



SUPPORTING A REGIONAL GREEN INFRASTRUCTURE NETWORK THROUGH LOCAL POLICY AND ACTION

*Best Practices for Using Green Infrastructure to
Enhance Resilience to Coastal Storms and Climate Change*



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Making Great Communities Happen

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The [Greater Baltimore Wilderness Coalition](#) is a voluntary alliance of public agencies, non-governmental organizations, professional associations, and conservation coalitions that supports the vision of expanding a connected and protected green infrastructure network in populous central Maryland from the Chesapeake Bay to the Piedmont. Green infrastructure refers to natural areas and open spaces that provide multiple benefits for people and wildlife, such as parks and nature preserves, river corridors and greenways, and wetlands. In developed areas, green infrastructure includes resources and practices such as the urban forest, green streets, green roofs, rain gardens, and pervious pavement.

The goal of the Coalition's first major project, Coastal Resilience for Greater Baltimore, is to develop a regional vision for climate resilience which will identify key green infrastructure investments across the Patapsco, Patuxent, and Gunpowder River watersheds. This project is being funded through a Hurricane Sandy Coastal Resiliency Grant administered by the National Fish and Wildlife Foundation. [The Conservation Fund](#) is leading the project team, with assistance from the [American Planning Association](#) (APA). Other team members include the U.S. Geological Survey, Center for Chesapeake Communities, and Chesapeake Conservancy.

INTRODUCTION

The Coastal Resilience for Greater Baltimore project team has identified five fundamental strategies for using green infrastructure to enhance community and regional resilience to coastal storms and climate change:

- **Natural Resource Protection:** Preserve lands with valuable and vulnerable resources providing hazard mitigation and other co-benefits, including floodplains, wetlands, forest, stream systems, steep slopes, hydric and highly erodible soils, and important habitat areas.
- **Urban Forest Enhancement and Restoration:** Maintain, enhance, and restore tree canopy in urban and suburban communities to reduce stormwater runoff, ameliorate the urban heat island effect, and improve air quality.
- **Multi-Benefit Green Stormwater Infrastructure:** Retrofit developed areas to reduce impervious surface and incorporate best management practices such as bioretention areas, green streets, and green roofs in order to reduce vulnerability to flooding.
- **Critical Infrastructure Protection:** Use green infrastructure to reduce extreme weather risks to critical infrastructure, including key transportation corridors, power production and transmission facilities, hospitals, and emergency management centers.
- **Coastal Defense:** Preserve/restore natural habitat and introduce nature-based practices (e.g., living shorelines) to protect against coastal flooding, storm surge, and sea level rise.

Similarly, the local policies and actions that affect the implementation of these strategies can be grouped into five broad categories: local plans, regulatory tools, other policy tools, capital investments, and programmatic tools. Under each category there are numerous potential green-infrastructure-related tools localities can use to enhance resilience. This report provides a brief overview of these categories and tools and includes noteworthy examples from within the Coastal Resilience for Greater Baltimore project area and across the country to illustrate each.

LOCAL PLANS

Local governments use plans to articulate goals and objectives (i.e., desired outcomes) and to recommend policies and actions in furtherance of those goals and objectives. There are three distinct types of plans localities are likely to use to articulate communitywide goals, objectives, policies, and actions related to using green infrastructure to enhance resilience: comprehensive plans, green infrastructure plans, and hazard mitigation plans. Meanwhile, localities may use watershed plans to provide more specific guidance within one or more subareas of a jurisdiction.

Comprehensive Plans

The comprehensive plan, sometimes referred to as the general plan or the master plan, is the foundational policy document for local governments, establishing a framework to guide decisions over the next 20 to 30 years. Comprehensive plans are named as such because they cover a broad range of topics of communitywide concern. All states either allow or require local governments to prepare comprehensive plans, and many states require local development regulations to be in conformance with an adopted comprehensive plan.

While enabling laws vary from state to state common topics for plan elements include land use, transportation, housing, economic development, and community facilities. In recent years an increasing number of localities have added elements addressing green infrastructure, hazard mitigation, and climate adaptation to their comprehensive plans.

