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Local Leaders Council

Policy Primer

Stormwater Management: *Low Impact Development*

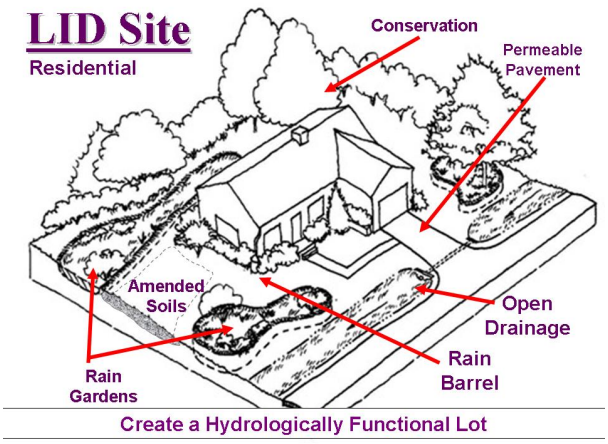
Wherever there is pavement, stormwater runoff results in pollution. Every structure, road and parking lot causes runoff to wash pollutants like motor oil, fertilizers, chemicals, animal waste and construction sediment into streams, rivers, lakes, wetlands and watersheds and to worsen flooding and sewage backflows. However, a low impact development (LID) approach in new construction and major rehabilitation projects can greatly reduce runoff volumes.

What is low impact development?

In natural, undeveloped areas and on agricultural land, 80% of stormwater infiltrates the ground and only about 20% runs off site. In suburban and urban areas, not very much of the stormwater is absorbed on site, with 50-80% becoming runoff.[1]

Where conventional structural stormwater management relies on costly pipes, tunnels and water storage facilities to collect and hold stormwater, low impact development employs vegetation, natural drainage and innovations like permeable concrete to allow runoff to infiltrate the ground where it is naturally filtered by plants and soil, protecting local water bodies from pollution and creating healthier, more beautiful urban environments.

Stormwater runoff causes flooding and pollution.
Photo from www.isustainableearth.com



Low impact development reduces stormwater runoff.
Image from Haywood Community College (NC)

Low impact techniques include green roofs, buffering tree lines along roadways, curb extensions with stormwater landscaping, porous pavement and rain gardens. This approach helps recharge local streams and wetlands and protects the watershed.

Many communities are encouraging or requiring private developers and public projects to incorporate low impact design in new construction and major rehabilitation projects to mitigate flooding, sewer backflows and water pollution.

Economic benefits

Low impact development can be a major money saver by reducing flooding, cooling costs and stormwater impact fees developers must pay per square foot of impervious surface on site. It cuts costs associated with structural stormwater management, such as costly pipe and tunnel systems, and makes projects more marketable.

Chicago City Hall's green roof saves $3,600 a year in heating/cooling. Photo by Diane Cooke and Len Jenshel

Developers of the Gap Creek project in the City of Sherwood (AR) increased overall profit by $2.2 million by incorporating low impact design.[2] Open space was increased from 1.5 to 23.5 acres. Greenbelts were used to preserve natural drainage areas. Traffic-calming circles reduced street widths from 36 to 27 feet, and trees were kept close to the curb line. The design allowed 17 additional lots, and lots sold for more money and cost less to develop.

Studies in Maryland and Illinois found low impact development in new residential projects lowered paving and site preparation costs, saving $3,500 to $4,500 per lot.[3]

Philadelphia (PA) requires the first inch of stormwater to be retained on site. The estimated two square miles of properties using low impact designs keep 250 million gallons of stormwater out of structural storage facilities, saving the City $340 million in capital, operating and maintenance costs.[4]

Establishing regulations, incentives

Low impact development goals and regulations may be established through a Comprehensive Plan, a legislative ordinance, a zoning amendment or a combination. Sometimes cities designate mandatory and voluntary zones.

