GEORGETOWN CLIMATE CENTER

Local Ordinances for Climate Adaptation & Mitigation | Oct. 2025

Local Ordinances to Address Freeboard Standards

The Opportunity

Each year, severe weather events are becoming more frequent, intense, and costly due to climate change and sea-level rise. In coastal and riverine floodplains, both people and infrastructure are affected by increased precipitation, flooding, and inundation. With each new catastrophic flooding event, people are displaced, insurance prices rise, and municipal bond ratings fall. Increasing building elevations is one important way to address this risk.

Faced with increasing flood risk, communities have two meaningful ways to reduce risk: 1) reduce the number of structures and people in flood-prone areas, and 2) raise buildings higher than the water is expected to rise. Higher elevation above expected high-water levels (generally called “freeboard”) protects homes and people from flooding. Freeboard regulations generally start by defining the projected flood levels from 100- or 500-year storms, and setting an additional elevation above which buildings (or some subset of structures) must be raised.

Different elevations may apply to different buildings based on their risk tolerance. For example, local regulations might require that critical facilities, such as hospitals and fire stations, be elevated to higher levels than private homes or businesses.

This reduction in risk exposure benefits municipalities by making infrastructure more insurable and improves bond ratings, which in turn reduces the cost of borrowing for local governments. Here, we present two models of floodplain standards that go beyond the federal minimum for freeboard elevation. We propose that localities adopt the American Society of Civil Engineers (ASCE) 2024 floodplain standards, and engage with communities to agree upon shared planning horizons and future sea-level rise scenarios to inform local freeboard values.

Freeboard values are mandated at the federal level through flood insurance, and at the local and state levels through building codes and floodplain ordinances. The National Flood Insurance Program (NFIP), run by the Federal Emergency Management Agency (FEMA), provides flood insurance to participating communities across the country. Participating states and localities must adhere to minimum floodplain management standards, including a minimum freeboard value, to purchase flood insurance coverage.

While they are a good starting point, federal standards do not account for local environmental conditions or future climate change impacts (such as sea-level rise). National standards also do not take local risk tolerance under consideration. State and local-level floodplain ordinances are an effective way to mitigate against increased coastal and riverine climate hazards. However, freeboard ordinances must be coupled with other floodplain management regulations to sufficiently address local flood risk.

Proposed ordinance

Coastal and riverine communities can adopt a floodplain ordinance that includes several elements related to freeboard: 1) expand the flood-prone area where development is regulated to include the 500-year floodplain; 2) incorporate local future sea-level rise into freeboard values; 3) elevate critical facilities higher than other buildings; 4) adopt the most restrictive (i.e., highest) freeboard value when regulations overlap; and 5) use community input to determine a shared, risk-informed future sea-level scenario and planning horizon.

Where has this been tried?

States and localities across the country have proposed and implemented floodplain management standards that address local climate risks and community needs. Our analysis focused on comprehensive review of state-level floodplain ordinances, and included local ordinances recommended by experts we consulted. Here we outline two strong examples of floodplain management practices: one from a national society, and one from a barrier island town. These practices provide instructive examples for other states and localities looking to understand the elements of an effective freeboard regulation.

The policy interventions we offer here are some of many methods to reduce flood risks at the state to local levels. Ultimately, floodplain management standards should address the needs and risk tolerance of the communities they are implemented within. This guidance may be adopted either statewide or locally, although states may take a more conservative approach to climate risk mitigation since they represent the interests of the entire populace, not only the most at-risk and/or risk-averse coastal and riverine towns. Adopting tailored freeboard requirements at the municipal level is a sensible way to address the particular geographical and other factors that may increase the risk to a particular community.

