Getting to Green:
Paying for Green Infrastructure
Financing Options and Resources for Local Decision-Makers

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Introduction

Better stormwater management through green infrastructure can have many benefits. Many different studies have documented multiple and quantifiable costs and benefits across a range of social, economic, and environmental improvements (see most recently "Enhancing Sustainable Communities With Green Infrastructure" (http://www.epa.gov/smartgrowth/pdf/gi-guidebook/gi-guidebook.pdf) and an entire webpage of approaches for cost-benefit analysis at http://water.epa.gov/infrastructure/greeninfrastructure/gi_costbenefits.cfm).

Water-related benefits can include reduced stormwater runoff resulting from successful infiltration practices, increased groundwater recharge, reduced downstream flooding and pollutant loading, and reduced combined sewer overflows. Green infrastructure can also reduce energy use and the urban heat island effect when practices such as green roofs and tree planting are used. Air quality benefits can be realized through increased vegetative practices like bioretention, planting trees, and use of green roofs. Finally, community benefits including enhanced aesthetics, higher land values, and reduced noise pollution can be achieved through green infrastructure (CNT, 2010).

Green Infrastructure practices typically involve compact design to retain or manage stormwater from individual or neighborhood group parcels. The information presented in this report is targeted at people making decisions about how to finance those projects. The report identifies various funding sources that can be used to support stormwater management programs or finance individual projects and includes:

- Available financing options, mostly applicable to small parcel projects, that summarizes various funding sources that can be used to support stormwater management programs or to finance individual projects;
- Examples of several municipal programs by type of funding source, along with a list of additional resources; and
- An appendix that presents the results and analysis of a survey conducted to assess Providence Rhode Island's readiness to finance and implement LID aspects of stormwater management.

These categories are meant as a general guide but should be tailored to specific communities and needs. Some funding sources may be more applicable to capital projects while others are meant to sustain program development including operations and maintenance.

The comparative matrix below summarizes the advantages and disadvantages of the funding sources discussed in this report.

Funding Source	Description	Advantages	Disadvantages
Taxes/General Funds	Funds raised through taxes such as, property, income, and sales that are paid into a general fund.	• Consistent from year-to-year • Utilizes an existing funding system	• Competition for funds; • Tax-exempt properties do not contribute; • System is not equitable (does not fully reflect contribution of stormwater runoff)
Fees	Funds raised through charges for services such as inspections and permits. Funds raised through developer impact fees are one-time charges linked with new development.	• Specific permit and inspection fees allow for more direct allocation of costs for services provided • Addresses potential stormwater impacts related to new construction	• Funding not available for larger projects or system-wide improvements • Developer impact fees may be an unreliable source when development slows (due to market downturns/contractions) • Requires administrative framework to assess and manage
Stormwater Utility	A stormwater utility generates its revenue through user fees and the revenues from the stormwater charges will go into a separate fund that might be used only for stormwater services.	• Dedicated funding source • Directly related to stormwater impacts • Sustainable, stable revenue • Shared cost • Improved watershed stewardship • Addresses existing stormwater issues	• Feasibility study required for implementation, fee structure, and administration of utility • Approval by vote of the local legislative body • Perception by the public of a “tax on rain”
Grants	State and federal grants provide additional funding for water quality improvements.	• Existing sources available for stormwater-related funding • Does not require repayment	• Competitive • Typically one-time, project-specific, or time-constrained funds • Often requires a funding match
Bonds	Bonds are not a true revenue source, but are a means of borrowing money. “Green” bonds are a new source of funding dedicated to environmentally friendly projects, including clean water projects.	• Existing sources available for stormwater-related funding • Can support construction-ready projects • Can provide steady funding stream over the period of the bond	• One-time source of funds • Requires individual approval for each issuance • Requires full repayment • Possible interest charges • Requires dedicated repayment revenue stream • May require design-level documents to be prepared in advance • Likely requires voter approval • Can have high transaction costs relative to requested amount • May require significant administrative preparation to issue
Loans	Low-interest loans may be secured, but are generally used for planning and capital projects.	• Existing sources available for stormwater-related funding • Offers low- or no-interest financing	• One-time source of funds • Requires full repayment
Public-Private Partnerships	Contractual agreement between a public agency and a private sector entity that allows for the private sector participation in the financing, planning, design, construction, and maintenance of stormwater facilities.	• Can reduce costs to government • Significantly leverages public funding and government resources • Ensures adequate, dedicated funding • Improved O&M • Shared risk	• Perceived loss of public control • Assumption that private financing is more expensive and belief that contract negotiations are difficult

I. Taxes and General Funds

A. Description

Parcel green infrastructure projects include:

- Green roofs
- Permeable pavement
- Rain gardens
- Tree boxes
- Vegetated swales
- Disconnected downspouts

Tax revenue (e.g., property, income, and sales) usually contributes the greatest amount to municipal general funds, and many communities rely on taxes to fund their public works, including stormwater management. Though appropriated for specific purposes through the budget process (NAFSMA 2006), general funds are relatively consistent from year to year and may be used by local governments for any legal purpose. Unless the municipality is responding to a recent major storm or regulatory action, however, in the competition for general funds annual operating budgets, stormwater management programs are typically considered low priority in comparison to other public services such as public safety, schools, and social services. Further, there is a lack of transparency in the general fund financing system; the total cost of stormwater management is not apparent when costs are dispersed across general fund departmental budgets. Allocations from taxes can be unreliable means of financing stormwater programs because community leaders may face difficulty diverting funds from general municipal budgets to finance stormwater pollution control and because budgets are subject to political pressures and such activities may not align with the priorities of elected officials.

More broadly, as a means of paying for stormwater management, the general fund system is not equitable because the basis for determining property taxes is not related to the costs of stormwater generated by individual properties. Property taxes are calculated based on an assessment of the value of land, which is unrelated to stormwater runoff quantity or quality. Further, many properties may be exempt from taxes (e.g., state-owned properties, public universities, hospitals and non-profit organizations, religious institutions, and military installations) and, therefore, do not support any of the cost of stormwater management, even though these properties are often large contributors of stormwater runoff.

Capital Improvement Planning (CIP) funds are another type of general fund that might be used to fund the initial building of a project, or a demonstration project. Further, the CIP process is a long-term planning process and would require forecasting for project development. CIP funding may offer funds for a start-up project; however, would not be suitable for financing the maintenance of a project.

B. Municipal Examples

The Ramsey-Washington Metro Watershed District developed the Maplewood Mall Rainwater Runoff Retrofit Project in the Minneapolis suburb of Maplewood to improve water quality in Kohlman Lake, and ultimately the Mississippi River. The District covers 56 square miles that drain into the Mississippi River. The project reduces and filters rainwater runoff prior to leaving the mall's 35-acre parking lot through the use of rainwater gardens, rainwater tree groves, permeable pavers, and a cistern that captures roof runoff (RWMWD 2014). The District's Capital Improvements Budgets (CIB) Fund fully financed the project's first phase (rain gardens at each of the mall entrances), and supplemented grant funds during Phases II and III. The CIB Fund is funded by a District-wide ad valorem tax. The District's principle source of funds is the property tax levy. A large tax base creates a tax levy of approximately 3 percent of total property tax for each parcel (Berahzer 2013). Phase IV, the final phase, was funded by Minnesota's Clean Water Fund Grant, a TMDL Implementation Grant, and Clean Water Revolving Fund (CWRF) loans and grants (RWMWD 2014). The Clean Water Fund was created in 2008 with the passage of Minnesota's Clean Water, Land, and Legacy Amendment to the Minnesota Constitution, that increases the state sales tax by three-eighths of one percent beginning July 1, 2009 and continuing until 2034. The additional sales tax is distributed to four major funds, including 33 percent distributed to the clean water fund. The clean water fund may only be spent to protect, enhance, and restore water quality in lakes, rivers, and streams and to protect groundwater from degradation (Minnesota Legislature 2014).

> The University of Maryland Environmental Finance Center (EFC) maintains an interactive Green Infrastructure Financing Map on their website (http://efc.umd.edu/gimap) that presents financing examples from communities across the country using infographics.

C. For More Information

Ramsey-Washington Metro Watershed District, Minneapolis, Minnesota
http://www.rwmwd.org/

http://www.rwmwd.org/index.asp?Type=B_BASIC&SEC=%7BDB475310-069F-4230-9E97-01E92FD50527%7D

II. Fees

A. Description

Local governments have funded stormwater pollution control measures through charging inspection and permit fees (Lehner et al. 1999). Fees may be obtained from permit reviews, plan reviews, new development impact fees, and special user fees (UMEFC 2014 and NAFSMA 2006).

Fees collected for permit and plan reviews may be applied towards general public safety, health, and welfare but may also be used for carrying out specific regulatory functions. For

example, fees charged for inspections necessary to ensure proper best management practices (BMP) installation and maintenance may be perceived as more reasonable than using funds from the general fund raised by taxes or utility rates (NAFSMA 2006). Permit fees collected should be directly linked to stormwater management or drainage systems; the permit agency should identify a clear connection between the permit fees collected and the project financed. One method to consider is to use dedicated accounts for individual facilities and projects (CASQA 2003). Establishing special fees allows for more direct allocation of costs for services provided.