Washington (DC) created the Anacostia Waterfront Development Zone, which requires projects around the river to employ low impact design. The City also operates a RiverSmart Homes program, which provides homeowners with up to $1,200 to add green infrastructure enhancements to their properties. Flood-prone regions may require higher standards.

Regulations must specify the size, scope, location and stormwater management responsibilities of projects; the incentives (density bonus, zoning upgrade, funding, fee discounts, expedited permitting); and qualifying low impact development techniques.

Local programs

Cities including Lexington (SC), Chicago (IL), and Philadelphia (PA) have established stormwater management programs. Montgomery County (MD) has had a program for 40 years. Portland (OR) provides stormwater fee discounts to property owners employing low impact development on site. Alachua County (FL), home of the University of Florida, implemented regulations for site design, open space preservation, stream buffers and ecosystem preservation for new development and new homes in 2006.

Seattle's (WA) Northgate Mall uses rain gardens and bioretention swales. Photo from www.KingCounty.gov

[1] Landscape for Life. (n.d.). Landscape practices contribute to water pollution. *Landscapeforlife.org.* Retrieved on September 17, 2013, from http://landscapeforlife.org/water/landscape-practices-contribute-to-water-pollution

[2] U.S. Environmental Protection Agency. (2007). Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices. U.S. EPA. p.17.

[3] Garrison, N., & Hobbs, K. (2011). *Rivers to Rooftops II: Green strategies for controlling stormwater and combined sewer overflows*. Natural Resources Defense Council. p.20.

[4] U.S. Environmental Protection Agency. (2010). *Green Infrastructure Case Studies: Municipal policies for managing stormwater with green infrastructure*. U.S. EPA. p.9.

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Debunking Myths

Stormwater Management: *Low Impact Development*

Stormwater runoff is *not* a major problem

Stormwater runoff is a major problem with significant economic and public health costs. The longer we wait, the bigger the problem will become.

- Over 10 trillion gallons of untreated runoff make their way to rivers, lakes and drinking water sources each year,[1] sometimes flowing through sewage systems first. The U.S. EPA has found half of America's rivers are in *poor condition for aquatic life.*[2]

- Whereas only 20% of rainwater runs off the land in undeveloped areas and on farms, 50-80% runs off in suburban and urban areas creating major pollution and flooding hazards.[3] This also leads to costly flooding and sometimes sewage overflows. Even in rural towns, roads and sprawling development can disrupt natural drainage patterns significantly.

- As more land is developed, aging water infrastructure in communities throughout the nation is deteriorating. For example, Washington (DC) averages a pipe break every day.[4]

This will be too costly and discourage projects

Traditional or structural stormwater management is a costly solution. It requires repairing, upgrading, expanding and maintaining enormous storage facilities, water tunnels and pipes to hold runoff until it can be treated and safely released into natural water bodies.

More communities are looking to a green infrastructure strategy. Also called low impact development, it employs vegetation, natural drainage and innovations like porous concrete to allow runoff to infiltrate the ground, where it is naturally filtered by plants and soils without running off site. This vastly reduces runoff, recharges local streams and wetlands, protects the watershed and has economic benefits for neighborhoods.

- Philadelphia (PA) chose a low impact stormwater plan, which would cost the City $2.7 billion over 25 years, compared to the traditional approach, which would have cost $10 billion. The City plans to convert 10,000 acres of impervious sources into greened acres, which will reduce billions of gallons of runoff.

A report by the American Society of Landscape Architects found that in 75% of projects studied, green infrastructure either reduced or had no impact on development costs.[5]

- Developers of the Gap Creek project in the City of Sherwood (AR) increased overall profit by $2.2 million by switching to a low impact design, which allowed an increase in open space from 1.5 to 23.5 acres, less overall paving, more trees and vegetation and increased lot marketability.[6]

- A luxury retail, office and residential skyscraper in downtown Chicago (IL), located at 900 Michigan Avenue, installed its first green roof over the parking garage due to city requirements, but two more were added by choice over the condo and office portions of the building once it was clear the feature was attracting tenants.[7]

The benefits are unproven

This is very much a proven strategy. Communities large and small are seeing the effectiveness of low impact development.

