United States Environmental Protection Agency

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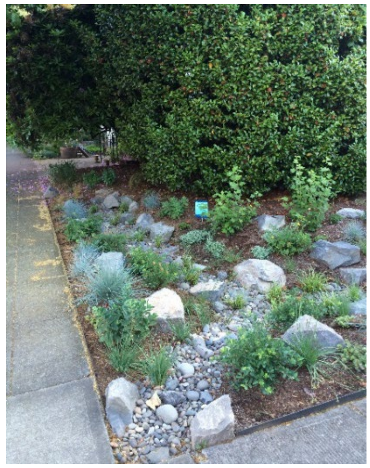
Tools, Strategies and Lessons Learned from EPA Green Infrastructure Technical Assistance Projects

U.S. Environmental Protection Agency, Office of Wastewater Management

Contents



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Introduction

This report summarizes practical, successful solutions to inspire city managers, community leaders and engaged citizens looking to design their community space for better health, abundant water resources, and improved quality of life.

Green infrastructure is an adaptable and multifunctional approach to stormwater management and climate resiliency with many benefits for communities:

- Improves water quality and conserves water
- Strengthens the local economy
- Enhances community and infrastructure resiliency

Green infrastructure design and implementation also has been identified as a critical tool for achieving goals of the President's Priority Agenda Enhancing the Climate Resilience of America's Natural Resources.

Urban stormwater continues to be a persistent and growing source of water pollution across the United States. Climate change is leading to more intense weather events and dwindling water supplies. Communities are feeling the effects of climate change now through flooding, drought, heat waves, and coastal erosion. Together these conditions are stressing the performance of the nation's water infrastructure and challenging all of us to consider new, integrated ways to manage our water resources.

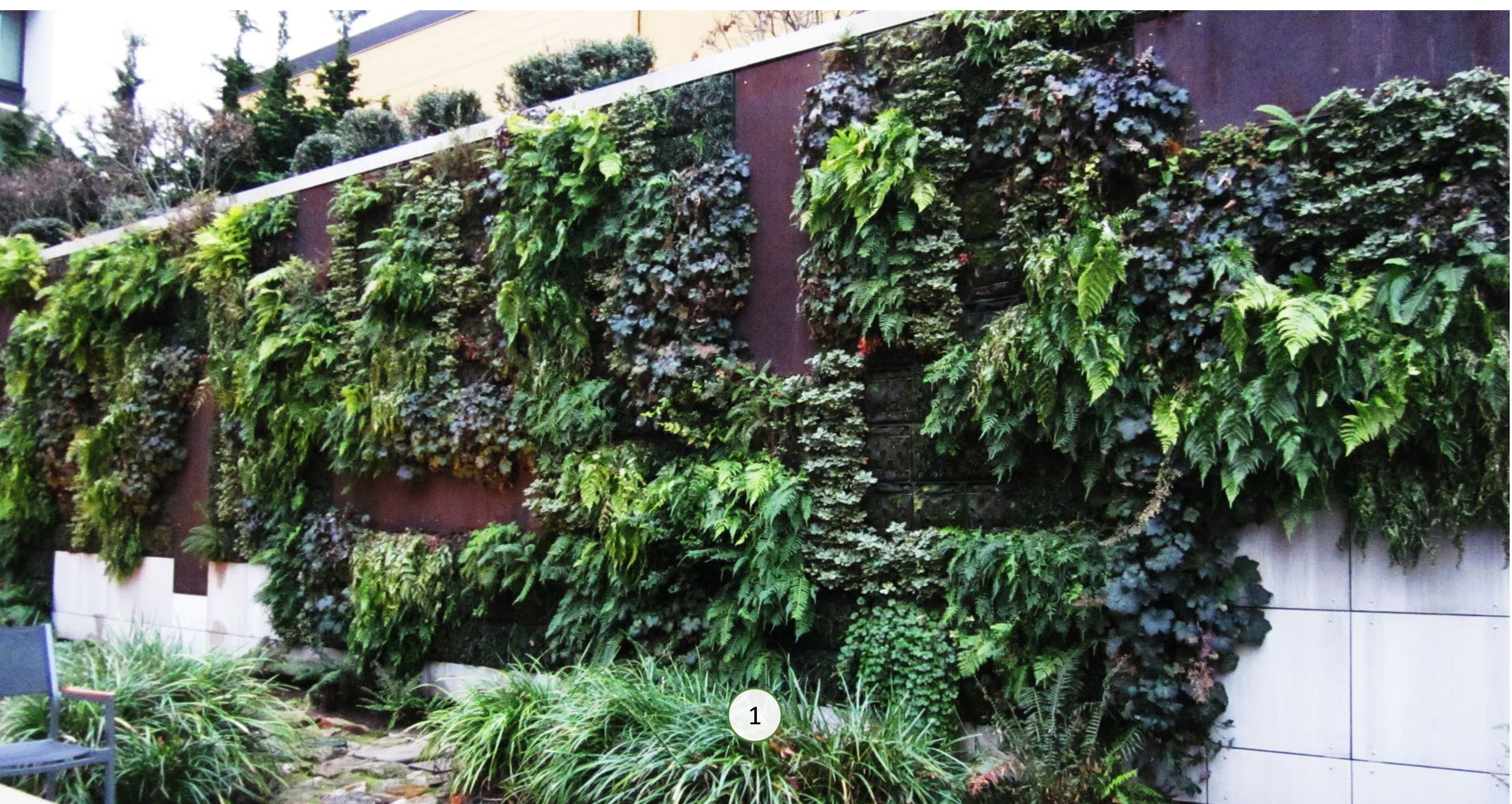
Cities can incorporate green infrastructure into many different types of projects, including when wastewater or stormwater infrastructure is installed or modified, when a roadway intersection is rebuilt, or when a new park is being planned.

Communities can use green infrastructure principles as a holistic and adaptive method to meet their environmental and community goals now and into the future. Larger-scale implementation of infiltration and rainwater harvesting can build resiliency as different parts of the country become drier, wetter or hotter.

Technical assistance is a key component of EPA's investment for accelerating green infrastructure to become business-as-usual for stormwater management as well as infrastructure investments and community development.

This report summarizes results from EPA's green infrastructure technical assistance program for cities, communities and citizens who want to learn from the experiences of others and find the best solutions for their unique challenges. It's a quick reference guide that matches problems with real-world, tested solutions.

A living wall enhances the aesthetics of a courtyard



What is Green Infrastructure?