Local governments frequently impose impact fees to fund various public infrastructure components. The goal of development impact fees is to raise revenue for the construction or expansion of capital facilities necessitated by new development, such as roads, schools, or sewer lines (Gartner et al. 2013). They are generally used to compensate for the effects of new development by developing offsite management practices when the impacts cannot be solved on-site (NAFSMA 2006). These fees are typically a one-time fixed fee charged for each housing unit built, or they may vary with the square footage of a house (Kousky et al. 2011). Impact fees are typically limited to situations in which the impact of new development on existing infrastructure systems is 1) measureable and certain; 2) on definable geographic or systemic extent; and 3) quantifiable in terms of the incremental capital investment that will be required to maintain an adequate service level in the face of the added growth attributable to the subject development (NAFSMA 2006, p. 2-21). Ability to meet these criteria requires an administrative or other type of framework to determine and manage assessments. Impact fees are not appropriate funds to bring inadequate existing systems up to an adequate level of service. Further, impact fees are designated for specific projects (e.g., provision of additional water and sewer systems, roads, schools, and libraries), must be used quickly, and if they are not, must be returned to the developer (NAFSMA 2006). Finally, developer impact fees can be an unreliable source of funding because they are directly related to the health of the housing market; available funds can diminish when development slows due to a downturn in the economy.

Using dedicated fees is preferable because it avoids competing with other programs and needs that might be covered by general funds and because the funding is linked directly to the services provided.

Stormwater utility fees are discussed separately in this document.

Special assessments are unique charges a local government proportionately assesses against specific properties to fund certain projects such as sidewalks, sewer connections, road maintenance, and street lighting. For stormwater management, they are most suitable for small-scale retrofit applications, such as improving a ditch or channel that improves drainage for a small service area or a few properties (NAFSMA 2006). Effective stormwater management typically occurs on a larger scale, however, and is not tied directly to individual properties; therefore, special assessments are generally not used as a primary funding source for that purpose (NAFSMA 2006).

B. For More Information

The *Guidance for Municipal Stormwater Funding*, prepared by the National Association of Flood and Stormwater Management Agencies under grant provided by USEPA, provides an informative discussion of various fees that can be used to finance stormwater

management projects. The document can be accessed through the following link: http://water.epa.gov/polwaste/nps/upload/Guidance-Manual-Version-2X-2.pdf.

How development impact fees can finance essential public facilities in growing local economies: http://www.scholarsstrategynetwork.org/sites/default/files/ssn_key_findings_burge_on_development_impact_fees.pdf.

New Hampshire's Office of Energy and Planning: http://www.nh.gov/oep/resource-library/planning/.

III. Stormwater Utilities

A. Description

To generate funds to manage stormwater and its impacts, some communities have created stormwater utilities that charge a fee to residential, industrial and commercial water customers. A stormwater utility is a mechanism to fund the cost of services directly related to the implementation of stormwater programs. Stormwater utilities are similar to water, sewer, or fire districts in that they are stand-alone service units within a government that generate revenues through user fees for services related to the control and treatment of stormwater, separate from the general tax fund and used only for those services.

Establishing stormwater fees/rates facilitates an equitable and transparent relationship between the volume of stormwater generated by a given property, the benefit received by the rate-payer, and the corresponding fee required (Lehner et al. 1999). The supporting rate structure should reflect site characteristics (e.g., property area and relative impervious coverage) that are directly related to runoff generation. Fees can be added to property tax bills or water bills, or simply be stand-alone stormwater bills. Adding a fee to the water and/or sewer bill can help to raise public awareness of the impacts of stormwater.

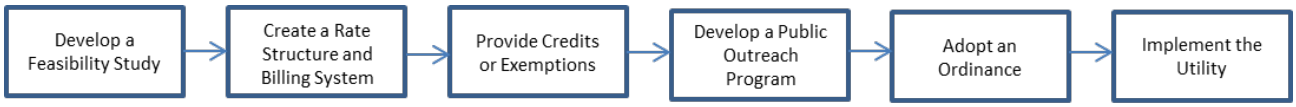
Three common methods used for collecting stormwater utility fees are to charge by 1) flat fee, 2) equivalent residential unit (ERU), and 3) tiered rate structure. Flat fees and tiered rate structures are used most frequently for residential customers while charging by ERU is more common for non-residential customers and the most widely used method of establishing rates. An ERU is generally defined as the average impervious area on a single-family residential (SFR) parcel, although some communities define it as the average of all residential parcels. Using ERUs as the basis, fees are divided into two categories: for single-family properties and for nonsingle-family properties. The ERU system is used by more than 80 percent of all stormwater utilities (USEPA 2009b). A representative sample of SFR parcels was surveyed to determine the impervious area of a typical SFR parcel, called one ERU. In some cases, several tiers of SFR flat rates were established on the basis of an analysis of SFR parcels within defined total area groups (USEPA 2009b). Generally, fees for non-

residential properties are proportional to the ratio of the parcel impervious area to the ERU (Campbell 2013).

There are several factors that should be considered when setting the stormwater utility fee. While population size might be the most obvious one, poverty rate, median household income, and geographical/site characteristics are other factors that should be evaluated. Further, a sustainable stormwater utility fee structure should include a credit program for customers that implement mitigation steps such as rain gardens or rain barrels on their own properties. Depending on the mitigation method(s) installed and assurance of continued proper maintenance, customers could receive a certain percentage off their stormwater bills each month (Berahzer 2014).

Establishing stormwater utilities is viewed as a viable option to finance stormwater management programs because stormwater utilities:

- Are more equitable because they can be used to link fee levels to the service benefits that payers receive
- Can provide opportunities and incentives for payers to reduce their fees by installing BMPs on their properties
- Can be dedicated to stormwater services only, eliminating the need for competing for allocations with other programs and obligations
- Can be designed to include tax-exempt properties (e.g., churches, hospitals, public properties, and schools)



Creating a Stormwater Utility (Adapted from EPA's *Funding Stormwater Programs 2009*)

Stormwater utilities are not prevalent in New England or other locations where the lack of larger administrative units such as counties or special-purpose districts inhibit economies of scale and effort. However, new and more stringent permit requirements are leading many communities to review their legal authorities to create and implement stormwater utilities.

B. Municipal Examples

Reading, Massachusetts – The town developed the utility between 2003 and 2006 and approved it in April 2006. Single- and two-family properties are assessed a flat fee (i.e., $10/quarter or $40/year) and other properties are charged fees based on the total amount of impervious cover on their property (MAPC 2010). Undeveloped properties are not assessed a stormwater fee. Residential and nonresidential properties that install and maintain infiltration systems or other means to reduce runoff are eligible for a fee reduction of up to 50 percent of their total stormwater fee assessment (Town of Reading 2014).

Newton, Massachusetts – Newton's stormwater fee is a set charge based on whether a property is residential or nonresidential, with a discounted fee for senior residents. All residential properties with a domestic water meter are charged $6.25/quarter; the elderly discount fee is $4.38/quarter. All nonresidential properties are charged $37.50/quarter (City of Newton 2014).

Lewiston, Maine – The city adopted a stormwater utility during 2006-2007 budget deliberations to meet federal mandates for stormwater while also creating a funding mechanism to more fairly distribute the cost of implementing the stormwater program (City of Lewiston 2014a). The city developed a Stormwater Utility Fee Schedule and Credit Policy to establish user fees based on the amount of impervious surface on any property. Single-family home and mobile home properties are charged a flat rate of $50 per year and duplex residential properties are charged a flat rate of $74 per year. Other properties are charged a flat fee of $50 per year if the impervious surface area is 2,900 SF or less. In addition to the $50 base rate, parcels having more than 2,900 SF of impervious surface are charged $0.054 for every square foot of impervious surface exceeding the 2,900 SF base (City of Lewiston 2014b).

South Burlington, Vermont – South Burlington established a stormwater utility in 2006 with user fees based on the amount of impervious area on a property. The ERU was set using a scientific process to determine the amount of impervious surface for a typical single-family home and establishing monthly fees for single-family homes, duplexes, and triplexes ($4.50/month). All other properties also are assessed a fee based on the amount of impervious surface. The utility offers credits as specified in the South Burlington Credit Manual to owners of nonsingle-family residential properties for constructing and maintaining stormwater treatment practices as specified in the Vermont Stormwater Management Manual (Hoyle, Tanner & Associates, Inc. and AMEC Earth and Environmental, Inc. 2006). The manual indicates that non-single-family residential properties include, but are not limited to, multiple dwelling unit residential properties (e.g., apartments, condominiums, and townhomes) that have greater than three units per building, commercial and office buildings, and other types of buildings. Individual single-family residential properties are not eligible for credits. Single-family residential properties are defined in the manual as "…developed land containing one structure which is not attached to another dwelling and which is designed for occupancy in one, two, or three residences. These may include houses, duplexes, and triplexes, manufactured homes, and mobile homes located on one or more individual lots or parcels of land".

Duplexes and triplexes are traditional stock housing throughout New England; therefore, this should be a significant consideration when evaluating the feasibility of creating a stormwater utility similar to the South Burlington utility.