- Mature deciduous trees can intercept 500 to 700 gallons of water per year, and mature evergreens more than 4,000 gallons per year.[8]

- Philadelphia's stormwater regulations on new developments and redevelopments reduce the City's runoff by more than 900 million gallons per year.[9] (The City aims to "green" 10,000 acres over 25 years to avert over 7 billion gallons in runoff.)

- The Walnut Way community in Milwaukee (WI) annually diverts 552,000 gallons of runoff from the sewage system after disconnecting 38 downspouts that carry water directly to underground storage and installing 38 rain gardens and 4 rain barrels.[10]

- Syracuse's (NY) Pearl Street one-acre parking lot was converted in 2010 by incorporating porous pavement and other low impact features to capture 1.3 million gallons of runoff annually.[11]

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[1] Garrison, N., & Hobbs, K. (2011). *Rivers to Rooftops II: Green strategies for controlling stormwater and combined sewer overflows*. Natural Resources Defense Council. p.5.

[2] Kikia, S. (2013, March 26). EPA Survey Finds More Than Half of the Nation's River and Stream Miles in Poor Condition [News Release]. *Yosemite Environmental Protection Agency*. Retrieved September 26, 2013, from http://yosemite.epa.gov/opa/admpress.nsf/0/C967210C37CFFB6885257B3A004CFAF6

[3] Landscape for Life. (n.d.). Landscape practices contribute to water pollution. *Landscapeforlife.org.* Retrieved September 17, 2013, from http://landscapeforlife.org/water/landscape-practices-contribute-to-water-pollution

[4] Duhigg, C. (2010, March 14). Saving U.S. Water and Sewer Systems Would Be Costly. *The New York Times*. Retrieved September 17, 2013, from http://www.nytimes.com/2010/03/15/us/15water.html

[5] American Society of Landscape Architects. (2011). Stormwater Case Studies. *ASLA.org*. Retrieved September 25, 2013, from http://www.asla.org/stormwateroverview.aspx

[6] U.S. Environmental Protection Agency. (2007). *Reducing Stormwater Costs Through Low Impact Development (LID) Strategies and Practices.* U.S. EPA. p.17.

[7] De Melker, Saskia. (2012, October 9). How to Build a Cooler City. *Pbs.org.* Retrieved September 25, 2013, from http://www.pbs.org/newshour/multimedia/chicago/6.html

[8] Seitz, J., & F. Escobedo. (2008). *Urban Forests in Florida: Trees Control Stormwater Runoff and Improve Water Quality*. University of Florida: IFAS Extension. p.1.

[9] Philadelphia Water Department. (2013). What We're Doing: Policy and Regulations. *Phillywatersheds.org*. Retrieved September 25, 2013, from http://www.phillywatersheds.org/what_were_doing/policy_regulations

[10] Milwaukee Metropolitan Sewerage District. (2011). *Signature Projects Milwaukee: Walnut Way Neighborhood*. MMSD. p.2.

[11] Save the Rain, Onondaga County. (2010). Pearl Street Parking Lot. Savetherain.us. p.1. Retrieved September 25, 2013, from http://savetherain.us/str_project/pearl-street-parking-lot/

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Case Study

Stormwater Management: *Low Impact Development*

PHILADELPHIA, PA

Background

Managing stormwater is an especially daunting challenge for cities like Philadelphia (PA), where 60% of the City is served by a combined sewer system, which carries sewage *and* stormwater. The average age of Philadelphia's wastewater and stormwater lines is estimated to be 100 years old.[1] Chronic combined sewer overflows[2] and nearly 14 billion gallons of polluted runoff pour into the City's streams and rivers annually.[3]

After studying the options, the City chose to aggressively pursue low impact development to reduce runoff (costing $2.4 billion over 25 years[4]) over constructing massive underground tunnels to store excess storm runoff until it can be treated ($10 billion[5]).