Connection to Resilience Strategies: Comprehensive plans provide an opportunity to articulate a wide range of communitywide goals, objectives, policies, and actions related to natural resource protection, urban forest enhancement and restoration, multi-benefit green stormwater infrastructure, critical infrastructure protection, and coastal defense. In practice, these strategies may be addressed primarily in a single green infrastructure, hazard mitigation, or climate adaptation element or integrated throughout multiple elements.

Noteworthy Examples

- Howard County, Maryland's most recent comprehensive plan, [PlanHoward 2030](#), recommends adopting a countywide green infrastructure plan (which happened shortly after the county adopted this plan).
- Lancaster County, Pennsylvania's most recent comprehensive plan, [Envision Lancaster County](#), includes an green infrastructure element with extensive implementation recommendations.
- Ranson, West Virginia's [2012 Comprehensive Plan](#) includes a framework for integrating "Light Imprint" green infrastructure for stormwater management into each Transect Zone.

Green Infrastructure Plans

Green infrastructure plans are functional plans that address green infrastructure as a communitywide system. In counties and predominantly rural municipalities, these plans typically focus primarily on an interconnected network of wilderness, greenways, and open spaces that provide ecosystem services on a large scale. In more urban contexts, these plans often focus on site-scale green infrastructure, with a heavy emphasis on stormwater management.

Connection to Resilience Strategies: Like comprehensive plans, a stand-alone green infrastructure plan provides an opportunity to articulate a wide range of communitywide goals, objectives, policies, and actions related to natural resource protection, urban forest enhancement and restoration, multi-benefit green stormwater infrastructure, critical infrastructure protection, and coastal defense.

Noteworthy Examples

- Prince George's County, Maryland, adopted the first [Countywide Green Infrastructure Plan](#) in the study area in 2005.
- Hoboken, New Jersey's [Green Infrastructure Strategic Plan](#) outlines a citywide strategy for using green infrastructure to enhance resilience to coastal storms and flooding.

Hazard Mitigation/Climate Adaption Plans

Local hazard mitigation plans are functional plans that present goals and recommendations related to reducing risk from identified natural hazards. Under the Disaster Mitigation Act of 2000, local governments must adopt hazard mitigation plans in order to access federal disaster mitigation funds. Meanwhile, an increasing number of localities are adopting functional climate adaption plans that present goals and recommendations related to adapting to changing climatic conditions. In practice, there is often considerable overlap among hazard mitigation and climate adaptation goals and recommendations.

Connection to Resilience Strategies: Like comprehensive and green infrastructure plans, a hazard mitigation or climate adaptation plan provides an opportunity to articulate a wide range of communitywide goals, objectives, policies, and actions related to natural resource protection, urban forest enhancement and restoration, multi-benefit green stormwater infrastructure, critical infrastructure protection, and coastal defense.

Noteworthy Examples

- The City of Baltimore's [Disaster Preparedness and Planning Project](#) plan shows how localities can combine hazard mitigation and climate adaptation planning processes, and it places a heavy emphasis on the use of natural systems to enhance community resiliency.
- Guilford, Connecticut's [Community Coastal Resilience Plan](#) describes the role of green infrastructure in sea level rise retreat, accommodation, and protection.
- Norfolk, Virginia's [Coastal Resilience Strategy](#) recommends small-scale green infrastructure projects on private land as well as larger-scale publicly driven living shoreline and wetland restoration projects in order to enhance coastal resilience.

Watershed Plans

Watershed plans are subarea plans that identify the major causes and sources of water quality impairment in a particular watershed and present goals and recommendations for protecting and restoring water resources within that watershed. The limited geographic and thematic scope of these plans provides an opportunity to focus on specific site-level interventions. Watershed plans often recommend a combination of green and gray infrastructure to protect and restore natural lands and features, including streams, floodplains, and wetlands, for the ecosystem services they provide and their impacts on water resource quality.

Connection to Resilience Strategies: Watershed plans provide opportunities to articulate site-specific goals, objectives, policies, and actions related to natural resource protection, urban forest enhancement and restoration, multi-benefit green stormwater infrastructure, critical infrastructure protection, and coastal defense.