Prince William County, Virginia – The Board of County Supervisors established a Stormwater Management Program in 1994 that included a utility. Residential and nonresidential owners of developed property in the county pay fees to the utility based on the amount of impervious area on their property. The fees appear on the real estate bill and are paid biannually. On April 8, 2014, the Board approved an increase in the fee, reflected in the Fiscal Year 2015 stormwater management fees: annually owners of single-family dwellings are charged $38.21/year; owners of townhouses, apartments, and condominiums are charged

$28.69/year; and nonresidential property owners are charged $18.56 per 1,000 square feet of impervious area. Fee reductions or credits are available if a stormwater management system is already in place (PWCVADPW n.d.).

Watershed Protection Utility – An expansion of the typical stormwater utility model is the concept of a watershed protection utility (WPU). This emerging approach to generating funds was proposed during meetings held by the U.S. Water Alliance between March 2013 and February 2014 to develop ways to reduce nutrient pollution in waterways within the Mississippi River Basin, referred to as the "Mississippi River Nutrient Dialogues". A WPU would be an entity modeled after a private or quasi-private utility to utilize public funds and address local and regional issues using economies of scale to restore and protect ecosystem services and achieve local, state, and regional water quality improvements (U.S. Water Alliance 2014, p. 17) at potentially lower costs. Projects could address pollutants from nonpoint sources, traditional point sources, and agriculture. Funding for a WPU could be secured and directed to projects directly by the WPU, or other funds could be used to create a union between the WPU and the entity that owns or governs the other funds (U.S. Water Alliance 2014). Further, special assessments, taxes, state sales tax, and grants could provide other sources of funding for a WPU (U.S. Water Alliance 2014). Careful consideration must be given to the scale of the project before promoting the concept of the WPU to community stakeholders.

C. For More Information

Upper Narragansett Bay Regional Stormwater Utility Feasibility Study Phase 1 Draft Final Report: *Exploring Regional Solutions to Regional Problems: Upper Narragansett Bay Regional Stormwater Utility Feasibility Study Phase 1 Draft Final Report*.

Reading, Massachusetts' Stormwater Enterprise Fund:
http://www.readingma.gov/collector/pages/storm-water-faqs

Newton, Massachusetts' Stormwater Fee:
http://www.newtonma.gov/civicax/filebank/documents/27361

Lewiston, Maine's Stormwater Utility:

- General Program Information: http://me-lewiston.civicplus.com/index.aspx?nid=199
- 2014 Brochure: http://me-lewiston.civicplus.com/DocumentCenter/View/4063
- Stormwater Utility Fee Schedule and Credit Policy:
  http://www.lewistonmaine.gov/DocumentCenter/View/4394

Prince William County's Department of Public Works Stormwater Management Fee:
http://www.pwcgov.org/government/dept/publicworks/environment/Pages/Storm-Water-Management-Fee.aspx

South Burlington, Vermont's Stormwater Utility: http://www.sburlstormwater.com/

South Burlington, Vermont's Credit Manual for Stormwater Fees:
http://www.sburlstormwater.com/wp-content/uploads/downloads/manuals/credit_manual.pdf

General: Approaches to Stormwater Management: Stormwater Utilities and Green Infrastructure by Stacey Isaac Berahzer of the University of North Carolina Environmental Finance Center (2014): http://www.efc.sog.unc.edu/reslib/item/approaches-stormwater-management-stormwater-utilities-and-green-infrastructure

IV. Credits and Incentive Programs

A. Description

Stormwater utility fee structures often include a credit/fee discount or other incentive program for customers who implement approved practices that reduce the impacts of stormwater on a property or in a community; mitigation steps can include reductions in impervious area, installation of BMPs, managing stormwater runoff on-site, or other stormwater improvements. Sometimes utilities provide credits in time of financial hardship. (WMEAC 2014).

Credits create incentives for property owners to become aware of and undertake practices that reduce the amount and/or improve the quality of stormwater runoff generated on their properties. Incentive programs support efforts to reduce stormwater runoff discharged to sewer systems and can include fee discounts or opt-outs, a stormwater credit exchange or water quality trading, development incentives, and rebates and installation financing (West Michigan Environmental Action Council, n.d.). Credits and incentive programs can be applied towards both new development and retrofit projects.

Two general types of credits exist:

1. Impact Reduction –This is often tied to managing stormwater onsite and reducing impact to the larger system or meeting design criteria.
2. Cost Reduction – This is less common and essentially reduces the city's or regional entity's costs through contribution of private efforts such as providing education/outreach support or taking on maintenance responsibility.

B. Municipal Examples

As discussed above, programs in Reading, Massachusetts and South Burlington, Vermont offer credits or fee discounts to customers that manage stormwater on-site. Examples of additional creative programs for generating credits include:

Anne Arundel County, Maryland – The Department of Public Works administers the Watershed Protection and Restoration Program (WPRP), implements the Stormwater Remediation Fee Credit Policy and Guidance, and encourages property owners to proactively manage stormwater on their property (Anne Arundel County 2014). The maximum allowable stormwater fee credit is 50 percent of the stormwater remediation fee for a property and can be achieved by implementing one or more eligible practices or activities under the stormwater credit policy (Anne Arundel County 2014). Stormwater credits are applicable for three years. Practices must be operated and maintained in accordance with the current credit application (Anne Arundel County 2014).

Portland, Oregon – In 1977, the City created a stormwater utility fee. The Clean River Rewards is Portland's stormwater utility discount program through which customers can receive up to a 100 percent discount on their onsite stormwater management charges if they manage stormwater on their properties. Partial credit is also available on a sliding scale for properties that manage any portion of stormwater on their site (Portland Environmental Services 2014a). Options for management practices include disconnecting downspouts and directing roof drainage to landscaped areas or rain gardens and installing drywells and soakage trenches. Portland's Ecoroof Program offers building owners and developers an incentive of up to $5 per square foot for an approved ecoroof project (City of Portland Bureau of Environmental Services 2014b). Portland's Treebate Program credits residential customers' city sewer/sewer utility bills for half the purchase price per tree (up to a certain amount based on tree size) for eligible trees (City of Portland Bureau of Environmental Services 2014c).

Philadelphia's stormwater charges are separated for commercial (non-residential) customers and residential customers.

- For commercial and nonresidential customers, the stormwater management service charge is based on the specific square footage of impervious area covering the property and the total square footage of the property. *Commercial and nonresidential property owners are eligible for fee credits by installing stormwater management controls.*
- For residential customers, the stormwater management service charge is a standard amount based on the average surface area of impervious cover on residential properties throughout the city. *Residential property owners are not currently eligible for fee credits.*

Philadelphia, Pennsylvania – Green City, Clean Waters is the city's 25-year plan to protect and enhance watersheds by managing stormwater with green infrastructure. The plan was developed in 2009 and amended in 2011 as part of the city's Combined Sewer Overflow Long Term Control Plan Update. The plan is to fund treatment plant upgrades and the installation of green infrastructure in streets, parks, schools, and other public spaces. The plan also encourages the private sector to use green infrastructure (Philadelphia Water Department n.d.). The plan includes several green stormwater infrastructure programs, such as: Green Streets, Green Schools, Green Public Facilities, Green Parking, Green Parks; Green Industry; Business, Commerce; and Institutions; Green Alleys; Driveways, and Walkways; and Green Homes.

Minneapolis, Minnesota – In 2005, the city began identifying costs for providing stormwater management as a separate line item on customers' utility bills. Minneapolis operates a Stormwater Credit Program to give incentives to implement stormwater management practices onsite. The program offers up to 50 percent credit towards customers' stormwater utility fees for management practices that improve stormwater quality and a 50 percent or 100 percent credit for management practices that address stormwater quantity.

C. Rebates and Installation Financing

Communities offer rebates and installation financing to provide incentives for property owners to install green infrastructure practices on their property. These rebates and financing

opportunities are often targeted to specific areas with the greatest need for green infrastructure, most often combined sewer areas. However, these programs may also be developed to achieve a range of water quality goals and implement community livability initiatives. For example, subsidies might be provided in neighborhoods with a high percentage of imperviousness or limited access to public green space. Rebates and financing tools are also commonly used to encourage the use of specific practices based on priority environmental and community goals such as cisterns for water conservation, rain gardens to improve groundwater recharge, and green roofs to mitigate urban heat island effects (USEPA 2009a).

Municipal Examples

Washington, DC – In 2008, the District Department of the Environment (DDOE) kicked off the pilot for its RiverSmart Homes Program. The citywide program offers incentives to homeowners to reduce stormwater runoff from their properties. A DDOE inspector meets with property owners, assesses the property and recommends appropriate landscaping enhancements. All River Smart Homes landscaping enhancements require co-payments, with participating homeowners paying approximately 10 percent of the installation costs, up to $1,200, for one or more LID features (DDOE 2014a). DDOE partners with local contractors who have completed its training course on LID to work with homeowners on these enhancements.