"We want to do anything we can do to return us as close as possible to the way nature intended the water cycle to be. But we need to do that within the context of a city that is fully grown, with incredible impervious cover everywhere."

Howard Neukrug, Director PWD, Watersheds Office

Citywide regulations were adopted in 2006, enabling Philadelphia to review new projects and major redevelopments to ensure stormwater management is integrated in the plans. In 2009, the ambitious and comprehensive "Green City, Clean Waters" plan was unveiled, laying out how the City would use low impact development, and other strategies, to convert *one-third* of impervious cover within the combined sewer service area into green, *pervious* surfaces, significantly reducing runoff over 25 years.[6] In 2010, the stormwater utility fee formula for nonresidential properties was changed to reflect the runoff actually generated by properties (based on square footage of impervious surfaces on site). Property owners can reduce, up to 100%, the amount they must pay by installing low impact features such as porous pavement, stormwater planters, tree trenches, rain gardens, rain barrels and green roofs.

Also in the plan, but not reviewed in this case study, Philadelphia will retrofit public property, green its streets and improve structural stormwater infrastructure, as well as run a public education campaign to encourage homeowners to make stormwater upgrades to their properties.

Results

Stormwater regulations on new developments and redevelopments reduce the City's runoff by more than 900 million gallons per year, according to the Philadelphia Water Department (PWD).[7] In FY 2012, Philadelphia approved 82 full technical plans for new projects, including 8.1 acres of green roofs and 19.8 acres of porous pavement, and inspectors made 1,118 site visits to 114 sites in the construction phase. Assuming a 1% annual redevelopment rate, stormwater regulations could deliver 2,500 to 5,000 green acres (of the City's 25-year goal to develop nearly 10,000 greened acres).[8] In 2011, the Natural Resources Defense Council designated Philadelphia an "Emerald City" for national leadership and excellent efforts in stormwater management.

Program Structure

Before receiving building permits, developers must first submit conceptual plans, which allow the City to highlight the applicable stormwater standards the project must meet based on size, scope and location. An Operation and Maintenance Agreement is recorded against the land deed, specifying stormwater infrastructure used by the project and the schedule of corresponding maintenance actions. Technical plans are submitted for review. The Philadelphia Water Department (PWD) has partnered with other relevant agencies to streamline the review, inspection and permitting process. Inspectors make multiple site visits to ensure compliance during the construction phase, as well as conduct post-construction inspections. Table 1 summarizes the basic requirements of the stormwater regulations. Learn more at www.phillywatersheds.org.

Development Incentives

Developments and redevelopments planning to disconnect 95% of their impervious surfaces from the structural sewer system can get fast-tracked stormwater reviews (within 5 days of submittal). Properties adding green roofs can get property tax credits worth 25% of the installation cost.

Table 1. Stormwater regulations for new developments and redevelopments

Requirements		< 15,000sf	15,000sf to 1 acre	> 1 acre
Capture first 1" of rainwater on site	New development	No*	Yes	Yes
	Redevelopment	No*	Yes	Yes
Minimize accelerated channel erosion resulting from runoff	New development	No*	Yes	Yes
	Redevelopment	No*	No	Yes*
Prevent flooding caused by extreme storms in watershed districts	New development	No*	Yes	Yes
	Redevelopment	No*	Yes*	Yes*
Employ low impact techniques to increase impervious surfaces	New development	No*	Yes	Yes
	Redevelopment	No*	Yes	Yes
Complete post-construction stormwater management plan	New development	No*	Yes	Yes
	Redevelopment	No*	Yes	Yes

No* – Not required unless development results in stormwater discharge that exceeds system capacity, causes a combined sewer overflow, or degrades receiving waters

Yes* – Requirement may be waived depending on post-development site conditions

SOURCE: Philadelphia Stormwater Regulations, PWD

[1] Philadelphia Water Department. (2013). Water Infrastructure Management. *Phillywatersheds.org.* Retrieved September 24, 2013, from http://phillywatersheds.org/watershed_issues/infrastructure_management

[2] Garrison, N., & Hobbs, K. (2011). *Rivers to Rooftops II: Green strategies for controlling stormwater and combined sewer overflows*. Natural Resources Defense Council. p.72.

