

# Green City Clean Waters

The City of Philadelphia's Program for Combined Sewer Overflow Control  
A Long Term Control Plan Update  
Summary Report

Submitted by the Philadelphia Water Department  
September 1, 2009



The creation and implementation of our *Green City, Clean Waters* vision is all the more possible through the contributions of our partner City agencies and departments that provided, and continue to share, their expertise, guidance and support toward the realization of this plan.

- Streets Department
- Mayor's Office of Sustainability
- Fairmount Park
- Recreation Department
- Planning Commission
- Office of Housing and Community Development
- Housing Authority
- School District
- Parking Authority
- Redevelopment Authority
- Licenses and Inspections
- Zoning Commission
- Commerce Department
- Philadelphia Industrial Development Corporation
- Health Department

PWD also recognizes the invaluable contributions of our watershed partnerships, special service districts and other non-governmental organizations in making this vision a reality.

The Philadelphia Water Department is pleased to present our *Green City, Clean Waters* vision for meeting our regulatory obligations while helping to revitalize our City. Our Combined Sewer Overflow Long Term Control Plan Update (LTCPU) explains how this vision and the commitment to its implementation have grown out of our history, build on our extensive watershed analysis and planning, and are informed by local and national policy trends. The full LTCPU document is available online for download at [www.phillywatersheds.org/ltcpu/](http://www.phillywatersheds.org/ltcpu/).

Through evaluation of a number of alternative implementation approaches, we determined that a green stormwater infrastructure-based approach would provide maximum return in environmental, economic, and social benefits within the most efficient timeframe, making it the best approach for the City of Philadelphia.

In our *Green City, Clean Waters* work, green stormwater infrastructure is partnered with stream corridor restoration and preservation and with wet weather treatment plant upgrades. Each is mutually supportive and essential. We describe those areas of effort and the specific tools and programs of our green stormwater infrastructure approach.

Over the next five years, the Philadelphia Water Department will lay the foundation for achieving the *Green City, Clean Waters* vision over the full 20 year implementation period of this plan and beyond. The cost and affordability of those programs and the dollars they will leverage have been robustly analyzed and vetted. The desire to ensure our watersheds are healthy while building a competitive, sustainable future for Philadelphia is shared by other City agencies, partner organizations, and residents, who have expressed enthusiastic support for achieving our vision of *Green City, Clean Waters*.



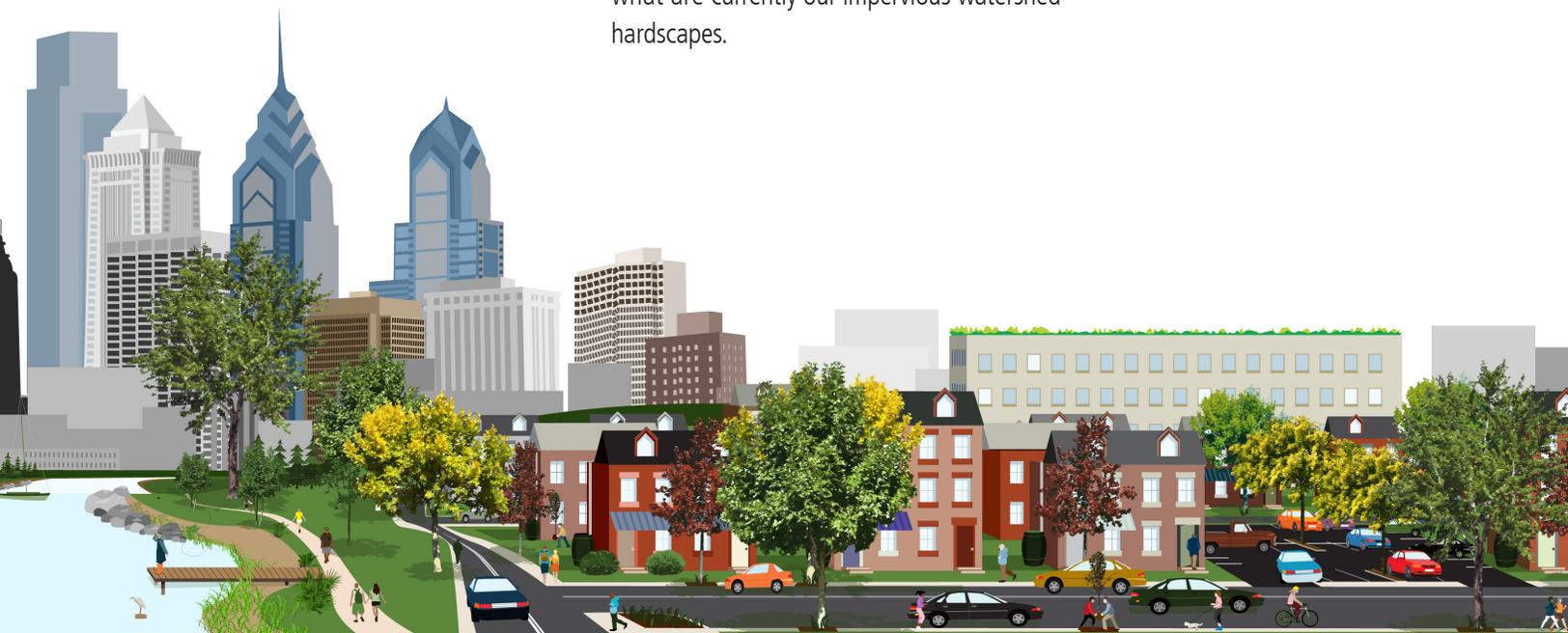
## Introduction

The Philadelphia Water Department (PWD) has developed a robust plan for supporting an effort that will resonate with the values and hopes of Philadelphia's neighborhoods and **provide a clear pathway to a sustainable and resilient future**, while strengthening the utility, broadening its mission and complying with environmental laws and regulations.

