

HIGHER STANDARDS: Opportunities for Enhancing Flood Resilience in the Eastern Shore of Maryland

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Summary

This report was prepared by the Georgetown Climate Center (GCC) for the Eastern Shore Climate Adaptation Partnership (ESCAP). ESCAP worked with the Eastern Shore Regional GIS Cooperative to assess sea-level-rise vulnerabilities in Eastern Shore communities and, with GCC and the University of Maryland Environmental Finance Center to identify legal and policy options for enhancing flood resilience in ESCAP jurisdictions. This report presents opportunities for enhancing flood resilience through local floodplain regulations, subdivision regulations, Critical Area programs, and other non-regulatory options including acquisitions, conservation easements, and public education and outreach programs. Case studies highlight how other jurisdictions have used similar approaches to enhance flood resilience. Example regulatory language is provided to help jurisdictions implement these approaches. The report also discusses legal and policy considerations, including the potential to earn points under the Community Rating System, to help jurisdictions assess the feasibility of different options.

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1. Introduction

This report provides strategies that local governments in the Eastern Shore of Maryland can consider to help enhance resilience to future flooding as a result of sea-level rise. Maryland's Eastern Shore is one of the most vulnerable regions in the country to future sea-level rise. Sea-level rise (SLR) will inundate low-lying shorelines, exacerbate impacts from extreme events (such as hurricanes and nor'easters) and the erosion of subsiding lands, and will increase flood heights and the geographical extent of flooding.¹ This report was written to inform Eastern Shore jurisdictions that are working to address flood risk at the regional level through the Eastern Shore Climate Adaptation Partnership (ESCAP).

Changes in land-use policies and regulations will be required to address increasing flood risks in ESCAP jurisdictions from sea-level rise. However, the window of opportunity is closing to address these increasing risks through regulatory approaches. Even though it may be decades before Eastern Shore communities see the full brunt of impacts from sea-level rise along their shorelines, land-use policies take many years to implement and take effect. It can take many years to engage in a code update process, and it takes many more years for code changes to affect land-use patterns and the built environment. Newly enacted regulations will only affect new construction and substantial improvements, but many communities on the Eastern Shore have a lot of existing development that is already vulnerable to flood impacts. It may take decades to bring these structures into compliance as nonconformities are phased out, as structures are replaced or damaged.

To help local governments address these challenges, this report highlights higher regulatory standards that Eastern Shore jurisdictions can adopt, in combination with non-regulatory approaches, to reduce increasing flood risks posed by sea levels. Through regulatory approaches, local governments can ensure that fewer people and structures are in harm's way when impacts occur, that developers site and construct new structures to be more resilient to flooding and other impacts, and that redevelopment (particularly after damage from big storm events) is designed to account for increasing flood risks.

Not only will higher standards help communities reduce flood risks, these solutions can also help to counteract another mounting challenge in Eastern Shore communities: rising flood insurance rates. Recent reforms to the National Flood Insurance Program (NFIP) mean that flood insurance rates are on the rise for many homeowners and businesses. However, communities that implement more rigorous floodplain management practices can qualify for flood insurance premium discounts through a subprogram of the NFIP – the Community Rating System (CRS). Many ESCAP jurisdictions either currently participate in the CRS program or are interested in joining. Throughout this report, we highlight where adoption of certain approaches could help jurisdictions earn points under the CRS program. Reduced insurance rates can provide an important economic incentive for improving floodplain management practices and help to build the political support needed to make regulatory changes.

What are ESCAP jurisdictions already doing?

ESCAP jurisdictions have already adopted higher regulatory standards through their floodplain ordinances and building codes. Currently, all ESCAP jurisdictions only apply floodplain regulations to structures in the 100-year floodplain or 1-percent chance floodplain (i.e., A-zones, or areas that have a 1 percent chance of flooding in any given year based upon historic flood data). Many ESCAP jurisdictions have also adopted higher standards for "Coastal A-zone" (CAZ, or areas that experience wave heights of between 1.5 and 3 feet).

Some examples of higher standards that are already being enforced in ESCAP jurisdictions, include:

- The Town of Oxford enforces a 3-foot freeboard requirement and limits fill in the floodplain.
- Dorchester County enforces a 2-foot freeboard requirement, requires V-zone design standards in the CAZ, limits subgrade crawl spaces, and requires continuous footers for foundations through its building code.
- Cecil County enforces a 2-foot freeboard requirement and 3 feet or the 500-year elevation for critical facilities and uses V-zone design standards in the CAZ.

In addition to these higher standards, this report suggests additional climate-smart practices that ESCAP jurisdictions could adopt to further enhance flood resilience in Eastern Shore communities.

What more could be done in ESCAP jurisdictions?

This section describes both regulatory and non-regulatory strategies that could be implemented in ESCAP jurisdictions to ensure a comprehensive approach for enhancing flood resilience.

1. Expand regulatory floodplain

The Flood Insurance Rate Maps (FIRMs) that communities use to regulate development in flood-prone areas do not accurately account for changing flood risks as a result of sea-level rise because these maps are developed using only *historical* flood data. As shown by the flood vulnerability studies for the Eastern Shore of Maryland, SLR will increase flood elevations and the lateral extent of flooding in ESCAP communities. And because all of the ESCAP communities currently base floodplain regulations on FIRMs, existing and new development in floodplains will not be designed or sited to account for these increasing flood risks. Communities can counteract these deficiencies in the floodplain maps by expanding the lateral extent of the regulatory flood zone boundaries and requiring that more structures comply with local floodplain regulations. In addition to the 1-percent chance floodplain, FIRMs also designate the 500-year floodplain or 0.2-percent chance floodplain (i.e., areas with a 0.2 percent chance of flooding), and ESCAP jurisdictions now have SLR maps that could potentially be used for regulatory purposes (however, jurisdictions should carefully design their approach to avoid potential legal risks, discussed below).

Options:

- **Use the 0.2-percent chance floodplain:** For jurisdictions where the 0.2-percent chance floodplain is a good proxy for increasing flood risks as a result of sea-level rise, expanding floodplain regulations to the 0.2-percent chance floodplain may be the simplest approach. By doing so, new development and redevelopment of “substantially improved”² structures in the 0.2-percent chance floodplain will be required to comply with the design standards included in the local floodplain ordinance, such as requirements that structures be elevated or floodproofed (to the 0.2 percent chance flood elevation or other design flood elevation). This will ensure some additional measure of flood protection for structures that are at current risk of flooding and that will be subject to increased risks in the near-term as SLR increases flood heights and drives flooding further inland. To fully implement this option, however, Maryland communities may need to work with state agencies or FEMA to make flood elevation transects available for the 0.2-percent chance flood event. Although FIRMs designate the boundaries of the 0.2-percent chance floodplain, in most cases the maps do not establish flood elevations for the 0.2-percent chance flood event. This information often must be found in the Flood Insurance Study for the jurisdiction.

Baltimore, Maryland amended their floodplain ordinance (in 2014) to extend floodplain regulations to the 500-year floodplain and added new flood resilience measures. The ordinance:

- requires two feet of freeboard above the 1-percent chance flood elevation for new and redeveloped structures in the riverine floodplain (3 feet for critical facilities),
- designates a Flood Resilience Area in the coastal floodplain requiring structures to be elevated to two-feet above the highest identified elevation in the city’s Flood Insurance Study (and 3 feet for critical facilities),
- requires elevation of plumbing and electrical systems, and
- prohibits new or substantially improved structures in the city’s floodway.³

Cedar Falls, Iowa, in the aftermath of catastrophic flooding in 2008, amended its ordinance to extend floodplain regulations to the 0.2-percent chance floodplain, to prohibit new subdivisions in the 0.2-percent chance floodplain, and to restrict fill and prohibit letters of map revision in the 0.2-percent chance floodplain. The town also coupled these regulatory programs with a buyout program to purchase frequently flooded homes and to create green space to reduce flood risks.⁴

- **Establish a community-wide floodplain:** Some of the smaller municipalities in the Eastern Shore could consider applying floodplain regulations to the whole community. This approach better accounts for changing flood risks from sea-level rise, but also mitigates the “in vs. out” challenge posed by current floodplain regulations – where a line on a map determines whether you are “in” the floodplain (and therefore need to mitigate flood risks to the property) or “out” of the floodplain (and can build at grade, but may still face risk of flood damage during more intense storm events).
- **Establish a “SLR Floodplain”:** Jurisdictions could also adopt SLR maps (e.g., 100-year floodplain in consideration of 2050 sea-level rise estimates) as their regulatory floodplain map (or even as an advisory option in the short-term). This approach may be a little more technically challenging because the jurisdiction will need to ensure that the maps are readily available to inform permitting officials, developers, and property owners. Elevation requirements will also need to be established for areas outside of FEMA mapped flood zones. Jurisdictions will also want to adopt findings to establish the public health, safety and welfare justifications for these higher standards (discussed below).

