avoidance constitutes the foundation principle of the setback promulgated in ROH 23. Revisions to the ordinance that are consistent with this knowledge, have the greatest probability of successfully achieving C&C objectives.
2. **Acknowledge the science of climate change and sea level rise.** Insert language at the beginning of the chapter that acknowledges the coastal zone impacts of climate change. This will alert all who turn to this chapter for guidance that in order to achieve the policy goals of ROH 23, the setback on Oʻahu is designed in recognition of the scientific reality of climate change.
    a. For example, on beaches, sea level rise drives chronic coastal erosion and shoreline recession, both of which threaten the backshore. Attempts to protect the backshore with shoreline hardening (e.g., seawalls and revetments) ignore the scientific truth that in an environment of rising sea level, shoreline hardening causes beach narrowing and loss. This decreases open space, damages pubic access to and along the shoreline, and is a profoundly negative environmental impact.[1]
3. **Design a place-based setback regime.** The Oʻahu shoreline is heavily developed. It is not clear that a new setback regime offers significant advantages for places like Waikiki, the Ala Moana shoreline, and other locations where the coast is a heavily engineered. For instance, there is a fundamental difference between hardened shorelines and otherwise, suggesting that a single setback regime that does not recognize these differences may be inappropriate. Some coastal segments are characterized by prized beaches and critical ecosystems that are of obvious continued and future value when considered from the perspective of tourism, local lifestyle and recreation, ecological networks, and hazard mitigation. Identifying geographic areas that share common ecological and physical characteristics, and applying a singular consistent management approach within these segments, rather than the current parcel-scale system, leverages the natural as well as the engineered characteristics of the coastal zone to more effectively achieve policy objectives.

4. **Utilize multiple criteria to determine the no-build zone.** As shown in **Table 1**, both Maui and Kauaʻi counties employ multiple criteria in their setback rules to identify the no-build zone: lot depth, historical erosion rate, future erosion hazards. This use of multiple criteria, each of which have a nexus to risk, provides increased flexibility to planners in order to maximize successful achievement of policy objectives.
5. **Carefully review and revise the variance procedure given historical evidence that it can lead to land-use that is inconsistent with the objectives of ROH 23.** Research clearly shows that shoreline hardening not only causes beach narrowing and loss, it limits public access to and along the shoreline, increases community vulnerability to coastal hazards, reduces open space, and can lead to degraded water quality and damage to adjacent shallow marine ecosystems. Nowhere in ROH 23 or its rules, should there be allowance for shoreline hardening, except as defined as a place-based characteristic (e.g., airports, harbors, etc.).
6. **Develop criteria guiding the repair and maintenance of existing structures that harden the shoreline.** Repair of existing seawalls and revetments encourages increased development density in a highly risky setting. This goes against objectives of ROH 23. Additionally, shoreline hardening interferes with natural movement of the shoreline, violating case law establishing that loss of land by erosion is an inherent aspect of littoral property.[2] Further, Attorney General's Opinion No. 17-01[3] concludes "that the State owns additional public land resulting when the shoreline has migrated landward or mauka due to erosion or sea level rise." Shoreline hardening interferes with this process. A permitting regime that allows perpetual repair of shoreline hardening violates the avoidance principle underlying the coastal setback, and constitutes an enticement for continued development in a known area of growing risk and danger due to accelerating sea level rise. Locations where shoreline hardening should be maintained (e.g., where needed for a public good, in support of clean nearshore waters, to protect major public infrastructure, etc.) can be defined and supported through place-based critera.
7. **Maintain the buffer zone effect.** For setback criteria that may change over time, such as updates to rate-based distances, disallow any seaward shift in the location of the setback. Allowing narrowing, or seaward shifts in the buffer zone, violates ROH 23 objectives.
8. **Build into ROH Chapter 23 rules, the ability to revisit and amend the ordinance every 5 years.** New information in the disciplines of sea level rise, climate change, and coastal risk are constantly emerging, and improved modeling results that promote successful achievement of policy objectives are frequently released. Revising the setback law accordingly should not be a time-consuming and difficult task given that the ojectives are to protect public health and safety and the public trust

DISCUSSION AND NARRATIVE

I. INTRODUCTION

At this writing, surface temperature datasets suggest 2019 will be the second warmest year in the instrumental record (85% probability)[a] and the fifth year in a row more than 1.8°F (1°C) above late 19th century temperature. The five warmest years all occur in the past five years.

Global warming is leading to changes in many Earth systems. Among these is the average level of the ocean surface. Because warming causes melting of glaciers and ice sheets (the resulting meltwater flows into the ocean), and thermal expansion of the marine water column as it absorbs heat from the air, global mean sea level (GMSL) is rising. This is a problem that has caused as much anxiety (How high will it rise and by when?) as it has confusion (How and when should we adapt to sea level rise?).

The good news: current science suggests that many coastal locations still have time to prepare for this slow moving disaster with innovative policies and community design concepts.

[a] NASA – Goddard Institute for Space Studies: https://data.giss.nasa.gov/gistemp/

The bad news: sea level rise has been accelerating since the 1960's,[4] and is already causing dramatic changes in many coastal communities.

While there is time to act, there is no time to wait.

This white paper provides a review of the problems that are caused by sea level rise, catalogs national and local "shoreline setback" policies (the shoreline setback in a no-build zone adjacent to the shoreline), and provides guidance to the City and County of Honolulu in amending their setback regulations, in Chapter 23 of the Revised Ordinances of Honolulu (ROH).

II. SEA LEVEL RISE AND COASTAL HAZARDS

Energy Projections - Greenhouse gas emissions are projected to continue,[5] and warming could reach 7.2° F (4° C) as early as 2064.[6] Trends in population, land use, and demands for new energy indicate that warming is unlikely to stop before reaching 7.2-9° F (4-5° C).[7] These research findings are consistent with forecasts of continued growth in global energy consumption and carbon emissions. For instance, the July 2019 Global Energy Outlook[8] by the congressionally-mandated, Washington-based Resources for the Future Institute[b] found the following:

1. Absent ambitious climate policies—global energy consumption will grow 20–30% or more through 2040 and beyond, led largely by fossil fuels.
2. This growth is driven by population and economic growth in the global "East," while energy consumption in the "West" remains roughly flat.
3. The global economy becomes more energy efficient over time, though carbon dioxide emissions continue to grow unless there is a shift in current policy and technology trends.
4. Renewable energy, led by wind and solar power, grows rapidly, though they primarily add to, rather than displace, fossil fuels unless more ambitious climate policies are put into place.
5. Electricity plays an ever-growing role in final energy consumption, and while electric vehicles also play an important role in the future of transportation, their effect is more likely to restrain the growth of, rather than lead to a decline in, global oil demand over the next two decades.
6. Under ambitious climate scenarios, the global economy becomes much more energy efficient, global coal consumption declines by more than half relative to current levels, oil use falls by up to 20%, natural gas increases modestly, nuclear energy grows by more than 50%, renewables more than double, and carbon capture and storage (CCS) technologies are deployed at scale by 2040.