RiverSmart Homes project (Photo Credit: Alliance for the Bay 2011. https://allianceforthebay.org/2011/03/collaboration-a-key-ingredient-to-reducing-stormwater-runoff/)

Seattle, Washington – Seattle's RainWise Program provides resources for residents to manage stormwater at their homes. It offers online information regarding planting trees; improving soil with compost; reducing pavement and permeable paving options; disconnecting downspouts, installing cisterns; building and maintaining rain gardens, rock-filled trenches, materials and supplies; and a list of approved contractors that have completed the required RainWise training program. For homeowners that reside in one of the city's several target CSO basins, the city will pay up to 100 percent of the cost of installing rain gardens and cisterns, based on how many square feet of roof runoff is controlled (Seattle Public Utilities 2014).

Montgomery County, Maryland – The RainScapes Rebate Program is funded by the county's Water Quality Protection Charge and issues rebates up to $2,500 for residential projects and $10,000 for commercial, multi-family, or institutional projects that meet specific design criteria. RainScapes practices may include water harvesting (e.g., rain gardens and rain barrels), permeable pavement and porous concrete, pavement removal, and conservation landscaping (Montgomery County Department of Environmental Protection 2014).

Another form of incentive program, credit exchange/trading, provides a market or clearinghouse where reduction-credits for pollution or stormwater runoff are sold or traded. There has not been widespread adoption of credit exchange programs in regard to stormwater management; however, recent efforts to implement such programs are underway.

Washington, DC – In 2013, DDOE released its new Soil Erosion and Sediment Control Rules and its updated Stormwater Management Guidebook. The Guidebook provides for a stormwater retention credit program whereby a property owner can apply for certification of stormwater retention credits for eligible BMPs and land cover changes. To be eligible for certification, a BMP must:

- Achieve retention volume in excess of either the District's regulatory requirements, but less than the stormwater retention credit ceiling;
- Be designed and installed according to the District's Stormwater Management Plan and Guidebook;
- Pass a post-construction inspection and ongoing maintenance inspections; and
- Provide a contract or agreement for ongoing maintenance.

A stormwater retention credit is equal to one gallon of retention capacity for one year, can be traded or banked for future use without expiring, and can be voluntarily retired without being used (Center for Watershed Protection 2013).

Lower Fox River, Wisconsin – On April 16, 2013, the Great Lakes Commission announced the proposed development of a phosphorus credit trading program for the Lower Fox River Watershed in Wisconsin. To encourage voluntary water conservation by private landowners, it provides a market-based mechanism for water users from various sectors to engage with one another in a non-regulatory manner to make better decisions about reducing nonpoint source nutrient loadings to Great Lakes water resources (Great Lakes Commission 2013).

Finally, communities may consider establishing an off-site mitigation credit program to allow nonresidential owners to obtain economic benefits for installing retrofits on residential properties where owners do not receive a discount on their stormwater fees (Valderrama et al. 2013). Residential properties within Philadelphia's combined sewer system are currently not eligible for receiving a credit against their stormwater fees (Valderrama et al. 2013). In addition, some nonresidential customers may lack cost-effective on-site options for reducing stormwater runoff on their property. Credits could be sold to other property owners who lack financially attractive options for onsite investment. Incorporating an off-site mitigation program to the existing fee structure could offer additional benefits including increasing private sector participation; maximizing retrofits on commercial properties by incentivizing property owners

to retrofit beyond what is required to receive stormwater fee reductions; establishing a market price to reveal low-cost mitigation opportunities and possibly attracting private capital to the most cost effective retrofits; and creating transparency and a market price for stormwater management practices retrofits (Valderrama et al. 2013).

D. For More Information

Anne Arundel County Department of Public Works' Stormwater Remediation Fee Credit Policy and Guidance: http://www.aacounty.org/DPW/Stormwater/WPRF_Final_CreditPkg.pdf

Portland, Oregon's Stormwater Discount Programs:

- Clean River Rewards: https://www.portlandoregon.gov/bes/41976
- Ecroof Program: https://www.portlandoregon.gov/bes/article/261074
- Treebate Program: https://www.portlandoregon.gov/bes/article/314187

Philadelphia's Stormwater Programs: http://www.phillywatersheds.org/what_were_doing/documents_and_data/cso_long_term_control_plan

Minneapolis, Minnesota's Stormwater Credit Program: http://www.ci.minneapolis.mn.us/publicworks/stormwater/fee/stormwater_fee_stormwater_mngmnt_feecredits

Washington, DC's RiverSmart Homes Program: http://green.dc.gov/riversmarthomes

http://green.dc.gov/service/riversmart-homes-frequently-asked-questions

Seattle, Washington's RainWise Program: https://rainwise.seattle.gov/city/seattle/overview

Montgomery County, Maryland's RainScapes Rebates Rewards Program: http://www.montgomerycountymd.gov/dep/water/rainscapes-rebates.html

Washington, DC's Stormwater Retention Credit Trading Program: http://green.dc.gov/src

Lower Fox River, Wisconsin Phosphorus Credit Trading Program: http://glc.org/announce/2013-04-glc-usda-nrcs-ptrade/

V. Bonds

A. Description

Bonds are not a true revenue source, but are a means of borrowing money. Bonds allow expenditures that exceed a local entity's current resources; costs are spread over time, similar to a mortgage or an auto loan (NAFSMA 2006).

Municipal bonds are a typical form of financing for many municipal projects and are a relatively low-cost mechanism for utilities and state and local governments to borrow money for capital expenses (Gartner, et al. 2013). The term "municipal bonds" generally refers to either revenue bonds, which are secured by a utility's future rate revenues, or general obligation bonds, which

are backed by the full faith and credit of a government and its future tax revenue (Gartner, et al. 2013). Revenue bonds are supported by specified revenues, such as service fees and assessments (NAFSMA 2006), and have traditionally been issued by utilities to finance large capital expenditures. General obligation bonds have traditionally been used to fund public projects such as bridges, airports, and schools. Many communities also propose and vote on bond measures for natural infrastructure such as parks, open spaces, and watershed protection (Gartner, et al. 2013).

Green bonds are a new source of funding dedicated to environmentally-friendly projects, including clean water projects. "Green bonds" are fixed income, liquid financial instruments that raise funds dedicated to environmentally beneficial activities (World Bank 2014). Green bonds first appeared on the market in 2008, creating a broader investor group.

The Commonwealth of Massachusetts plans to use a $350 million Green Bond sale to pay for a marine terminal to support offshore wind projects, clean water, energy efficiency, river revitalization, and open-space protection efforts (Cherney 2014).

B. Municipal Examples

New York City's comptroller proposed a green bonds plan through which water efficiency projects could be funded. Water-related projects could include seawalls to protect Manhattan from storm surges and protection for 14 low-lying wastewater treatment plants deemed vulnerable to floods and sea-level rise.

In June 2014, the New York Environmental Facilities Corporation, the financing arm of the Governor's administration that offers low-cost loans and grants through the Clean Water State Revolving Fund (CWSRF), identified $213 million of bonds to finance 128 drinking water and wastewater projects as Green Bonds. Proceeds from the Green Bonds will be combined with $223 million in EFC equity funds to provide a total of more than $436 million to 60 counties, cities, towns, villages, and public authorities, which have projects completed or under construction (New York City Comptroller 2014).

The State of California conducted its first Green Bond sale in September 2014, with the intent to finance projects that provide clean water and drinking water, air pollution reduction, and energy efficiency and conservation in public buildings (Cherney 2014).

C. For More Information

Bonds can be used by municipalities and states to secure SRF or other loans, as well as to provide match grants. Loans and grants are discussed separately in this document, in sections VI and VII, respectively. Bonds are generally discussed in the National Association of Flood and Stormwater Management Agencies' 2006 document: *Guidance for Municipal Stormwater Funding*, available at the following website:
http://water.epa.gov/polwaste/nps/upload/Guidance-Manual-Version-2X-2.pdf

New York City's Green Bond Program:
http://comptroller.nyc.gov/wp-content/uploads/documents/Green_Bond_Program_-September.pdf

VI. Grants

A. Description

State and federal grants provide additional funding for water quality improvements provided by both new development and retrofit projects.

In 2009, President Obama signed the American Recovery and Reinvestment Act (ARRA) that provided $6 billion for clean water and drinking water infrastructure through the State Revolving Fund (SRF). As part of the package, 20 percent of the water infrastructure funding was dedicated to programs for green infrastructure, water and energy efficiency, and environmental innovation, called the Green Project Reserve. (American Rivers n.d.) Authorization for these uses has been maintained in more recent SRF funding as well.

B. Municipal Examples

New York State Environmental Facilities Corporation (EFC) – The Green Innovation Grant Program (GIGP) was established in 2009 under the ARRA. In the first year of the program, EFC committed over $44 million to projects statewide. Since its inception, GIGP has funded 121 innovative green infrastructure projects, awarding over $92 million in grants and, ultimately, leveraging more than $162 million in funding from additional resources (NYSEFC 2014). The GIGP supports projects across New York State that use unique stormwater infrastructure design. The GIGP will continue to provide financial assistance, technical support, and administrative guidance to a range of grant recipients. Recipients will receive a grant for up to 90 percent of their construction costs (including eligible planning and design costs). Further, all recipients are responsible for providing a minimum local match of 10 percent from local or State (non-federal) funds (NYSEFC 2014).