Durham, New Hampshire established an “Advisory Climate Change Risk Area” to identify waterfront areas vulnerable to future threats from climate change and projected sea-level rise (of up to 3.9 feet). The town recommends (but does not require) that new development and substantial improvements to existing structures elevate structures two feet above the highest grade of the site to account for future sea-level rise and to apply other resilient design best practices.⁵

Example ordinance language

- **500-year floodplain:** The general requirements of this section apply to all development proposed within the 500-Year Floodplain. The five-hundred year flood is defined as the flood that has 0.2 percent chance of being equaled or in any given year. The five-hundred year floodplain (500-Year Floodplain) is defined as the areas subject to the 500-year (0.2 percent chance) flood that have a moderate risk of flooding and are located outside the community’s delineated special flood hazard area. See also definitions of flood zones Zone B and Zone X (shaded).

- **Flood Resilience Area:** (1) The Flood Resilience Area comprises those lands within a tidal floodplain that: (i) due to hurricanes, tropical storms, and the rising Bay are subject to a 0.2 percent chance of flooding in any given year; and (ii) lie in areas where detailed study data are available. (2) The Flood Resilience Area appears: (i) on the Flood Insurance Rate Map, as that part of the tidal floodplain that is designated Zone X (“areas of 0.2 percent annual chance flood”); and (ii) in the Flood Insurance Study’s {“Transect Data”}, under the column heading “0.2 percent annual chance”⁶

Considerations

CRS:

- Under **Activity 412.a**, communities can receive up to 350 points for conducting new studies of flooding that meet FEMA standards, including in areas not mapped by FEMA or for areas where higher standards above FEMA requirements will be implemented.
- Under **Activity 412.c**, communities can receive up to 60 points when a new study is reviewed by an independent entity (usually a state agency) for quality assurance.
- Under **Activity 412.d**, communities can earn up to 200 points for developing and making accessible floodplain maps developed to one or more higher standards.
- Under **Activity 442.a**, communities can receive up to 160 points for creating and maintaining map systems that improve a community’s access to and quality of data and update flood and FIRM data.⁷

Legal:

In enacting new higher standards, particularly where the jurisdiction is expanding flood zone boundaries beyond FEMA delineated flood zones, local governments will want to add findings to their floodplain ordinance establishing the public purpose served by taking these actions. In particular, jurisdictions will need to ensure compliance with federal and state Constitutional substantive due process protections for property owners, where courts require that regulations be “rationally related to a legitimate public interest.”⁸ Courts are typically very deferential to local governments’ policy decisions and only prohibit irrational decisionmaking. In order to insulate new regulations from legal challenges, local governments should explicitly state the rationales for amending the floodplain ordinance (i.e., the public safety, health and welfare purposes served by enacting regulations to address future impacts from SLR). Findings explain the public purposes served by the regulatory changes and anticipate legal challenges. In the event a law is challenged, the court will look to the findings in the ordinance to evaluate the reasonableness of the law and to determine whether the law is consistent with constitutional protections.

Local regulations that use established flood zones (i.e., 0.2-percent chance flood zones) to add protections for increased flood risks from SLR are likely to survive any substantive due process challenge. These areas have a risk of flooding as demonstrated by the floodplain models used by FEMA to develop Flood Insurance Studies and FIRMs for the jurisdiction. However, where a jurisdiction uses future sea-level rise maps that include areas outside of flood zones depicted on FIRMs, policymakers will want to articulate clear public policy rationales for warranting a more precautionary approach to regulating for future flood risks (as adopting sea-level rise maps could potentially impose floodplain regulations on structures that have no past history of flooding).

Maryland courts have said that local governments may consider the needs of the “reasonably foreseeable future.”⁹ The test articulated by the court seems to permit consideration of future conditions so long as they are sufficiently documented. Sea-level rise will clearly increase risks in tidally influenced floodplains, thus justifying increased regulations in FEMA mapped flood zones. This sea-level rise vulnerability study for Eastern Shore communities also helps to demonstrate the scientific basis and modeling that was completed to assess future flood risks in

ESCAP jurisdictions. Language from this study and other state studies (such as updated sea-level rise projections developed by the Scientific and Technical Working Group of the Maryland Climate Change Commission¹⁰) could be used to develop model findings to support adoption of regulations to enhance resilience of the built environment to future sea-level rise.

Example ordinance language

Findings:

- “Coastal systems are inherently dynamic; coastal landforms shift with changing conditions of water levels, waves, and winds. Changes to coastal landforms will increase risks to coastal development as sea levels rise and natural flood protections are eroded away or drown. Development in coastal high hazard areas¹¹ is especially vulnerable to increased impacts because it is subject to wind and wave damage from storm events, higher base flood elevations, and inundation.
- Under any scenario of increasing sea levels, development in coastal high hazard areas will increase the harm of development to coastal ecosystems as coastal resources are squeezed by rising seas on one side and coastal development on the other. Rising sea levels will also expose development in coastal high hazard areas to increased risk of damage, increased risk that damaged structures will cause collateral impacts to adjacent structures, and risks to rescue personnel servicing the development.¹²
- FEMA flood maps do not take into account any amount of sea level rise. They are predictions based on historic conditions. The draft FEMA maps are a result of sophisticated engineering modeling, but are based only on historic flood data. FEMA maps do not consider future increases in sea level and population growth and, therefore, may under-represent risk in some, if not all, areas.
- Tide gauge data for Maryland shows that the median rate of relative sea-level rise has accelerated by 0.15 to 0.18 mm/yr² between 1969 and 2014.
- The latest sea level rise projections for Maryland from the University of Maryland Center for Environmental Science suggest a likely range of 0.8 to 1.6 feet of sea-level rise by 2050 and up to 5.2 feet by 2100.
- Rising seas will cause low-lying coastal areas to become inundated and may exacerbate erosion in some areas. Another key predicted impact of a warming climate is an increase in the frequency and intensity of coastal storms. Rising seas will drive storm surge further inland and may increase base flood elevations.

Purpose:

- To prevent loss or diminution of coastal resources and their natural beneficial functions that contribute to storm and flood damage prevention or pollution prevention, including by allowing them to migrate landward in response to relative sea level rise.
- To restrict or prohibit development in known hazard areas where the provision of public safety may be jeopardized or where public safety personnel may be endangered, thereby minimizing the need for rescue relief efforts associated with flooding and generally undertaken at the expense of the general public and to enable safe access to and from coastal homes and buildings for homeowners and emergency response personnel in order to effectively provide public safety services.
- To be fiscally responsible by minimizing expenditures of public funds for costly flood control and damage recovery projects.
- To help maintain a stable tax base by providing for the sound use and development of flood prone areas, which could minimize prolonged business or economic losses and interruptions caused by structural damage and/or flooding.
- To reduce or prevent public health emergencies resulting from surface and groundwater contamination from inundation of or damage to sewage disposal systems and storage areas for typical household hazardous substances.

- To maintain vegetative buffers to coastal wetlands and water bodies so as to reduce and/or eliminate runoff, and other non-point source discharges of pollutants in order to protect coastal water quality and public health for reasons including the propagation of fish and shellfish, and for recreational purposes.
- To preserve and enhance the community character and amenities of [jurisdiction] and to conserve natural conditions, wildlife and open space for the general welfare of the public and the natural environment.¹³

2. Increase flood resilient design standards

Resilient design techniques require that structures be sited, designed, and constructed to be more resilient to flooding impacts in the face of increasing flood risks (increased flood heights and more frequent flooding). Resilient design standards include freeboard¹⁴ or floodproofing requirements¹⁵ (for non-residential structures), building height and size limits, requirements to elevate mechanical and electrical utilities, setback requirements, among other standards. Stormwater management practices can also be used to reduce flood risks from rain-driven flooding and to reduce pollutant runoff into rivers, streams and the Chesapeake Bay. Resilient design practices can reduce flood damages for individual structures and reduce the impacts of flooding on the broader community. For example, where critical infrastructure is designed and sited to be more resilient to flooding, these facilities can maintain function and continue to provide services during emergencies.

Options:

Common resilient design standards that are often incorporated into local floodplain ordinances include the following options:

- **Apply V-zone requirements in Coastal A-Zones:** Many ESCAP jurisdictions have already implemented FEMA’s recommended approach by requiring V-Zone design standards in Coastal A-Zones (“CAZ”, areas where FEMA has delineated the Limit of Moderate Wave Action (LiMWA) on the community’s FIRM) or by adopting updated building codes developed by the International Code Council.¹⁶ This extends V-zone requirements to larger areas of the coast to ensure that structures are designed to withstand damage from wind and waves. Structures must be elevated on pilings or columns on open foundations. Other communities, like Kent County, have gone farther to limit new development in CAZ (see ordinance language below). For communities that have not yet applied V-Zone requirements to their Coastal A-Zones, this would be a simple first step for ensuring that development in the most flood-prone areas is designed to be resilient to wave action and storm surges.