Nationwide, water utilities are finding themselves under increasing pressure as they confront a new set of complex environmental, demographic and financial challenges while also trying to meet expanded customer expectations for a safe and affordable water supply; the collection and high level treatment of wastewater and stormwater; flood protection; and clean, attractive, fishable, swimmable rivers and streams. Philadelphia's local water challenge is evident when looking at the degraded conditions of our streams and the inaccessibility of what should be our City's riverfront "jewel" along the Delaware River. Unfortunately this dilemma comes at a time when the City is grappling with some very real problems of population and financial decline.

Also significant are our new challenges of water quality and quantity, aging infrastructure, and the impacts of climate change on human health and our ecosystems. While changing demographics and conservation have resulted in an infrastructure system which, in some places, provides capacity that exceeds overall needs, new regulatory, energy, climatic and environmental issues require significant new investments. Meeting these challenges requires either a significant new investment in capacity, or a paradigm shift in our approach to urban water resources.

For the past decade, PWD has been creating, testing and implementing new integrated strategies which promote the economic and social growth of the City while meeting the environmental, ecological and business missions of the utility. As the City agency charged with ensuring optimal compliance with the Federal Clean Water Act, **PWD has developed an infrastructure management program that will protect and enhance our region's waterways by managing stormwater runoff in a way that significantly reduces our reliance on construction of additional underground infrastructure.** In effect, we plan to invest in green stormwater infrastructure solutions to essentially reseed what are currently our impervious watershed hardscapes.



## Our Heritage

Over three hundred years ago, William Penn created the “Greene Country Towne” vision for his beloved Philadelphia. As the City grew, it became a hub of politics, technology and business. In keeping with this innovative approach to promoting healthy communities, Philadelphia was the first City in America to supply its citizens with drinking water (1801) and, in 1855 began purchasing land along the Schuylkill River to protect the water supply, creating several thousand acres of buffer known as Fairmount Park, now the world’s largest urban park.

It is with great pride that we embrace our forefather’s appreciation of the vital connection between a green city and clean water. Today, the Philadelphia Water Department (PWD) has a unique opportunity to address modern challenges to managing our water resources and infrastructure in an innovative way. By transforming Philadelphia into a 21st Century Sustainable City, we can move toward a realization of Penn’s vision for a vibrant, healthy and green city.



## What Are Combined and Separate Sewer Systems?

The City of Philadelphia had one of the first sewer systems in the country, with portions dating back to the second half of the 19th century. Much of that original infrastructure is fully operational to this day. PWD’s significant commitment to continuously inspect and maintain the 3,000 mile system of pipes, manholes, storm drains, and control chambers will sustain the use by City residents for years to come.

The City of Philadelphia’s sewer system is comprised of both combined and separate sewer systems. A combined sewer system is simply a single sewer system that carries both sewage and stormwater to a water pollution control plant for treatment before being released to a waterway. During moderate to heavy rainfall events, the system will reach capacity, overflow, and discharge a mixture of sewage and stormwater directly to our streams and rivers from the 164 permitted Combined Sewer Overflow (CSO) outfalls within the City. Sixty percent of the City of Philadelphia, or 64 square miles, is within the combined sewer system drainage area. Typically these systems are in the older areas of the City.