Global Sea Level - Simulations indicate that under these conditions, melting of the Antarctic ice sheet[9] could raise global sea level by up to 10 ft (3 m) by the year 2300 and continue for thousands of years.[10]

Geologic evidence shows this has occurred on multiple occasions over the past three million years, when global temperatures increased 1.8 to 5.4° F (1 to 3° C), melting polar ice sheets caused global sea levels to rise at least 20 ft (6 m) above present levels.[11] In fact, the most recent time Earth's atmosphere was as warm as today (125,000 yrs ago, the last Interglacial)[12], global sea level rose over 20 ft higher than it is today[13] and formed the limestone layer (a fossil reef) that underlies the Primary Urban Core of the City of Honolulu.

In Volume I of the 4th National Climate Assessment (NCA4) Climate Science Special Report (2017[14]), it was found that relative to the year 2000, GMSL is very likely (90% -100% likelihood) to rise by 0.3–0.6 ft (9–18 cm) by 2030, 0.5–1.2 ft (15–38 cm) by 2050, and 1.0–4.3 ft (30–130 cm) by 2100 (very high confidence in lower bounds; medium confidence in upper bounds for 2030 and 2050; low confidence in upper bounds for 2100). It was also found that future greenhouse gas emissions pathways have little effect on projected GMSL rise in the first half of the century, but significantly affect projections for the second half of the century (high confidence).

[b] Resources for the Future Institute: https://www.rff.org/publications/reports/global-energy-outlook-2019/

Emerging science regarding Antarctic ice sheet stability suggests that, for high emission scenarios, a GMSL rise exceeding 8 ft (2.4 m) by 2100 is physically possible, although the probability of such an extreme outcome cannot currently be assessed. Regardless of pathway, it is extremely likely that GMSL rise will continue beyond 2100 (high confidence).

To address this problem, a structured expert judgement published in May, 2019 identifies a 10% chance of global mean sea level (GMSL) exceeding 6.5 ft (2 m) by the end of the century.[15] Notably, it was stated by experts in media[16] interviews that "Coastal decisions require long lead times. It would be nice if we could wait for the science to clear up, but we can't." Research has clarified that the physical process of ice cliff collapse on which the worse case scenario of end-of-century sea level rise relies may be overestimated.[17]

There is broad scientific consensus that accelerating SLR will increase the damage caused by coastal erosion, hurricanes, tsunami, high waves, and other coastal hazards.

Local Impacts - The Honolulu tide station records local mean sea level rising 1.49 +/-0.21 mm/yr.[18] Rising sea levels are subjecting coastal communities to more coastal hazards including, but not limited to, frequent and intense storms, floods, strong waves (including tsunami), coastal erosion and land loss.

In 2017, the State of Hawaiʻi Climate Change Mitigation and Adaptation Commission[19] adopted the Hawaiʻi Sea Level Rise Adaptation and Vulnerability Report,[20] providing the first state-wide assessment of Hawaii's vulnerability to sea level rise and recommendations to reduce exposure and sensitivity to sea level rise while increasing the State's capacity to adapt.

The report provides a statewide assessment of the combined assets that are exposed to coastal hazards as a result of sea level rise. With 1 ft (30 cm) of sea level rise, the developed assets and land value that are exposed to erosion, groundwater inundation and storm-drain backflow, and/or high seasonal waves sums to over $4 billion, including 13.7 mi (22 km) of roadway; approximately 2000 residents will be displaced. At 3.2 ft (98 cm) of sea level rise, a total $19 billion of developed assets and land value are exposed with over 19,800 residents displaced, and 38 mi (61 km) of roadway at risk valued at $15 billion.

The report recommends that the Sea Level Rise Exposure Area (SLR-XA) with "3.2 feet of sea level rise be used as a state-wide vulnerability zone for planning at state, county and community levels." The results of the report, and the recommendations, highlight the need to:

1. Incorporate the 3.2SLR-XA in land use planning,
2. Prioritize smart redevelopment outside of the SLR-XA 3.2,
3. Improve flood risk management,
4. Address cultural and environmental vulnerabilities that encourage resilient land and community development, and
5. Create funding sources for research, adaptation, monitoring and collaboration.

At the University of Hawaiʻi at Mānoa, the PacIOOS[c] program publically serves the Hawaiʻi Sea Level Rise Viewer[d] which provides maps (downloadable as GIS layers) showing modeled impacts (flooding, erosion, wave run-up) of sea level rise at increments derived from the 5th Assessment Report (AR5) of the Intergovernmental Panel on Climate Change.[21] These model results were used in the Hawaiʻi Sea Level Rise Adaptation and Vulnerability Report in their impact assessment.

[c] The Pacific Islands Ocean Observing System (PacIOOS: https://www.pacioos.hawaii.edu) is a federally funded ocean data and information program, hosted by the University of Hawaiʻi at Mānoa School of Ocean and Earth Science and Technology. PacIOOS collects real-time data on ocean conditions, forecasts future events, and develops user-friendly tools to access this information.

[d] Hawaiʻi Sea Level Rise Viewer: https://www.pacioos.hawaii.edu/shoreline/slr-hawaii/

Coastal Erosion - Communities located in most coastal settings engage in some form of tourism economy and from a tourist point of view, beaches are the most desirable natural asset. From a residents point of view, beaches are endemic to the Hawaiian lifestyle, a place of cultural practice, food harvesting, recreation, and a basic necessity for access to the ocean and its resources. In fact, access to and along the ocean, open view planes, healthy coastal environments, and other attributes are guaranteed by law in Hawai'i.[e]

Challenging these rights however, is the fact that as sea level rises coastal erosion accelerates, spreads, and increasingly threatens beachfront land.[22]

During sea level rise, the beach environment, which extends offshore under the surf zone, and onshore across the coastal dune system, is forced to retreat landward. In so doing, beachfront land is eroded. If this land has not been altered by landscaping and other forms of development, and if it is sand-rich (such as with a dune field or other types of geologic sand deposits), erosion of this land will supply the migrating beach with its life-blood, sand. Even if a beach is backed by alluvial or volcanic geology, depending on specific coastal processes at the site, a beach may continue to exist through sand delivery from alongshore and/or offshore sources.