Example language: Coastal high hazard areas (V-Zones and Coastal A Zones): (a) New development shall not be permitted in the Coastal High Hazard Area where the action of wind and waves, in addition to tidal flooding, is a factor unless the applicant demonstrates that: (i) No reasonable alternative exists outside the Coastal High Hazard Area; (ii) The encroachment into the Coastal High Hazard Area is the minimum necessary; (iii) The development will withstand the 100-year wind and water loads without damage; (iv) The development will not create an additional hazard to existing structures; and (v) Any natural dune system will not be disturbed.¹⁷

- **Restrict critical facilities in flood hazard areas:** ESCAP jurisdictions can restrict the building of new or redevelopment of critical facilities in the 1-percent chance or even 0.2-percent chance floodplain. This will ensure that assets that must remain operational during extreme weather events (hospitals, fire and police stations, etc.) are sited in locations where they are at less risk to flood impacts.

Example language: Construction of new or substantially improved critical facilities¹⁸ shall be prohibited in the [special flood hazard area (SFHA, one hundred-year floodplain)]. Construction of new or substantially improved critical facilities shall be, to the extent possible, located outside the limits of the [five hundred-year floodplain]. Construction of new critical facilities may be permissible within the [five hundred-year floodplain], but outside of the [SFHA], if no feasible alternative site is available. Critical facilities constructed within the [500-year] shall have the lowest floor elevated [three] feet at or above the level of the base flood elevation [or one-foot above the approximate five hundred-year flood elevation] at the site, [whichever is greater]. Floodproofing and sealing measures must be taken to ensure that toxic substances will not be displaced by or released into floodwaters. Access routes elevated to or above the level of the base flood elevation shall be provided to all critical facilities to the extent possible.”¹⁹

Definition of Critical Facilities: Buildings and other structures that are intended to remain operational in the event of extreme environmental loading from flood, wind, snow or earthquakes. [Note: See Maryland Building Performance Standards, Sec. 1602 and Table 1604.5.] Critical and essential facilities typically include hospitals, fire stations, police stations, storage of critical records, facilities that handle or store hazardous materials, and similar facilities.

- **Require freeboard and floodproofing above base flood elevation:** Currently, NFIP minimum standards require that residential structures be elevated to at or above the base flood elevation (BFE). Freeboard goes beyond the NFIP minimums by requiring that structures are elevated to a specified amount above the BFE – often called the “design flood elevation”. Many ESCAP jurisdictions already require 2 to 3 feet of freeboard. For non-residential structures, structures can be required to be constructed with flood resistant materials or protected with sealant up to the design flood elevation (except Maryland state law prohibits dry floodproofing in tidal floodplains).²⁰ If jurisdictions extend floodplain regulations to the 0.2-percent chance floodplain, they could instead require structures to be elevated to the 0.2-percent chance flood level (or 0.2-percent chance plus freeboard) for new and substantially improved structures.

Example language: Flood Protection Elevation: The elevation of the regulatory flood shall be considered to be the 500-year (0.2%) flood elevation. Flood insurance policies and insurance rates may continue to be evaluated and established based on federal and state laws and regulations. For all other flood regulatory purposes, however, the regulatory elevation shall be the 500-year (0.2%) flood elevation.²¹

- **Require elevation of mechanical and electrical equipment, where feasible:** Elevating mechanical and electrical systems in structures (e.g., air conditioners, circuit breaker panels) can protect these expensive systems from damage during flood events and ensure that systems remain operational during flood events.²²

Example language: Electrical, mechanical and plumbing systems: electric, plumbing, and mechanical systems and their attendant components and equipment, including heaters, furnaces, generators, heat pumps, air conditioners, distribution panels, toilets, showers, sinks, ductwork, and other permanent electrical, plumbing, or mechanical installations, are only permitted at or above the flood-protection elevation. Exceptions: This section does not apply to a system that is designed and installed, in accordance with ASCE 24, to prevent water from entering or accumulating within its components and to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the flood-protection elevation.²³ Definitions: “ASCE 24” means ASCE/SEI 24, “Flood Resistant Design and Construction” (American Society of Civil Engineers).

- **Prohibit fill or require compensatory storage:** The placement of fill impairs natural floodplain function, including the ability of the floodplain to manage floodwater, improve water quality and provide natural habitats. By prohibiting fill or requiring mitigation where fill in the floodplain is unavoidable, communities can reduce the negative effects to natural floodplain function.

Example language:²⁴

- **Prohibitions on Fill:** Fill shall not be used to elevate structures within the special flood hazard area. (a) Minor grading, and the placement of minor quantities of fill, shall be permitted for landscaping and for drainage purposes under and around buildings and for support of parking slabs, pool decks, patios and walkways. (b) Site preparations shall not alter sand dunes unless an engineering analysis demonstrates that the potential for flood damage is not increased.
- **Compensatory Storage:** Fill within the area of special flood hazard shall result in no net loss of natural floodplain storage. The volume of the loss of floodwater storage due to filling in the SFHA shall be offset by providing an equal volume of flood storage by excavation or other compensatory measures at or adjacent to the development site.

- **Restrict heights and sizes of structures in flood hazard areas:** ESCAP jurisdictions can also limit the size and height of new and redeveloped structures in the floodplain to reduce the size and density of development in harm's way. By limiting the size of structures in the floodplain, local governments can reduce the number of people in danger, reduce collateral damage from destroyed structures, and allow for structures to be more easily relocated as natural flood buffers erode and become inundated.²⁵ Jurisdictions should also consider exempting structures from height or other regulations, where the structure is being elevated to enhance flood resilience and where structural elevation will conflict with height restrictions in local codes.

New York City – After Hurricane Sandy, the City waived height and setback requirements to allow homeowners to comply with higher building elevation requirements adopted to ensure that flood-damaged structures could be rebuilt to higher standards to account for future flood risks from sea-level rise. The waivers were needed because height limits and setback requirements in the City's zoning law hindered the ability of some property owners to elevate structures after the storm.²⁶

Considerations

CRS:

- **Coastal A Zones:** Under **Activity 432.k**, communities can earn up to 500 points for applying V-zone requirements in CAZs.²⁷
- **Critical Facilities:** Under **Activity 432.f**, communities can earn up to 80 points for imposing higher regulatory standards to critical facilities.
- **Freeboard:** Under **Activity 432.b**, communities can earn up to 500 points for establishing a 3 foot freeboard requirement and prohibiting fill.
- **Fill Restrictions:** Under **Activity 432.a**, communities can earn up to 280 points for prohibiting fill in the floodplain.

3. Track cumulative substantial improvement

Floodplain ordinances typically require that nonconforming structures be brought into compliance with current regulations when an existing structure is “substantially improved” (including rebuilt after damage) where the cost of the improvement will exceed 50 percent of the structure’s pre-construction market value. However, this allows structures to be improved or repaired, sometimes multiple times, without incorporating flood risk mitigation measures, when the damage or improvement to the structure is less than 50 percent of the value. By tracking cumulative substantial improvements (over a specified period, typically 10 years), jurisdictions can require that new mitigation requirements are incorporated when a structure is incrementally improved or repaired over a period of years, when the total cost of the improvement costs over the 10-year period exceed 50 percent of the structure’s fair market value.

Considerations

CRS: Under [Activity 432.d](#), communities can earn up to 90 points for requiring compliance with floodplain requirements for cumulative substantial improvements.

Example language:²⁸

- Substantial Damage (cumulative substantial damage): Damage of any origin sustained by a building or structure on two (2) or more separate occasions during a 10-year period for which the cumulative costs of restoring the building or structure to its before damaged condition would equal or exceed 50 percent of the market value of the building or structure before the damage occurred. Also used as “substantially damaged” structures.
- Substantial Improvement (cumulative substantial improvement): Any reconstructions, rehabilitations, additions or other improvements of a building or structure over a ten-year period, the cumulative costs of which equals or exceeds 50 percent of the market value of the building or structure before the start of construction of the improvement. The designated 10-year period begins at the date of the initial improvement to the structure. *Source: Adapted from Maryland Model Floodplain Ordinance*
- Substantial improvement: “Incremental improvements shall be considered substantial improvements if within a five year period, they cumulatively meet the definition of substantial improvement.” The term “substantial improvement” includes structures that have incurred “substantial damage” or “repetitive loss,” regardless of the actual repair work performed. The term “substantial improvement” does not, however, include either: costs of alterations or improvements whose express purpose is the mitigation of future storm damage, provided they do not exceed 50 percent of the market value of the structure over any one-year period; examples of such mitigation include the installation of storm shutters or shatterproof glass, strengthening of roof attachments, floors, or walls, and minor floodproofing. (1) Storm mitigation improvements may be made during the same year as other improvements, but the total cost of improvements of both types that are made over any one-year period may not exceed 50% of the market value of the structure. (2) The annual allowance for storm mitigation improvements is not applicable to any costs associated with a lateral or vertical addition to an existing structure or to the complete replacement of an existing structure.