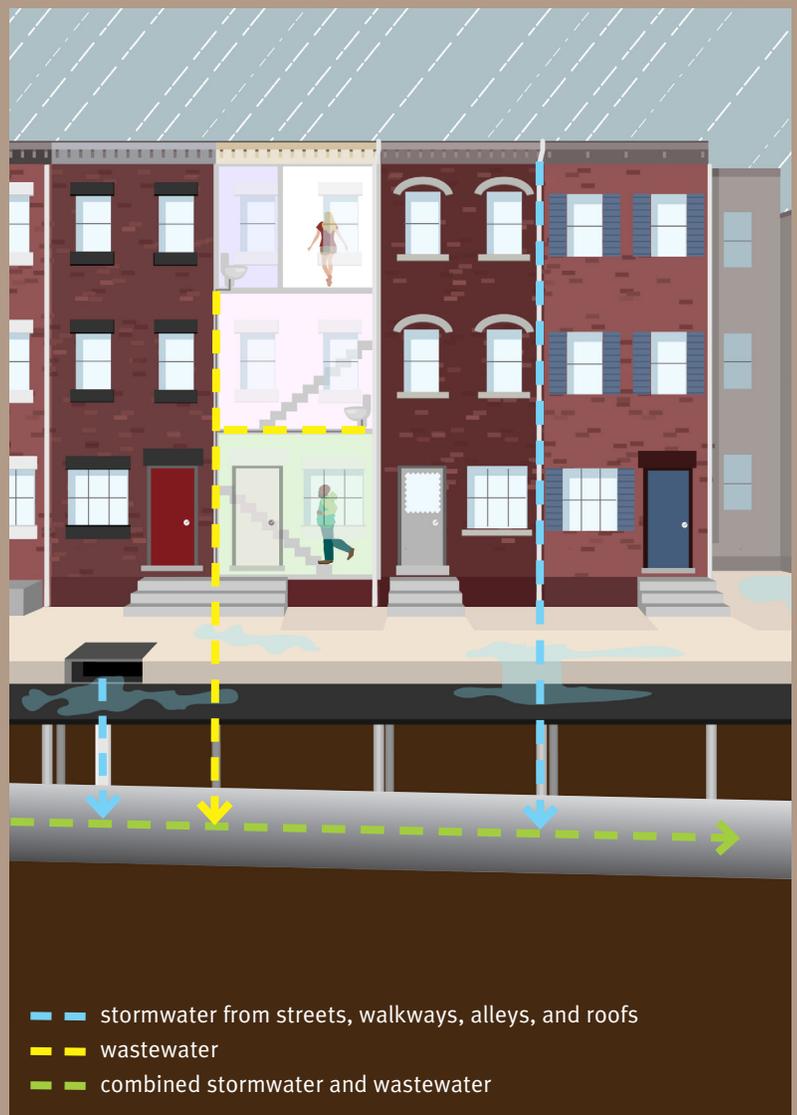
The remainder of the City of Philadelphia’s sewer system is drained by what is called a separate system. A separate sewer system collects stormwater in a storm sewer pipe and discharges it directly to a waterway, while the sanitary sewage collected from homes, businesses, and industry is collected in a sanitary sewer pipe and taken to the water pollution control plant for treatment before being released to the waterways.

Four watersheds within the City of Philadelphia receive CSO discharges.

Watersheds Receiving CSO Discharges	m <sup>2</sup> drained within Phila.	served by CSS (approx)
Tookany/Tacony-Frankford Creek	19	80%
Cobbs Creek	6	80%
Delaware River	40	71%
Schuylkill River	36	40%

This amounts to 64 square miles of Combined Sewer Service drainage area for potential implementation.

Combined Sewer System



## Our Vision

PWD's *Green City, Clean Waters* program is the much talked about philosophy of the land-water-infrastructure approach made real. We have put less emphasis on the use of traditional infrastructure as it is cost prohibitive while also missing the restoration mark, instead pledging our precious investments into greening the City as a means to provide specific benefits to the residents of the City of Philadelphia while meeting ecological restoration goals.

Our vision is to unite the City of Philadelphia with its water environment, creating a green legacy for future generations while incorporating a balance between ecology, economics, and equity.

We will integrate CSO and water resources management into the socioeconomic fabric of the City by creating amenities for the people who live and work here.

PWD's *Green City, Clean Waters* program integrates management of Philadelphia's watersheds into a larger context. It is designed to provide many benefits beyond the reduction of combined sewer overflows, so that every dollar spent provides a maximum return in benefits to the public and the environment.

### Our Vision Includes

Large-scale implementation of green stormwater infrastructure to manage runoff at the source on public land and reduce demands on sewer infrastructure

Requirements and incentives for green stormwater infrastructure to manage runoff at the source on private land and reduce demands on sewer infrastructure

A large-scale street tree program to improve appearance and manage stormwater at the source on City streets

Increased access to and improved recreational opportunities along green and attractive stream corridors and waterfronts

Preserved open space utilized to manage stormwater at the source

Converted vacant and abandoned lands to open space and responsible redevelopment

Restored streams with physical habitat enhancements that support healthy aquatic communities

Additional infrastructure-based controls when necessary to meet appropriate water quality standards.

## Our Commitment

More than  
**\$336 million**  
in commitments  
already in place

**\$1.6 billion**  
invested by PWD  
by 20-year mark

**\$3 billion**  
full investment  
in plan through  
the addition  
of leveraged  
activities

We have heard a theme echoed in civic and public forums, in our watershed partnerships, and in our model neighborhood projects. People want to see more “green” in their communities, and they are ready to commit both time and heart to make it happen.

Our pledge is to put the mechanisms in place over the coming years to equip the City to function as a “Green Machine.” Long into the future, even beyond the limited timeframe of our 20-year planning horizon, every time land is touched by development or redevelopment (for streets, homes, business, industry and so on), the principles of sustainability and stormwater management will be incorporated into the design and engineering of the development.

Our strategy is to focus on improving the water resources and revitalizing the City of Philadelphia. Commitments made in this plan will lay the foundation for a sustainable Philadelphia by greening our neighborhoods, restoring our waterfronts, improving our outdoor recreation spaces, and enhancing our quality of life. With the assistance of many public and private partners, we envision greening at least one third of the existing impervious cover in our Combined Sewer System drainage areas over the next two decades, transforming them into “Greened Acres” that will filter or store the first inch of rainwater runoff each time it rains.