[3] Philadelphia Water Department. (2011, June 1). *Green City Clean Waters* (Amended). Philadelphia Water Department. p.2.

[4] Philadelphia Water Department. (2011, June 1). *Green City Clean Waters* (Amended). Philadelphia Water Department. p.20.

[5] Luntz, Taryn. (2009, December 24). City's 'All Green' Stormwater Plan Raises Eyebrows at EPA. *The New York Times.* Retrieved September 24, 2013, from http://www.nytimes.com/gwire/2009/12/24/24greenwire-citys-all-green-stormwater-plan-raises-eyebrow-45258.html?pagewanted=all

[6] Philadelphia Water Department. (2011, June 1). *Green City Clean Waters* (Amended). Philadelphia Water Department. p.4.

[7] Philadelphia Water Department. (2013). What We're Doing: Policy and Regulations. *Phillywatersheds.org.* Retrieved September 24, 2013, from http://www.phillywatersheds.org/what_were_doing/policy_regulations

[8] Garrison, N., & Hobbs, K. (2011). *Rivers to Rooftops II: Green strategies for controlling stormwater and combined sewer overflows*. Natural Resources Defense Council. p.74.

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Model Policy

Stormwater Management: Low Impact Development

Ordinance template

By Brackett Smith and Neha Bhatt

This model policy is part of the Stormwater Management (LID) Policy Toolkit. Visit the "Policy Toolkits" page of the Local Leaders Council web site for more information and implementation tips.

The following sample sustainable stormwater management ordinance is based on New York City's (NY) sustainable stormwater program. The New York-specific references have been removed to facilitate easier adaption by other most local governments. The original language is available in the New York City Administrative Code § 24–526.1. This template may be used to understand how stormwater programs can be set up and may easily be customized to fit other local circumstances.

New York's ordinance clearly lays out the process for adopting a sustainable stormwater management plan, implementing sustainable practices, obtaining public input, and noting where regulations are needed to make a plan work. These provisions enable local governments to take the critical first steps to implementing a successful stormwater management plan centered on adopting low impact development standards for public and private sector development projects.

NYC's law on stomwater management development regulations
http://codes.lp.findlaw.com/nycode/ADC/24/5/24-526.1
(New York City Administrative Code § 24–526.1)

NYC's guidelines for Design and Construction
http://www.nyc.gov/html/dep/pdf/green_infrastructure/stormwater_guidelines_2012_final.pdf

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= Ordinance template =

(a) Policy

(1) It is the goal of [city/county] to:

(A) Reduce the volume of stormwater flowing into its sewer system, to improve water quality of its surface waters and to protect the public health through the restoration and protection of the ecological health of its watershed, and to enhance use and enjoyment of its watershed for recreational activities;

(B) Require the implementation of green infrastructure on public property and on new private homes and developments; and

(C) Encourage homeowners and developers to retrofit exiting homes and developments with green infrastructure by offering incentives.

(b) Definitions. For the purposes of this section only, the following terms shall have the following meanings:

(1) “Best Management Practices” or “BMPs” mean source control measures.

(2) “Bioretention” means using living vegetative systems to capture, store, and cleanse stormwater. Bioretention may be achieved by, among other things, rain gardens, vegetated buffers, swales, and medians.

(3) “Bluebelt” means engineered and natural aquatic systems, such as existing wetlands, streams and ponds that control the movement of water and prevent flooding, as an alternative to constructing storm sewers.

(4) “Blueroof” means a rooftop detention system.

(5) “Cisterns” means storage tanks that are used to capture and store rainwater and other precipitation.