4. Restrict or condition new subdivisions

Subdivision regulations can be used to limit new development in flood-prone areas and encourage developers to concentrate (or “cluster”) development in areas of lower flood risk, helping to preserve open space and natural floodplains.²⁹ Subdivision permitting can be used to require clustering of development in specific areas of a subdivision, the permanent preservation of natural floodplains, and the elevation of roads and utilities that service new subdivisions.

Augusta, Georgia updated its comprehensive zoning ordinance in 2003 to allow conservation subdivisions (Section 28 D). The city created this ordinance to balance flood resilience and rural growth by limiting development in vulnerable floodplains, wetlands, and riparian habitats while permitting larger “cluster” developments. The subdivision regulations apply to projects with a minimum area of 20 acres and require the permanent protection of at least 40 percent of the overall acreage as green or open space. Additionally, approved conservation subdivisions must include a greenspace management plan and provide for the use, ownership, maintenance, and permanent protection of the newly-created green or open space (i.e., by deed restriction or conservation easement).

Considerations:

CRS: Under [Activity 422.f](#), communities can earn up to 250 points for adopting regulations setting aside flood-prone portions of new developments as open space. This credit recognizes a number of regulatory tools that encourage keeping areas of the floodplain undeveloped. Points are distributed on a sliding scale, where maximum credit is given when the entire floodplain in a subdivision is set aside as open space (250 points). Regulations that permit cluster development through subdivisions receive 25 points.

5. Incorporate resilience in Critical Area requirements

The Maryland the Chesapeake Bay Critical Area law, adopted in 1984 by the General Assembly, was the centerpiece of a suite of initiatives aimed at improving the water quality of the Chesapeake Bay; the Act was expanded in 2002 to include the Atlantic Coastal Bays.³⁰ The goals of the Critical Area law are to minimize the negative impacts of new development on water quality, to conserve fish, wildlife and plant habitats, and to establish land use policies that accommodate development even though it may create adverse environmental impacts.³¹ The law is implemented on a cooperative basis, whereby local governments establish programs through local regulations but are subject to state-level oversight from the Critical Area Commission. The Act requires local governments to create and enforce a local regulatory program within the Critical Area (areas within 1,000 feet of mean high water) pursuant to state-developed criteria.³² The city of Baltimore, 16 counties and 47 municipalities have each enacted a local Critical Area Program designed to comply with state requirements.

The Act required local governments to map three types of development areas based upon their use and intensity of development as they existed at the time of Program adoption. The three designations are: (1) Intensely Developed Areas (IDA) – areas identified by their concentrated development and little natural habitat. They are composed of at least 20 adjacent acres of primarily residential, commercial, industrial and institutional land uses. Additional development is not restricted, and improving water quality through the implementation of stormwater management practices is the main goal within IDAs. (2) Limited Development Areas (LDAs) – areas characterized by low to moderate amounts of development intensity with some natural areas and habitats. Development and redevelopment is restricted by a 15% lot coverage limit of a lot, parcel or subdivision, although that number may be higher for small grandfathered lots. Clearing of trees, forests and developed woodlands is also limited and mitigation required for clearing in order to maintain and increase forest cover, which provides a variety of environmental benefits. (3) Resource Conservation Areas (RCA) – areas characterized by natural

environments and limited intensity of development. Dominant land uses include agriculture, forestry, wetlands, barren land and open space. The provisions of LDAs apply to RCAs, in addition to a one dwelling per 20 acre density requirement in order to minimize higher densities of development in these land resources that must be protected and enhanced. New commercial, industrial and institutional uses are prohibited in the RCA without growth allocation.

In addition to designation of the three Critical Areas described above, a minimum 100-foot Buffer to the shoreline is required and regulated. It may be expanded beyond 100 feet, for the presence of steep slopes, hydric soils, or for a new subdivision in the RCA. The Buffer is intended to be a naturally vegetated area that protects development and natural environments from the other, and to provide a final filtration opportunity before runoff reaches the Bay. A functioning Buffer may also stabilize the shoreline and therefore prevent or reduce erosion, increase habitat, improve water quality, and dampen storm surge impacts. Recognizing the significance of this valuable resource, development and disturbance in the Buffer are not permitted. In the limited circumstances in which it occurs, mitigation is required at varying ratios for specific activities. The mitigation is provided in the form of trees, shrubs and grasses and may help to reduce erosion, dissipate wave energy, capture some flood waters and reduce pollutants from entering the Bay. Some Buffers are mapped specifically as Buffer Modified Areas (BMAs, also known as BEAs and MBAs) in acknowledgement of existing shoreline development and reduced Buffer capacity. BMAs have varying setbacks and mitigation requirements that differ from traditional Buffer requirements.³³

To address flood risks and enhance resiliency opportunities within their Critical Area programs, ESCAP jurisdictions could consider the following ideas:

- **Evaluate current Critical Area designations and their vulnerability to coastal hazards** – Currently, development is most limited within the RCA, thus directing growth towards the LDA and IDA. Those designations are based on growth patterns as they existed in 1985. A jurisdiction could consider evaluating these areas for coastal vulnerability and assess whether those vulnerabilities may justify a change in those designations. The legal mechanisms to do this type of analysis and change would need to be explored with the Critical Area Commission. This report makes no determination as to the feasibility of this suggestion.
- **Enhance and revise Buffer requirements to address coastal vulnerability** – As discussed above, the 100-foot Buffer is expanded under specific, defined circumstances in order to reduce erosion and protect both the environment and sensitive habitats and development. The Buffer is protected through very restricted development and enhanced through mitigation requirements. State regulations lay out very specific requirements related to development, mitigation and planting. A local jurisdiction has the authority to propose alternatives to those requirements if they can demonstrate they are at least as effective as the regulations and those requirements are approved by the Commission. A local jurisdiction may consider several innovative ways to utilize Buffer requirements for coastal resilience purposes including altered planting requirements that enhance resiliency of the Buffer and other ideas.
- **Enhance or expand stormwater management practices** – Currently, state regulations only necessitate that local jurisdictions require a 10% phosphorous reduction, and thus stormwater management practices, for development in the IDA. Flooding and water retention is a concern in all Critical Area designations, however, especially with increased flooding events and sea level rise. Local jurisdictions may consider expanding this requirement to designations other than the IDA in order to capture greater amounts of water and thus possibly reduce damage potential and nuisance flooding. In an effort to address their nuisance flooding problem, the Town of Oxford has already adopted and implemented this requirement in all designations.

- **Increase flexibility of uses of Fee-In-Lieu** – Local jurisdictions collect fee-in-lieus (FILs) of mitigation for a variety of activities when mitigation cannot be met on-site. Those monies are then meant to fund projects of the same type somewhere in the jurisdiction for which it was collected. For example, if Buffer mitigation cannot be planted on the impacted site, funds are collected to plant in the Buffer elsewhere. A jurisdiction might explore the idea of utilizing their collected FILs more creatively, in order to meet both the requirement for which it was collected as well as the growing need for funding of landscape-scale resiliency projects that could benefit the community rather than a single property. Additionally, a jurisdiction might consider partnering with others in order to implement multijurisdictional projects for shoreline enhancement. Neither of these ideas have been pursued yet, and the legal implications would need to be researched first. And as the previous examples specified, coordination and multiple levels of approval would follow. For example, where jurisdictions have updated the Critical Area program, FILs can be used for water-quality enhancement programs outside of the Critical Area boundaries, so long as they are located within a designated “Green Infrastructure Network.”

The Critical Area Commission has been working closely with local jurisdictions on a volunteer basis to assess coastal vulnerabilities and resilience opportunities within their Critical Areas. The resulting information is then used to identify potential strategies to incorporate into programs. The Town of Oxford was the first jurisdiction that the Commission collaborated with for these purposes, resulting in several programmatic changes after a community assessment, as well as a coastal hazards risk and opportunity mapping tool and a Coastal Resilience Planning Guide for Critical Area planners. Other towns have since completed similar processes to identify potential next steps, including expansion of Buffer Modified Areas in developed areas that are not vulnerable to SLR and storm surge, or simply having conversations regarding other enhancement opportunities such as creating open space or implementing a tree canopy program. The Commission has also made available illustrations that demonstrate the importance of a planted Buffer for resilience purposes, and planting plans for both hardened and natural shorelines.