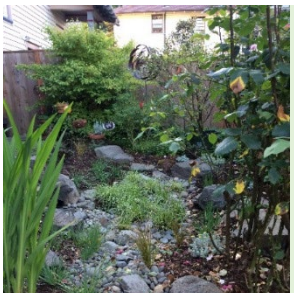
Green infrastructure uses plants, soils, and nature itself to manage stormwater and create healthier urban environments. Green infrastructure practices can be used to reduce the need for expensive gray infrastructure—pipes, storage facilities, and treatment systems—because plants and soils soak up, store, and use the rainwater. Communities also can create or preserve existing vegetated areas to maintain a high quality of life for residents through flood protection, cleaner air and water, and more appealing transportation corridors and outdoor spaces.

Downspout Disconnection

Rerouting rooftop drain pipes to direct rainwater to rain barrels, cisterns, or permeable areas instead of the sewer. This practice can benefit any community but can be particularly beneficial in cities with combined sewer systems.

Rainwater Harvesting

Systems that collect and store rainfall for later use, slowing and reducing the volume of runoff. This can be especially important in arid regions to reduce demands on increasingly limited water supplies.



Rain Gardens and Bioswales

Shallow, vegetated areas that collect and absorb runoff from rooftops, sidewalks, and streets using plants and soil. Versatile, attractive features that can be installed in almost any unpaved space. Also known as bioretention or bioinfiltration cells.

Planter Boxes

Rain gardens that collect and absorb runoff from rooftops, sidewalks, parking lots, and streets. They have vertical walls that are ideal for space-limited sites in dense urban areas and can be used to provide seating and attractive plantings.

Green Roofs

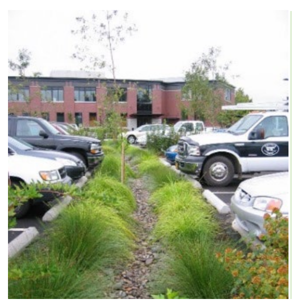
Roofs covered with plants that soak up and use rainwater. They cool and insulate buildings, reducing energy use. They are particularly cost effective where land values and traditional stormwater management costs are high.

Permeable Pavements

Paved surfaces that let water soak into the ground, including pervious concrete, porous asphalt, and permeable interlocking pavers. They are particularly cost effective where land values are high and where flooding or icing is a problem.

Green Alleys and Streets

Permeable pavement, bioswales, planter boxes, and trees integrated into street and alley designs to soak up and store stormwater and improve the pedestrian experience through shading and traffic calming.

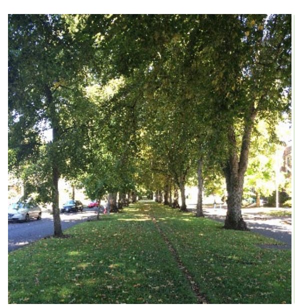


Green Parking

Permeable pavement, rain gardens, and bioswales incorporated into parking lot stalls, lanes, and landscaping. Besides collecting and absorbing stormwater, green parking can provide more shade and reduce the heat emitted by pavements.

Land Conservation

Protecting open spaces and sensitive natural areas within and adjacent to a city can reduce stormwater while providing recreational opportunities for city residents. Natural areas that should be a focus of this effort include riparian areas, wetlands, and steep hillsides.



Urban Tree Canopy

Urban trees soak up and use rainwater, provide shade and help to slow traffic. Homeowners, businesses, and cities can all participate in the planting and maintenance of trees throughout the urban environment.

How Can Green Infrastructure Benefit Your Community?

Improve Water Quality and Conserve Water

- Reduce polluted runoff entering waterways
- Reduce stream and habitat damage from high-velocity runoff
- Conserve water by recycling and using captured rainwater
- Reduce the incidence and severity of combined sewer overflows (CSOs) caused by excess rainwater

Strengthen the Local Economy

- Reduce cost to build storm drain infrastructure
- Reduce water treatment costs
- Reduce energy needed to transport and treat wastewater and drinking water
- Increase property value with green urban spaces
- Reduce property damage from flooding
- Make neighborhoods healthier and safer
- Reduce household energy use
- Create green jobs

Enhance Community and Infrastructure Resiliency

- Help reduce localized flooding and protect floodplains
- Capture rainwater for on-site use
- Decrease potable water demand
- Recharge groundwater supply
- Protect coastal areas from wave erosion with living shorelines
- Adapt to changes in sea level over time
- Reduce energy consumption needs

Improve Water Quality and Conserve Water

Green infrastructure is designed to capture stormwater close to where it lands to be used by plants, soaked into the ground, evaporated, or recycled for irrigation or other uses. Green infrastructure improves water quality by slowing down and filtering polluted runoff before it reaches waterways. Green infrastructure helps to recharge groundwater and increases flow to streams, rivers, lakes, and reservoirs. Cooler-temperature runoff and shading provided by trees benefit aquatic plants and animals. Green infrastructure can be successful in a variety of settings including cold or arid climates, in ultra-urban areas, in soils with slower infiltration rates, and in areas with intense rainstorms. Successful programs often have locally tailored guidance and standards to address local water quality priorities, conditions, and constraints.

Save Money with Green Infrastructure on Public Projects

There are advantages to integrating green infrastructure on public property. The municipality already owns and maintains the property so there are no land acquisition costs or easements required. Also, the municipality already performs long-term maintenance on the property similar to maintenance necessary for green infrastructure.

Municipally owned transportation corridors offer many right-of-way opportunities for green infrastructure:

- Installing bioswales between the sidewalk and street, at curb bump-outs, or in medians or roundabouts.
- Using permeable pavement in parking areas and sidewalks.
- Planting trees and installing planter boxes along streets and sidewalks.

Green infrastructure can be integrated into other community improvements or capital projects designed to improve traffic flow, increase pedestrian safety, create multi-modal transportation corridors, revitalize neighborhoods, enhance aesthetics, or address localized flooding and poor drainage.

EPA worked with several communities to develop conceptual designs for road rights-of-way and parks to address local stormwater concerns. Each project provided the opportunity to highlight typical obstacles faced by municipalities undertaking community improvements. The Boone Boulevard concept design in Atlanta, Georgia, was for a community facing a range of environmental, social, and economic challenges; the design integrated seamlessly with other planned roadway improvements, making the project easier to implement. In Beaufort, South Carolina, representatives of the Northwest Quadrant neighborhood wanted to ensure that green infrastructure elements were consistent with the historic character of the neighborhood. In Boise, Idaho, local stakeholders sought to encourage redevelopment of an urban area west of downtown by allowing private property owners to meet stormwater retention requirements using green infrastructure improvements in the right-of-way, thereby saving them money. In Denver, Colorado, and Gary, Indiana, renderings show how local streets would look if they were retrofitted with different types of green infrastructure practices that met local stormwater management standards. In Iowa City, Iowa, a diverse group of stakeholders and developers worked on a design to enhance a wetland and creek and incorporate green infrastructure features into a large-scale park system at the site of a decommissioned wastewater treatment plant.