Noteworthy Examples

- Baltimore County, Maryland's [Lower Patapsco River Small Watershed Action Plan](#) includes goals, measurable objectives, and specific recommended green infrastructure projects to improve the ecological function of the watershed.
- Chesapeake, Virginia's [A Plan for the Northwest River Watershed](#) incorporates watershed restoration and protection recommendations from regional green infrastructure planning efforts.

REGULATORY TOOLS

Local governments use development regulations, and other local ordinances, to help implement the recommendations of local plans. Broadly defined, development regulations include zoning and subdivision codes as well as a wide range of other regulations that control the location and nature of real property disturbance or development. Localities have numerous opportunities to require or incentivize the provision, enhancement, or protection of green infrastructure through development review and approval processes. The discussion below focuses on some of the most promising tools.

Green Infrastructure Overlays

A green infrastructure overlay imposes additional regulations related to establishing, enhancing, or protecting green infrastructure in order to implement a green infrastructure network vision. Like all zoning overlays, it modifies, but does not replace, base zoning district standards. The distinguishing characteristic of a green infrastructure overlay is that it is explicitly concerned with establishing or enhancing a green infrastructure network, rather than protecting discrete natural features.

Connection to Resilience Strategies: Localities can use green infrastructure overlays to protect natural resources and critical infrastructure, enhance and restore urban forests, require multi-benefit green stormwater infrastructure, and improve coastal defenses.

Noteworthy Examples

- Ames, Iowa, uses its ["O-E" Environmentally Sensitive Area Overlay](#) to protect floodplains, designated natural resource areas, park and open space areas, designated greenways, and aquifer protection areas from new development (§29.1103).
- Burlington, Vermont, uses its [Natural Resource Protection Overlay \(NR\) District](#) to preserve natural features, protect surface waters and wetlands from development encroachment, manage floodplain development, and to facilitate connections and corridors for wildlife habitat (Comprehensive Development Ordinance §4.5.4).

Conservation Zoning Districts

Conservation zoning districts protect lands that are of high ecological (e.g., wetlands, floodplains, steep slopes, wildlife habitat) or resource (e.g., productive agricultural or forest land) value by limiting development to uses compatible with natural resource conservation and land management goals. Typically commercial and industrial development is prohibited outright, and residential development may be prohibited or limited to very large-lot subdivisions (e.g., greater than 40 acres per lot).

Connection to Resilience Strategies: Localities can use conservation zoning districts to protect natural resources and maintain coastal defenses.

Noteworthy Examples

- Highland Beach, Maryland's [open space zoning district](#) prohibits new residential, commercial, or industrial development (Zoning Ordinance § 3-3).
- Milford, Connecticut, applies its [Open Space District](#) to publicly owned beaches, forests, wetlands, nature preserves, and parks; private forests, wildlife or nature preserves or other areas held by land trusts or otherwise protected by conservation easements; farmland dedicated to farming through the transfer of development rights; and reserved open space in subdivisions (Zoning Regulations §3.14).

Natural Resource Protection Standards

Natural resource protection standards prohibit or severely limit the disturbance of existing natural features—such as forests, floodplains, stream buffers, steep slopes, wetlands, or shoreline areas—by new development. In practice, localities may impose these standards through one or more zoning overlays or through provisions related to land subdivision or site development.

Connection to Resilience Strategies: Localities can use natural resource protection standards to protect natural resources and critical infrastructure and to improve coastal defenses.

Noteworthy Examples

- Anne Arundel County, Maryland's "[Natural Features](#)" standards protect nontidal wetlands, streams, steep slopes, and nontidal floodplains from new development (§§17-6-401–405).
- Iowa City, Iowa's "[Sensitive Lands and Features](#)" standards protect wetlands, stream corridors, steep slopes, wooded areas, fully hydric soils, and prairie remnants from new development (§§14-5I-1–12).

Low Impact Development Standards

Low impact development (LID) standards require new development to mitigate stormwater impacts through techniques, including rain gardens, bioswales, green roofs, and permeable pavement, which help capture and treat stormwater at its source and mimic predevelopment hydrology.