6. Establish a Transferable Development Rights (TDR) program

A Transferable Development Rights (TDR) programs could be developed to enable landowners in high-risk areas to sell their development rights to support development in higher ground areas, with less flood risk. To establish a TDR program, ESCAP jurisdictions would need to designate two areas (1) “sending areas” that are a priority for preservation as natural areas or floodplains (i.e., areas with current or future high-flood risk, valuable natural resources, and areas with high potential for future development or subdivision) and (2) “receiving areas” that are appropriate for additional growth (i.e., higher ground areas with lower flood risk and existing supporting infrastructure and services). The jurisdiction would then need to adopt a TDR program allowing landowners in “sending areas” to sever and sell their development rights, where they agree to preserve flood-prone lands as undeveloped open space. Developers in “receiving areas” can then use those development rights to increase densities and intensities of use.³⁴ In this way, TDR programs create economic incentives for the preservation of flood-prone areas by creating a market for the sale of development rights of vulnerable lands, which can then be used to build additional densities or sometimes more intense uses in “higher ground,” more developed areas. To calibrate the market and create needed incentives for the purchase and sale of development rights, jurisdictions often need to amend zoning ordinances to limit allowable densities in both sending and receiving areas.

A TDR program could also be aligned with a jurisdiction’s local Critical Area program. The RCA has a density limit of 1 dwelling per 20 acres; this restriction could be used as a way to both preserve land in perpetuity and to encourage the purchase of development rights to allow for greater development. There is already existing authority within regulation to encourage local jurisdictions to develop TDR programs in the RCA.

Alternatively, a Purchase Development Right (PDR) program could be created to designate “sending areas” where the purchase of development rights is allowed to help ensure that undeveloped natural resource areas remain undeveloped. Unlike a TDR program, no “receiving areas” are needed and no additional growth is contemplated in more developed areas.

Pine Barrens TDR Program – A successful TDR program was created in a more rural region of Long Island New York to protect water quality and the ecologically sensitive pine barrens ecosystem. The TDR program was created in Suffolk County and spans three townships (Brookhaven, Riverhead, and Southampton). The program has preserved 60,000 acres of habitat and open space and directed new development to “compatible growth areas” around the townships that have existing development, infrastructure and services. The Pine Barren program, however, is unique in that it was formed by state legislation which created an independent Commission charged with developing and implementing a Comprehensive Land Use Plan that designates preservation areas (“sending areas”) and growth areas (“receiving areas”). Elected officials from each town are represented on the Commission board.³⁵

Single jurisdiction TDR programs have also successfully been used to preserve agricultural lands in ***Montgomery County, Maryland*** and to limit development on highly erosive lots without access to roadways or septic in ***Malibu, California***.³⁶

Considerations:

CRS:

- Under ***Activity 422.e***, jurisdictions can earn up to 70 points for regulations that direct development away from floodplains (such as transfers of development rights or density bonuses), credit is determined based upon the amount of the regulatory floodplain covered by open space incentives.
- Under ***Activity 422.a***, up to 1,450 points can be earned for open space preservation within the regulatory floodplain. Land must be permanently preserved as open space by policy or deed restriction in writing, and the credits earned are impact-adjusted based upon the amount of open space that is preserved in the regulatory floodplain. Active farmland may not be creditable. Additional credits are earned if the land is subject to a deed restriction that prohibits new buildings (422.b) or restored to enhance natural floodplain function (422.c). Low-density zoning restrictions can also be credited under Activity 422.f

Administrative: It can be difficult to create the needed market incentives for the purchase and sale of development rights in more rural communities, where there is not a lot of development pressure and where there is not a strong market for additional density or more intense uses. TDR programs have been most successful in metropolitan regions where strong market incentives can be created for preserving land in more rural regions by driving growth to urban centers surrounding transit and other services, such as in Montgomery County.

Political: Because TDR programs require zoning changes to create the needed market incentives for the purchase of development credits, such programs can be politically challenging to implement because residents often object to changes in allowable densities. Additionally, to create the appropriate incentives, Eastern Shore communities may need to create a regional TDR program to shift development to appropriate “high-ground” urban centers. This may also be politically challenging because one jurisdiction may lose the tax base generated by shifting development to a neighboring jurisdiction. Revenue sharing structures could be considered to mitigate concerns about lost tax base.

7. Non-regulatory options

Regulatory approaches for enhancing flood resilience can also be aligned with non-regulatory programs and policies, including incorporating flood resilience into local plans and capital investment decisions. The following strategies could be used to supplement regulatory approaches in ESCAP communities:

- **Identify funding sources and prioritize high-risk areas for buyouts:** ESCAP jurisdictions can identify contiguous parcels that are a priority for acquisition and restoration. Priority properties could include: repetitive loss structures, properties that could provide space for migration of important ecosystems, and properties that could be restored to enhance natural flood risk reduction, open space, or habitats. Land-use or hazard-mitigation plans could be used to analyze and prioritize properties for potential acquisition. Doing so will help jurisdictions direct resources (such as FEMA mitigation grants) when funding becomes available. Jurisdictions could also consider different incentives (and find appropriate funding sources) that could be offered to buy out contiguous properties and to encourage owners in high-risk areas to opt for buyouts when structures are damaged during flood events. By buying out continuous properties, local governments can restore lands to maximize flood protection for upland developments and discontinue services to those areas to increase cost savings. Where jurisdictions have properties that are subject to tax liens, rather than sell properties, jurisdictions could deed restrict properties in high flood risk areas and permanently conserve these properties as open space (while earning CRS credits).

Charlotte-Mecklenburg Stormwater Services, North Carolina is using stormwater utility fees with federal mitigation funding (FEMA mitigation grants) to acquire repetitive loss structures and restore natural floodplain function. These buyouts help reduce flood losses, improve water quality, improve habitats, and provide recreational amenities for residents. The Service estimates some of the buyouts of larger apartment complexes have helped to avoid future losses that would have been 400 percent higher than the costs of the buyouts.³⁷ A “quick buy” program was created to facilitate buyouts of structures in the immediate aftermath of damage from destructive flooding; and an “orphan” property program was created to use stormwater fees to buy out properties that do not meet federal grant criteria but that are adjacent to other properties that are being bought out with federal funds. The goal of the orphan property buyout program is to encourage the last homeowners living in a high-risk neighborhood to move so that the site can be restored to its natural floodplain function and services can be discontinued to the area, increasing the cost savings to the City and County.³⁸

The New York Governor’s Office of Storm Recovery designated “Enhanced Buyout Areas” after Hurricane Sandy – areas that were substantially damaged by the storm and that are most susceptible to future flood risks. In these areas the state offered property owners 5 to 15 percent above fair market value for their property to encourage these owners to opt for a buyout and to encourage whole community buyouts so that bought out lands could be restored to enhance flood-risk reduction benefits for upland neighborhoods and services could be discontinued in those areas. The state also offered incentives for property owners that resettled in the same county to minimize the financial implications of buyouts on local governments.³⁹

- **Acquire conservation easements:** ESCAP jurisdictions can similarly identify parcels that are a priority for conservation easements (e.g., agricultural lands that have high potential for sale/subdivision where conservation easements can diversify income stream and help landowners preserve floodplain to reduce flood risks to farmland and adjacent properties). Agricultural easements can also be used to enhance flood resilience by including easement provisions that prohibit development of any structures or accessory structures in the floodplain. A number of state easement purchase programs can be used to purchase

conservation easements, including the Maryland Agricultural Land Preservation Foundation (MALPF)⁴⁰ and the Maryland Rural Legacy Program.⁴¹ Alternatively, under the Maryland Environmental Trust (MET), easements may also be donated in exchange for income tax or property tax credits.⁴² ESCAP jurisdictions could also explore conservation easements to preserve portions of properties with forested floodplains and intact hydrology systems in exchange for property tax credits offered under these programs.

North Carolina used conservation easements as part of a larger voluntary buyout program in the aftermath of Hurricane Floyd in 1999, in which the state suffered over \$1 billion in losses to crops, livestock, and farm buildings. Under the North Carolina Swine Floodplain Buyout Program,⁴³ the state invested more than \$18 million in purchasing conservation easements on 43 farms in the 100-year floodplain, spanning 1,218 acres and 106 waste lagoons. Using funds from the state's Clean Water Management Trust Fund, which provides grant assistance to local governments and nonprofits for the protection of surface waters, the state purchased developmental rights from farmers, placing easements on the land by banning swine farming and lagoons. The program placed a permanent conservation easement on lands containing hog facilities, but permitted continued uses of the property for low-intensity agricultural use, including pasture-based beef production and vegetable farming.⁴⁴ Within the easement area, the program prohibited non-agricultural development, the use of feedlots, and the depositing of swine waste in the easement area. Locations for the storage of hazardous materials and mixing areas were restricted in order to minimize the potential for water pollution from leaks, spills, and flooding. The program also required the implementation of a soil and water conservation plan for the area within the 100-year floodplain; a permanent, 50-foot forested riparian buffer on perennial and intermittent streams; and a 35-foot grassed filter strip on all field ditches. In comparison with Hurricane Floyd, which killed over 21,000 hogs and flooded 55 waste lagoons in 1999, the damage resulting from Hurricane Matthew in 2016 was a fraction of that of Hurricane Floyd, with just under 3,000 hogs killed and 14 waste lagoons flooded, due in large part to a successful state buyout program that has continued in the aftermath of Hurricane Florence in 2018.⁴⁵

- **Fund hazard mitigation projects:** ESCAP jurisdictions can incorporate consideration of sea-level rise in local hazard mitigation plans and use these planning projects to identify priority mitigation projects for implementation with FEMA funding (including funding from the Pre-Disaster Mitigation (PDM) and Hazard Mitigation Grant Program (HMGP)) in the aftermath of a disaster. Mitigation projects can include structural elevation and reconstruction-mitigation grants, or buyouts and acquisitions.