Any attempt to stop coastal erosion such as with a wall or revetment will damage, narrow, and eventually destroy the beach.[23] A wall of any type will also cause flanking (accelerated erosion to a neighboring property), as well as wave reflection (energy transmited seaward by waves that "bounce" off a wall and disrupt incident waves, benthic ecosystems, and water quality).

A widely held view is that coastal erosion can be managed. The answer is yes, but unless one is willing to augment the shoreline with additional sand, any attempt to slow erosion, divert it, or stop it altogether will stop the natural process of beach migration, condemning the coastal zone to wave scour and drowning. If preservation of beaches and littoral biodiversity, public access, and open space are the goals of a management program (as they are for the Hawai'i Coastal Zone Management Program), there is only one way to manage coastal erosion – get developed assets out of the way and let nature take its unimpeded course.

If left alone to migrate landward with the rising ocean levels, beaches can adapt to and survive sea level rise, as they have for 20,000 yrs since global sea level was over 420 ft (128 m) lower at the culmination of the last ice age. When seawalls, or any form of shoreline hardening, are used to protect homes and roads from the effects of erosion it provides a temporary reprieve, but eventually leads to beach narrowing and beach loss.[24]

Beach narrowing and loss represents the destruction of a critical and diverse natural ecosystem essential to a number of endangered, federally protected species (e.g., monk seals and sea turtles), the loss of a valuable tourism asset, and a blow against the lifestyle sought by Hawai'i residents. And, importantly, beach loss violates public trust assets that are protected by law.[25]

Hurricanes - Climate change is projected to cause a northward shift of hurricanes toward the Hawaiian Islands – and this may be already taking place. This shift will increase the chance of landfall, posing severe flood risks to Honolulu communities and infrastructure along the coast as well as further inland.[26]

Of great concern for Hawai'i, and Honolulu specifically, is that tropical cyclones are following new pathways[27] that will bring them near island communities more often than has been seen historically.[28] An increasing number of storms have tracked closer to Hawai'i in recent years: Hurricane Guillermo in 2015, Hurricanes Celia, Darby and Lester in 2016, and Hurricanes Lane and Olivia in 2018. During the 2015 hurricane season, a record 15 tropical cyclones entered, or formed in, the North Central Pacific basin. This above-average activity has been attributed in part to the very strong 2014–16 El Niño.

Sea level rise increases the vulnerability of coastal communities to damage related to flooding by intense rainfall and marine storm surge associated with hurricanes. Houses, roads and other assets are exposed to the rising threat of

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[e] Hawai'i Revised Statutes, Chapter 205A, Coastal zone Management: https://www.capitol.hawaii.gov/hrscurrent/Vol04_Ch0201-0257/HRS0205A/HRS_0205A-.htm

hurricanes through both sea level rise and new storm tracks. It is important to revise and update coastal management policies in light of this new reality.

Tsunami – These Islands are no strangers to tsunamis. In fact, the Hawaiian Archipelago lies like a bullseye in the center of the "Ring of Fire", a geologic region that embodies the earthquake, volcanic, landslide, and tsunami-prone area of the Pacific Ocean. All sides of the Pacific are lined with coasts where lithospheric plates meet and are capable of generating tsunami that travel to Hawaiian shores with the potential to cause devastating damage.

The most destructive tsunami in Hawaiʻi occurred on April 1, 1946 after an earthquake measuring 7.4 on the Richter Scale struck the ocean floor off the Aleutian Islands of Alaska.[29] Waves traveled toward Hawaiʻi at 500 mph. In Hilo, the death toll was high. Statewide 173 were killed, 163 injured, 488 buildings were demolished and 936 more were damaged. Damage at the time was estimated to be $25 million. Witnesses told of waves inundating streets, homes, and storefronts. Many victims were swept out to sea by receding water.

The current tsunami evacuation zone is a product of modeling the flooding impact of a 1946-type tsunami and does not take into account future sea level rise. A future tsunami that may not have caused significant damage in the past, will be able to penetrate further landward, cause greater damage, and poses a more significant threat because of sea level rise. Public agencies tasked with protecting public health and safety, can begin to address this problem by revising coastal policies so that they decrease exposure to tsunami flooding.

King Tides - High tide flooding has already ocurred in the Primary Urban Corridor of Honolulu in what became known as a series of "King Tides" in 2017, the highest water levels in the 112 yr record of the Honolulu Tide Station.

The scientific term for a king tide is a perigean spring tide. King tides in Hawaiʻi tend to occur during the summer months (e.g., July and August) and winter months (e.g., December and January) in conjunction with new moons and full moons. Record setting king tides occur when:

1) The moon is at its closest point to Earth in its monthly orbit, so the gravitational pull is stronger.
2) When the sun the moon and Earth are in alignment. Which means that the sun and moon's individual gravitational pulls work together, producing the highest high tides of the year.
3) Water levels rise an additional amount above the pure tide components and reach unusual heights. Warmer than usual sea surface temperatures, winds, and ocean circulation patterns can add this additional component in some cases.

High tide flooding is a unique coastal hazard. The timing of these extreme water level events can be anticipated through the use of tidal predictions, yet their impacts (coastal flooding and inundation in low-lying areas) can have devastating consequences for coastal inhabitants, particularly when combined with severe weather or high wave events. With continued sea level rise, Hawaiʻi can expect more frequent and more extensive high tide flooding, including monthly and even daily high tides exceeding coastal inundation thresholds.

Typically, high tide flooding is the first evidence of sea level rise experienced by a community. Occurring at the highest tide of the year, waves run-up on the shoreline higher than usual, wetlands are flooded with standing water, storm drains fill with seawater and may spill out onto the road, buildings with basements may show flooding. The first time these are noticed they may be ignored. But these are the early signals of sea level rise.

Thompson et al. (2019)[30] modelled the occurrence of high tide flooding in Honolulu and found that by the year 2030, the Intermediate and Intermediate High scenarios proposed by NOAA (2017)[31] may lead to an average 48 and 131 days per year (resp.) of high tide flooding equivalent to the 2017 episode, and by 2040, 171 and 316 days per year of high tide flooding (resp.).

The frequency of flooding more than triples from 75 to 246 days per year on average from the 2030's to the 2040's. By the decade of the 2030's, the NOAA Intermediate scenario (1 m of GMSL rise by the year 2100) may lead to more than 169 days of flooding during the worst year of the decade.