One of the key factors in the success of these projects was local stakeholder participation, including neighborhood residents. EPA's green infrastructure designs were tailored to achieve the benefits desired by stakeholders and support the neighborhood's vision while meeting local development codes, stormwater management standards, historic preservation guidelines, and other requirements. The designs were also sensitive to driveway access, parking, and utility constraints. It was also helpful for the communities to identify green street projects where other roadway improvements were planned or underway to minimize traffic disruption and save money.

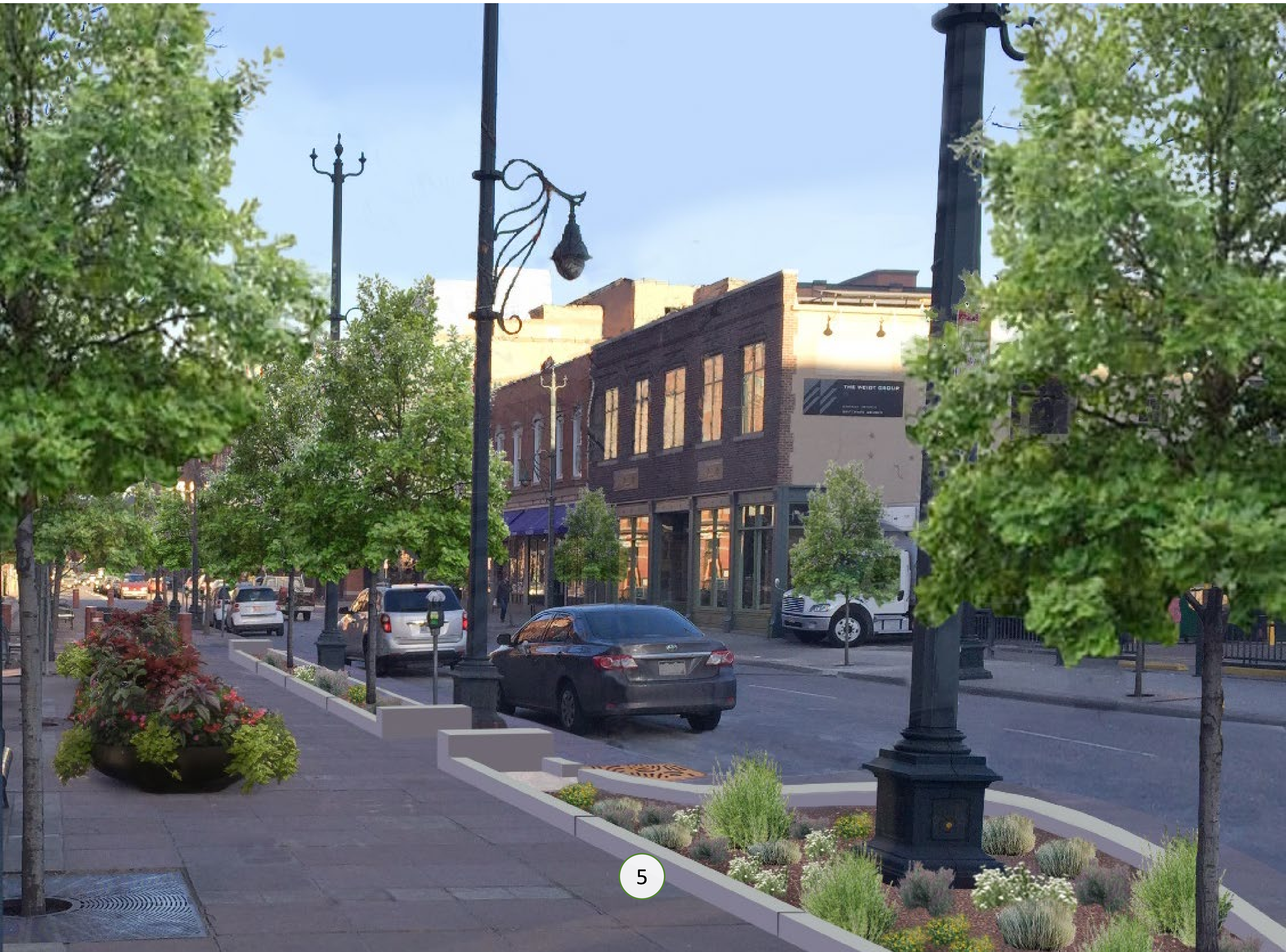
Work with Developers to Identify Opportunities on Private Property

Private property constitutes substantially more land area in communities than public property; therefore, there are many opportunities to incorporate green infrastructure on individual private parcels as part of new development or redevelopment.

Local stormwater management regulations can require that green infrastructure be implemented through retention or other requirements. In such cases, municipalities can work with developers to identify ways that green infrastructure can be incorporated into a development plan to maximize environmental and community benefits. They can provide design assistance and facilitate accelerated plan reviews and approvals for stormwater management plans that include green infrastructure.

In some circumstances, on-site stormwater management requirements might be difficult to meet on certain properties. A municipality may want to offer alternatives to allow developers to install green infrastructure features at another location or contribute to a fund that is used for stormwater management projects elsewhere in the watershed. EPA worked with the Ada County Highway District and the City of Boise, Idaho, to examine different types of off-site alternative compliance options that could be used to achieve local stormwater management goals and developed a conceptual design for a redevelopment project where the desired development density limited on-site green infrastructure use.

Rendering of a street retrofitted with stormwater planters in Denver, Colorado



Rendering of permeable pavement and tree planters along Fairview Avenue in Boise, Idaho

Where green infrastructure is not explicitly required by local codes and regulations, municipalities can offer incentives for green infrastructure implementation on private property. Incentives could include financing or cost-share programs for design and construction of green infrastructure, rebates for installation undertaken by the property owner, or stormwater utility fee credits or discounts in exchange for green infrastructure implementation. More information about incentives for green infrastructure implementation can be found in Managing Wet Weather with Green Infrastructure Municipal Handbook: Incentive Mechanisms.