Gloucester County, Virginia manages a flood risk mitigation program that works with the state and federal departments of emergency management to both buy out and acquire and elevate homes that have experienced (or could experience) damage from flooding and storms.⁴⁶ Given the high level of interest in this voluntary program, the county ranks eligible properties according to criteria including benefits to wetlands, creation of open space, and flood risk reduction (e.g., properties that have suffered repetitive losses, residential properties, and properties on previously acquired lots or with access to natural resources, etc.). For acquisitions, the County also requires that all properties comply with an "Open Space Hazard Mitigation Management Plan" (Open Space HMP).⁴⁷ Bought-out properties must meet the Open Space HMP's requirements to preserve open space and mitigate flood risk to life and property.⁴⁸ The Open Space HMP must be consistent with County's Hazard Mitigation Program, Floodplain Ordinance, and Comprehensive Plan.⁴⁹

- **Develop a post-disaster redevelopment plan:** Post-disaster redevelopment plans guide how a community will recover and rebuild after a major disaster. Redevelopment plans can be integrated with hazard mitigation planning and local comprehensive planning. The State of Florida requires post-disaster redevelopment planning and provides best practices and guidance for developing redevelopment plans.⁵⁰ ESCAP jurisdictions or the ESCAP region could develop a post-disaster redevelopment plan to identify opportunities to enhance resilience during disaster recovery efforts and to prioritize use of disaster recovery funding.

Sarasota County, Florida developed a Post-Disaster Redevelopment Plan to guide long-term recovery and redevelopment decisions after a flood or other natural disaster. The Plan was designed to align with other relevant plans and codes including the County’s local comprehensive plan, hazard mitigation, and transportation plan. The Plan identified recovery strategies based upon a vulnerability assessment looking at critical facilities and populations at-risk of impacts from natural hazards. The Plan also evaluated how flood risks will change given sea-level-rise projections for the region. Finally, the Plan includes both pre- and post-disaster action items for four core sectors: housing and planning; infrastructure, public facilities and public safety; economic redevelopment; and environmental restoration. Action items and milestones are also provided based upon different stages of response and recovery include pre-disaster coordination, post-disaster activation, emergency response, short-term recovery, and long-term redevelopment.⁵¹

- **Consider sea-level rise in capital investments and budgeting:** Maryland local governments have been delegated authority to administer their own finances. Capital budgeting and planning requirements are typically specified in local statutes or provisions in the local charter.⁵² Maryland jurisdictions must have capital budgets approved by the local elected bodies, but these budgets can be amended by a vote of the elected officials. There are no state law requirements for capital improvement planning, but local codes or charters may require development of a capital improvement plan to set spending priorities over a period of years (typically 5 to 6 years).⁵³ ESCAP jurisdictions could align capital investment and budgeting to advance flood resilience projects (e.g., setting aside funds to acquire repetitive loss structures, restore wetlands and floodplains to enhance natural flood risk reduction, or to direct investments in higher ground “receiving areas” where jurisdictions want to drive economic development and growth out of harm’s way). ESCAP jurisdictions could also develop routine procedures to examine the potential for flood damages to community assets, such as roads, bridges, culverts, water and sewer lines during regular maintenance and use these assessments in capital improvement planning processes to prioritize high-risk assets for future resilience investments. Opportunities to incorporate adaptation in capital planning and budgeting is explored in more detail in the accompanying report contributed by the University of Maryland Environmental Finance Center.
- **Encourage better alignment of State minimum floodplain standards:** ESCAP jurisdictions could also encourage the State to update and align state minimum floodplain development standards for both coastal and riverine floodplains. Maryland has a one-foot freeboard requirement for its non-tidal floodplains, meaning that structures in these areas must be elevated one foot above the base flood elevation under state law. However, state law does not require freeboard in tidal floodplains—regulation of tidal floodplains is delegated to local governments who have sole discretion to require freeboard.⁵⁴ By aligning state law, local governments can reduce the complexity of floodplain regulations and a state-imposed freeboard requirement will provide political cover to local jurisdictions.

- **Coordinate Regionally on Community Rating System (CRS) activities:** ESCAP jurisdictions participating in the Community Rating System can further enhance flood resilience in their communities by collaborating with other CRS communities to pursue CRS activities at a regional scale. Pathways for regional coordination around CRS include developing a multi-jurisdictional regional Program for Public Information (PPI) to help ESCAP members coordinate messaging around flood risk and resilience, which will increase the CRS credits that ESCAP jurisdiction earn for local community outreach activities. ESCAP members could also adopt a regional coordinator – or “circuit rider” – approach for providing technical assistance to local governments on CRS participation. In sharing information and other resources around the CRS, particularly in areas with similar flood hazards, ESCAP jurisdictions could enhance opportunities to maximize the CRS credits earned in individual jurisdictions while also enhancing regional flood resilience.

The Cape Cod Cooperative Extension⁵⁵ in Barnstable County, MA provides resources on floodplain management to fifteen towns on the Cape Cod peninsula. With funding assistance from the Woods Hole Sea Grant, in 2015 the county hired a regional CRS coordinator to provide both technical and administrative assistance to towns entering or continuing to participate in the CRS. By Spring 2018, nine towns in Barnstable County were participating in the CRS; three towns were waiting on pending applications, and the remaining four towns had expressed interest in joining. In addition to leading the development of regional CRS projects and identifying opportunities for garnering credit for CRS activities, the regional coordinator was able to translate for local elected officials the CRS credits earned into dollars saved, thereby helping to generate buy-in from elected officials on CRS participation.

The Atlantic/Cape May Coastal Coalition in southeast New Jersey recently formed a 13-member multi-jurisdiction Program for Public Information (PPI), one of the largest in the country. Initially formed in the aftermath of Hurricane Sandy to focus on hurricane recovery efforts, the Coalition sought to collaborate on the PPI as part of a larger strategy to increase the region’s flood resilience and to enhance an already-high level of participation in the CRS among jurisdictions in the region. Thirteen municipal members formed a PPI committee to share best practices, identify common outreach topics and flood risk messaging, and catalogue outreach projects. The Regional PPI helped the jurisdictions cultivate partnerships with private entities in the region, like a local utility, that supported the initiative by including flood resilience outreach materials with utility mailers.

Conclusion

Although ESCAP jurisdictions have taken steps to reduce flood risks in their communities, this region will see increasing flood risks with rising sea levels. Additional steps can be taken to reduce risks to people, properties, and local economies. This report includes legal and policy approaches for enhancing flood resilience that were identified as priority options for consideration by ESCAP members, including options for: expanding the regulatory floodplain; increasing flood resilient design standards; tracking cumulative substantial improvements; establishing a TDR program; integrating resilience in Critical Area programs; funding buyouts, conservation easements, and hazard mitigation projects; developing a post-disaster redevelopment plan; considering sea-level rise in capital investments and budgeting; encouraging better alignment of state minimum floodplain standards; and coordinating regionally on CRS activities. This list highlights feasible strategies for reducing flood risks that could be adopted in ESCAP communities to begin to prepare for future sea-level