The rising threat of high tide flooding will lead to strong impacts on shoreline assets. Coastal policies should reflect this knowledge and need revision to recognize, and mitigate, the growing exposure to marine hazards.

Seasonal High Waves Impacts related to 3.2 ft (98 cm) of sea level rise include flooding by predictable high waves that enter island waters every year. These seasonal high waves are responsible for the renowned surfing culture that originated here and for which Hawaiʻi is world famous today.

On shores facing to the south, high waves produced by storminess in the southern hemisphere arrive every summer, and on shores facing to the north, high waves produced by storminess in the North Pacific arrive every winter. At present, these seasonal high waves are responsible for occasional flooding of the first row of beachfront homes and certain sections of coastal roads. They also drive changes in beach configuration that can lead to temporary acceleration in erosion trends.

However, sea level rise is changing this historical pattern. Modeling the characteristics of these annual waves under higher sea levels reveals that between 2 to 3.2 ft (60 to 98 cm) of sea level rise, wave flooding moves from being damaging, to being catastrophic. This threshold has been called a critical point.[32] It is the sea level height beyond which flooding rapidly accelerates and threatens an entire beachfront community.[33] A critical point can be thought of as a "tipping point", a limit at which some aspect of the climate system irretrievably shifts to a new state.

Amendments to Chapter 23 of the Revised Ordinances of Honolulu (ROH) that focus on reducing exposure of developed assets to this threat, would significantly improve public health and safety.

Honolulu Climate Change Commission Sea Level Rise Guidance - According to the Sea Level Rise Guidance issued by the Honolulu Climate Change Commission,[34] sea level rise will lead to increasing flood damage associated with tsunami and storm surge that are coincident to high tide.

The Commission recommended that the City and County of Honolulu set a planning benchmark of 3.2 ft (~1 m; 3.2SLR-XA) of GMSL rise by the end of the century. High-tide flooding will arrive decades earlier and the 3.2SLR-XA will be an area experiencing chronic high tide flooding by mid-century.

In recognition that global emissions are on a warming pathway of over 5.4°F (3.0°C) in the second half of this century, they also recommended setting a planning benchmark up to 6 ft (1.8 m) of GMSL for critical infrastructure projects with long expected lifespans and low risk tolerance. The commission advised that all ordinances related to land development, such as policy plans and regulations, should be reviewed and updated, as necessary.

Given the multiple signals that, because of sea level rise, the coastal zone is becoming an increasingly hazardous and unwise location in which to invest human treasure, it is prudent to revisit the City and County policy that governs the placement of assets along the coast, the setback.

III. REVISED ORDINANCES OF HONOLULU, CHAPTER 23

Revised Ordinances of Honolulu (ROH) Chapter 23 is the shoreline setback provision for the City & County of Honolulu. The purpose of ROH 23 is to "establish standards and to authorize the department of land utilization (now Department of Planning and Permitting [DPP]) to adopt rules pursuant to HRS Chapter 91, which generally prohibit within the shoreline area any construction or activity which may adversely affect beach processes, public access along the shoreline, or shoreline open space."

ROH 23 states that it is the:

> "primary policy of the City to protect and preserve the natural shoreline, especially sandy beaches; to protect and preserve public pedestrian access laterally along the shoreline and to the sea; and to protect and preserve open space along the shoreline. It is also a secondary policy of the city to reduce hazards to property from coastal floods."

ROH 23 prohibits any construction that might adversely affect beach processes, shoreline access and open space. It applies to all lands between the certified shoreline and a fixed distance inland (40 ft, 60 ft for newly subdivided land). DPP administers the shoreline setback regulations.

Variances - ROH 23 provides authority to the Director of DPP to grant variances for structures or activities within the setback that would otherwise be forbidden. For instance, per discretion of the Director, a variance may be awarded for structures or activities that meet a public interest standard (e.g., harbors, airports, etc.), or a hardship standard.

The existing system of policies were developed in the 1970's and built on the assumption that, within an envelop of variability, the shoreline would largely hold its position through time. The current setback is a best guess at the landward edge of that envelop. However, long-term sea level rise violates these assumptions and changing these policies is long overdue. With the advance of climate change, rising sea levels, and increasing intensity of coastal hazards, it is clear that coastal zone management policies need to be updated to accurately reflect our current understanding of climate change and how it threatens public health and safety, and the public trust.

The hardship standard is triggered if an applicant would be deprived of reasonable use of the land if required to comply fully with the shoreline setback ordinance and the shoreline setback rules. A key aspect of the hardship standard is determination of "reasonable use of the land." In past practice, reasonable use of the land was found to include improvements such as roads, habitable dwellings, and even the intention of future habitation where no existing improvement was actually threatened.

Under these conditions, discretionary allowances have been made for seawalls, revetments, and other shoreline hardening structures that clearly violate the primary purpose of ROH 23 established in Sec.23-1.2 "...to protect and preserve the natural shoreline, especially sandy beaches; to protect and preserve public pedestrian access laterally along the shoreline and to the sea; and to protect and preserve open space along the shoreline." These regulations reflect society's understanding of the science at the time they were adopted. They additionally reflect society's values, which, like many other places in America, are driven by a strong commitment to property rights, a belief that land can be conveyed, and that owners have fundamental rights to that land. In the coastal zone where private property is coming under increasing risk related to climate change, we are only now coming to the collective conclusion that this model is failing us.

It is appropriate to ask, in an era of accelerating sea level rise due to global warming, when objective economic analysis concludes that the cause of warming, and therefore the cause of sea level rise, emissions of carbon dioxide, are projected to continue for another two decades or more and likely to quadruple the current level of warming: "Is it a reasonable use to develop coastal lands that are highly likely to be swallowed by the sea before the useful life of an improvement is reached?" To government agencies tasked with safe-guarding public health and safety, and protecting the environment, the current era of climate change invokes a re-examination of what constitutes reasonable use of land and its role in the ROH 23 variance process.

Research has shown that coastal development activity and beach stability are negatively correlated.[f] Fundamental to this relationship is "flanking," an acceleration of erosion on previously stable land following construction of a seawall. One study found a 29% increase in coastal hardening that occurred between 1975 and 2006 on a segment of O'ahu shoreline. Data showed this spike in hardening followed the build-out of 78% of shoreline lots by 1975, and was concurrent with the expansion in average building area that occurred between the 1970's and 2015.