Massachusetts Green Infrastructure for Coastal Resilience Pilot Grants Program – The Massachusetts Office of Coastal Zone Management (CZM) administers the Green Infrastructure for Coastal Resilience Pilot Grants Program through its StormSmart Coasts program (Massachusetts EEA 2014a). The grant program provides financial and technical assistance to advance the use of natural approaches to mitigating flooding problems and coastal erosion. Grants support the planning, feasibility assessment, design, permitting, construction, and monitoring/evaluation of green infrastructure projects that implement natural approaches. The 78 municipalities located within Massachusetts' coastal zone and certified 501(c)(3) non-profit organizations that have coastal property available to the public are eligible to apply for the grants. Grants awarded in FY 14 totaled approximately $1.3 million for projects that protect public access infrastructure and containment basins (Town of Barnstable); remove an asphalt parking area (Town of Brewster); construct beach grass nurseries to provide dedicated sources of native vegetation (Duxbury Beach Reservation, Inc.); and evaluate beach nourishment, dune restoration, and other green infrastructure options (Town of Gosnold, Barges Beach on Cuttyhunk Island) (Massachusetts EEA 2014b).

In response to the 2015 request for responses (applications were due October 10, 2014 and awards are expected to be announced in late-November 2014), CZM expects to award up to $1.5 million in grants and applicants may request up to $750,000 in funding (Massachusetts EEA

2014a). Applicants must provide at least 25 percent of the total project cost. The 25 percent match may be cash or in-kind contributions or a combination of the two. Projects awarded during this disbursement must be completed on or before June 30, 2015, or June 30, 2016, depending on the specific project (Massachusetts EEA 2014a).

Photo Credit: David Gregg, Rhode Island Natural History Survey

EPA's National Estuary Program (NEP) – The NEP goal is to protect and restore water quality of the 28 estuaries and associated watersheds designated by legislation and EPA as being of national significance. Under Section 320 of the Clean Water Act, EPA supports individual programs known as NEP Management Conferences to develop and implement long-term Comprehensive Conservation and Management Plans (CCMPs) that bring together actions and partners to collectively address priority problems. Virtually all the NEPs have identified stormwater as a major stressor leading to water quality problems and habitat losses, and many of them have provided grants or other funding and project support for local green infrastructure efforts, municipal training, and assistance in developing finance tools. In addition, any action items in approved CCMPs are statutorily eligible for funding under the SRF program, although each state has developed its own guidelines for allowing access to the SRF. For more information, see http://www.epa.gov/nep.

C. For More Information

New York State's Green Innovation Grant Program (GIGP):
http://www.efc.ny.gov/Default.aspx?tabid=461

Massachusetts' CZM Coastal Resilience Pilot Grants Program:
http://www.mass.gov/eea/agencies/czm/program-areas/stormsmart-coasts/green-infrastructure-grants/#HowmuchcanIaskfor

VII. Loans

A. Description

Low-interest loans may be secured, but are generally used for planning and capital projects.

Under Title VI of the Clean Water Act, EPA has two revolving load funds administered through the states. The Clean Water State Revolving Fund (CWSRF) provides low-interest loans to states that are generally paid back over 20 years, and interest rates can be as low as zero percent (Green For All 2011). A variety of water infrastructure projects —water quality, wastewater, and storm water – are eligible, as are nonpoint source projects on public property and any project identified in an approved Comprehensive Conservation and Management Plan (CCMP) under the National Estuary Program (NEP). The CWSRF can fund the capital costs of water quality improvement (EPA 2008) as well as retrofit projects. Certain types of green projects are also eligible for this type of funding. Similarly, the Drinking Water SRF provides funding for development of a utility or related capital projects and to acquire land for source water protection.

B. Municipal Examples

Spokane, Washington – The city developed a demonstration program to construct street-side rain gardens. The Spokane Urban Runoff Greenway Ecosystem (SURGE) program retrofits the existing urban landscape using green infrastructure strategies, to study the impact on water quality. Using a $599,000 ARRA loan from the Washington State Department of Ecology's Water Pollution Control Revolving Fund, the city installed pervious sidewalk, trees, and plants as part of its stormwater management system (City of Spokane 2014); in all, 28 urban storm garden boxes and 386 square yards of porous surfaces were built to capture, treat, and infiltrate runoff, with 50 percent of the loan in the form of principal forgiveness (USEPA 2011), and the other 50 percent in the form of a 20-year low-interest loan (City of Spokane 2011). The city received USEPA's PISCES Award for successfully demonstrating innovative stormwater management strategies on West Broadway Avenue (City of Spokane 2011, 2014).

> CWSRF loans can have interest rates as low as 0%, and cover up to 100% of a project's costs with no matching requirement on behalf of the borrower. This is different from a grant, which typically requires the grantee to provide matching funds that must be available at the start of a project (EPA 2008).

C. For More Information

Spokane, Washington's SURGE program:
http://www.spokanewastewater.org/surge.aspx?AspxAutoDetectCookieSupport=1

Loans are generally discussed in the Green For All 2011 publication: *Water Works – Rebuilding Infrastructure, Creating Jobs, Greening the Environment*, available at:
http://www.pacinst.org/wp-content/uploads/sites/21/2013/02/water_works3.pdf

VIII. Public-Private Partnerships

A. Description

As an alternative to using taxes, fees, bonds, loans, and grants, communities should also consider establishing public-private partnerships. This approach engages the private sector

more deeply in funding infrastructure projects to meet public service needs (Valderrama 2013) and could encompass a wide range of projects and interventions. These could substantially expand the market for private investment in green infrastructure and help to lower the costs of construction and maintenance, accelerate implementation, access new sources of investment capital, and incentivize optimal performance by shifting performance risk to private partners where payments are tied directly to performance (Valderrama 2013).

However, the possibility of financing with private investment should not drive the structure of the partnership. Key considerations for developing such relationships should include alignment of goals, sustainability, efficient use of funds, commitment, values, transparency, accountability, surety of execution/funding, transfer of risk, and local benefits.

Public-Private Partnership

What it is: Involving the private sector through a *contractual agreement* between a public agency and private sector that allows for the private sector involvement in financing, planning, design, construction, operation, maintenance, and rehabilitation and replacement of urban retrofit facilities.

Why it is of interest: Competitive market drives cost effectiveness; leverages local government resources; shares risk and increased accountability; fosters innovative technologies. Investors see innovation in the stormwater market as an emerging market. (Lueckenhoff 2013)

B. Municipal Examples

Prince George's County, Maryland – In July 2013, Prince George's County passed legislation establishing a fee to fund reduction of pollution coming from stormwater generated on county streets and parking lots in order to meet its obligations under the Chesapeake Bay TMDL. The Clean Water Act Fee is collected from property owners (excluding property owned by the Federal Government, state, units of state government, the county, municipalities in the county, regularly organized volunteer fire departments, and lands with an agricultural use assessment) to reduce stormwater runoff pollution from impervious areas (Prince George's County 2013b). The Watershed Protection and Restoration Program (WPRP) is an economic driver in improving the county's stormwater management practices by creating new green jobs, local business development, an Alternative Compliance Program for religious entities and nonprofit groups, public-private partnerships and property owners fees (Prince George's County 2013a). In order to meet the Federal mandate to meet Clean Water Act standards to address stormwater runoff pollution from impervious areas, Prince George's County will retrofit approximately 8,000 acres of impervious surfaces (parking lots, roads, and roofs) at an estimated cost of $1.2 billion and complete the program by 2025 (Prince George's County 2013c). Initially, 2,000 acres of impervious surfaces in the public right-of-way will be retrofitted. The private company will provide financing capabilities and will fund about 30 percent to 40 percent of the program costs upfront, theoretically allowing project construction to begin sooner and proceed more quickly (WEF 2013). The fee establishes a Public-Private Partnership that will work with non-profits, churches, businesses and schools and others to finance techniques that reduce pollutant flow. This innovative thinking reduces the burden on the average homeowner while giving incentives to businesses, churches, and others to green their properties and practices. While the utility fee legislation was being passed segments of the business community were expressing their

concerns at a Chamber of Commerce meeting. Collaboration will be necessary to educate Prince George's County's workforce, including offering new programs for green practices in schools, much like what Prince George's Community College recently began (Clean Water Action 2014).