Freeboard regulations are widely recognized by experts as a sound approach to flood risk mitigation — the Association of State Floodplain Managers has been advocating for increased freeboard since 1990.[1] FEMA recognizes that adding freeboard values can save lives.[2] Across the country, localities have adopted freeboard standards specific to their own environmental and risk tolerance conditions. These increased standards do not come without their challenges. Increasing the elevation of homes and other infrastructure costs money. Real estate developers often do not favor stricter regulations on development in the floodplain. Homeowners may not want to shoulder the cost of elevating their homes. However, in the long-term, floodplain regulations are an investment that will save money and protect people. Building only 1 foot above the 100-year flood level has a 6-to-1 benefit-cost-ratio, per the National Institute of

[1] *The ASFPM Story: Association Milestones and Wall of Honor*, Association of State Floodplain Managers (2025) https://www.floods.org/about/asfpm-history/

[2] *Freeboard Saves Town from Additional Flood Losses*, Federal Emergency Management Agency (2021) https://www.fema.gov/case-study/freeboard-saves-town-additional-flood-losses

Building Sciences.[3] The same report shows that 10 feet of freeboard has a 12-to-1 benefit-cost ratio in the face of hurricane surge. Tenants and landlords alike have been shown[4] to save money when adopting freeboard elevation, and the economic benefits of freeboard policies are nearly equally distributed[5] across income levels. Tools are available[6] to help communities determine cost-efficient freeboard elevation values. Like any change in zoning policies, these come with costs and potential resistance from property owners. Nevertheless, we recommend freeboard regulations because we know they protect communities.

General best practices

American Society of Civil Engineers "Flood Resistant Design and Construction"

The American Society of Civil Engineers (ASCE) publishes science-backed guidance and standards for the built environment. The society is the oldest of its kind in the United States, with over 160,000 members worldwide.[7] Their guidelines are cited frequently and seen as the industry standard for the built environment. "Flood Resistant Design and Construction" (hereafter ASCE 24-24),[8] a guidebook for minimum standards for designing and building structures in flood hazard areas published in early 2025, uses best-available building science to suggest requirements for flood-resilient infrastructure. The ASCE standards aim to protect homes and infrastructure by raising them to a higher, locally-relevant, risk-informed height.

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[3] *Mitigation Saves: Mitigation Saves up to $13 per $1 invested*, National Institute of Building Sciences (2020) https://nibs.org/wp-content/uploads/2025/04/ms_v4_overview.pdf

[4] Ehab Gnan, Carol J. Friedland, et al., *Freeboard life-cycle benefit-cost analysis of a rental single-family residence for landlord, tenant, and insurer*, Frontiers in Climate (Jan. 17, 2024) https://www.frontiersin.org/journals/climate/articles/10.3389/fclim.2023.1295592/full

[5] Anisha Deria, Rubayet Bin Mostafiz, et al., *Implications of freeboard policy for homeowners in different income-groups: A case study of Jefferson parish,* Springer Nature (Jan. 7, 2025) https://link.springer.com/article/10.1007/s11027-024-10194-6

[6] Carol J. Friedland, Rubayet Bin Mostafiz, et al., *FloodSafeHome: evaluating financial benefits and savings of freeboard for improved decision-making in flood risk mitigation,* Frontiers in Communication (May 10, 2023) https://www.frontiersin.org/journals/communication/articles/10.3389/fcomm.2023.1060901/full

[7] *About ASCE,* American Society of Civil Engineers (2025) https://www.asce.org/about-asce

[8] *Guidance on Structural Safety in Flood Areas: ASCE 24-24,* American Society of Civil Engineers (2025) https://www.asce.org/publications-and-news/codes-and-standards/asce-sei-24-24

ASCE 24-24 suggests that flood-prone jurisdictions regulate development in the floodplain. Historically, the default flood hazard zone has been the 100-year floodplain, which has a 1% chance of flooding in any given year. ASCE recommends expanding planning to cover the 500-year floodplain, the area that would be covered by water during a flood that has a 0.2% chance of happening in any given year. As the climate continues to change, so will the severity and frequency of flooding events. This means that floodplains will change shape and size in ways that cannot be precisely predicted. For this reason, plans that encompass current estimates for the 500-year, not just the 100-year, floodplain, provide an added measure of protection.

ASCE 24-24 also suggests that when determining building elevations, coastal communities should incorporate future relative sea-level rise (i.e., local sea-level change relative to the global mean). Rather than the standard federal minimum elevation for freeboard values, the guide recommends that relative sea-level rise values be added to the freeboard value calculated using the guide instead. For structures that adopt this standard, relative sea level can be calculated from the local historic rate and projected forward. This method makes it more likely that buildings can accommodate flooding on top of future sea-level change for their entire service life.