There is an abundant body of published scientific research documenting the negative effects of shoreline hardening (described in local reports and permit applications with the misdirection "shoreline protection"), including beach narrowing and beach loss,[35] loss of littoral biodiversity,[36] and other impacts. However, the hardship variance allows damaging land use practices in violation of this body of knowedge. In light of these historical truths, and the existence of rising sea level and increasing risk from changes in coastal hazards, there is a critical need to amend policies and laws to increase coastal resiliency and sustainability.

[f] Summers et al., 2018

Within the system of current coastal policies, sea level rise triggers a number of consequences: shifts in government jurisdiction and land ownership; erosion and land loss that threaten human communities and their assets; environments that host sensitive coastal ecosystems, especially beaches, undergo forced change; hazards such as storms, seasonal high waves, tsunami, and extreme tides have greater landward reach, causing damage, especially flooding, in unique and challenging ways; and extreme weather events (e.g., tropical cyclones), complex weather patterns (e.g., the El Niño Southern Oscillation), and local ocean and atmosphere conditions (e.g., sea surface temperature and winds) are changing in complicated and often poorly understood ways.

Given that ROH 23 has not been updated in over 20 years and does not reflect a modern understanding of risk in the coastal zone, and in light of the scientifically-backed literature documenting the physical and financial risks associated with sea level rise on coastal communities, including Hawaiʻi, there is a need to amend ROH 23 to adapt to the new understanding of climate change impacts to our coasts.

As part of this process, it is apropriate to review the nature of setback policies across the U.S. and here in Hawaiʻi.

IV. NATIONAL AND LOCAL COASTAL ZONE POLICIES

In 1972, the U.S. Congress passed the Coastal Zone Management Act (CZMA) to "preserve, protect, develop, and where possible, to restore or enhance the resources of the nation's coastal zone" (16 USC 1451 – 1466).[g]

In order to manage the coastal zone in Hawai'i, the State created the shoreline setback (HRS Chapter 205A) to be not less than 20 ft and not more than 40 ft inland from the shoreline, which is the highest annual reach of the waves.[h]

Hawaiʻi law allows counties to increase their setback beyond 40 ft from the shoreline.[i] Conservation districts also exist in the state of Hawaiʻi and include lands that are subject to flooding, soil erosion and areas that are needed to protect watershed, water sources, scenic/historic areas, parks, open space, submerged lands seaward of the shoreline and more.[j] In these districts, structures are allowed at a setback of 40 ft + 70 times the average annual coastal erosion rate[k] for structures with average lot depth greater than 200 ft.[l]

Additionally, Hawaiʻi has protective subzones in which are lands and waters necessary for protecting other areas. No new structures are allowed in these protective subzones.[m]

The shoreline setback for the state of Hawaiʻi was established in 1970 and has yet to be updated. Although originally created with the intention of promoting a stable coastal zone to host development, sea level rise and chronic erosion were not recognized at the time. Given changes in environmental conditions relating to retreating shorelines, storminess, and various feedbacks to these such as coastal erosion, groundwater inundation, and an increase in tropical cyclones in Hawaiian waters, the shoreline setback for the state, and the City and County of Honolulu, should generally be considered out of date.

Hawaiʻi is a participant in the National Coastal Zone Management Program (CZMP) which is run locally through the Office of Planning. The purpose of the Hawaiʻi Coastal Zone Management Program (HCZMP) is to "provide for the effective management, beneficial use, protection, and development of the coastal zone."[n] The HCZMP is authorized through the Coastal Zone Management Act, Hawaiʻi Revised Statutes, Chapter 205A which mandates the establishment of Special Management Areas (SMA). The SMA lies along the coast with special controls on development no less than 100 yards from the shoreline. However, it is the various counties that are responsible for implementing the SMA and setback, as well as permit guidelines within the SMA.

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[g] https://coast.noaa.gov/czm/act/

[h] https://dlnr.hawaii.gov/occl/files/2013/07/205a.pdf

[i] https://coast.noaa.gov/data/czm/media/nobuildareas.pdf

[j] https://coast.noaa.gov/data/czm/media/nobuildareas.pdf

[k] Data on the rate of sandy shoreline change have been calculated for Maui, Kauai, and Oʻahu islands by the Coastal Geology Group at the University of Hawaiʻi at Mānoa, School of Ocean and Earth Science and Technology.

[l] https://coast.noaa.gov/data/czm/media/nobuildareas.pdf

[m] https://coast.noaa.gov/data/czm/media/nobuildareas.pdf

[n] http://planning.hawaii.gov/czm/

Setback Policies from Other U.S. States - After the National CZM Program was established in 1977, several states opted to participate in a federal-local partnership designed to encourage states to create coastal management plans and policies to foster federal, state and local cooperation. Under this coperative structure, states have established "no-build zones" (setbacks) using various types of criteria (**Appendix**). These incude methods that are erosion rate-based (the width of the no-build zone is calculated based on the annual rate of coastal erosion), fixed-distance (a fixed distance, such as used by C&C, determines the width of the no-build zone), or use some other criteria such as distances from coastal landforms (e.g.,dunes), application of multiple criteria depending on site-specific conditions, or guided by existing development (e.g., string-line).

Setback Policies from Other Hawaiian Counties - Other counties in Hawaiʻi have changed their shoreline setbacks in recognition that 40 ft does not offer sufficient protection from coastal hazards. For example, both Kauaʻi and Maui have adopted erosion rate-based setbacks using a combination of criteria: the rate of historical shoreline change or the average depth of the lot (**Table 1**).

On the island of Hawaiʻi, the shoreline setback is 40 ft.

On Kauaʻi, the shoreline setback determination[o] for lots included in the Kaua'i Coastal Erosion Study[37] is:

- 40 ft + distance of 70 times the annual coastal erosion rate + 20 ft safety buffer from the certified shoreline for lots with a depth of less than 140 ft.
- For lots with average lot depth of 140 to 220 ft, the greater distance of the two applies: 40 ft + 70 times the annual coastal erosion rate + 20 ft or taking the average lot depth, subtracting 100 ft, dividing by 2 + 40 ft.
- For lots with average lot depth over 220 ft, the greater of the two shall apply: 40 ft + 70 times the annual erosion rate + 20 ft or a setback line of 100 ft from the certified shoreline.