EPA worked in partnership with several local governments and private developers to prepare green infrastructure conceptual designs for private development projects that met local water quality and stormwater management goals. For the Blake Street conceptual design in Denver, Colorado, EPA worked with stakeholders at a former industrial site in a neighborhood undergoing revitalization to identify cost-effective green infrastructure that provided stormwater treatment to meet local requirements while also providing desired amenities to residents. At Zidell Yards in Portland, Oregon, EPA developed phased stormwater management concept plans in which stormwater from private property and the transportation right-of-way are managed in a unified collection system. Similarly, in the West Side Flats neighborhood of St. Paul, Minnesota, the city and EPA developed three greenway concept designs that allow stormwater from multiple private parcels to be managed in a shared, multi-benefit green infrastructure system that incentivizes redevelopment, treats stormwater, provides recreational space, and improves air quality. In the Iron Arts District in Scranton, Pennsylvania, EPA identified green infrastructure opportunities—including green streets and rain gardens in vacant lots that serve as demonstration parks and gathering spaces—that could reduce CSOs, catalyze community reinvestment, and remove blight in the historically and culturally significant neighborhood.

Rendering of the Schimpff Court rain garden pilot project in Scranton, Pennsylvania

Design It and They Will Build: Guidance and Standards

Sometimes green infrastructure practices are not well-represented or described in local stormwater management practice design guidance. Developers and engineers may not be familiar with what green infrastructure is or how it can perform in local soil, topographic, and climate conditions. Communities that want to promote the use of green infrastructure can develop a concise green infrastructure handbook or fact sheets that visually demonstrate how green infrastructure can be used locally and provide the design tools necessary for the development community to implement green infrastructure.

EPA helped several communities develop local green infrastructure guidance. Through work with these communities, EPA learned that to be effective, guidance should include visual examples of how green infrastructure could be integrated into specific local settings, as demonstrated by Neosho, Missouri's handbook and Denver, Colorado's guidance. Renderings of green infrastructure features integrated into local streetscapes are an excellent way to demonstrate how green infrastructure can enhance the aesthetics of a site while helping to meet stormwater management goals.

Local guidance should also focus on tools that designers and engineers will use to choose, locate, and design green infrastructure practices appropriate for their sites. Such tools include the following:

- Standard BMP details and cross-sections that can be readily adapted to different development settings.
- Plant lists and guidelines for selecting appropriate vegetation.
- Instructions for sizing green infrastructure facilities to meet local stormwater management requirements.

A sculptural element links this green infrastructure to the aquatic resources it is intended to protect

EPA supported the development of Pima County, Arizona's green infrastructure guidance, which includes standard engineering drawings, a plant list, and BMP sizing guidance.

Plan submittal checklists are helpful to ensure that all calculations and details are provided in submittals to expedite plan reviews. Inspection checklists will help to ensure that long-term maintenance of green infrastructure facilities is completed as needed.

Checklists also can be developed for local staff to review plans that include green infrastructure, to inspect and approve newly built green infrastructure features, and to periodically inspect practices to ensure they are maintained and function properly. EPA developed a series of checklists for Denver, Colorado, including a plan review checklist, post-construction inspection checklist, and maintenance checklist.

Mythbusting Green Infrastructure

A potential barrier to green infrastructure implementation is the perception that it cannot be used in certain climates or when certain site conditions are present. Developers and designers often state that topography, soil, rainfall characteristics, and available space are factors that could preclude the use of green infrastructure at a development site. Research shows, however, that green infrastructure can function well in most site conditions with certain design modifications. To address these concerns, EPA developed a series of white papers and fact sheets with Pittsburgh UNITED detailing how green infrastructure can be designed for sites with steep slopes, clay soils, high-intensity rainfall, and space constraints. Communities can tailor their own local green infrastructure guidance to address specific concerns they have heard from local developers and the design community and can include design modifications in standard drawings (e.g., hydraulic barriers, underdrains) to address the concerns.

Measuring Benefits for Water Quality

Many communities look to green infrastructure to help reduce the discharge of specific pollutants into local waterways. Green infrastructure practices can be selected, sited, and designed to remove a particular pollutant or group of pollutants (e.g., sediment, nutrients). Green infrastructure can be incorporated into various pollution reduction strategies. Quantifying the effects of green infrastructure on pollutant loads is an important tool for local communities to plan how and where to implement green infrastructure to reduce water pollution.

EPA provided technical assistance to several communities looking to use green infrastructure to address specific water quality concerns. In Barnstable and Yarmouth, Massachusetts, EPA evaluated parcels for green infrastructure suitability and proposed several conceptual designs to reduce the discharge of nitrogen into coastal waters. EPA used a decision-support tool—the System for Urban Stormwater Treatment and Analysis INtegration (SUSTAIN)—to simulate and compare the effectiveness of the proposed green infrastructure practices in reducing nitrogen in runoff. In Franklin, Massachusetts, EPA developed a strategy to implement green infrastructure policy changes, build new green infrastructure facilities, and undertake other activities, such as education and outreach, to reduce phosphorus pollution that is causing algal blooms in the Charles River.

EPA also worked with Lincoln, Nebraska, to develop a pollution reduction strategy for Antelope Creek to reduce the discharge of bacteria into local waterways. EPA helped to identify pollutant sources, conducted a review of local water quality-related plans, gathered examples of pollution reduction plans from other areas of the country that targeted bacteria, and proposed a set of prioritized recommendations to most effectively reduce bacteria in stormwater.

A courtyard bioswale serves dual purposes as stormwater management and attractive landscaping

Strengthen the Local Economy

Green infrastructure can provide a wide range of economic benefits to a community through tangible infrastructure savings—reduced gray infrastructure needs, lower water management and treatment costs (including energy consumption), and potable water conservation. However, some of the important benefits of green infrastructure are harder to monetize. For example, studies show that properties that incorporate more green space or are located closer to green space are more valuable and therefore demand higher sales prices and generate higher property taxes for municipalities (Ward et al. 2008; Schultz 2008; Anderson 1998; Voicu 2008; Espey 2001). Also, areas that are greener promote more outdoor activity, more walking, more spending, are safer and generally improve people's sense of well-being and health. Happier, healthier, safer people work harder, get sick less, and invest more in their communities. (Kardin et al. 2015; Wolf 1998; Kuo 2001a; Kuo 2001b; Kuo 2003; Hastie 2003; Wolf 1999). All of these economic benefits are essential for decision makers to consider when assessing the value of green infrastructure in public spaces or on private property.

Count Benefits for Decisionmakers

The costs to build green infrastructure practices are straightforward, but the monetized benefits of green infrastructure implementation are not as obvious. When evaluating green infrastructure benefits, it is important to have the following:

- Local data or estimates of water storage and infiltration capacity for typical green infrastructure practices to estimate benefits.
- Costs of green infrastructure construction and maintenance to estimate expenditures.
- Water supply, wastewater treatment, regulatory compliance, and gray infrastructure costs to estimate avoided costs.

If these data are not available, values available in scientific literature can be substituted and still provide meaningful information for decisionmakers.