One recommendation from the recent ASCE 24-24 guidance is a significant shift from traditional building elevation determinations. While most state and local floodplain ordinances assign a uniform building elevation value for structures in the floodplain, ASCE guidance recommends freeboard values based on the "risk to human life, health, and welfare"[9] that might occur if a building was affected by flooding. Each recommended structure elevation includes both a flood level associated with storm probability (i.e., 100-year, 500-year flood, and so on), and an added relative sea-level change on top of that value. ASCE 24-24 recommends that residential, commercial, and industrial structures be elevated to the 500-year flood level, and critical infrastructure to a higher flood level (plus relative sea-level change). The Louisiana State University AgCenter has even developed a calculator[10] to help determine a building's elevation using the ASCE 24-24 guidance.

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[9] *ASCE 24-24* at 7, American Society of Civil Engineers (2025) https://sp360.asce.org/PersonifyEbusiness/Merchandise/Product-Details/productId/318295190

[10] *Minimum Required Elevation Calculator,* LSU AgCenter (2025) https://floodelev.lsuagcenter.com/

The guide also advises that the more restrictive elevation value should always be chosen. We suggest this principle be applied to all floodplain management: when presented with multiple potential structure elevations, communities should opt for the more conservative (higher) elevation for added protection. Common language in an ordinance that enforces this practice is: "Buildings and structures in flood hazard areas… shall have the lowest floors elevated to or above the base flood elevation plus 1 foot, or the design flood elevation, *whichever is higher*."[11]

ASCE is not an enforcing organization, but the standards they suggest may get adopted into the International Code Council (ICC) when the next update takes place in 2027. Model codes provided by the ICC are commonly used as templates for updating state and local building codes and floodplain ordinances. However, waiting until these best practices are adopted into a model code means losing valuable time when more communities could be planning for, and protected from, flooding. States and localities may elect to adopt the recommendations into their own floodplain management practices at any time, and should do so to proactively lower their flood risk.

Many coastal and riverine cities across the US have already adopted ASCE 24-14, the previous iteration of "Flood Resistant Design and Construction" guidance from 2014. Woodbury, New Jersey[12] and Hampton, New Hampshire[13] are two examples. Woodbury's building code uses ASCE24-14's regulations as a baseline protection for critical facilities. Hampton's 2025 updated building codes already align with some of the ASCE 24-24 recommendations. For example, their code restricts the development of critical facilities in the 100-year floodplain. If a structure must be built in the floodplain for any reason, the building must be elevated to the 500-year flood level plus one foot of freeboard, or the 100-year flood level plus 3 feet, whichever is higher. This means that critical facilities will be protected from increasingly common, severe coastal storms that lead to flooding. These localities demonstrate that local-level codes and standards

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[11] *2022 Connecticut State Building Code - 2021 IRC Portion* at 2, International Code Council (May 2023) https://codes.iccsafe.org/s/CTRC2022P1/chapter-3-building-planning/CTRC2022P1-Pt03-Ch03-SecR322. Emphasis added.

[12] *Amending Ordinance No. 2386-23 and Repealing and Replacing Chapter 92 Food Hazard Mitigation,* City Council of the City of Woodbury (Apr. 17, 2023) https://woodbury.nj.us/DocumentCenter/View/2406/Ord-2386-23---Amending-Ordinance-2383-23-and-Repealing-and-Replacing-Chapter-92-Flood-Hazard-Mitigation

[13] *2025 Zoning Ordinance Building Codes and Impact Fee Ordinance,* Zoning Ordinance & Building Codes of the Town of Hampton, NH (2025) https://www.hamptonnh.gov/DocumentCenter/View/9707/Zoning-Ordinance-2025

are an accepted method to mitigate flood risk, and the new ASCE guidance will support further risk mitigation.

Satellite Beach, Florida

Satellite Beach, FL, is a local government that has gone above and beyond the federal minimum for floodplain management. The city engaged with residents to determine a planning horizon for future development in the floodplain, and a sea-level scenario to plan for when determining building elevations. A barrier island city of about 11,000 on the Space Coast of Eastern Central Florida, Satellite Beach has been working on floodplain management since 2009 — they commissioned multiple studies[14] on sea-level-rise adaptation following intense hurricanes in the early 2000s, and found that flood risk is increasing. As of 2025, the city has passed various ordinances and adopted myriad floodplain management practices beyond the state and federal minimum requirements. One ordinance captures several locally-oriented strategies that promote forward-thinking flood hazard mitigation.