On Maui, all lots have a shoreline setback line that is the greater of the distances from the shoreline as calculated under the methods listed:

- 25 ft + distance of 50 times the annual erosion hazard rate from the shoreline.
- Based on the lot depth:
  - Lots with average depth of 100 ft or less shall have a setback of 25 ft from the shoreline.
  - Lots with average depth >100 ft but <160 ft shall have a setback of 40 ft from the shoreline
  - Lots with average depth >160 ft, shall have a setback of 25% of the average lot depth, but not >150 ft.
- For irregularly shaped lots, the setback will be equivalent to 25% of the lot depth as determined by the Director to a maximum of 150 ft from the shoreline.[p]

On the island of Oʻahu, the shoreline setback is 40 ft. Where the depth of the buildable area of a lot, as measured seaward from its inland edge, is reduced to less than 30 ft, the shoreline setback line shall be adjusted to allow a minimum depth of buildable area of 30 ft; provided that the adjusted shoreline setback line shall be no less than 20 ft from the certified shoreline. In the case of a new subdivision or consolidation of land, new lots must accomodate a 60 ft setback.

In Conservation Districts in the State of Hawaiʻi, the following shoreline setback applies:

- Structures with average lot depth >200 ft: 40 ft from seaward reference feature plus 70 times average annual coastal erosion rate

[o] https://www.kauai.gov/Government/Departments-Agencies/Planning-Department/Shoreline-Setback

[p] https://www.mauicounty.gov/697/Shoreline-Setback-Area-Limitations

- Structures with average lot depth ≤200 ft: 40 ft from seaward reference feature plus 70 times average annual coastal erosion rate or between 40 and 90 ft from seaward reference feature based on average lot depth
- Structures with average lot depth ≤ 100 ft: a minimum of 40 ft applies

Erosion Hazard Line - Among the model results presented in the Hawaiʻi Sea Level Rise Adaptation and Vulnerability Report is an Erosion Hazard Line (EHL) representing the 80% probability of erosion with 3.2 ft of GMSL rise. The EHL is being proposed by Maui County Planning Department as the basis for a new set-back. Because it is available on the PacIOOS site as a downloadable GIS layer, it is useful for planning and design. It represents the best available science for managing the erosion problem in a future characterized by accelerating sea level rise. Maui County is proposing the following shoreline rule amendments:

1. In areas where the EHL is mapped, the setback is the EHL+40 ft.
2. In areas without the EHL and with no certified shoreline survey, the setback is 200 ft from the shoreline as mapped by the department.
3. In areas without the EHL and with a certified shoreline survey, the setback is based on the lot depth (as in current rules).
4. In areas without the EHL with irregularly shaped lots or cliffs or not mapped by the department, the setback is 25% of the lot depth.

The EHL is determined, in part, by historical rates of shoreline change derived from analysis of orthorectified aerial photogrammetry. This time series begins with imagery collected prior to WWII and is periodically updated.

<table>
<tr><th colspan="4">TABLE 1 – Hawaiʻi Counties No-Build Area Delineation</th></tr>
<tr><th>County</th><th>Erosion Rate-Based</th><th>Fixed-Distance</th><th>Area/Other Methods</th></tr>
<tr><td>Oʻahu</td><td>Conservation Districts only (DLNR)*</td><td>40 ft inland from the certified shoreline (C&C)[q]</td><td>n/a</td></tr>
<tr><td rowspan="3">Maui</td><td colspan="3">The greater of the distances from the shoreline as calculated under the methods listed or the overlay of such distances[r]</td></tr>
<tr><td>25 ft + distance of 50 times the annual erosion hazard rate from the shoreline</td><td colspan="2">Based on the lot’s depth as follows:
1) Lots with average depth of 100 ft or less shall have a setback 25 ft from the shoreline
2) Lots with average depth >100 ft but <160 ft shall have a setback 40 ft from the shoreline
3) Lots with average depth >160 ft, shall have a setback equal to 25% of average lot depth, but not >150 ft
4) For irregular lots, or cliffs, bluffs or other topographic features inhibit safe measurement of boundaries and/or the shoreline, the setback will be equivalent to 25% of the lot depth as determined by Director of the Department of Planning to a maximum of 150 ft from the shoreline</td></tr>
<tr><td colspan="3">NOTE: Maui Department of Planning has introduced a new set-back criteria for the island of Maui, the erosion hazard line (see PacIOOS SLR Viewer) marking 80% probability of exposure to chronic erosion when sea level has risen 3.2 ft.</td></tr>
<tr><td>Kauaʻi</td><td>For lots in the Kauaʻi Erosion Study[s]
1) For lots with average depth of <140 ft: 40 ft + distance of 70 times annual coastal erosion rate + 20 ft safety buffer from certified shoreline
2) For lots with average depth of 140 ft to 220 ft, the greater setback of the following: 40 ft + 70 times annual coastal erosion rate + 20 ft, or taking average lot depth, subtracting 100 ft, then dividing by 2 + 40 ft
3) For lots with average depth greater than 220 ft, the greater setback of the following: 40 ft + 70 times annual coastal erosion rate + 20 ft, or a setback of 100 ft from the certified shoreline</td><td>n/a</td><td>For lots not included in the Kauaʻi Erosion Study, the setback shall be calculated by the following formula[t]:
Average Lot Depth - 100)/ 2 + 40), subject to the following:
1) For lots with naturally occurring rocky shorelines, the shoreline setback line shall be no less than 40 ft
2) For all other lots, the shoreline setback line shall be no less than 60 ft
1) 3) For all lots, the maximum setback that can be required shall be 100 ft</td></tr>
<tr><td>Hawaiʻi</td><td>In Conservation Districts only*</td><td>Fixed-Distance: 40 ft inland from the certified shoreline</td><td>-</td></tr>
</table>

[1] Summers, A., et al. (2018) Failure to protect beaches under slowly rising sea level. Climatic Change. https://doi.org/10.1007/s10584-018-2327-7
[2] Presented in Attorney General Opinions: https://ag.hawaii.gov/wp-content/uploads/2017/12/Opinion-No.-17-01.pdf
[3] Attorney General Opinions: https://ag.hawaii.gov/wp-content/uploads/2017/12/Opinion-No.-17-01.pdf
[4] Dangendorf, S. et al. (2019) Persistent acceleration in global sea-level rise since the 1960s, Nature Climate Change: http://dx.doi.org/10.1038/s41558-019-0531-8. R. S. Nerem el al., "Climate-change–driven accelerated sea-level rise detected in the altimeter era," PNAS (2018). www.pnas.org/cgi/doi/10.1073/pnas.1717312115

[q] https://www.honolulu.gov/rep/site/ocs/roh/ROH_Chapter_23__.pdf.pdf
[r] https://www.mauicounty.gov/DocumentCenter/View/8412/Chpt-203--MPC-Shoreline-Procedure-Rules?bidId=
[s] https://www.kauai.gov/Portals/0/Planning/Ord_979_Shoreline_Setback.pdf
[t] https://www.kauai.gov/Portals/0/Planning/Ord_979_Shoreline_Setback.pdf