Baltimore, Maryland – Baltimore is another municipality that was affected by the WPRP and was required to develop a stormwater financing and revenue program. Baltimore established a dual-fee structure, creating fees for single-family properties and non-single family properties. The city has focused on cost-effectiveness and engaging the private sector and nonprofits (UMEFC 2013). The study conducted by the Environmental Finance Center at the University of Maryland recommended shifting from a traditional practice-based stormwater financing system (focusing on outputs [e.g., the number of practices installed]) to a performance-based financing system (focusing on environmental outcomes [e.g., improvements in water quality]) in order to incentivize innovation and efficiency in the private sector (2013). Baltimore has an opportunity to establish a financing program designed around incentivizing cost reduction and efficiency through the use of pay-for-performance financing systems designed to incentivize private firms, businesses, and residents to maximize environmental benefit per every dollar spent (UMEFC 2013). The shift is from pre-determined activities or outputs to desired outcomes or results. Baltimore stormwater managers and leaders would pay for the direct delivery of environmental benefits, such as reductions in nutrient and sediment pollution, rather than funding levels of implementation (i.e., projects constructed) (UMEFC 2013). The focus of investments should be on achieving an environmental goal in the most efficient way possible. A performance-based financing system shifts implementation and financing risk from public agencies and programs to private entities or project managers seeking to create and sell nonpoint source reductions (e.g., trading) (UMEFC 2013). Project managers would have the flexibility to determine the most effective ways to reduce pollutant loading, instead of being limited to choosing pollutant control actions from a preselected suite of BMPs (UMEFC 2013). When the public sector evaluates stormwater management practices, risk is a factor in the evaluation. The uncertainty of the performance of certain stormwater practices presents great risk to the public sector and may cause a delay in project implementation and subsequently, increased costs thus reducing the efficiency of the project. By investing in delivered projects and performance of those projects, the risk shifts to the private banks and in the end, improves the effectiveness of stormwater investments (UMEFC 2013).

Performance payment systems are based on the interaction between public agencies and the private sector. The potential of performance financing exists due to the fact that private actors (residents, businesses, investors, entrepreneurs, and associated industries) are motivated and incentivized to achieve environmental goals. The incentives are based on the opportunity to generate profits, reduce costs, and maximize community welfare (UMEFC 2013).

C. For More Information

Prince George's County, Maryland:
http://yosemite.epa.gov/opa/admpress.nsf/0/C73E9DD8611D83AD85257C5C005CBD1B

http://www.princegeorgescountymd.gov/sites/StormwaterManagement/News/Pages/Prince-Georges-County-Passes-Stormwater-Bill-with-Broad-Support.aspx

The Baltimore, Maryland study is discussed in the University of Maryland Environmental Finance Center's 2013 report: *Stormwater Financing Report to Baltimore, Maryland*.

General: http://stormwater.wef.org/2013/07/financing-urban-retrofits-via-a-public-private-partnership/

IX. Findings

Green infrastructure BMPs are a practical solution for mitigating stormwater runoff in urbanized locations with space constraints, particularly in older cities (e.g., those throughout New England). Although individually they may not have large impacts on pollutant loading reductions, the aggregation of many BMPs provides benefits such as cumulative pollutant load reduction, enhanced BMP effectiveness and longevity as vegetation and other self-sustaining components increase over time, mitigation of urban heat island effects, and reduced flood risks. Public acceptance of both green infrastructure BMPs and the need to pay for green infrastructure is likely to strengthen because of the open space, aesthetic, and property value improvements that accompany well-executed green infrastructure projects. This document serves to assist local governments in determining how to finance Green Infrastructure BMPs to manage their stormwater runoff.

X. References

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Appendix A. Providence Ordinance and Utility Case Study

I. Introduction

The Phase 1 feasibility study drew five major conclusions:

1. *The Upper Narragansett Bay region has real, growing, shared, and unresolved challenges in managing stormwater.*

2. *With adequate resources, the expertise is available to address these challenges – and the solutions would provide tangible benefits to each municipality.*

3. *The solutions will cost more than municipalities are now spending on stormwater management.*

4. *A regional approach will be more efficient and effective than an individual approach.*

5. *A stormwater user fee, based on how much a property contributes to stormwater runoff, is the best and fairest way to pay for the improvements.*

Providence faces problems similar to those of many smaller older and industrial cities that might seek to establish more efficient ways of managing their stormwater. In addition to the common issues of aging infrastructure, brownfields, and old development sited in flood plains and filled wetlands, the city also has experienced a declining commercial and industrial base, residential property owners already paying high taxes and resistant to another "tax on rain", confusion over ownership of stormwater systems and relation to CSOs, and lack of administrative tools. But Providence also has the advantage of utility-enabling legislation. Anticipating the first round of MS4 permits, the Rhode Island General Assembly in 2002 authorized cities and towns to ". . . adopt ordinances creating stormwater management districts (SMD) . . . designated to eliminate and prevent the contamination of the state's waters and to operate and maintain existing stormwater conveyance systems." To encourage adoption of such districts, the Rhode Island Department of Environmental Management (RIDEM) first offered state grants for towns to develop their stormwater management program plans, and some years later also offered reduced grant match requirements for municipalities interested in exploring establishment of a utility. An additional incentive is Rhode Island's most recent Stormwater Design and Installation Standards Manual, which prioritizes low impact development (LID) and green infrastructure (GI) as the state's preferred approaches for managing stormwater. The accompanying guidance to the manual highlights the administrative, operational, and financial systems – including utility districts -- needed to ensure that LID approaches are successful.

Recognizing the need to upgrade its capacity in these areas, Providence in 2013 initiated discussions with several adjoining municipalities to explore SMD options and the potential to implement stormwater management partnerships. The result was the Upper Narragansett Bay Regional Stormwater Management Initiative (UNBRSMI). This effort was launched to look at a coordinated stormwater utility as a way to provide a long term and sustainable solution to

stormwater management for seven municipalities (Central Falls, Cranston, East Providence, North Providence[1], Providence, Pawtucket, and Warwick). Initial findings, summarized in a June 2014 report "Upper Narragansett Bay Regional Stormwater Utility Feasibility Study Phase I," (AMEC 2014), concluded that the regional level of investment for municipal stormwater management programs is wholly inadequate to meet present or anticipated infrastructure maintenance needs. Current annual stormwater expenditures across the region are estimated at approximately $3.8 million, while the estimates for future stormwater needs range from $7.8 million to $11 million annually – a number that likely may rise once additional infrastructure data are available and costs for combined sanitary and storm sewer infrastructure are included.

In addition to confirming the need for stable, dedicated funding for stormwater management, the study also called for a broad regional approach that can accommodate a mix of structural and non-structural controls, including green infrastructure practices. With their smaller scales, these green infrastructure practices may be the most difficult to implement under conventional financing mechanisms; moreover, retrofitting these practices in dense older cities with layers of development and infrastructure can be extremely challenging. But the ancillary benefits of their design -- open space, aesthetics, and neighborhood amenities -- also offer a highly effective interface with local communities. Residents, developers, and property owners are more likely to endorse funding for a management approach that enhances quality of life and property values.

Compelling Drivers for Implementing GI and LID:

1. Water quality and ecology
2. Quality of life and aesthetics
3. Preservation of property value
4. Drinking water supply protection and enhancement
5. Flooding problems
6. Aging infrastructure
7. Development pressures
8. Erosion of channels and creeks
9. Regulatory mandates
10. Lawsuits

To assess Providence's readiness to engage in implementing and financing the green infrastructure aspects of stormwater management, this report analyzes results of a survey of checklist responses conducted by RIDEM in 2013. The checklist is organized by three broad goals and ten objectives adapted from the Rhode Island Stormwater Design and Installation Standards Manual (see Appendix A of the LID manual: Ordinance Checklist for LID Stormwater Site Planning and Design Techniques). In addition to Providence, several abutting communities were also reviewed. These included North Providence, Johnston, Pawtucket, and Cranston. The results for these five communities are presented in Figure 1, and demonstrate the need to better prepare communities to plan for, implement, and pay for green infrastructure as a key

[1] Note that North Providence opted to discontinue participation in the utility discussions.

component of their stormwater management programs; to build the necessary financial systems needed to effectively manage a utility; and to integrate the elements for LID and green infrastructure into their city's operations.

A. Findings

1. Providence

Providence indicated "no" for all of the questions related to Objective I (protect as much undisturbed open space as possible to maintain pre-development hydrology and allow precipitation to naturally infiltrate into the ground). Providence's regulations require or encourage new lots to exclude freshwater and/or coastal wetland jurisdictional areas and they direct building envelopes away from natural drainage areas. Although Providence has not adopted erosion and sediment control, grading, or tree canopy ordinances, the City has established minimum tree preservation standards; in addition, capital improvement plans include tree planting as part of project budgets. However, the City has not adopted requirements ensuring minimal soil compaction. In meeting Objective VI (minimizing impervious surfaces), the City indicated that while pervious surfaces and shared driveways are allowed in residential developments, the City has not allowed flexibility in designing curbs or sidewalk designs to encourage drainage away from roadways. The City requires planting strips and trees in parking areas, but requires internal planting areas to be curbed (without mentioning curb cuts) which limits their use as an LID technique. The City requires all stormwater management practices to be consistent with the *Rhode Island Stormwater Design and Installation Standards Manual* (Sec. 5-85). The City did not indicate they provide source controls to prevent or minimize pollutants in stormwater. The City has not revised the comprehensive plan to include the three goals and objectives.

> ***RIDEM recommends that private property owners and the City of Providence establish a vegetated buffer along the shoreline of Mashapaug Pond.***
> *(from the 2007 Mashapaug Pond TMDL)*

The City of Providence answered "yes" to all questions for Objective 8; 50 percent for Objective 2; 43 percent for Objective 3; and 31 percent for Objective 6. The City did not answer any questions for Objectives 1, 4, 5, 7, 9, and 10 as "yes" (i.e., zero percent). Among the five communities including Providence and adjoining communities, the City of Providence responses registered zero percent "yes" under the most number of objectives – six of the ten objectives contained zero percent of "yes" responses.