In February 2016, the Satellite Beach City Council passed Ordinance 1113,[15] which amended the city's Comprehensive Plan. The Florida Community Planning Act of 2011 requires every locality in Florida to adopt a comprehensive plan that guides development. Through public hearings at regular city council meetings and online surveys, the Satellite Beach Comprehensive Planning Advisory Board gathered feedback from the community on planning for climate change impacts. The ordinance amended the city's Comprehensive Plan to plan for flooding out to 2070 and use a high-emission sea-level curve for future planning.

Per the ordinance, any infrastructure with a service life over 50 years that will be built by 2025 must plan for flooding out to the year 2070. Sea-level change should be estimated using the U.S. Army Corps of Engineers (USACE) "high" curve, or the most up-to-date projections if they become available. USACE is one of several federal institutions that regularly interface with

[14] Randall W. Parkinson, *Municipal adaptation to sea-level rise: City of Satellite Beach, Florid*a, RWParkinson Consulting, Inc. (Jul. 18, 2010) https://www.cakex.org/sites/default/files/documents/Sea%20Level%20Rise%20-%20CRE%20Report%2007-18-10.pdf; Jason M. Evans, Crystal Goodison, Eilyn s Mitchell, et al., *Sea-Level Rise Technical Planning Assessment for the City of Satellite Beach,* Research Gate (Apr. 2019) https://www.stetson.edu/other/iwer/media/Sea-Level%20Rise%20Technical%20Planning%20Assessment.pdf

[15] *Ordinance No. 1113,* City of Satellite Beach (2018) https://www.flseagrant.org/wp-content/uploads/2022/10/Ord-No-1113-Comp-Plan-Amend_3.5.18.pdf

sea-level science, and have therefore produced trusted sea-level change visualization tools.[16] Sea-level rise must be considered for any projects being built within areas particularly susceptible to inland flooding. The ordinance states that Satellite Beach plans to assess the usefulness of this approach periodically, and update sea-level data at least every five years. These measures aim to reduce the number of buildings and community members affected by flooding out to 2070. The process by which Satellite Beach passed these ordinances is as important and their content. Community engagement in environmental issues is common[17] in the town — a volunteer citizen committee has contributed to planning since 1977.[18] As a community, Satellite Beach assessed its risk and resources and determined that they wanted to plan for the less likely, but higher risk, high-emission pathway resulting in more sea-level rise. Even if sea level rises less than what the town planned for, they will ultimately be protected against flood events further into the future.

Since it adopted Ordinance 1113 in 2016, Satellite Beach has commissioned additional reports[19] on climate impacts and passed many more floodplain ordinances. As of its most recent Sustainability Action Plan (2022),[20] the city plans to adopt the equivalent of New York City's Climate Resiliency Guidelines[21] for Design Flood Elevation for all new buildings in Satellite Beach. These guidelines account for future sea-level rise out to 2070 and will add a uniform freeboard value for the city (to be determined — likely somewhere between 0.5 feet and two

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[16] *Sea-Level Change,* U.S. Army Corps of Engineers Headquarters Website (Accessed Sept. 2025) https://www.usace.army.mil/Infrastructure-and-Installation-Resilience/Public-Tools-Developed-by-USACE/Sea-Level-Change/

[17] Randall W. Parkinson and Tara McCue, *Assessing municipal vulnerability to predicted sea level rise: City of Satellite Beach. Florida,* Springer Science + Business Media (May 10 2011) https://research.fit.edu/media/site-specific/researchfitedu/coast-climate-adaptation-library/united-states/florida/east-coast-mainland/Parkinson--McCue.-2011.-Municipal-Vulnerability--SLR.pdf

[18] *Ordinance No. 170,* City Council of the City of Satellite Beach (1977) https://mcclibraryfunctions.azurewebsites.us/api/munidocDownload/31156/2c2317281a5a1/pdf?forceDownload=true

[19] Thomas Ruppert, *City of Satellite Beach: Policy Recommendations for Resilience*, The Institute for Water and Environmental Resilience (Apr. 2019) https://www.flseagrant.org/wp-content/uploads/2022/10/Policy-Recommendations-05_FINAL.pdf