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[19] http://climate.hawaii.gov

[20] https://climateadaptation.hawaii.gov/wp-content/uploads/2017/12/SLR-Report_Dec2017.pdf

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APPENDIX State No-Build Zone (setback) Details

State or Territory	Seaward Reference Feature (SRF)	Landward Boundary (LB)	No-Build Areas (NBA) Delineation	Local Programs	Specifications for NBA Delineation	Regulating Agency
Alabama	Mean High Tide	Construction Control Line (CCL, link in Specifications)	Area/Other Methods: CCL	Some cities/counties delegated permitting, monitoring, & enforcing powers	http://www.adem.state.al.us/alEnviroRegLaws/files/Division8.pdf	Dept Env. Management, Dept Consv. & Natural Resources, State Lands Division
American Samoa	Mean High Tide	200 ft from SRF	Fixed-Distance: 200 ft from SRF. Area/Other Methods: Coastal Hazard Areas (floodplains, storm wave, inundation areas, landslide hazard areas, erosion-prone areas).	Office of Development Planning vested with exclusive authority to designate uses subject to land use permit requirements	https://coast.noaa.gov/data/czm/media/nobuildareas.pdf	American Samoa Dept Commerce
California	Does not explicitly have a No-Build Area or Shoreline Setback Law or Regulation, since the state has local coastal programs and no state mandated setback			Yes, Local Coastal Programs	California Coastal Commission; San Francisco Bay Conservation and Development Commission	
Commonwealth of the Northern Mariana Islands	High Tide Line	Fixed-Distance: A) 0-35 ft: beach/shoreline reservation zone, structures generally not allowed. Typically, non-vertical construction & parking areas potentially allowed at 35 ft. B) 35-100 ft: Parking areas & vertical construction that obstruct openness not allowed, but pools, terraces. C) 100-125 ft: Single-story structures, allowed but not exceed 12 ft height measured from natural grade. D) +125 ft: If building height >2 stories, then 150 ft from high tide line is considered property line.		No, Coastal Resource Management Agency. Board approves all permits.	https://dcrm.gov.mp/wp-content/uploads/crm/2018_CRMRegs_FINAL.pdf	CNMI Coastal Resources Management Office
Connecticut	No explicit set-back law or regulation		Development of shoreline regulated at local level through municipal planning & zoning boards		Dept. Energy & Environmental Protection, Office of Long Island Sound Programs	
Delaware	Mean High Water Line	Building Line As Defined (link in Specifications)	Fixed Distance: Building Line defined geographically at various coastal communities and natural features (e.g., beaches extending from DEL/MD line to Cape Henlopen, 100 ft landward of the adjusted 9 ft elev. contour, NAVD; Commercial Areas w/ boardwalks and no natural dune, Building Line shall be along west edge of the boardwalk).	Yes, both state and local governments regulate shorefront development on dry land	http://regulations.delaware.gov/AdminCode/title7/5000/5102.shtml	Dept. Natural Resources and Environmental Control, Office of the Secretary, Delaware Coastal Programs
State or Territory	Seaward Reference Feature (SRF)	Landward Boundary (LB)	No-Build Areas (NBA) Delineation	Local Programs	Specifications for NBA Delineation	Regulating Agency

Florida	Seasonal high water line or mean high water line	Whichever is most seaward: Erosion-Rate Based: Various methods determine location of the 30 yr erosion projection seasonal high water line: http://www.flrules.org/gateway/ruleno.asp?id=62B-33.024&Section=0. Area/Other Methods: Coastal Construction Control Line, landward limit of the beach-dune system subject to 100 yr storm surge, storm waves, or other predictable weather conditions: https://floridadep.gov/sites/default/files/CCCL_FrequentlyAskedQuestions_0.pdf Fixed-Distance: Where there is no CCCL, 50 ft from mean high water line.		Yes, regulated at county level	https://www.lawserver.com/law/state/florida/statutes/florida_statutes_161-052	Dept. Environmental Protection, Bureau of Beaches & Coastal Systems
Georgia	Ordinary low water mark	Line of permanent vegetation	Fixed-Distance: 50 ft for marshlands. Area/Other Methods: Any area between SRF and the LB is not allowed on beaches and eroding sand dune areas.	Yes, county level	https://coast.noaa.gov/data/czm/media/nobuildareas.pdf	Dept. Natural Resources
Guam	Mean high water mark	35 ft or 75 ft of SRF	Fixed Distance: Structures ≤20 ft high: 35 ft from SRF Structures >20 ft high: 75 ft from SRF	No	https://coast.noaa.gov/data/czm/media/nobuildareas.pdf	Guam Bureau Statistics & Plans
Hawai'i	Shoreline– Upper wash of waves at high tide	20-40 ft from SRF	Erosion-Rate Based: Maui & Kauai w/ erosion rates. Fixed-Distance: Hawai'i & O'ahu w/ 40 ft. Area/Other Methods: Conservation District where structures setback from shoreline (upper wash of waves at high tide) 40 ft + 70 times avg. annual coastal erosion rate.	Yes, at the county level	https://coast.noaa.gov/data/czm/media/nobuildareas.pdf	HI DBEDT, Office Planning & HI DLNR, Office Conservation & Coastal Lands
Louisiana	No explicit setback			Some parishes have CZM programs.		Dept. Natural Resources Office of Coastal Management
Maine	Atlantic shoreline: highest annual tide elev. or top of unstable bluff	Atlantic Shoreline: 75 ft from SRF or General Development I Districts: 25 ft from SRF.	Fixed-Distance: Shoreline Zone (General): 75 ft from SRF. Area/Other Methods: General Development I Districts: 25 ft from SRF.	Municipalities develop & administer zoning ordinances	https://coast.noaa.gov/data/czm/media/nobuildareas.pdf	Dept. Environmental Protection
Maryland	Ocean	Ocean City Building Limit Line as defined	Area/Other Methods: State-Ocean City Building Limit Line defined by Army Corps based on control points.	Local jurisdictions establish shoreline buffers & minimum setbacks	https://coast.noaa.gov/data/czm/media/nobuildareas.pdf	Dept. Natural Resources
Massachusetts	No explicit Setback or Regulation			Municipalities administer regulations		Executive Office Energy & Environmental Affairs
Mississippi	No explicit setback or regulation					
State or Territory	Seaward Reference Feature (SRF)	Landward Boundary (LB)	No-Build Areas (NBA) Delineation	Local Programs	Specifications for NBA Delineation	Regulating Agency