Connection to Resilience Strategies: Localities can use LID standards to require multi-benefit green stormwater infrastructure.

Noteworthy Examples

- Under Maryland state [law](#), all local stormwater management ordinances must require developers to use environmental site design (i.e., low-impact development) practices to the "maximum extent practicable" (Environment Article §4-203(b)(5)(ii)3.A).
- Colonial Beach, Virginia's "[Low Impact Development](#)" standards require developers to use low impact development techniques to the maximum extent possible in new subdivisions (Subdivision Ordinance §5-4).

Urban Forestry/Landscaping Standards

Urban forestry and landscaping standards specify tree and shrub planting, protection, and mitigation requirements for new development or site disturbances and may also include parkland and street tree planting and protection requirements.

Connection to Resilience Strategies: Localities can use urban forestry and landscaping standards to protect, restore, and enhance the urban forest and to require multi-benefit green stormwater infrastructure.

Noteworthy Examples

- Annapolis, Maryland's "[Trees in Development Areas](#)" standards require tree preservation or mitigation on smaller sites not subject to forest conservation requirements under the state's Forest Conservation Act (§17.09).
- Palm Beach County, Florida's "[Landscaping](#)" standards illustrate a comprehensive and integrated approach for using landscaping, tree protection, and urban canopy enhancement requirements to enhance resilience to coastal storms and flooding (Unified Land Development Code Article 7).

Site Design Standards

Site design standards control the design and layout of new streets, lots, and parking areas and establish minimum setbacks or build-to lines for new structures. Through these standards, localities have a lot of influence over how little or much impervious cover is added through new development. In practice, localities may impose these requirements through provisions related to land subdivision or site development, or through zoning district development standards.

Connection to Resilience Strategies: Localities can use site design standards to protect natural resources, the urban forest, and critical infrastructure; require multi-benefit green stormwater infrastructure; and maintain coastal defenses.

Noteworthy Examples

- Baltimore's "[Sustainable Site Design](#)" standards contain a series of design principles to improve the environmental performance of new development projects (Rules and Regulations for Land Subdivision §3.20).
- Monroe, Ohio's "[Green Infrastructure](#)" standards authorize specific site design alternatives that use green infrastructure to improve stormwater management (§1208.10).

Wellhead Protection Standards

Wellhead protection standards limit site disturbances and land-use activities near public drinking water supply wells to preventing contaminants from reaching drinking water sources and to promote groundwater recharge. In practice, localities may impose these standards through one or more zoning overlays or through provisions related to land subdivision or site development.

Connection to Resilience Strategies: Localities can use wellhead protection standards to protect natural resources.

Noteworthy Examples

- Hampstead, Maryland's [Groundwater Conservation District](#) includes a series of approval conditions to minimize the environmental impact of new development in groundwater recharge areas (§§135-144–150).
- New Castle County, Delaware's "[Wellhead Protection Areas](#)" standards require all lands within 300' of public water supply wells to be maintained as open space and limit impervious cover to 20 percent within 300' of other wellheads (Unified Development Code §40.10.162).

Conservation Subdivision Design Standards

Conservation subdivision design standards require site developers to design and layout new streets and lots in a way that protects sensitive environmental features and maximizes the amount of site area retained as permanent open space. In practice, localities often incentivize conservation subdivision design by permitting developers to use smaller individual lot sizes and sometimes a greater number of total lots than would otherwise be permitted under conventional residential subdivision design standards.

Connection to Resilience Strategies: Localities can use conservation subdivision design standards to protect natural resources and maintain coastal defenses.

Noteworthy Examples

- Westminster, Maryland's "[Residential Cluster Subdivision](#)" standards allow developers to design subdivisions that protect environmental features without sacrificing the number of lots they'd be able to develop under a conventional subdivision scenario (§164-197.1).
- North Kingstown, Rhode Island's "[Conservation Developments](#)" standards incentivize conservation subdivision design by permitting smaller minimum lot sizes and offering residential density bonuses in exchange for subdivisions that preserve coastal green infrastructure and dedicate in excess of 30-75 percent (based on zoning district) of buildable site area as permanent open space (§§21-211–241).