The PWD Combined Sewer Overflow Long Term Control Plan Update (LTCPU) presents our *Green City, Clean Waters* program. At the close of this 20 year implementation period, PWD will have invested approximately \$1.6 billion (\$1.0 billion in 2009 dollars) to initiate the largest Green Stormwater Infrastructure Program ever envisioned in this country, thereby providing for the capture of 80 percent of the mixture of sewage and stormwater that would otherwise flow into portions of the Schuylkill and Delaware Rivers, and the Tacony, Frankford and Cobbs Creeks, every time it rains.

This *Green City, Clean Waters* commitment is in addition to numerous CSO-related PWD programs already in place, including:

- Approximately \$200 million already spent toward PWD’s 1997 LTCP commitments (including Nine Minimum Controls, capital projects, and watershed planning)
- Approximately \$2 million committed annually to conducting PWD’s Stormwater Plan Review Program
- Approximately \$56 million committed to relining streamside interceptor pipes in the Cobbs and Tookany/Tacony-Frankford (TTF) watersheds—as outlined in the Integrated Watershed Management Plan (IWMP) commitments
- Approximately \$2 million committed annually to Public Outreach and Education (including support of the Fairmount Waterworks Interpretive Center, and Fairmount Park’s Environmental Stewardship and Education Division.)

Through these and other leveraged activities by our many stakeholders and partners, we anticipate that the full investment in Philadelphia’s *Green City, Clean Waters* programs will reach more than \$3 billion.

We agree that it is extremely important that we reduce overflows to our waterways in order to provide our citizens with destinations to play, fish, relax, and reconnect with nature. Our waterways are—and should be—protected and preserved to remain sources of beauty and life. Even after the close of this 20-year implementation period, the practices put in place will continue to produce Greened Acres, achieving additional cumulative reductions in combined sewer overflows to our rivers and streams. We pledge to continue this reduction.

**Reducing overflow to our waterways in order to provide our citizens with destinations to play, fish, relax, and reconnect with nature is the foundation of our environmental ethic.**

All together, the following principles will help us enjoy clean, safe and accessible streams and rivers.

### Basic Principles Underlying the City's Green City, Clean Waters Approach

- Utilizing rainwater as a resource by recycling, re-using, and recharging long neglected groundwater supplies rather than piping it away from our communities into our already stressed tributaries
- Maintaining and upgrading one of the nation's oldest water infrastructure systems
- Transforming our rivers and streams into recreation destinations and green open space for visitors and our citizens
- Preserving and restoring habitat for aquatic species within our urban stream corridors
- Collaborating to revitalize our City with an emphasis on sustainability
- Energizing our citizens, partnerships, public and regulatory partners to adopt and join us in this watershed-based strategy

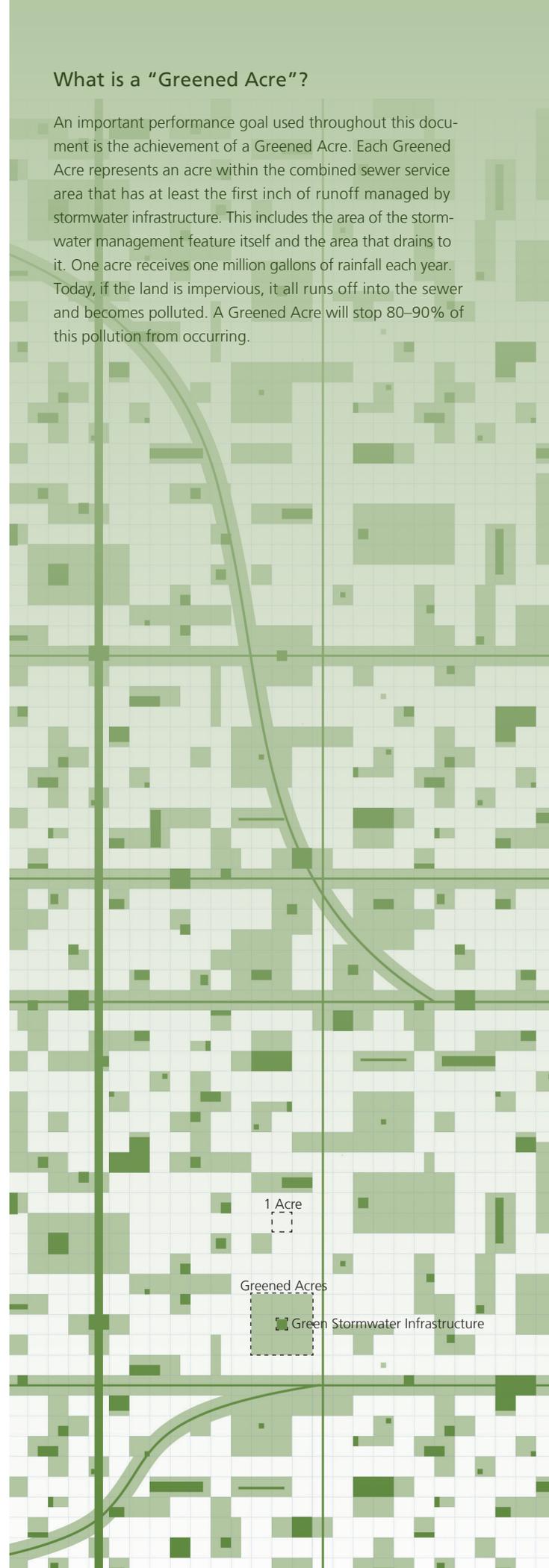
This plan commits the City to significantly reducing the negative impacts of stormwater on the effectiveness of our sewer collection system. Our strategy will be to reduce the stormwater burdening our sewers, changing the way that our landscape interacts with stormwater by enhancing our city's impervious cover with natural features. PWD will measure progress through Greened Acres that capture and manage the first inch of stormwater.