(6) “Downspout disconnections” means disconnecting downspouts from the sewer system, such that water from downspouts drains into bioretention devices, cisterns, or other stormwater control devices.

(7) “Green infrastructure” means the implementation of various tools, primarily vegetation and soil, to manage stormwater and reduce stormwater runoff.

(8) “Green park” means public and private parks that use stormwater management tools such as rain gardens, stormwater tree trenches and porous paving, among other tools, to capture runoff water from rain and snowstorms

(9) “Green roof” means a living vegetative system partially or wholly covering a roof.

(10) “Green street” means a street that incorporates environmentally beneficial engineering techniques into its design, including vegetative source control measures.

(11) “Green wall” means a living vegetative system partially or wholly covering a wall.

(12) “Gray-water reuse” means reuse of wastewater for beneficial purposes such as irrigation.

(13) “High level storm sewer” means a storm sewer in which the catch basin connection is removed from the combined sewer under streets or in the public right-of-way and connected to a new storm sewer that will convey stormwater directly to ambient surface waters. As a general matter this type of separation is also called "partial separation."

(14) “Loading” means an amount of matter that is introduced into a receiving watershed.

(15) “Low Impact Development” means development that mimics a landscape’s natural water cycle in order to reduce the negative impacts of stormwater runoff on bodies of water.

(16) “Non-technological measure” or “non-technological source control measure” means a source control measure that does not use technology to control stormwater, such as operational strategies, procedural changes to design and construction protocols, or performance standards.

(17) “[Designated water management agency]” means such office or agency as the [mayor/county commission chairman] shall designate.

(18) “Permeable pavement” means any area paved with material that permits water penetration into a suitably designed discharge bed. Permeable pavement may consist of any porous surface materials that are installed, laid, or poured.

(19) “Pollution loading” means an amount of pollutants that is introduced into a receiving watershed.

(20) “Rain barrel” means a barrel used to hold rainwater.

(21) “Source control measure” means any stormwater management practice designed to reduce and/or slow the flow of stormwater into a combined sanitary and stormwater sewer or a separate stormwater sewer, including, but not limited to, any such practices commonly referred to as “Low Impact Development” or “Best Management Practices.”

(22) “Subgrade storage chambers” means underground stormwater storage facilities that are designed to hold stormwater to prevent such water from entering combined or other sewer systems.

(23) “Technological measure” or “technological source control measure” means a source control measure that uses a technology to control stormwater, such as rooftop detention or a constructed bioswale.

(24) “Tree cover” means the extent to which an area is covered by the canopy of living trees.

(25) “Tree pit design” means the specifications according to which space is created for the planting of trees in paved areas, including but not limited to the depth and breadth of the planting area, the type of soil, and the type of barrier, if any, constructed around the perimeter of the planting area.

(26) “Vegetative source control measure” means a source control measure that relies on living vegetative systems to reduce and/or slow the flow of stormwater into a combined sanitary and stormwater sewer or a separate stormwater sewer.

(27) “Watershed” means any river, tidal estuary, bay, creek, canal, or other body of surface water.

(c) Development of sustainable stormwater management plan.

(1) The [designated water management agency] shall develop a proposed and final sustainable stormwater management plan. Such plan shall identify and provide for the implementation throughout the [city/county], on both public and private properties, of efficient, effective, and feasible technological and non-technological source control measures to reduce the volume of water flowing into the [city/county]'s sewer system and the pollution loadings carried by stormwater into the [city/county]'s watersheds.

(2) No later than [designated date], the [designated water management agency] shall submit a draft sustainable stormwater management plan that meets the requirements of this section to the [mayor/ chairman], [the council or commission], and the public for review and comment. Submission to the public may be made by posting a draft plan on the internet.

(3) [At a later designated date], the [designated water management agency] shall submit a final sustainable stormwater management plan that meets the requirements of this section to [the mayor/chairman], the [council/commission], and the public. This plan shall be reviewed and revised by the [designated water management agency] as necessary to achieve such plan's goals.