ENDNOTES

- * This report was written by staff of the Georgetown Climate Center including the Center’s adaptation program director, Jessica Grannis; institute associate, Katie Spidalieri, and climate fellow at Georgetown’s Harrison Institute for Public Law, Jennifer Li. Research and editorial support were provided by Kate McCormick, GCC law fellow, and Georgetown law students, Julius Pak and Nicholas Malin.
- ¹ See Eastern Shore Flood vulnerability studies, completed by Eastern Shore Regional GIS Cooperative director Dr. Michael Scott.
- ² “Substantially improved” includes both improvement and repair of damage where the cost to improve exceeds 50 percent of the structure’s market value. See *e.g.* Anne Arundel County, Md., Code, art. 16, § 1-101 (90) (2005).
- ³ Baltimore, Md. Municipal Code art. 7, §3-1.
- ⁴ <https://www.georgetownclimate.org/files/report/Case%20Studies%20in%20Floodplain%20Regulation%206-3-final.pdf>
- ⁵ Town of Durham, Article XV Flood Hazard Overlay District, Sec. 175-83.C
https://www.ci.durham.nh.us/sites/default/files/fileattachments/planning/page/21491/article_xv.pdf
- ⁶ Adapted from Baltimore’s Floodplain Ordinance at Sec. 2.2(g).
- ⁷ Additional map data can include the following to add up to the maximum 160 points: 20 points for showing SFHA boundaries, corporate limits, streets and parcel or lot boundaries; 26 points for a GIS layer that shows buildings/building footprints and new construction information; 12 points for showing floodways or coastal high hazard areas; 12 points for showing base flood elevations; up to 10 points for including FIRM zone attributes; 10 points for showing the 500-year floodplain elevations or boundaries; up to 12 points for displaying other hazards, such as subsidence or soils unsuitable for septic fields; 8-10 points for including GIS contour lines; 6 points for including updated floodplain data in the tax assessment database; 6 points for overlays for all FIRMS in effect after the date of a community’s application to join the CRS; 8 points for other overlays or data used to support regulation or mitigation programs; 14 points for areas with natural floodplain functions, such as wetlands and riparian habitats; and 14 points for including building elevation data.
- ⁸ This standard derives from judicial interpretations of state and federal constitutional clauses that prohibit governments from “depriv[ing] anyone of life, liberty, or property without due process of law.” U.S. CONST. amend XIV, § 1; see also *Beverly Bank v. Illinois Dep’t of Transp.*, 579 N.E.2d 815, 821 (Ill. 1991). The test, as originally articulated by the Supreme Court of the United States, requires that ordinances must have “substantial relation to public health, safety, morals or general welfare.” *Village of Euclid v. Ambler Realty, Co.*, 272 U.S. at 395 (1926). Although the precise test may vary in name, the basic substance of a court’s analysis is essentially the same across jurisdictions. See generally Ziegler, RATHKOPF’S THE LAW OF ZONING AND PLANNING § 3:17 (4th ed. 2010).
- ⁹ In *Jacobs v. County Board of Appeals for Baltimore County*, the court stated “it is universally recognized, in those jurisdictions where zoning has been established, that zoning is not static, and the zoning authorities, either in adopting a comprehensive zoning plan or in granting a reclassification, may take into consideration needs of the reasonably foreseeable future.” 198 A.2d 900, 902 (Md. 1964). *Jacobs*, 198 A.2d 900, 902 (Md. 1964).
- ¹⁰ The Maryland Commission on Climate Change Act of 2015 requires updated sea-level rise projections and maps of areas that will be vulnerable to flooding for Maryland’s coastal areas every five years. Md. Code, Environment, § 2-1306. Updated projections were published in 2018. University of Maryland, Center for Environmental Science, Sea-Level Rise Projections for Maryland 2018, available at: <https://www.umces.edu/sea-level-rise-projections>
- ¹¹ See definition in Anne Arundel County Ordinance § 16-2-103 for “coastal high hazard areas [include] coastal floodplains, zones V9, V10, V11, and V12 with an elevation number (EL-) on the flood insurance rate maps and subject to inundation by high-velocity waters and wave action based on a detailed wave height study.” Anne Arundel County, Md., Code art. 16, § 2-103 (2005) available at [http://www.amlegal.com/nxt/gateway.dll/Maryland/annearundelco_md/annearundelcountycode2005?f=templates\\$fn=default.htm\\$3.0\\$vid=amlegal:annearundelco_md](http://www.amlegal.com/nxt/gateway.dll/Maryland/annearundelco_md/annearundelcountycode2005?f=templates$fn=default.htm$3.0$vid=amlegal:annearundelco_md) (last visited Sept. 29, 2011).
- ¹² Adapted from 06-096 Me. Code R. § 355(1) Coastal Sand Dune Rules (2004) available at <http://www.maine.gov/sos/cec/rules/06/096/096c355.doc> (last visited Sept. 28, 2011).
- ¹³ Adapted from Sea Grant Model Bylaw, at 22-23, art. 2, available at http://www.floods.org/ace-files/documentlibrary/State_Local%20Resources%20and%20Tools/Best%20Practices/Sea_Grant_Coastal_Floodplain_Bylaw_Model_1_2_14_09.pdf.
- ¹⁴ FEMA defines freeboard as: “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. <https://www.fema.gov/freeboard>.

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- ¹⁵ FEMA defines floodproofing as: “Any combination of structural and non-structural additions, changes, or adjustments to structures which reduce or eliminate flood damage to real estate or improved real property, water and sanitary facilities, structures and their contents. The National Flood Insurance Program (NFIP) allows a new or substantially improved non-residential building in an A Zone (Zone A, AE, A1-30, AR, AO or AH) to have a lowest floor below the Base Flood Elevation (BFE), provided that the design and methods of construction have been certified by a registered professional engineer or architect as being dry floodproofed in accordance with established criteria.” <https://www.fema.gov/floodproofing>.
- ¹⁶ Observations from previous storms have shown that structures located in the CAZ, inland of the V-zone, experience significant damage from storm surge from moderate wave heights of 1.5 to 3 feet. Therefore, FEMA recommends that communities extend V-zone regulations to these areas. FEMA defines coastal A-zones as areas of the SFHAs seaward of the limit of moderate wave action (“LimWA”). FEMA, *Homeowner’s Guide to Retrofitting: Six Ways to Protect Your Home from Flooding* at 3-1; 3.2.4 (2d ed. Dec. 2009), available at <http://www.fema.gov/library/viewRecord.do?id=1420>. The 2015 version of the International Building Codes also require V-zone design standards in Coastal A-zones. Therefore, CAZ requirements can be enforced by adopting the 2015 model building codes developed by the International Code Council. https://www.fema.gov/media-library-data/1446030649587-10e447987a16b1313253361ed0871a46/2015_Icodes_Flood_Provisions_508_v2.pdf
- ¹⁷ Adapted from Kent County, Maryland Code, Floodplain Management Chapter, Section 182-11.
- ¹⁸ Critical facility means “Public utility building or facility means a structure, use or land designed and maintained as a public or private utility or service facility which qualifies as a public service corporation under [state code definition] for the provision of services like gas, electric, telephone, radio, television, water, and sewer or a municipal utility or service facility.” Town of Chatham, Mass., Protective Bylaw, § II(B)(82) (1998) available at http://chatham.virtualltownhall.net/Public_documents/chathamma_CommDev/Zbylaw.pdf (last visited Sept. 29, 2011).
- Maryland’s state model ordinance defines as: Critical and Essential Facilities: Buildings and other structures that are intended to remain operational in the event of extreme environmental loading from flood, wind, snow or earthquakes. [Note: See Maryland Building Performance Standards, Sec. 1602 and Table 1604.5.] Critical and essential facilities typically include hospitals, fire stations, police stations, storage of critical records, facilities that handle or store hazardous materials, and similar facilities.
- ¹⁹ *Practice Notes*: Many ESCAP jurisdictions currently prohibit construction of critical facilities in coastal high hazard areas. This restriction could be extended to Coastal A-zones, the 1-percent chance floodplain or even the 0.2-percent chance floodplain, whatever is most feasible in that community. In order to use this provision the ordinance should define “critical facility”, “special flood hazard area” and “500-year flood elevation”. Policymakers may need to provide instruction on how 500-year flood elevations are to be calculated. Policymakers should consider how these provisions may affect compliance with American with Disabilities Act and historic preservation requirements. Public facilities must be accessible to persons with disabilities and where critical public facilities need to be elevated to comply with higher regulatory standards, maintaining access may require installation of ramps and/or elevators, which may increase the costs of retrofit, design, and construction. Policymakers should also consider the effect on existing facilities in the areas where the higher regulatory standards will apply.
- ²⁰ Maryland delegated authority to local governments to participate in the National Flood Insurance Program by enacting the Flood Hazard Management Act of 1976, Md. Envir Code §§ 5-801 *et seq.* (1995). The Act requires local governments to develop flood management plans and implementing regulations for the 100-year floodplain. *Id.* at § 5-803(d)(1)-(g)(1). The Maryland Department of Environment (MDE) has regulatory authority over non-tidal wetlands, defined to include the 100-year floodplain for non-tidal waters. Md. Code Regs. 26.17.04.01. Within the non-tidal floodplain, MDE requires 1-foot of freeboard. *Id.* at 26.17.04.07. However, because authority to regulated tidal floodplains has been delegated to local governments, state agencies cannot impose a freeboard requirement in tidal floodplains without additional authority from the state legislature. Md. *Comprehensive Strategy*, ch. 5 at 13.
- ²¹ Adapted from Cedar Falls Zoning Ordinance, Sec. 29-156 (definition of “floodway fringe”) (Jan. 31, 2018).
- ²² FEMA, *Homeowner’s Guide to Retrofitting: Six Ways to Protect Your Home from Flooding*. https://www.fema.gov/media-library-data/1404150306122-7fa382623802512d66e4835281547fd0/FEMA_P312_Chap_9.pdf
- ²³ Adapted from Baltimore Natural Resource Code, Art. 7, Div. 1 at Sec. 3-10.
- ²⁴ See Maryland Model Floodplain Ordinance and Assoc. of State Floodplain Mngrs, Higher Standards Reference Guide at 4 (March 2013), https://www.floods.org/ace-files/documentlibrary/committees/3-13_Higher_Standards_in_Floodplain_Management2.pdf.
- ²⁵ See NOAA Planning Guide at 65.
- ²⁶ For a discussion of the flood resilience provisions adopted to inform recovery efforts after Sandy, see *New York City’s Risk Landscape: A Guide to Natural Hazard Mitigation*, Chapter 4.3 Flooding at pp. 79-81, available at https://www1.nyc.gov/assets/em/downloads/pdf/hazard_mitigation/nycs_risk_landscape_chapter_4.3_flooding.pdf