**“This LTCP is the greatest investment — more than \$1 Billion — that we will see in our lifetimes to redress the ‘sins of the past’ against our neighborhoods, rivers and streams. This investment will launch the transformation of our City into the ‘Green... Towne’ that our founder envisioned.”**

Patrick Starr, Senior Vice President, PA Environmental Council

### What is a “Greened Acre”?

An important performance goal used throughout this document is the achievement of a Greened Acre. Each Greened Acre represents an acre within the combined sewer service area that has at least the first inch of runoff managed by stormwater infrastructure. This includes the area of the stormwater management feature itself and the area that drains to it. One acre receives one million gallons of rainfall each year. Today, if the land is impervious, it all runs off into the sewer and becomes polluted. A Greened Acre will stop 80–90% of this pollution from occurring.



## Development of the Long Term Control Plan Update

### What Do the Clean Water Act and Combined Sewer Overflow Policy Require Us to Do?

- Meet water quality standard goals by substantially reducing combined sewer overflows
- Restore our waterways to enable aquatic life to thrive
- Commit PWD funding but remain affordable to our customers
- Outline our strategy of innovative and effective technologies and policies

### What We've Been Doing

Since 1997, PWD has been committed to gaining a better understanding of how our sewer collection system functions every time it rains, including when the system fills to capacity, when and where overflows occur and in what volumes, and where and how more capacity could be added to meet our water quality standard goals.

We have also been studying our rivers and streams from a watershed wide perspective as Philadelphia occupies the downstream portions of our watersheds. That is why we are developing watershed management plans with our upstream suburban neighbors in Delaware, Montgomery and Bucks counties. Without their cooperation and commitment to take similar protection measures, we'd be *down the creek*. Following is a summary of our activities over the past 12 years:

- Developing Integrated Watershed Management Plans
- Conducting watershed-wide chemical and biological assessments to thoroughly understand the condition of our waterways, the diversity and health of our water ecosystems, and the physical condition of our waterways
- Implementing demonstration projects for stream renewal and stormwater management
- Modeling and characterizing the performance of our sewer collection system
- Constructing additional sewer storage capacity
- Implementing new regulations to manage stormwater for development
- Sponsoring regional, watershed-based stormwater management planning
- Implementing parcel based stormwater fees

The culmination of this work leads us to make this recommendation to the Pennsylvania Department of Environmental Protection (PADEP) and United States Environmental Protection Agency (USEPA), and more importantly, to our citizens.

### Watershed Planning Approach

PWD developed our concept of regional watershed management planning after recognizing that, as the downstream most entity in each of the watersheds draining to the City of Philadelphia, the necessary long-term sustainable improvements to water quality and habitat within each waterway could not be achieved without watershed-wide stakeholder and agency support.

Watershed management fosters the coordinated implementation of programs, addresses and manages stormwater, looks to control sources of pollution, reduces polluted runoff, and promotes managed growth in the City and surrounding areas, while protecting the region's drinking water supplies, fishing and other recreational activities, and preserving sensitive natural resources such as parks and streams.

### Water Quality Summary

Major issues in each of the four watersheds are summarized in the following table. Limited public awareness and sense of stewardship, and water quality impairment during dry and wet weather were identified in each of the four watersheds as major concerns. Common types of impairment include high levels of fecal coliform, elevated water temperatures, large day and night time variations in dissolved oxygen, and dissolved oxygen levels below minimum standards. During dry weather, potential sewage flows in separate sewer service areas were a concern in all watersheds. Another common dry weather concern was the presence of litter and unsightly streams, which discouraged recreational use.

In the Tookany/Tacony-Frankford and Cobbs Creek Watersheds, degraded aquatic and riparian habitats, and limited diversity of fish and other aquatic life were cited as overlying ecosystem concerns. In those watersheds, bank and streambed erosion threatened the functions of nearby utilities and CSOs impacted both water quality and stream channels. In the Schuylkill and Delaware Watersheds, major concerns included the lack of recreational opportunities and public access to the riverfront, and the presence of PCBs which necessitated fish advisories.