Open Space Dedication Requirements

Open space dedication requirements stipulate that site developers must dedicate a portion of the site area as permanent open space (or pay a fee in-lieu of dedication) as a condition of development approval. In practice, localities may express these requirements as a percentage of site area or as a minimum amount per dwelling unit. Depending on context and community priorities, localities may intend dedicated open space to be used primarily for active or passive recreation or for natural resource conservation.

Connection to Resilience Strategies: Localities can use open space dedication requirements to protect natural resources and maintain coastal defenses.

Noteworthy Examples

- Laurel, Maryland's "[Mandatory Dedication or Fee-in-lieu of Open Space](#)" standards require all developers to dedicate a minimum of 1,000 square feet per dwelling unit for permanent open space (or to pay a fee in-lieu of dedication) (§20-29.10).
- Charlestown, Rhode Island's "[Recreation Facilities and Open Space Dedication](#)" standards require all developers to dedicate the equivalent of 1,634 square feet per dwelling unit for permanent open space (or to pay a fee in-lieu of dedication) (§188-5.3).

Transfer of Development Rights

Transfer of development rights (TDR) provisions allow property owners in areas designated for conservation (i.e., sending areas) to sell unused development rights to developers for use in areas designated for infill or redevelopment (i.e., receiving areas). In practice, localities may use TDR for natural resource, historic, or agricultural preservation.

Connection to Resilience Strategies: Localities can use TDR to protect natural resources and maintain coastal defenses.

Noteworthy Examples

- Harford County, Maryland, encourages agricultural, open space, and forest conservation by permitting landowners in [Agricultural Districts](#) to transfer unused development rights to sites in Rural Residential or Rural Village districts (§267-53).
- Brookhaven, New York's "[Pine Barrens Credit Program](#)" encourages Central Pine Barrens preservation by permitting landowners in core preservation areas to transfer unused development credits to designated residential receiving areas (§85-725).

Green Infrastructure Development Incentives

Green infrastructure development incentives offer developers bonus density, flexible development standards, reduced development fees, or streamlined approvals in exchange for green infrastructure enhancements or protections. In practice, localities often provide these incentives to projects that qualify for specific green building or neighborhood certifications.

Connection to Resilience Strategies: Localities can use green infrastructure development incentives to protect natural resources and critical infrastructure, enhance the urban forest, encourage multi-benefit green stormwater infrastructure, and improve coastal defenses.

Noteworthy Examples

- Howard County, Maryland, incentivizes “[Green Neighborhoods](#)” by setting aside a certain number of housing unit allocations for projects certified through the county’s green neighborhood program (§16.1102).
- Sammamish, Washington’s “[Low Impact Development](#)” standards allow developers to earn density bonuses and other development incentives by integrating various low-impact development techniques into their projects (§21A.85).

OTHER POLICY TOOLS

Local governments use stand-alone policy implementation directives, design manuals, and guidelines to supplement adopted plans and regulations. In some cases localities adopt these supplemental policy tools by reference, giving them the weight of law. In other instances, these tools may detail requirements for participating in a specific incentive program or illustrate desirable characteristics for development projects subject to discretionary review. Given the lack of uniformity from place to place in the number and nature of these tools, it is difficult to generalize about how supplemental policy tools can be used to require or incentivize the provision, enhancement, or protection of green infrastructure. The discussion below focuses on a few relatively common tools with clear potential for advancing green-infrastructure-related goals.

Green Infrastructure Design Standards

Stand-alone green infrastructure design standards provide supplemental requirements or guidance to developers or public agencies to help integrate green infrastructure into private development or public construction, landscaping, or maintenance projects. In practice, these standards often supplement development regulations related to natural resource protection or site design, or the procedures manuals of specific local agencies (e.g., an engineering manual used by a local public works or transportation department).

Connection to Resilience Strategies: Localities use stand-alone green infrastructure design standards to protect natural resources and critical infrastructure, enhance the urban forest, encourage or require multi-benefit green stormwater infrastructure, and improve coastal defenses.