One of the tools that allows a community to estimate the economic value of green infrastructure is the Center for Neighborhood Technology's *The Value of Green Infrastructure: A Guide to Recognizing Its Economic, Environmental and Social Benefits* (CNT 2010). EPA, the Center for Neighborhood Technology, and the City of Lancaster, Pennsylvania, used *The Value of Green Infrastructure* to estimate the value of the economic benefits of green infrastructure buildout as proposed in Lancaster's *Green Infrastructure Plan* relative to the estimated costs to install the practices. The analysis showed that Lancaster received the majority of the economic benefit from green infrastructure through reduced costs of wastewater treatment.

Similarly, the City of Seattle, Washington, was interested in quantifying the benefits of the green infrastructure that had already been installed as well as several future green infrastructure buildout scenarios. Seattle and EPA sought to examine benefits that typically aren't quantified:

- Energy savings for household use and stormwater treatment.
- Greenhouse gas emissions savings.
- Carbon sequestration in biomass and soil.
- Preserved sewer system/pipe capacity for climate adaptation.
- Criteria air pollutant reductions.
- Job impacts.

For example, it was shown that trees provided significant value in terms of air quality improvement, heat island reduction, household energy use reduction, and climate change mitigation.

Choose Projects to Maximize Community Benefits

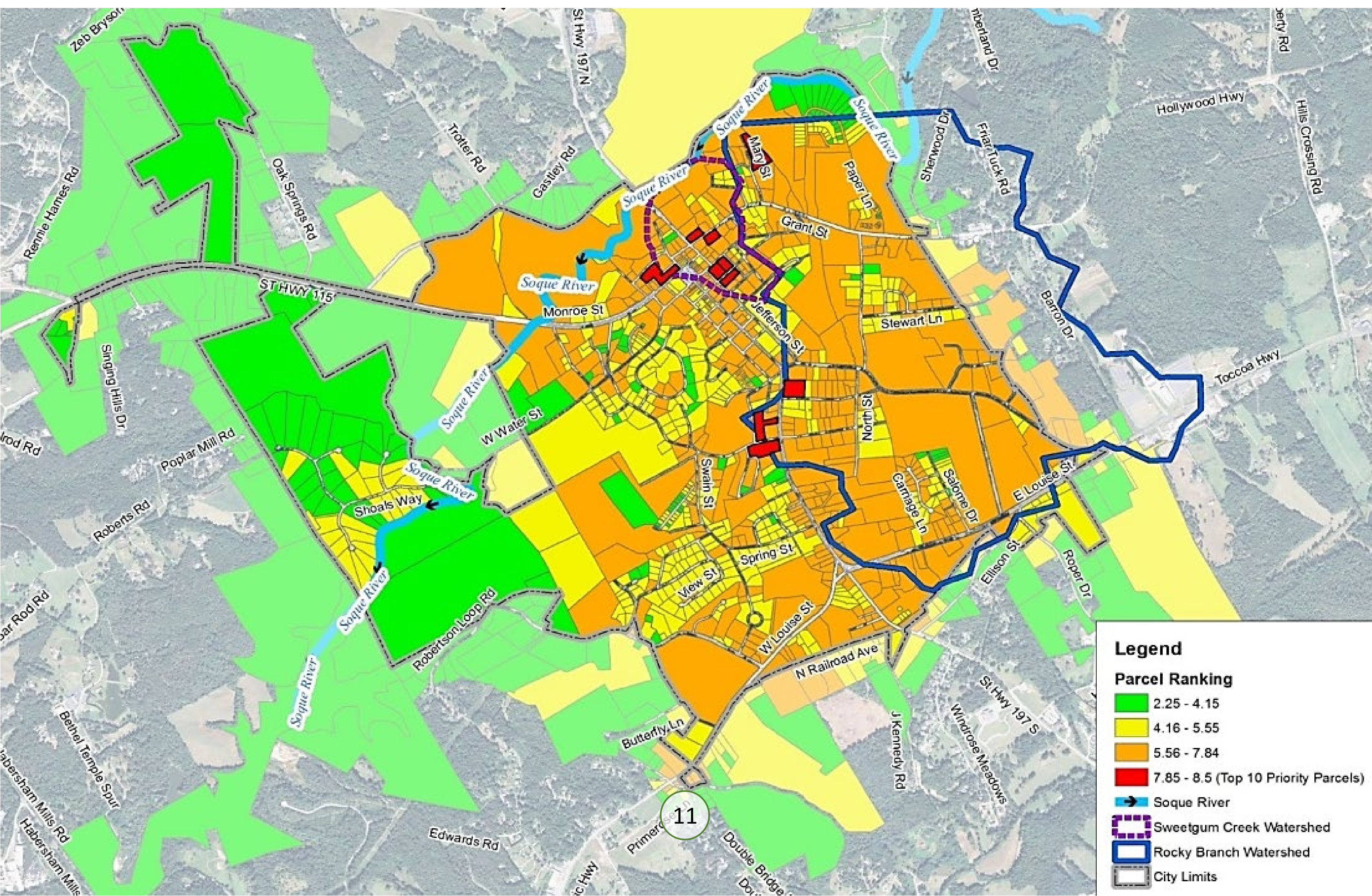
To allocate limited resources to provide as much benefit to the community and the environment as possible, municipalities should evaluate green infrastructure opportunities to identify the most suitable locations. For example, sites with some open space that have moderate to high soil infiltration and flat or moderately sloped topography will likely be the most appropriate for green infrastructure. In addition to site suitability conditions, communities can further evaluate sites for ownership (because public parcels do not require land acquisition or easements) and other local priorities such as history of flooding, storm drain system capacity concerns, socio-economic issues, park and open space deficits, and co-location with other planned improvements. EPA undertook one such prioritization study with Clarkesville, Georgia, using the following criteria:

- Parcel ownership (public vs. private).
- Parcel characteristics (size, slope, imperviousness, and infiltration capacity).
- Location in a priority watershed.
- Association with identified maintenance needs or other stormwater structures.

The analysis resulted in a prioritized list of high-value parcels that was further refined based on field visits and input from stakeholders.

In conjunction with the Buffalo Sewer Authority, EPA developed a protocol and mobile application to assess vacant properties for their suitability to serve as green space and retain stormwater to reduce CSOs. EPA collected information on general site conditions, elevations, vegetation, waste, impervious areas, soil types, and soil hydrology to identify parcels where green infrastructure practices could result in the most CSO reduction and economic value. The assessment protocol can be adapted for other communities to evaluate vacant properties for beneficial use in light of population decline and suburbanization.