State or Territory	Seaward Reference Feature (SRF)	Landward Boundary (LB)	No-Build Areas (NBA) Delineation	Local Programs	Specifications for NBA Delineation	Regulating Agency
New Hampshire	Highest observable astronomical tide line	Primary Building Line	Fixed-Distance: Primary Building Line is primary setback: 50 ft from SRF. Area/Other Methods: Construction in 100 ft tidal zone buffer prohibited	Municipalities	https://coast.noaa.gov/data/czm/media/nobuildareas.pdf	Dept. Env. Services, Wetlands Bureau, Shoreland Program
New Jersey	Beaches: Mean high water line	Beaches: most seaward of Manmade feature parallel to sea or Seaward foot dunes	Erosion Rate-Based: 30 times erosion rate for 1-4 unit dwelling structures & 60 times erosion rate for others. Fixed-Distance: Depends on situation, can include flood haz. areas (100 ft setback) & coastal bluffs (25 ft setback). Area/Other Methods: Depends on situation, can include beaches, dunes, coastal bluffs, overwash areas, coastal high hazards.	Yes, development must meet most stringent standards (whether that is state or local standards)	https://coast.noaa.gov/data/czm/media/nobuildareas.pdf	Dept. Environmental Protection
New York	Beaches: Bluff or dune: Mean low water line. or whatever most seaward of marked change in physiographic form or line of permanent vegetation	Beaches: Bluff or dune, whichever most seaward: - Seaward toe of dune - Seaward toe of bluff No bluff or dune: 100 ft landward of SRF	Erosion-Rate Based & Area/Other Methods: structural hazard areas, 40 X erosion rate from SRF. Fixed-Distance: natural protective feature areas, depends on situation; for beaches, 100 ft landward if no bluff or dune; for bluffs, 25 ft landward of bluff's receding edge/point of inflection; for primary dunes, 25 ft landward of primary dune's landward toe.	Yes, local governments	https://coast.noaa.gov/data/czm/media/nobuildareas.pdf	Dept. Environmental Conservation
North Carolina	First line of stable natural vegetation	Development must be landward of primary dune crest or the frontal dune (if primary dune absent) or in accordance with the Ocean Hazard Setback, whichever is most landward.	Erosion-Rate Based & Fixed-Distance: depends on size of structure and a setback factor based on shoreline position change rate. Area/Other Methods: Ocean Erodible Area of Environmental Concern. See link under Specifications for NBA Delineation.	Yes, county level	https://deq.nc.gov/about/divisions/coastal-management/coastal-management-oceanfront-shorelines/oceanfront-construction-setback-erosion-rate	Dept. Environment and Natural Resources
Oregon	Ocean shores: extreme low tide	Ocean shores: most landward of Statutory Vegetation Line or line of established upland shore vegetation	Area/Other Methods: Development not allowed between extreme low tide and LB. For more information see link.	Yes, local governments	https://coast.noaa.gov/data/czm/media/nobuildareas.pdf	Parks & Rec. Dept. & Oregon Dept. Land Conservation & Development
Puerto Rico	High tide line	Greater of: 50 m from SRF or 2.5 X building height	Fixed-Distance: Greater of: 50 m from seaward reference feature or 2.5 X building height for buildings constructed within 400 m of Maritime Terrestrial Zone. Area/Other Methods: urban zoning districts, additional calculations required to establish setback and building height limits.		https://coast.noaa.gov/data/czm/media/nobuildareas.pdf	Dept. Natural & Environmental Resources & Planning Board

Rhode Island	Inland boundary of most landward coastal feature (beach, dune, wetland, rocky shore, manmade shoreline, or headland/bluff /cliff)	Greater of: Residential, 30 X erosion rate from SRF Commercial, industrial, larger residential (4+ units): 60 X erosion rate from SRF 50 ft from SRF 25 ft from edge coastal buffer zone	Erosion-Rate Based: Residential, commercial and industrial structures. Fixed-Distance: Minimum setback 50 ft from coastal feature or 25 ft from edge of coastal buffer zone, whichever further landward. Area/Other Methods: barrier islands, no new development on moderately developed or undeveloped barrier islands + new infrastructure & utilities generally prohibited on all barriers. New construction not allowed on developed barriers on which only roads, utility lines, and other forms of public infrastructure were present as of 1985.	No, regulated by state	https://coast.noaa.gov/data/czm/media/nobuildareas.pdf	Coastal Resources Management Council
South Carolina	Ocean	Most seaward of: escarpment, first line stable natural vegetation	Area/Other Methods: no new construction, additions, or reconstruction on active beach, which is the area seaward of escarpment or first line of stable natural vegetation, whichever is most seaward, and on primary oceanfront sand dunes	Yes, local agencies	https://coast.noaa.gov/data/czm/media/nobuildareas.pdf	Dept. Health & Environmental Control
Texas	Public beach: Mean low tide	Public beach: Line of vegetation	Fixed-Distance: In dunes, mean high tide is seaward reference feature and landward is up to 1,000 ft from SRF. Area/Other Methods: At public beaches, line of vegetation is landward boundary.		https://coast.noaa.gov/data/czm/media/nobuildareas.pdf	Texas General Land Office
U.S. Virgin Islands	Line of low tide	Whichever is most seaward: 50 ft from seaward ref. feature or first line of vegetation or natural barrier	Fixed-Distance: Development not allowed between line of low tide & line measured 50 ft inland or Area/Other Methods: extreme seaward boundary of natural vegetation or the natural barrier		https://coast.noaa.gov/data/czm/media/nobuildareas.pdf	
Virginia	Beaches: Low water line	Beaches: Marked change in material composition or physiographic form, line of woody vegetation, or nearest impermeable manmade structure	Erosion-Rate Based: Structures on barrier islands, setback from dune crest 20x 100 yr long-term annual erosion rate. Area/Other Methods: law does not allow construction on beaches and primary sand dunes that impairs natural functions, physically alter the feature, or destroy vegetation	Yes, local agencies	https://coast.noaa.gov/data/czm/media/nobuildareas.pdf	Virginia Marine Resources Commission
Washington	No explicit setback law or regulation, instead uses Shoreline Management Act Law & implementing codes. Structural setbacks and vegetative buffers required on shorefront but depend on existing development patterns and ecological condition. There is to be "no net loss of ecological functions" applies to all shoreline areas in Washington.			Yes, Shoreline Master Programs	https://ecology.wa.gov/Water-Shorelines/Shoreline-coastal-management/Shoreline-coastal-planning/Shoreline-Management-Act-SMA	Dept. of Ecology