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- ²⁷ For communities with a coastal floodplain, the extension of V zone regulations and/or enclosure limitations into a designated Coastal A Zone (CAZ) is rewarded. To receive credit, communities must first designate a Coastal A Zone (a coastal SFHA not mapped as a Zone V) as a zone subject to wave action. The activity provides 500 points if all V Zone requirements are applied to buildings in the CAZ, plus an additional 150 points if regulations prohibit breakaway walls and enclosures greater than 299 square feet below base flood elevation. *CRS Manual* 430-32—432-35.
- ²⁸ Adapted from Fort Myers Beach, Fla., Land Development Code, ch. 6, § 405 (2008).
- ²⁹ Local governments in Maryland are authorized to adopt subdivision regulations under the state enabling statute, which permits the use of subdivision regulations to control development and manage growth, reduce erosion, and increase flood protection. By clustering development in upland areas, governments can increase the resiliency of development while allowing for full economic use of property, thereby reducing the potential for takings challenges. Some jurisdictions have already developed clustered development programs to promote other land-use objectives; these programs could be used as models to implement a program to address sea-level rise.
- ³⁰ Md. Code Ann., Nat. Res. § 8-1801
- ³¹ Md. Code Ann., Nat. Res. § 8-1808(b)
- ³² Md. Code Ann., Nat. Res. § 8-1807.1801. See also Md. Dep't of Natural Res., Critical Area Commission homepage, <http://www.dnr.state.md.us/criticalarea/index.asp> (last visited Sept. 28 2011).
- ³³ MD. CODE REGS. 27.01.09.01 §E(3) (2011).
- ³⁴ Maryland Department of Planning, *Transfer of Development Rights Committee Report* (April 2016), <http://www.planning.maryland.gov/Pages/OurWork/envr-planning/transfer-dev-rights.aspx>
- ³⁵ <https://pb.state.ny.us/our-work/credit-program-tdr/program-overview/>
- ³⁶ For a more detailed discussion of these and other TDR programs see Georgetown Climate Center, *Sea Level Rise Adaptation Toolkit* at pp. 57-59 (Oct. 2011), https://www.georgetownclimate.org/files/report/Adaptation_Tool_Kit_SLR.pdf.
- ³⁷ <https://charlottenc.gov/StormWater/Projects/Pages/ChantillyEcologicalSanctuaryatBriarCreek.aspx>
- ³⁸ <https://charlottenc.gov/StormWater/Flooding/Pages/FloodplainBuyoutProgram.aspx>
- ³⁹ New York Governor's Office of Storm Recovery, *NY Rising Buyout and Acquisition Program Policy Manual* at 15 (April, 2015 version 3), https://stormrecovery.ny.gov/sites/default/files/uploads/po_20150415_buyout_and_acquisition_policy_manual_final_v3.pdf
- ⁴⁰ Established in 1977, the Maryland Agricultural Land Protection Foundation (MALPF) remains one of the most prominent *purchase of agricultural conservation easement* (PACE) programs (also known as *purchase of development rights*, or PDR) in the country. Using public funds to purchase development rights on parcels of land, PACE programs like MALPF create conservation easements on the land even while the land remains in private ownership. By 2016, MALPF has spent over \$682 million on 2,218 easements across more than 300,000 acres of farmland in Maryland. In addition to the state PACE program, local government programs have also been successfully used to preserve farmland and discourage sprawl. For example, since its creation in 2006, Cecil County's local PDR program -- modeled after the MALPF program and funded by the County Recordation Tax -- has protected 12 farms on 997 acres. See Maryland Agricultural Land Preservation Foundation, <https://mda.maryland.gov/malpf/Pages/Overview.aspx>. See also Cecil Land Trust, <https://www.cecillandtrust.org/selling-an-easement.html>.
- ⁴¹ The Maryland Rural Legacy Program provides funding to preserve rural areas for agricultural, recreational, and environmental uses. The program has allotted over \$300 million to preserve over 86 thousand acres of land across Maryland, designating large, continuous tracts of land as Rural Legacy Areas within which landowners may apply to sell an easement. All counties in Maryland have a least one Rural Legacy area; in the Eastern Shore, the Eastern Shore Land Conservancy (ESLC) created the Agricultural Security Corridor Rural Legacy Area, which spans 45,781 acres across five counties: Caroline, Cecil, Dorchester, Kent, and Talbot. For a full list of Maryland's approved Rural Legacy Areas, see <http://dnr.maryland.gov/land/Pages/RuralLegacy/All-Rural-Legacy-Areas.aspx> (listing approved RLAs by county)
- ⁴² Landowners in the Eastern Shore may qualify for significant income tax and property tax credits through the Maryland Environmental Trust (MET) program, which works with state and local agencies as well as land trusts to acquire and maintain conservation easements, with preference for land that is productive farmland, contiguous to other open space property, and the protection of which would discourage sprawling development. The MET program is the primary recipient of donated conservation easements in Maryland and remains one of the oldest and largest land trusts in the country, protecting over 129,000 acres of open space. Landowners who donate an easement through the MET program and its pass-through entities may receive up to \$5,000 in tax credits. While there is no fixed minimum parcel size, the MET and cooperating land trusts prioritize donations on parcels greater than 25 acres. See Conservation Easement Policies of the Maryland Environmental Trust (2016), Maryland Department of Natural Resources, https://dnr.maryland.gov/met/Documents/Easement_Criteria.pdf.

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- ⁴³ Swine Floodplain Buyout, North Carolina Department of Agriculture and Natural Resources, <https://www.ncagr.gov/SWC/easementprograms/SwineFloodplainBuyout.html>.
- ⁴⁴ *Id.* See also Adam Wagner, *Could NC buy out more hog farms after Matthew's floods?*, Star News Online (Apr. 3, 2017), <https://www.starnewsonline.com/news/20170403/could-nc-buy-out-more-hog-farms-after-matthews-floods>.
- ⁴⁵ *Hurricane Matthew impact was minimal for our industry, and buyout program continues*, NC Pork Council (Sept. 11, 2018), <http://www.ncpork.org/buyout/>.
- ⁴⁶ *Adaptation Stories: Managed Retreat*, ADAPT VIRGINIA, <https://www.arcgis.com/apps/MapJournal/index.html?appid=bea8d4142fcf47bc90078e845e296d64#>.
- ⁴⁷ Gloucester County Open Space Hazard Mitigation Plan (Nov. 2014), available at <https://www.gloucesterva.info/DocumentCenter/View/1666/Hazard-Mitigation-Open-Space-Plan-PDF>.
- ⁴⁸ *Id.* at 1-2.
- ⁴⁹ *Id.* at 1.
- ⁵⁰ Florida Statute Section 163.3178, comprehensive community plans must include an objective to establish a Post-Disaster Redevelopment Plan. The State released a best-practices guide book titled *Post-Disaster Redevelopment Planning: A Guide for Florida Communities*.
- ⁵¹ <https://www.scgov.net/Home/ShowDocument?id=34542>.
- ⁵² POWERS OF LOCAL GOVERNMENT, MLG MD-CLE 3-1 , 3-125-28.
- ⁵³ E.g., Baltimore County has requirements for the development of six-year capital improvement plans
- ⁵⁴ Maryland empowered its local governments to participate in the NFIP Maryland by enacting the Flood Hazard Management Act of 1976, MD. CODE ANN., ENVIR. §§ 5-801 *et seq.* (1995). The Act requires local governments to develop flood management plans and implementing regulations for the 100-year floodplain. *Id.* at § 5-803(d)(1)-(g)(1). The Maryland Department of Environment (MDE) has regulatory authority over non-tidal wetlands, defined to include the 100-year floodplain for non-tidal waters. MD. CODE REGS. 26.17.04.01. Within the non-tidal floodplain, MDE requires 1-foot of freeboard. *Id.* at 26.17.04.07. However, because authority to regulated tidal floodplains has been delegated to local governments, state agencies cannot impose a freeboard requirement in tidal floodplains without additional authority from the state legislature. Md. *Comprehensive Strategy*, ch. 5 at 13.
- ⁵⁵ In-depth analysis of regional initiatives around CRS and recommendations for how ESCAP jurisdictions may pursue similar approaches in the Eastern Shore to advance CRS participation were also made available in case studies prepared by the Georgetown Climate Center.

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