Results of green infrastructure parcel prioritization in Clarkesville, Georgia



Drought-tolerant plants enhance the sustainability of green infrastructure in arid and semi-arid environments

Use Green Infrastructure to Support the Regulatory Landscape

Communities can make the case for green infrastructure by examining how it can be used to meet multiple regulatory requirements and goals.

EPA worked with the Council for Watershed Health in Los Angeles, California, to evaluate how green infrastructure could be used to meet several state and local regulatory objectives in addition to improving stormwater management and water quality. The analysis showed that green infrastructure can help local communities in the region meet specific climate-change and water security initiatives and mandates, water quality regulations such as municipal stormwater permits and total maximum daily loads (TMDLs), and integrated water planning efforts.

EPA also developed a protocol to assess vacant parcels or infill redevelopment sites that are potentially contaminated (commonly known as brownfields) to determine how stormwater management practices can be safely used. The protocol allows developers and communities to reconcile the goal of sustainably managing stormwater with brownfield site considerations to prevent stormwater infiltration from mobilizing contaminants and increasing the potential for groundwater contamination.

Enhance Community and Infrastructure Resiliency

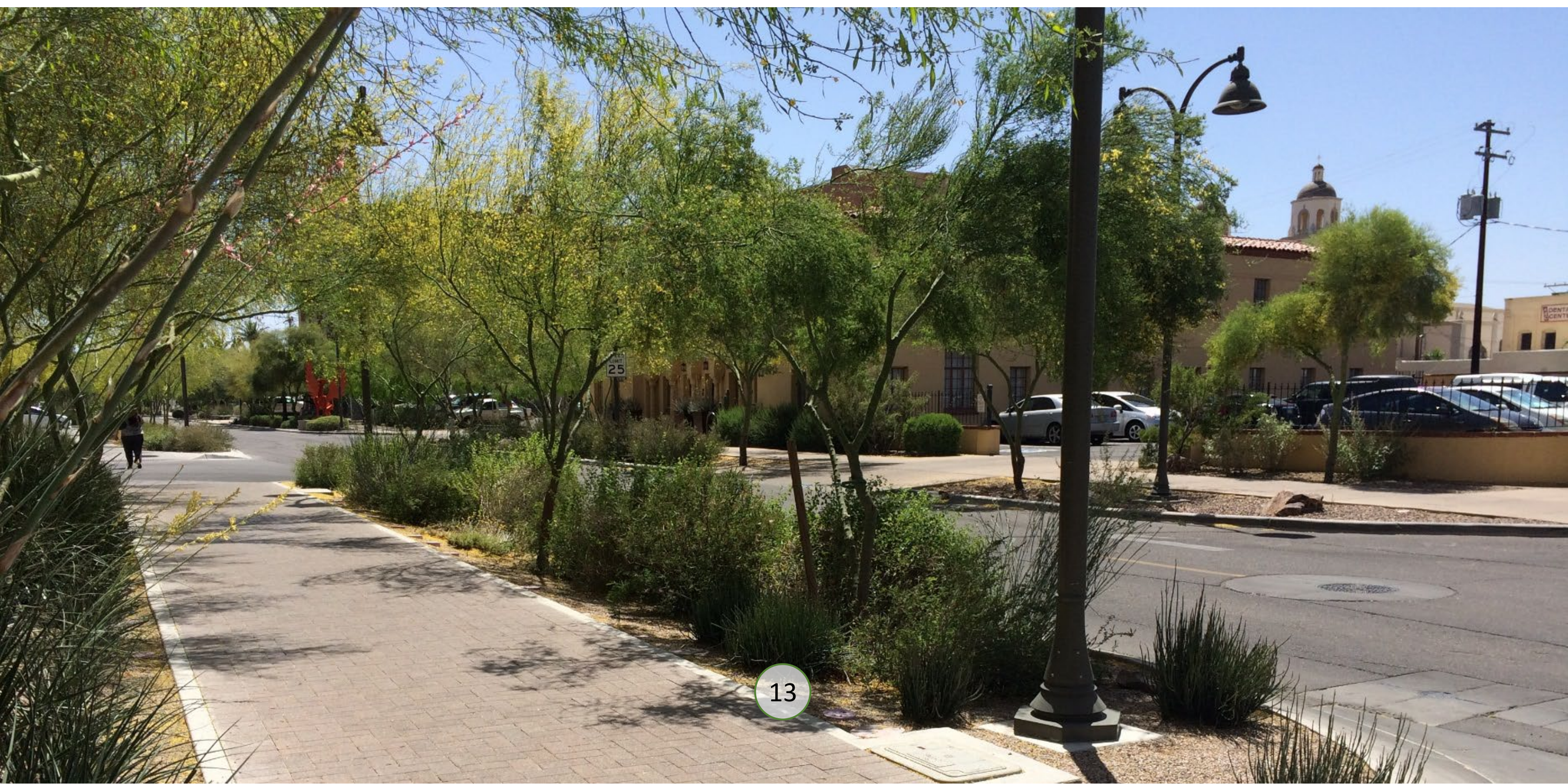
Communities are facing different challenges caused by climate change depending on where they are located. Impacts may include increased flooding due to more frequent and intense rainfall, drought due to less frequent rainfall, and coastal damage and erosion caused by sea level rise. Green infrastructure can help to alleviate some of these climate change effects while providing other community benefits and helping to mitigate further climate change with increased vegetation. Green infrastructure's vegetation, particularly trees, can improve communities' climate change resiliency by reducing the urban heat island effect, absorbing carbon dioxide, and filtering air pollutants such as sulfur dioxide and ground-level ozone. Enhanced tree canopy and other vegetation can reduce urban temperatures and offer respite during heat waves and can reduce costs associated with residential and commercial cooling. Green infrastructure can also help to conserve water, enhance local water supply, and reduce need for imported water. Prolonged droughts have brought water supply and conservation to the forefront of many communities' agendas. Cisterns and rain barrels can capture water for irrigation and use in graywater applications, reducing the amount of potable and recycled water needed for on-site use. Green infrastructure also can recharge groundwater supplies and help maintain drinking water supply levels during dry weather.

Use Green Infrastructure to Reduce Flooding and CSOs

Green infrastructure can reduce the amount of water entering the sewer system and stream channels, reducing localized flooding when the storm sewer capacity is exceeded and reducing the incidence of overflows in combined sewer systems. In La Crosse, Wisconsin, EPA analyzed several green infrastructure street improvement options to address flooding problems in the Johnson Street Basin. Replacing traditional asphalt with permeable pavement provided the greatest amount of flood reduction for less cost than other alternatives considered.