(4) [Designated water management agency] shall review the sustainable stormwater management plan at least once every four years. Any such revisions and the reasons for such revisions shall be indicated in such plan.

(5) [At a designated date two years after the sustainable stormwater management plan's designation], and [at a designated date] every second year thereafter, the [designated water management agency] shall submit a report to [the mayor/chairman], the [council/commission], and the public. This report shall include the implementation status of the measures included in the plan prepared pursuant to this ordinance, including a quantitative assessment, where susceptible to quantification, and a qualitative assessment of the progress made toward achieving each of the milestones identified in such plan and, where revised, an explanation for such revision.

(d) Sustainable stormwater management plan elements.

(1) The plan shall include, but not be limited to, the following:

(A) a statement of goals related to reducing the volume of stormwater flowing into the [city/county]'s sewer system, improving water quality in the [city/county]'s watershed, protecting the public health through the restoration and protection of the ecological health of the [city/county]'s watershed, enhancing use and enjoyment of the [city/county]'s watershed for recreational activities, and such other aspects of stormwater management deemed appropriate.

(B) an identification and description of the technological and non-technological measures included in such plan, including, for each such measure, (i) a statement regarding the general site conditions required and types of properties where each such measure is typically feasible for implementation and (ii) identification to the greatest extent feasible of the areas in the [city/county] that satisfy those conditions and a prioritization of such areas according to the magnitude of potential benefits achievable through implementation of source control measures;

(C) for each of the technological measures included in such plan, (i) an identification of the agencies and/or offices of the [city/county] that would oversee and/or be responsible for constructing, permitting or otherwise approving or promoting such measures and (ii) any prerequisites to adoption of such technological measures, including but not limited to technical studies, pilot projects, funding and budgetary considerations, and federal, state or local legislative or regulatory action;

(D) for each of the non-technological measures included in such plan, (i) an identification of protocol amendments and the agencies and/or offices of the [city/county] that would be responsible for adopting such measures and (ii) any prerequisites to adoption of such measures, including but not limited to funding and budgetary considerations, and federal, state or local legislative or regulatory action;

(E) descriptions of any modeling methodologies used to identify technological measures, a statement of all inputs used to complete any modeling run, and the results of any modeling, or a compilation of other supporting data, whether derived from a model or not;

(F) for each of the specific goals, measures and prerequisites included in such plan, (i) a timeline setting forth target dates to achieve interim and final milestones, including but not limited to protocols for monitoring, assessing, and reporting

progress toward achieving such milestones, provided that such milestones shall, where susceptible to quantification, be expressed quantitatively, and any potential prerequisites to achieving such milestones, including but not limited to technical studies, pilot projects, and federal, state or local legislative action; and (ii) identification of budgetary authorizations, appropriations, or other allocations that are necessary to implement the measures and goals included in such plan;

(G) protocols for signage and for a program of public notification to inform the public of the location and occurrence of combined sewer overflow events, which such program shall include a mechanism to alert potential users of the watershed affected by combined sewer overflow events, through the use of radio, print media, internet, 311, email alerts or similar modes of communication, of the estimated nature and duration of conditions that are potentially harmful to users of such watershed;

(H) a methodology to be used for quantitatively measuring the performance of source control measures undertaken and/or monitored by the [city/county] where feasible;

(I) a summary of public input provided during the development of the sustainable stormwater management plan, steps taken to solicit public input about such plan, the [designated water management agency]'s responses to comments received from the public, and a summary of steps the department has taken and will take to involve the public, including organizations and members of the public with relevant knowledge and expertise, in the implementation of such plan.

(e) Initial assessment of measures.