**Our watershed problems do not begin or end at the outfall.**

Through the watershed-based planning process, PWD commits to addressing a multitude of overlapping regulatory requirements, including EPA's Combined Sewer Overflow (CSO) Control Policy, Phase I and Phase II Stormwater Regulations, PA Act 167 Stormwater Management, Total Maximum Daily Load allocations, PA Act 537 Sewage Facilities Planning, the Clean Streams Law, and Safe Drinking Water Act based drinking water source protection

programs. The planning process must also fit within a whole host of non-regulatory planning processes and initiatives, including existing municipal and conservation planning efforts (e.g. River Conservation Plans, Open Space Plans, municipal comprehensive plans) and, just as importantly, stakeholder goals. **Implementation of this LTCPU commitment is just one part of PWD's larger, watershed-based commitment.**

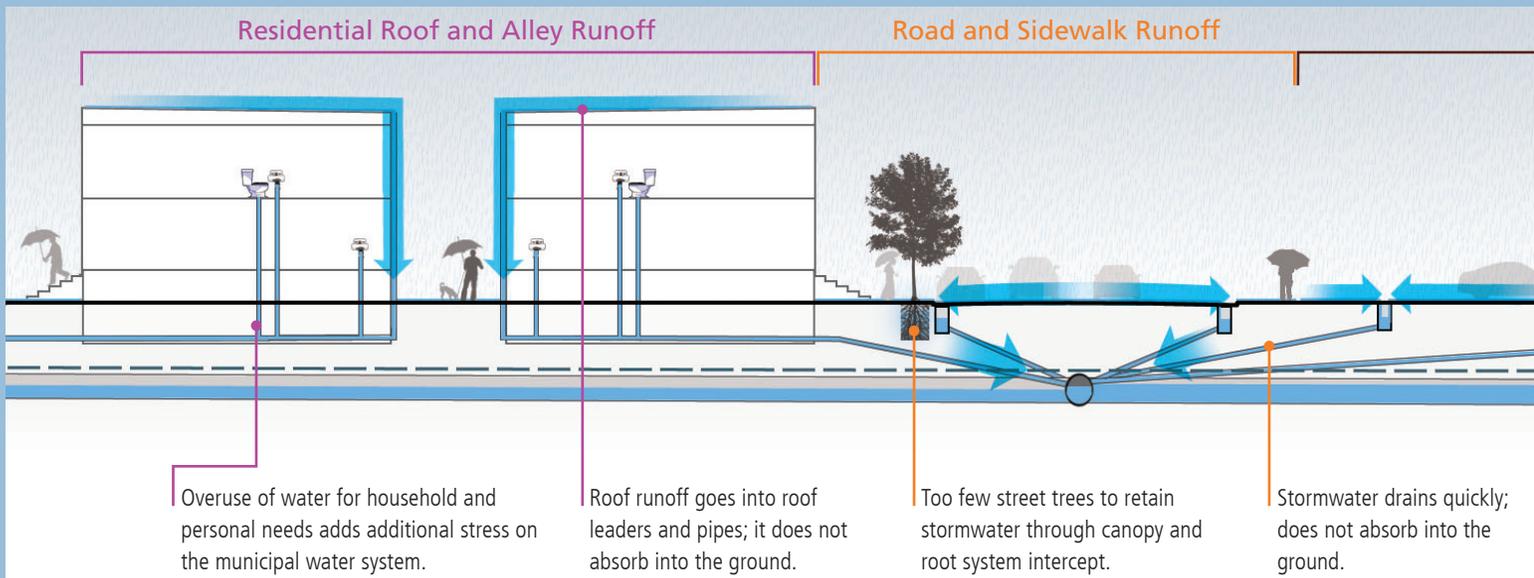
		Watersheds in the Combined Sewer Area			
		Tookany/Tacony-Frankford Creek	Cobbs Creek	Delaware River	Schuylkill River
Dry Weather Water Quality, Aesthetics and Recreation	Water quality concerns (including bacteria and dissolved oxygen)	●	●	●	●
	Potential sewage flows in separate sewer areas	●	●	●	●
	Litter and unsightly streams that discourage residential use	●	●	○	○
	Safety concerns along streams and stream corridors	●	●	○	○
Watershed Stewardship	Limited public awareness and sense of stewardship	●	●	●	●
	Recreational opportunities and public access below potential	●	●	●	●
Healthy Living Resources	Degraded aquatic and riparian habitats	●	●	○	○
	Limited diversity of fish and other aquatic life	●	●	○	○
	Channelized stream sections	●	○	○	○
	Loss of wetlands	●	●	●	●
	Utility infrastructure threatened by bank and streambed erosion	●	●	○	○
Wet Weather Water Quality and Quantity	Water quality concerns (including bacteria and dissolved oxygen)	●	●	●	●
	CSO and stormwater impacts on stream channels	●	●	○	○
	Total Maximum Daily Load and fish advisories established for PCBs	○	○	●	●
	Little volume control and treatment of stormwater flows in separate sewer areas	●	●	○	○

This watershed planning approach recognizes that there is a direct connection between all neighborhoods in Philadelphia, whether adjacent to or miles from the City's rivers and creeks, and their watersheds. Household wastewater, roof runoff, road and sidewalk runoff, and parking lot runoff all end up in the sewers and ultimately in our waterways. Stormwater management in neighborhoods near and far from the waterways is essential. By managing stormwater at its source, it is possible to reduce the amount