In Bath, Maine, EPA analyzed how green infrastructure practices could be used in concert with gray infrastructure improvements to reduce the frequency and magnitude of CSOs in the low-lying Willow Street neighborhood. Similarly, in Fall River, Massachusetts, EPA examined how street-side tree filters could provide the triple benefits of increased tree canopy, replacement of failing infrastructure, and CSO reduction. In Omaha, Nebraska, EPA helped the city compare green vs. gray infrastructure solutions to eliminate CSOs and evaluated green and gray solutions in a pilot project area using a cost-benefit approach. Through these projects, EPA found that green infrastructure could be used cost-effectively—both alone and in concert with gray infrastructure improvements—to reduce flooding and CSOs.

Trees can offer a welcome respite from the heat in warm climates



Support Water Reuse

Green infrastructure can also address water scarcity caused by more frequent and prolonged drought. Green infrastructure water harvesting practices can capture runoff for on-site use and decrease potable water demand. Infiltration practices can be used to recharge groundwater supply and restore flow to streams, rivers, lakes, and reservoirs. EPA supported several projects that had a water capture component. In Albuquerque, New Mexico, EPA designed an integrated green infrastructure system for the Imperial Building project that provided irrigation for a rooftop garden, practices at the ground level to capture and treat additional site runoff, and planter boxes and street trees to treat nuisance dry-weather flows in the adjacent storm drain system.

In Santa Monica, California, EPA developed plans for a water harvesting system using green infrastructure at Ozone Park. The system included a cistern and a 0.5-acre-foot underground infiltration gallery. The system has the potential to provide up to 100 percent of the approximately 450,000 gallon annual irrigation demand at Ozone Park. EPA also made policy recommendations for changing development codes to allow or encourage water harvesting and other green infrastructure practices for the Council for Watershed Health in the Los Angeles Region, Macatawa Area Coordinating Council in Michigan, and for the City of Franklin, Massachusetts.

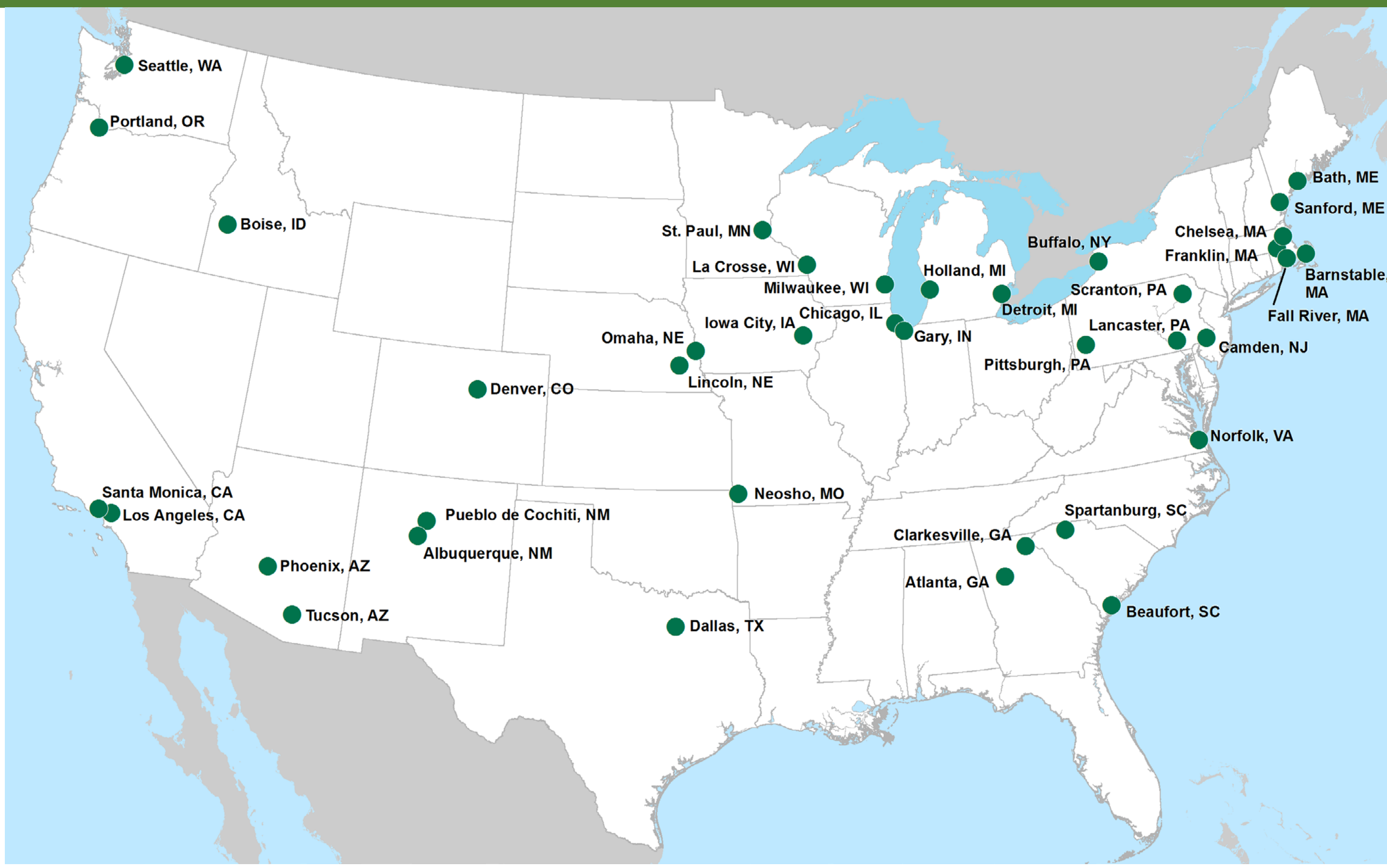
Adapt to Rising Sea Levels

Green infrastructure practices can protect coastal areas from increased wave erosion caused by sea level rise and can be designed to adapt to changes in sea level over time. EPA worked with the City of Norfolk, Virginia, and local watershed groups to develop a living shoreline project that will stabilize the existing eroded shoreline and takes the impacts of future sea level changes into consideration. The Mayflower Road BMP design includes a planned transition of infiltration-based bioswales to a wetland or wet pond over time as water levels rise.

Rendering of Mayflower Road conceptual design in Norfolk, Virginia

Learn More About the Projects

Since 2012, EPA provided technical assistance in communities to address significant barriers to using green infrastructure and share lessons learned. Projects were designed to serve as case studies for other communities with similar goals. Project locations are shown on the map below, and a catalog of technical assistance products can be found in the table on pp. 16–17. The goals of the projects included creating **conceptual designs**, reviewing **local codes** to remove barriers, developing **guidance**, estimating **economic benefits**, and **modeling** the effect of green infrastructure. Links to completed reports, manuals, and conceptual designs can be found on EPA's Green Infrastructure website at www.epa.gov/greeninfrastructure.