2. Common Focus Areas

Among the five communities including Providence and adjoining communities, none of the communities answered "yes" for Objective 4 (minimizing soil compaction). Further, for

Objectives 5, 8, and 10, responses were either zero or 100 percent "yes". This is because these objectives contained a single question.

Photo Credit: PWCVB/Nicholas Millard (http://www.goprovidence.com/media-gallery/media/skyline/)

Among communities statewide for which responses were compiled (39), most communities indicated they have regulations encouraging the exclusion of freshwater and/or coastal wetland jurisdictional areas for new lots and directing building envelopes away from drainage areas. Further, most communities (all except four) indicated the community has adopted an erosion and sediment control ordinance. Most (i.e., greater than 30 indicating "yes") communities adopted compact growth ordinances (e.g., conservation development, planned development, or mixed-use development); allow pervious surfaces to be used for residential driveways and overflow parking; allow the use of shared driveways in residential developments; flexibility with curbs in residential streets to encourage side-of-the-road drainage; and require landscaping within parking areas to break up pavement at fixed intervals. Further, most communities conduct regular street sweeping and cover road salt storage piles.

3. Disparities in LID site planning and design techniques

Photo Credit: EPA website (http://water.epa.gov/infrastructure/greeninfrastructure/gi_what.cfm)

Gaps in LID site planning and design techniques that are common among Providence and the adjoining communities include a lack of creation of a community buffer program (none of the communities responded as having created such a program). Further, only one community adopted a forest cover/tree ordinance and another community requires permits before removing trees on new or redevelopment sites. Two of the five communities adopted LID landscaping standards that require preservation of natural vegetation and encourage low-maintenance native landscaping. Related to Objective 6 (minimize impervious surfaces), none of the five communities require road widths to be as narrow as possible (except for Johnston, which does require road widths to be 26 feet or less for certain subdivisions); require street right-of-way

widths to be less than 45 feet; require driveway lengths and widths to be reduced to the extent possible; require sidewalks to be gently sloped to encourage drainage away from the street; allow cul-de-sacs to have a minimum radius of 45 feet or less; require a minimum of 25-30 percent tree canopy coverage over on-site parking; or adopted impervious cover limits on a community or partial-community basis.

Among all communities for which responses were compiled (39), very few have adopted requirements to meet Objective 4 (minimize soil compaction). Four communities answered "yes" for both questions related to this objective. Only one community overall requires driveway lengths and widths to be reduced to the extent possible; two communities require sidewalks to be gently sloped to allow drainage away from the street; three communities require a minimum of 25-50 percent tree canopy coverage over on-site parking lots; and four communities require 20 percent or more of the parking lot to have smaller dimensions for compact cars.

II. Recommendations

Developing projects to meet more stringent stormwater standards affects the costs of redevelopment projects. These costs become part of the analysis that developers conduct to assess the viability of a project (ECONorthwest 2011). Developers interviewed as part of a study conducted by ECONorthwest for Smart Growth America indicated their decision-making process incorporates a spectrum of economic factors, including construction costs, current and future market conditions, regulatory incentives (and disincentives), and uncertainty and risk (ECONorthwest 2011). Within this range, however, developers described the cost of implementing stormwater controls as minor compared to the other economic factors they considered in deciding whether or not to pursue a project (ECONorthwest 2011). While it is true that stronger stormwater standards increase the costs of implementing stormwater controls, some developers noted that using LID controls has helped offset some of the increased costs, when compared to using conventional controls (ECONorthwest 2011).

There are real stormwater needs that communities need to address, not just because the "RIPDES MS4 permit requires it."

As discussed, there are several possible sources of funding for small-scale BMPs, from taxes to community-based public-private partnerships. Stormwater utilities that charge stormwater parcel-based fees and implement credits (e.g., up to a certain percentage credit of the stormwater charges) and incentive programs (e.g., financial assistance for constructing stormwater management systems or eligibility for stormwater fee credits) can effectively finance small-scale BMPs. The fees charged are directly related to stormwater impacts and parcel-based fees offer a dedicated and stable funding source. Stormwater utilities

can be implemented at the municipal level or at a regional level. Public-private partnerships and project aggregation are relatively new approaches to financing and implementing small-scale BMPs, but innovative and successful partnerships are already being implemented in Philadelphia, Pennsylvania and Prince George's County, Maryland.

Despite their attractiveness, these approaches have not been seriously considered because the institutional and fiscal foundation has been lacking. Providence is the third-largest city in New England, with a population of approximately 180,000 – approximately twice the size of Newton, Massachusetts and about 6 times larger than Lewiston, Maine. Yet both of these municipalities have established stormwater utilities. This Phase I Study led by Providence is the first attempt in Rhode Island to seriously consider a regional solution to stormwater pollution, which is a watershed-based, regional problem. By taking this step, Providence may be on a path to solve the problems documented by the study, and to envision a comprehensive management program that could add environmental, aesthetic, and recreational value to the community.

III. References

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Figure 1. Summary of Responses to the Ordinance Checklist for Low Impact Development Site Planning and Design Techniques

GOAL: Avoid the impacts of development to natural features and pre-development hydrology.

Objective I:	**Protect as much undisturbed open space as possible to maintain pre-development hydrology and allow precipitation to naturally infiltrate into the ground.**				
	Cranston	**Johnston**	**North Providence**	**Pawtucket**	**Providence**
1. Has Conservation Development been adopted to protect open space and pre-development hydrology?	**Yes**	**Yes**	**Yes**	N/A	No
2. Has a transfer of development rights ordinance been adopted to provide an incentive for landowners to preserve natural lands?	No	No	**Yes**	No	No
3. Are limits of disturbance required to be marked on all construction plans?	No[1]	**Yes**	**Yes**	**Yes**	No
4. Are there limits on lawn area for residential lots to protect open space?	No	**Yes**	**Yes**	No	No
5. Are undisturbed vegetative areas required on new lots as visual screens?	No[1]	**No**	**Yes[2]**	N/A	No

[1] This is done on a case by case basis at the discretion of the Planning Board.
[2] Only when commercial or industrial abut residential developments.

Objective II:	**Maximize the protection of natural drainage areas, streams, surface waters, wetlands, and jurisdictional wetland buffers.**				
	Cranston	**Johnston**	**North Providence**	**Pawtucket**	**Providence**
6. Do regulations require or encourage new lots to exclude freshwater and /or coastal wetland jurisdictional areas, to the extent practicable?	No[1]	No	No[2]	No	**Yes**
7. Do regulations direct building envelopes away from steep slopes, riparian corridors, hydric soils, and floodplains, to the extent practicable?	No[1]	**Yes**	**Yes**	**Yes**	**Yes**
8. Has a community buffer program been created to establish or restore a naturally vegetated buffer system along all surface waters and wetlands to supplement and expand upon the minimum requirements of the DEM and CRMC programs, where applicable?	No	No	No[3]	No	No
9. Are zoning setback distances flexible in residential districts to avoid requiring house lot locations to be unnecessarily close to surface waters, wetland, and riparian corridors?	No	No	No[2]	**Yes**	No

[1] No specific written regulation, but follow DEM/CRMC regulations.
[2] Encouraged through application review process with the Planning Board.
[3] But follow DEM requirements.

Objective III: Minimize land disturbance, including clearing and grading, and avoid areas susceptible to erosion and sediment loss.					
	Cranston	**Johnston**	**North Providence**	**Pawtucket**	**Providence**
10. Has your community adopted an erosion and sediment control ordinance?	**Yes**	**Yes**	**Yes**	**Yes**	No
11. Did your community adopt a grading ordinance to require applicants to maintain as much natural vegetation as possible and limit clearing, grading, and land-disturbing activities to the minimum needed for construction maintenance and emergency services?	No[1]	**Yes**	**Yes**	No	No
12. Has your community adopted a forest cover, tree protection, or tree canopy ordinance?	No	No	No	No	No
13. Do you require permits before removing trees on new or re-development sites?	No	**Yes**	No	No[2]	No
14. Have minimum tree preservation standards been established for new development?	No	**Yes**	**Yes**	No[3]	**Yes**
15. Do capital improvement plans include tree planting as part of project budgets?	No	No	**Yes**	**Yes**	**Yes**
16. Do you require that public trees removed or damaged during construction be replaced with an equivalent amount of tree diameter? (for example, if a 24-inch diameter tree is removed it should be replaced with six four-inch diameter trees).	No[4]	**Yes**	No	**Yes**	No

1 Encouraged through application review process with the Planning Board.
2 Evaluated on a case by case basis. Planning Department works with applicants to try to save as many established trees as is feasible.
3 No written standard, but encouraged and done in practice.
4 Encouraged.