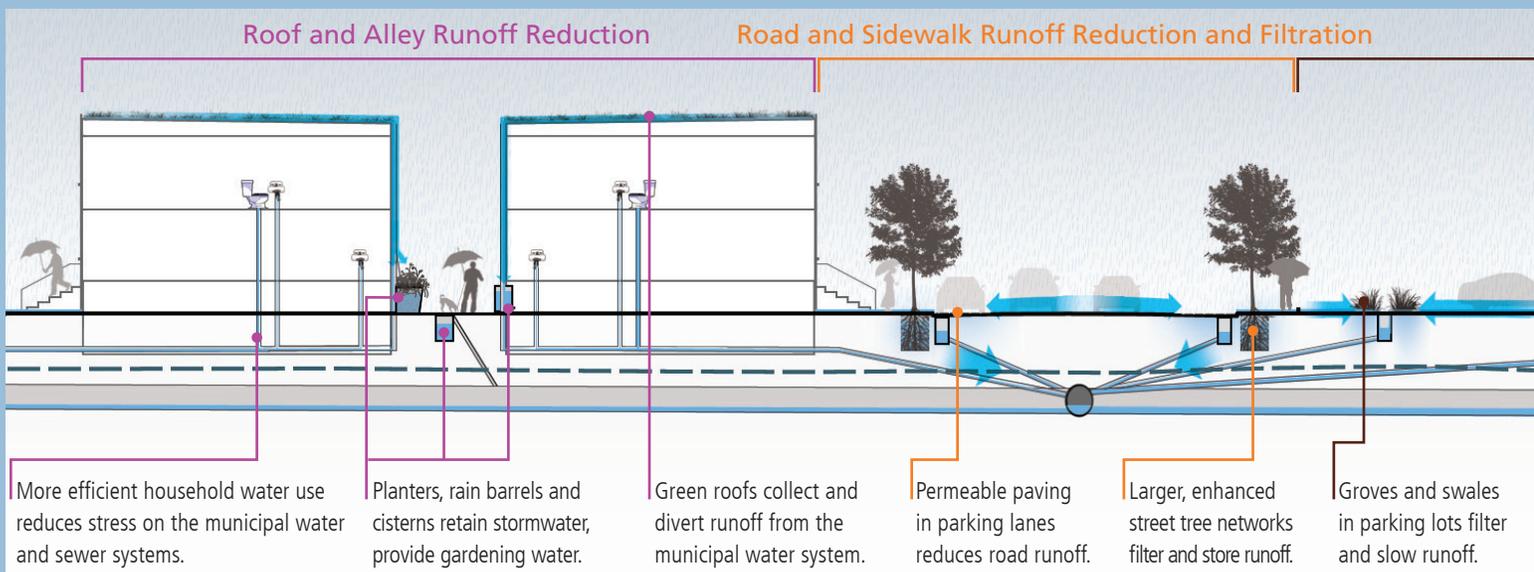
of stormwater that ends up in our rivers and creeks, simultaneously improving the quality of our neighborhoods and our waterways.

PWD has committed to development of watershed-based plans for each of the five major tributary streams that drain through the City of Philadelphia, including the Cobbs, Tookany/Tacony-Frankford, Wissahickon, Pennypack and Poquessing. Recently, PWD also committed to developing watershed-based plans for the City of Philadelphia portions