What Did the Communities Say?

The project has impacted the region's green infrastructure/ outlook in providing us with a clear and comprehensive document for outreach and education with municipalities and engineers in evaluating green infrastructure opportunities.

The [technical assistance] process was good, and it sowed a seed with our public works department. Hopefully that will grow in the next year or two!

We continue to seek ways that [our community] can benefit from the experience gained by other cities in implementing green infrastructure.

The project process...accelerated thinking about use of the [right-of-way] for addressing runoff from redevelopment activities in a way not done in the past.

The report helped the City see the possibilities more clearly, and helped us raise awareness and support for the Greenway. It is a great foundational effort.

EPA Region	Project Name	City	State
Conceptual Design			
1	Birch Street Green Infrastructure Pilot Program	Fall River	MA
1	Willow Street Green Infrastructure Design	Bath	ME
1	Conceptual Green Infrastructure Design for Washington Street, City of Sanford	Sanford	ME
3	Conceptual Green Infrastructure Design in the Point Breeze Neighborhood	Pittsburgh	PA
3	Conceptual Green Infrastructure Design in the Brookline Neighborhood	Pittsburgh	PA
3	Conceptual Green Infrastructure Design in the Swisshelm Park Neighborhood	Pittsburgh	PA
3	Greening the Iron Arts District	Scranton	PA
3	Restoring Knitting Mill Creek through Green Infrastructure	Norfolk	VA
4	Boone Boulevard Green Infrastructure Conceptual Design	Atlanta	GA
4	Block-Scale Green Infrastructure Design for the Historic Northwest Quadrant	Beaufort	SC
4	Northside Neighborhood Green Infrastructure Master Plan	Spartanburg	SC
5	Gary, IN Green Infrastructure Conceptual Design	Gary	IN
5	West Side Flats Greenway Conceptual Green Infrastructure Design	St. Paul	MN
6	Imperial Building Site Design	Albuquerque	NM
6	Pueblo de Cochiti Green Infrastructure Concept Design	Pueblo de Cochiti	NM
7	North Wastewater Treatment Plant Restoration	Iowa City	IA
7	Lincoln Children's Zoo Student Conceptual Designs	Lincoln	NE
7	City of Neosho Green Infrastructure Design Handbook	Neosho	MO
8	Conceptual Green Infrastructure Design for the Blake Street Transit-Oriented Development Site, City of Denver (PDF)	Denver	CO
9	Building Resilience to Drought in Ozone Park	Santa Monica	CA
10	Fairview Avenue Green Street Conceptual Design	Boise	ID
10	District-Scale Green Infrastructure Scenarios for the Zidell Development Site	Portland	OR
Guidance Development			
1	Using Green Infrastructure in the City of Chelsea (Brochure)	Chelsea	MA
1	Technical Support Document to Assist the City to Further Encourage and Promote the Use of Green Infrastructure	Chelsea	MA
2	City of Camden Green Infrastructure Design Handbook	Camden	NJ
3	Addressing Green Infrastructure Challenges in the Pittsburgh Region: Fact Sheet Series	Pittsburgh	PA
3	Addressing Green Infrastructure Challenges in the Pittsburgh Region: Space Constraints	Pittsburgh	PA
3	Addressing Green Infrastructure Challenges in the Pittsburgh Region: Steep Slopes	Pittsburgh	PA
3	Addressing Green Infrastructure Challenges in the Pittsburgh Region: Abundant and Frequent Rainfall	Pittsburgh	PA
3	Addressing Green Infrastructure Challenges in the Pittsburgh Region: Clay Soils	Pittsburgh	PA
5	Implementing Stormwater Infiltration Practices at Vacant Parcels and Brownfield Sites	Chicago	IL

EPA Region	Project Name	City	State
Guidance Development (continued)			
5	Green Street Opportunities in Gary, IN	Gary	IN
7	BMP Fact Sheet Series	Lincoln	NE
8	Green Infrastructure Checklists and Renderings	Denver	CO
9	Tools to Promote Green Infrastructure Implementation in Arid and Semi-Arid Regions	Pima County	AZ
Policy Review/Recommendations			
1	Chelsea, Massachusetts Development Code Review to Promote Green Infrastructure	Chelsea	MA
2	Green Infrastructure Barriers and Opportunities in Camden, New Jersey	Camden	NJ
4	Clarkesville Green Infrastructure Implementation Strategy	Clarkesville	GA
4	Northside Neighborhood Green Infrastructure Master Plan	Spartanburg	SC
5	Community Engagement Framework for the City of Gary	Gary	IN
5	Green Infrastructure Barriers and Opportunities in the Macatawa Watershed, Michigan	Holland	MI
5	Elements of a Green Infrastructure Maintenance Business Plan	Milwaukee	WI
6	Green Infrastructure Barriers and Opportunities in Dallas, Texas	Dallas	TX
7	Urban Pollutant Reduction Strategies	Lincoln	NE
7	Support Process Development for Assessing Green Infrastructure in Omaha	Omaha	NE
7	Green Infrastructure Barriers and Opportunities in Neosho, Missouri	Neosho	MO
9	Green Infrastructure Barriers and Opportunities in Phoenix, Arizona	Phoenix	AZ
9	Green Infrastructure Barriers and Opportunities in the Greater Los Angeles Region	Los Angeles	CA
10	Fairview Avenue Green Street Conceptual Design	Boise	ID
Screening and Prioritization			
1	Green Infrastructure Implementation Strategy for the Town of Franklin, Massachusetts	Franklin	MA
2	Urban Vacant Land Assessment Protocol	Buffalo	NY
4	Clarkesville Green Infrastructure Implementation Strategy	Clarkesville	GA
5	Green Infrastructure Targeting in Southeast Michigan	Detroit	MI
7	Support Process Development for Assessing Green Infrastructure in Omaha	Omaha	NE
Modeling			
1	Nitrogen-reducing Green Infrastructure in Environmental Justice Communities	Barnstable	MA
5	Using Green Infrastructure to Mitigate Flooding in La Crosse, WI	La Crosse	WI
7	Support Process Development for Assessing Green Infrastructure in Omaha	Omaha	NE
Economic Benefits			
3	The Economic Benefits of Green Infrastructure: A Case Study of Lancaster, PA	Lancaster	PA
10	Expanding the Benefits of Seattle’s Green Stormwater Infrastructure	Seattle	WA

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