Noteworthy Examples

- Anne Arundel County, Maryland’s [Stormwater Management Practices and Procedures Manual](#) supplements the state’s stormwater management manual and provides more specific requirements for environmental site design implementation in new development.
- Chicago’s [Sustainable Urban Infrastructure Policies and Guidelines](#) provide uniform design, construction, and maintenance guidance to city agencies to help them integrate and maintain green infrastructure into various types of public infrastructure projects.

Development Design Guidelines

Development design guidelines provide a set of design principles and standards, which communicate desirable design qualities, generally for a subarea, district, or land-use type. In practice, these guidelines typically supplement zoning district, or use-specific, development standards.

Connection to Resilience Strategies: Localities can use development design guidelines to encourage the protection of natural resources and critical infrastructure, enhancement of the urban forest, multi-benefit green stormwater infrastructure, and improvement of coastal defenses.

Noteworthy Examples

- Howard County, Maryland's [Downtown Columbia Design Guidelines](#) includes an entire chapter on sustainability with specific site design guidelines related to water quality protection and ecological restoration.
- Chicago's [Adding Green to Urban Design](#) includes numerous goals and recommended strategies for integrating multi-functional green infrastructure into public and private landscaping and development projects.

Landscape Design Guidelines

Landscape design guidelines provide a set of landscape design principles or standards, which communicate desirable plant selection and design qualities for the planting of trees, shrubs, and other vegetation. In practice, these guidelines typically supplement development regulations related to landscaping or urban forestry, or the procedures manuals of specific local agencies (e.g., a parkland maintenance manual for a local parks department).

Connection to Resilience Strategies: Localities can use landscape design guidelines to encourage the enhancement of the urban forest, multi-benefit green stormwater infrastructure, and improvement of coastal defenses.

Noteworthy Examples

- Prince George's County, Maryland's [Landscape Manual](#) contains landscaping requirements for all new development and places a special emphasis on reducing heat island effects, filtering and reducing stormwater runoff, improving air quality, controlling erosion, and providing wildlife habitat.
- Philadelphia's [Green Stormwater Infrastructure Landscape Design Guidebook](#) provides landscaping design guidance for all green stormwater infrastructure projects in the city.

Vacant Property Pattern Book

A vacant property pattern book presents a range of potential greening or reuse alternatives for vacant lots in weak-market neighborhoods with low potential for conventional residential, commercial, or industrial redevelopment. In practice, these pattern books often supplement public and private vacant land management and neighborhood revitalization efforts, and the goals often include aesthetic improvement, green stormwater management, and food or energy production.

Connection to Resilience Strategies: Localities can use vacant property pattern books to encourage the enhancement of the urban forest and multi-benefit green stormwater infrastructure.

Noteworthy Examples

- Baltimore's [Green Pattern Book](#) shows how different site-scale green infrastructure interventions can be used for vacant land management.
- Milwaukee's [Vacant Lot Handbook](#) provides guidance to residents and community groups interested in using site-scale green infrastructure to improve city-owned vacant lots.

CAPITAL INVESTMENTS

Local governments use capital investments to help implement the recommendations of local plans. Capital investments include public expenditures on any physical asset, including construction, landscaping, and maintenance projects. Localities have numerous opportunities to provide, enhance, or protect green infrastructure through direct public investments. The discussion below focuses on some of the most promising tools.

Land Acquisition

Land acquisition refers to the fee-simple acquisition of land by a public agency (or private entity) for the purpose of land conservation. In practice, localities may use land acquisition for natural resource, historic, or agricultural preservation.

Connection to Resilience Strategies: Localities can use land acquisition to protect natural resources and maintain coastal defenses.

Noteworthy Examples

- Montgomery County, Maryland, uses a mix of general obligation bonds and other revenue sources to acquire open-space lands of countywide significance through its [Legacy Open Space](#) program.
- Alachua County, Florida's [Alachua County Forever](#) program uses 10 percent of the proceeds of a ¼-mil property tax increase in 2000 to fund the acquisition of land with high ecological value in order to enhance community resilience to hurricanes, floods, droughts, and wildfires.