[20] *Sustainability Action Plan,* Sustainable Satellite (2022) https://cms8.revize.com/revize/satellitebeachfl/Departments/Sustainable%20Satellite/SAP/2022%20Satellite%20Beach%20Sustainability%20Action%20Plan%20-%205%20Year%20Update.pdf

[21] *We prepare New York City for the impacts of climate*, NYC Mayor's Office of Climate & Environmental Justice (2019) https://climate.cityofnewyork.us/wp-content/uploads/2024/05/CRDG41May_2022_digital_print.pdf

feet above the 100-year flood level). As compared to the ASCE standards, Satellite Beach is aligned with the recommendation to incorporate future sea-level rise, but does not regulate development in the 500-year floodplain or apply different freeboard standards based on building type. However, other floodplain management practices in the town, such as flood risk disclosure, phasing out maintenance of flood-prone roads, and applying restrictive design standards to particularly high-risk areas all protect people and property in Satellite Beach.

Identifying potentially promising local jurisdictions

We identified criteria by which to evaluate whether a community is a good candidate for adopting more stringent freeboard standards as part of its local floodplain ordinances. Starting with the universe of coastal and riverine areas within each state, we next looked for indications that a community has demonstrated a commitment to implementing stronger flood protection standards already. Finally, we looked for smaller cities, since larger communities face greater political and procedural barriers to implementing new flood protection policies because of their larger size and greater range of competing interests.

To identify jurisdictions that are well positioned to adopt increased freeboard ordinances, we first located coastal and riverine counties using FEMA's National Risk Index.[22] While we focus on local-level ordinances here, counties also play an important part in floodplain management. County-level Comprehensive or Hazard Mitigation Plans address regional flood risks and vulnerabilities, and make recommendations for mitigating said risk. We used U.S. Census data to sort the population size of cities within the identified counties from smallest to largest, calculating the median population. Then, we found the most recent FEMA NFIP Community Rating System (CRS) scores[23] (as of April 2025)[24] to identify coastal and riverine cities (per the

[22] *National Risk Index,* FEMA (2025) https://hazards.fema.gov/nri/map

[23] *Community Rating System,* FEMA (Accessed Sept. 2025) https://www.fema.gov/floodplain-management/community-rating-system

[24] *CRS Eligible Communities*, FEMA (Apr. 2025) https://www.fema.gov/sites/default/files/documents/fema_crs_eligible-communities_apr-2025.pdf

CRS definition) that have voluntarily adopted floodplain management practices beyond the federal minimum.

Communities achieve different CRS classifications by actively participating in different flood risk mitigation activities, such as mapping, regulation, and public outreach about flooding risks.[25] The lower a community's CRS score, the higher the discount on flood insurance a community is eligible for (ranging from 5% to 45%), so this provides a good indication that a city is proactively focused on reducing its flood risk. To assess which communities have gone beyond the federal or state minimums, and therefore may have momentum to adopt further floodplain management standards, we looked for medium-sized CRS-eligible cities with scores below 8. Scores 9 and below are considered participating communities in the CRS program. Cities with a score of 7 and below have performed enough flood information and warning, mapping, regulation, damage reduction, and response activities to earn a 15% discount on their flood insurance. Our recommendations are well-suited for the cities that fit these criteria for geography, population, and CRS scoring. Additionally, the low CRS scores indicate that a city has become eligible for discounts on their flood insurance for voluntarily taking action to reduce their community flood risk. The practices we put forth here will be more easily adopted into localities that have already fostered momentum for flood preparedness and risk mitigation.

Small to mid-sized towns (with populations of less than 65,000) are generally easier to build consensus within and pass changes to state laws and building codes. Larger cities will have to consider a wider range of environmental and community impacts — and related public engagement challenges — when adopting strict floodplain management standards. For example, states and large communities may have greater ability to participate in the CTP Program compared to smaller communities with limited resources, personnel, and bandwidth. However, the important element to achieve real resilience to flooding is connectivity. The more jurisdictions that pass ordinances protecting the floodplain (especially adjacent jurisdictions), the less risky development will take place. Ultimately, a range of small, medium, and large cities and counties adopting these guidelines will benefit communities that face ever-increasing risk from flood hazards.

[25] Community Rating System, FEMA (Accessed Sept. 2025) https://www.fema.gov/floodplain-management/community-rating-system

About this Research

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