(1) In addition to any other source control measure the [designated water management agency] deems appropriate in the plan prepared pursuant to this section, the [designated water management agency] shall assess the technical and environmental feasibility, benefits, costs and cost-effectiveness of including the following source control measures:

(A) amending the protocols, procedures and/or rules and regulations applicable to the scoping, design, preliminary and final budget approval, and operations and maintenance of [city/county] owned or [city/county]-financed projects, to require the consideration of source control measures and other stormwater controls at the earliest possible stage;

(B) establishing performance, construction and/or design standards for the minimization and control of stormwater runoff from new or existing roads, bridges, and other portions of the public right-of-way;

(C) establishing performance, construction and/or design standards for the minimization and control of stormwater runoff from new or existing public open space, public building green roofs, parks, or plazas;

(D) requiring mandatory technological source control measures on public and private property, including, but not limited to, bluebelts, green roofs, bioretention, tree cover and tree pit design, permeable pavement, wetland preservation and creation, green streets, green walls, blue roofs, rain barrels, cisterns, downspout disconnections, subgrade storage chambers, and gray-water reuse; provided that such plan shall prioritize vegetative source control measures where feasible;

(E) creating incentives, including, but not limited to, tax incentives, grant programs, low-interest financing, expedited permitting, and restructuring of water and sewer rates, to encourage the owners of new and existing private buildings to use Low Impact Development to retrofit or construct buildings and make improvements with appropriate source control measures;

(F) amending provisions in the building code, housing maintenance code, zoning resolution, and other applicable federal, state and local laws, rules and regulations applicable to all new or existing public or private construction projects or property, to require the implementation of source control measures and to institute quantitative performance standards for the minimum amount of stormwater that must be retained, detained, infiltrated, and/or reused on-site;

(G) using new and existing public open space, public building roofs, parks, and plazas for detention, retention, infiltration, reuse and natural filtering of stormwater;

(H) implementing a public education program to increase awareness about the need to reduce the flow of stormwater into the [city/county]'s sewer systems and watershed, and about specific methods and practices for doing so;

(I) supplementing high-level storm sewers with source control measures to reduce stormwater runoff volume and/or pollutant loadings at sites where high-level storm sewers are built, have been proposed, or are under consideration;

(J) promoting water conservation;

(K) adapting ongoing ambient water quality monitoring programs to provide for regular collection of samples in the immediate vicinity of combined sewer outfalls during or immediately following combined sewer overflow events; and

(L) encouraging the development of existing and new local markets, job training, and employment opportunities to support the implementation and maintenance of source control measures.

(2) For purposes of the assessments carried out pursuant to paragraph one of this subdivision benefits considered shall be quantified to the greatest extent practicable and shall include, but not be limited to (i) water quality benefits to particular watershed, stormwater capture rates, reductions in combined sewer overflow discharge volumes, the potential savings in hard infrastructure, construction and maintenance costs, and reduction of the [city/county]'s operating expenses for sewage treatment and (ii) non-water quality related environmental, public health, aesthetic, and economic benefits, such as those associated with cooling and cleansing the air, reducing energy demand, sequestering and reducing emissions of greenhouse gases, beautifying neighborhoods, providing habitat for birds and other wildlife, and developing new local markets that can stimulate job growth.

(f) Public input.

(1) The [designated water management agency] shall solicit public input during the development of the sustainable stormwater management plan. Opportunities for such input shall include, at a minimum, (i) a thirty day comment period immediately following the release of the draft plan pursuant to this section, at which time the [designated water management agency] shall consider all comments received on such plan and (ii) quarterly public forums at which representatives of the [designated water management agency] shall provide updates

on the [designated water management agency]'s progress in preparing such plan and invite feedback from participants. The [designated water management agency] shall respond to all substantive comments received during the comment period.

(2) The [designated water management agency] shall involve the public and organizations and members of the public with relevant knowledge and expertise in the implementation of the measures included in such plan.

(g) Reporting. Each management report and preliminary management report submitted to the [council/commission] by the [mayor/chairman] shall include, with respect to each agency or office identified in this section, quantitative indicators of progress towards implementing the measures included in the sustainable stormwater management plan.