Objective IV: Minimize soil compaction as a result of construction activities or prior development.					
	Cranston	**Johnston**	**North Providence**	**Pawtucket**	**Providence**
17. Have you adopted provisions within land development regulations that prohibit the compaction of soils in areas needed for stormwater recharge?	No[1]	No[1, 2]	No	No	No
18. Have you adopted requirements for construction site inspections to ensure that soils are not compacted?	No[1]	No[1, 2]	No	No	No

1 No specific written regulation, but follow DEM/CRMC regulations.
2 Reviewed on site by site basis.

GOAL: Reduce the impacts of land alteration to decrease stormwater volume, increase groundwater recharge, and minimize pollutant loadings from a site.

Objective V: Provide low-maintenance, native vegetation that encourages retention and minimizes the use of lawns, fertilizers, and pesticides.					
	Cranston	**Johnston**	**North Providence**	**Pawtucket**	**Providence**
19. Have LID landscaping standards been adopted that require the preservation of as much natural vegetation as possible and encourage low-maintenance native landscaping?	**Yes**	No	No	N/A	No

Objective VI: Minimize impervious surfaces.					
	Cranston	**Johnston**	**North Providence**	**Pawtucket**	**Providence**
20. Did your community adopt compact growth ordinances such as conservation development, planned development, or mixed use development?	**Yes**	**Yes**	No[2]	**Yes**	No
21. Has your community identified growth centers where increased density is appropriate and encouraged?	**Yes**	N/A	**Yes**	**Yes**	**Yes**
22. Are residential streets required to be as narrow as possible to accommodate traffic volumes without compromising safety?					
A. Do you require road widths of 22 feet or less for subdivisions of 40 or fewer homes or average daily trips less than 400?	No[3, 4]	No	No[5]	N/A	N/A
B. Do you require road widths of 26 feet or less for subdivisions of 40-200 homes or average daily trips of 400-2,000	No[3, 4]	**Yes**	No[5]	N/A	N/A
23. Are street right-of-way widths required to be less than 45 feet?	No[3, 4]	No	No	N/A	N/A
24. Are driveway lengths and width required to be reduced to the extent possible with pervious surfaces and shared driveways encouraged wherever appropriate?	No[4]	No	No	No	No
A. Do you require driveways to be nine feet or less (one lane) and 18 feet or less (two lanes)					
B. Do you allow pervious surfaces to be used for residential driveways?	No[4]	**Yes**	No	No	**Yes**
C. Do you allow shared driveways to be used in residential developments?	No[4]	**Yes**	**Yes**	No	**Yes**
25. Do you allow the flexibility with curbs in residential streets to encourage side-of-the-road drainage into vegetated open swales, where possible?	**Yes**	**Yes**	**Yes**	N/A	No
26. Where curbs are needed, do you allow opening in curbs that allow runoff to flow into swales?	No	**Yes**	**Yes**	N/A	No
27. Have flexible sidewalk design standards been adopted to limit impervious cover?	No[6]	No	**Yes**	N/A	No
A. Is the minimum sidewalk width four feet or less?					

Objective VI: Minimize impervious surfaces.					
	Cranston	**Johnston**	**North Providence**	**Pawtucket**	**Providence**
B. Do you require sidewalks on one side of the street only in low-density neighborhoods?	No[7]	**Yes**	No	**Yes**	N/A
C. Are sidewalks required to be gently sloped so that they drain into the front yard rather than the street?	No	No	No	N/A	No
D. Can alternative pedestrian access such as trails or unpaved footpaths be used instead of sidewalks?	**Yes**	**Yes**	N/A	**Yes**	**Yes**
E. Can pervious surfaces be used for sidewalks?	No	**Yes**	**Yes**	No	**Yes**
28. Did your community modify the dimension, design, and surface material of cul-de-sacs to reduce total impervious cover?	No[8]	No (50 ft)	No	No	N/A
A. Is the minimum radius allowed for cul-de-sacs less than 45 feet?					
B. Can a landscaped island or native vegetation be within the cul-de-sac?	No	**Yes**	**Yes**	No	N/A
C. Are alternative turnarounds allowed such as hammerheads or tees?	**Yes**	**Yes**	**Yes**	No	N/A
29. Have both minimum and maximum parking ratios been adopted to provide adequate parking while reducing excess impervious cover?	No[8]	**Yes**	**Yes**	**Yes**	No
30. Do you allow pervious materials to be used for parking areas and overflow parking?	No[8]	**Yes**	**Yes**	**Yes**	**Yes**
31. Are parking ratios reduced if the site is served by mass transit or has good pedestrian access?	No	**Yes**	N/A	No	**Yes**
32. Is shared parking encouraged and implemented wherever feasible in order to reduce total impervious cover?	**Yes**	**Yes[9]**	**Yes**	**Yes**	**Yes**
33. Do off-site parking allowances exist to accommodate re-development and mixed-use compact growth?	No	**Yes[9]**	**Yes**	**Yes**	**Yes**
34. Are parking stalls and aisles reduced to the extent feasible in order to decrease total impervious cover?	No	No	**Yes**	**Yes**	N/A
A. Are the minimum stall dimensions nine feet wide by 18 feet long?					
B. Is 20% or more of the parking lot required to have smaller dimensions (8 feet by 16 feet) for compact cars?	No	No	**Yes**	No	No
35. Are parking lot landscaping requirements flexible and do they encourage LID techniques?					
A. Do parking lots of ten or more spaces require that 10% of the parking lot area be dedicated to landscaped areas that can include LID stormwater practices?	**Yes**	No	**Yes**	**Yes**	No
B. Is landscaping required within parking areas to "break up" pavement at fixed intervals?	**Yes**	**Yes**	**Yes**	**Yes**	No

Objective VI: Minimize impervious surfaces.					
	Cranston	**Johnston**	**North Providence**	**Pawtucket**	**Providence**
C. Is a 25-30% tree canopy coverage over on-site parking lots required?	No	No (20%)	No	No	No
36. Have impervious cover limits been adopted to reduce impervious cover on a community or partial-community-basis?	No	No	No	No	No

1 No written standard, but is encouraged and reviewed in planning process.
2 Is being considered for the future. (As of 9/30/13)
3 No written requirements, but is allowed and encouraged.
4 Being looked into to implement in the near future.
5 Use NFPA Fire Standards of 26-24' road widths.
6 Reasoning no because of American Disabilities Act has different requirements.
7 Done on a case by case basis at the discretion of the Planning Board.
8 In progress of renewal.
9 Only in Redevelopment Overlay District.

GOAL: Manage the impacts at the source.

Objective VII: Infiltrate precipitation as close as possible to the point it reaches the ground using vegetated conveyance and treatment systems.					
	Cranston	**Johnston**	**North Providence**	**Pawtucket**	**Providence**
37. Have you amended regulations to require all development projects comply with LID pursuant to the Rhode Island Stormwater Design and Installation Standards Manual?	**Yes**	**Yes**	**Yes**	No	No
38. Have you revised regulations to allow and encourage LID vegetated treatment systems such as bioretention, swales, and filter strips to promote recharge and the treatment of runoff?	**Yes**[1]	**Yes**	No[2]	**Yes**	No

1 Use current DEM standards.
2 No written regulation, is encouraged.

Objective VIII: Break up or disconnect the flow of runoff over impervious surfaces.					
	Cranston	**Johnston**	**North Providence**	**Pawtucket**	**Providence**
39. Have you amended regulations to encourage runoff to be diverted over pervious surfaces to foster infiltration, runoff reduction, and pollutant removal, where appropriate?	**Yes**[1]	No	No[2]	**Yes**	**Yes**

1 Use current DEM standards.
2 No written regulation, is encouraged.

Objective IX: Provide source controls to prevent or minimize pollutants in stormwater.					
	Cranston	**Johnston**	**North Providence**	**Pawtucket**	**Providence**
40. Do you encourage or require appropriate pet waste disposal to prevent pet waste from entering stormwater runoff?	No	**Yes**	**Yes**	No	No
41. Are commercial and industrial developments required to sweep their impervious areas on an annual basis?	No	**Yes**	No[1]	No	No
42. Is street sweeping done regularly on community streets to limit pollutant transport to waterbodies and reduce maintenance of catch basins?	**Yes**	**Yes**	**Yes**	**Yes**	No
43. Are community road salt storage piles covered?	**Yes**	No	**Yes**	**Yes**	No
44. Has a community wastewater management district been adopted to encourage or require all onsite wastewater treatment systems be inspected and maintained regularly?	No[2]	**Yes**	N/A	N/A	N/A
45. Have you adopted a stormwater utility district to manage the existing impacts of stormwater runoff?	No[2]	No	No	No	No

[1] No adopted written standards, at times done at the owners will.
[2] In progress of renewal.

Objective X: Re-vegetate previously cleared areas to help restore groundwater recharge and pollutant removal.					
	Cranston	**Johnston**	**North Providence**	**Pawtucket**	**Providence**
46. Have regulations been adopted to encourage re-vegetation with native species, where possible?	No[1]	No	No[2]	**Yes**	No

[1] Encouraged during planning process and renewal.
[2] No adopted written regulation, but highly encouraged and done in practice.

BONUS					
	Cranston	**Johnston**	**North Providence**	**Pawtucket**	**Providence**
47. Did you revise your comprehensive plan to include the three goals and then objectives described above?	**Yes**	No	**Yes**	No	No