Purchase of Development Rights

Purchase of development rights (PDR) refers to the purchase (and retirement) of unused development rights by a public agency (or private entity) for the purpose of land conservation. Typically properties subject to a PDR agreement are protected by a conservation easement precluding specific development or land-use activities. In practice, localities may use PDR for natural resource, historic, or agricultural preservation.

Connection to Resilience Strategies: Localities can use PDR to protect natural resources and maintain coastal defenses.

Noteworthy Examples

- Anne Arundel County, Maryland, uses a mix of local bonds and other revenue sources to purchase and extinguish development rights through its [Agricultural and Woodland Preservation](#) program.
- Albemarle County, Virginia, uses a mix of state matching funds and private donations to purchase and extinguish development rights on working farms and high-ecological-value open spaces through its [Acquisition of Conservation Easements](#) program.

Stormwater Management Projects

Stormwater management projects refer to capital investments intended to minimize flooding, runoff, and water quality degradation associated with precipitation. In practice, localities typically use a combination of green and gray infrastructure to address these issues.

Connection to Resilience Strategies: Localities can use stormwater management projects to provide multi-benefit green stormwater infrastructure.

Noteworthy Examples

- Baltimore uses stormwater utility fees to pay for [Large Stormwater BMP Projects](#).
- Philadelphia's [Green City, Clean Waters](#) program uses water utility fees to pay for green infrastructure stormwater management projects intended to help mitigate longstanding flooding problems associated with its combined sewer-stormwater system.

Environmental Restoration Projects

Environmental restoration projects refer to capital investments intended to restore the ecological functions of environmental features—such as streams, wetlands, and floodplains—that have been degraded by development, land-use activities, or extreme weather events. In practice, localities often use environmental restoration projects to enhance compliance with total maximum daily load (TMDL) limits imposed under the federal Clean Water Act.

Connection to Resilience Strategies: Localities can use environmental restoration projects to enhance the urban forest, provide multi-benefit green stormwater infrastructure, and improve coastal defenses.

Noteworthy Examples

- Baltimore County, Maryland, uses general obligation bonds and state waterway improvement funds to pay for [Watershed Restoration Projects](#).
- Frederick County, Maryland, uses general funds to pay for [Watershed Restoration](#) projects.

Tree Planting/Greening Projects

Tree planting or greening projects refer to capital investments for planting trees or other vegetation on public property. In practice, localities often focus tree planting and greening efforts in public rights-of-way and parks.

Connection to Resilience Strategies: Localities can use tree planting or greening projects to enhance the urban forest and provide multi-benefit green stormwater infrastructure.

Noteworthy Examples

- Montgomery County, Maryland, uses general funds to pay for [Street Tree Planting](#).
- New Haven, Connecticut, uses Community Development Block Grant Funding to pay for its [public tree planting program](#), which is the oldest in the nation.

PROGRAMMATIC TOOLS

Local governments (as well as private entities) use various types of programmatic investments to implement local plans. Programmatic tools often involve resource (or asset) management, direct financial assistance (e.g., rebates, grants, and loans), financial incentive (e.g., tax abatements or credits), technical assistance, or public education. Localities have numerous opportunities to provide, enhance, or protect green infrastructure through programmatic investments. The discussion below focuses on some of the most promising tools.

Land Conservation Programs

Land conservation programs refer to programmatic efforts to protect natural or working lands for conservation purposes. In practice, these programs often use a range strategies, including resource management, technical assistance, public education, and financial incentives.

Connection to Resilience Strategies: Localities can use land conservation programs to protect natural resources and improve coastal defenses.

Noteworthy Examples

- Harford County, Maryland's [Agricultural Land Preservation Program](#) offers a tax credit to landowners who agree not subdivide their land for at least five years.
- Burlington, Vermont's [Conservation Legacy Program](#) combines land stewardship, acquisition planning, and conservation education.

Forest Conservation Programs

Forest conservation programs refer to programmatic efforts to protect, enhance, and restore forested land (including urban forests). In practice, these programs often use a range of strategies, including resource management, technical assistance, and public education.

Connection to Resilience Strategies: Localities can use forest conservation programs to protect natural resources, enhance the urban forest, and provide multi-benefit green stormwater infrastructure.

Noteworthy Examples

- Baltimore County, Maryland's [Forest Sustainability Program](#) takes a comprehensive approach to forest conservation and management that involves capital projects; partnerships; planning, assessment, and monitoring; and technical assistance (profiled in PAS Report 555, Planning the Urban Forest).
- Minneapolis, Minnesota's [Urban Tree Canopy](#) program aims to increase cooperation among city agencies in their collective efforts to expand and sustain the urban forest (profiled in PAS Report 555, Planning the Urban Forest).

Tree Planting Programs

Tree planting programs refer to programmatic efforts to enhance urban forests on private property. In practice, these programs often use direct financial assistance, technical assistance, and public education.

Connection to Resilience Strategies: Trees provide a broad range of environmental benefits, including carbon sequestration and reduced stormwater runoff.

Noteworthy Examples

- Montgomery County, Maryland's [Leaves for Neighborhoods Program](#) provides coupons to help private property owners offset the costs of purchasing trees.
- Portland, Oregon, offers a credit on residential water/sewer utility bills for property owners that plant trees under the city's [Treebate Program](#).

Volunteer Restoration Programs

Volunteer restoration programs refer to programmatic efforts to actively engage residents and community groups in natural resource restoration projects. In practice, these programs typically use resource management, technical assistance, and public education.

Connection to Resilience Strategies: Localities can use volunteer restoration programs to encourage the protection of natural resources, enhancement of the urban forest, and maintenance of multi-benefit green stormwater infrastructure and coastal defenses.

Noteworthy Examples

- Montgomery County, Maryland's [Stream Stewards Volunteer Program](#) uses volunteers to build awareness about the importance of stream restoration and to adopt stormwater management and stream restoration projects on public property.
- Cleveland Metroparks' [Watershed Volunteer Program](#) trains volunteers on how to protect watersheds through a variety of learning, restoration, and monitoring activities.

Technical Assistance Programs

Technical assistance programs refer to programmatic efforts to provide information and expertise to help private entities plan and implement small-scale green infrastructure projects. As the name suggests, these programs typically rely exclusively on technical assistance.

Connection to Resilience Strategies: Localities can use technical assistance programs to encourage the enhancement of the urban forest and multi-benefit green stormwater infrastructure.

Noteworthy Examples

- Montgomery County, Maryland's [Rainscapes Program](#) provides technical assistance (in addition to rebates) to help landowners complete green stormwater management projects.
- The Central Massachusetts Regional Planning Commission's [Low Impact Development, Green Infrastructure Technical Assistance Program](#) provides assistance to municipalities to help them plan and implement green stormwater infrastructure.

Educational Programs

Educational programs refer to programmatic efforts to provide outreach, education, and training to local stakeholders on issues related to green infrastructure and resilience. As the name suggests, these programs typically rely exclusively on public education.

Connection to Resilience Strategies: Localities can use educational programs to encourage the protection of natural resources, enhancement of the urban forest, and multi-benefit green stormwater infrastructure.

Noteworthy Examples

- Maryland Department of Natural Resources' [Maryland Master Naturalist Training](#) program provides education and training to residents in exchange for volunteer labor on conservation and restoration projects.
- Rutgers' [Green Infrastructure Education](#) and Implementation Program provides education and training to local stormwater management coordinators.

SUMMARY

Local plans, regulations, policies, and programs can be used together to define and implement strategies for using green infrastructure to enhance community and regional resilience to coastal storms and climate change. Localities can use local comprehensive and functional plans to define goals, objectives, policies, and actions for using green infrastructure to enhance resilience. Regulatory tools allow localities to incentivize green infrastructure through the development review and approval processes, while other policy tools supplement adopted plans and regulations. Capital investments create opportunities to provide, enhance, or protect green infrastructure through direct public investments, and programmatic tools allow for investment in implementation.