### A **typical** urban watershed has negative effects on its creeks:



### A more **sustainable** approach to stormwater will positively affect the watershed:



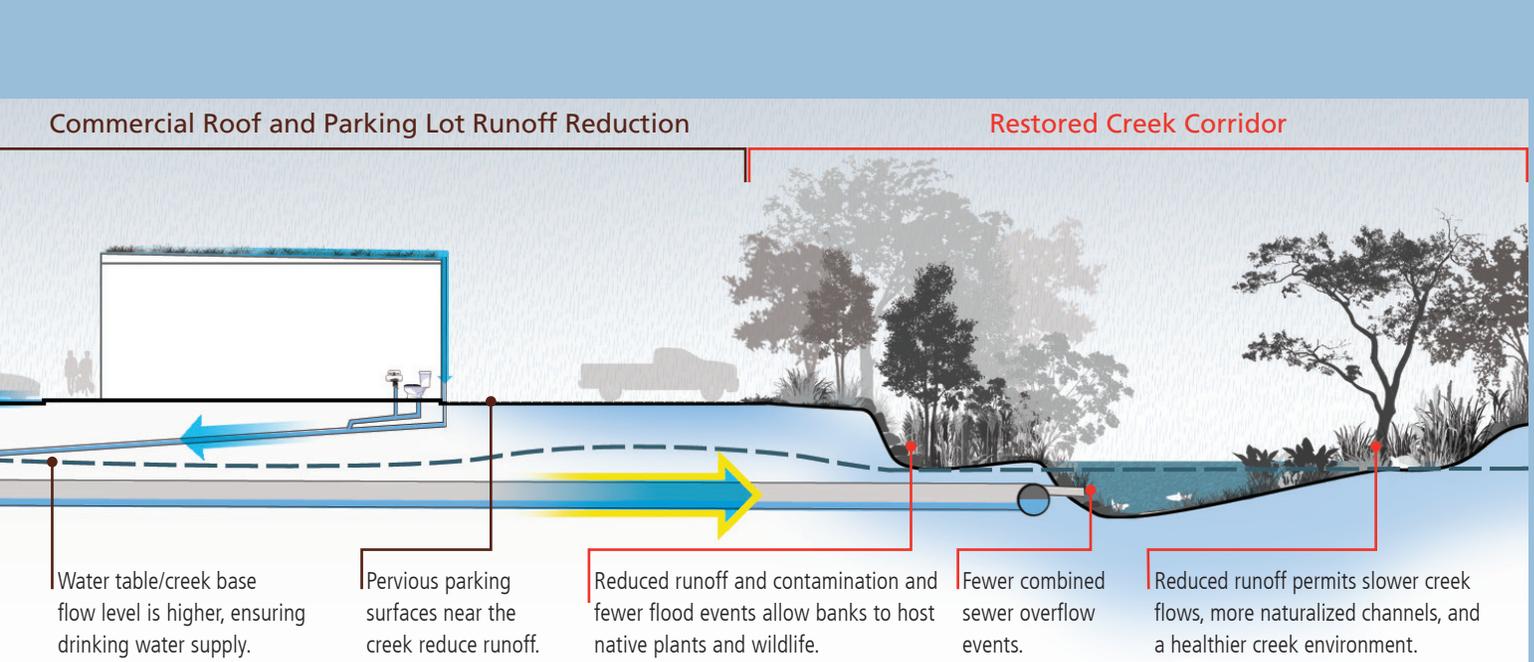
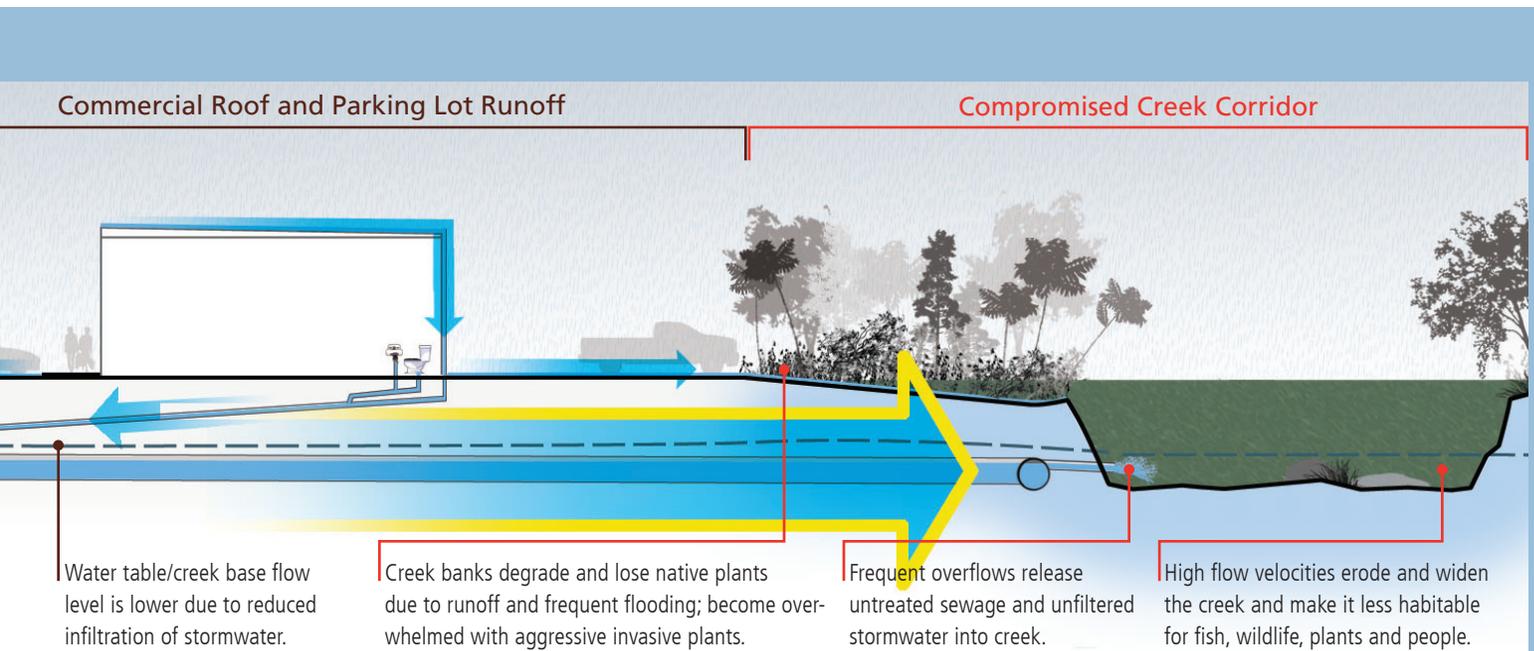
of the Schuylkill and Delaware River systems. To date, IWMPs have been completed for the Cobbs and Tookany/Tacony-Frankford Watersheds.

PWD's watershed-based planning process is based on a carefully crafted approach to meeting the challenges of watershed management in an urban setting. The primary intent of the planning process is to improve the environmental health and safe enjoyment of the watershed on a region-wide scale by sharing resources and through

“Philadelphia has shown a long-term commitment to the concepts of preservation and restoration applied on a watershed scale.

Although these are not new ideas, they have the feeling of something innovative, because they are winning more and more interest around the country as the best way to a sustainable water future.”

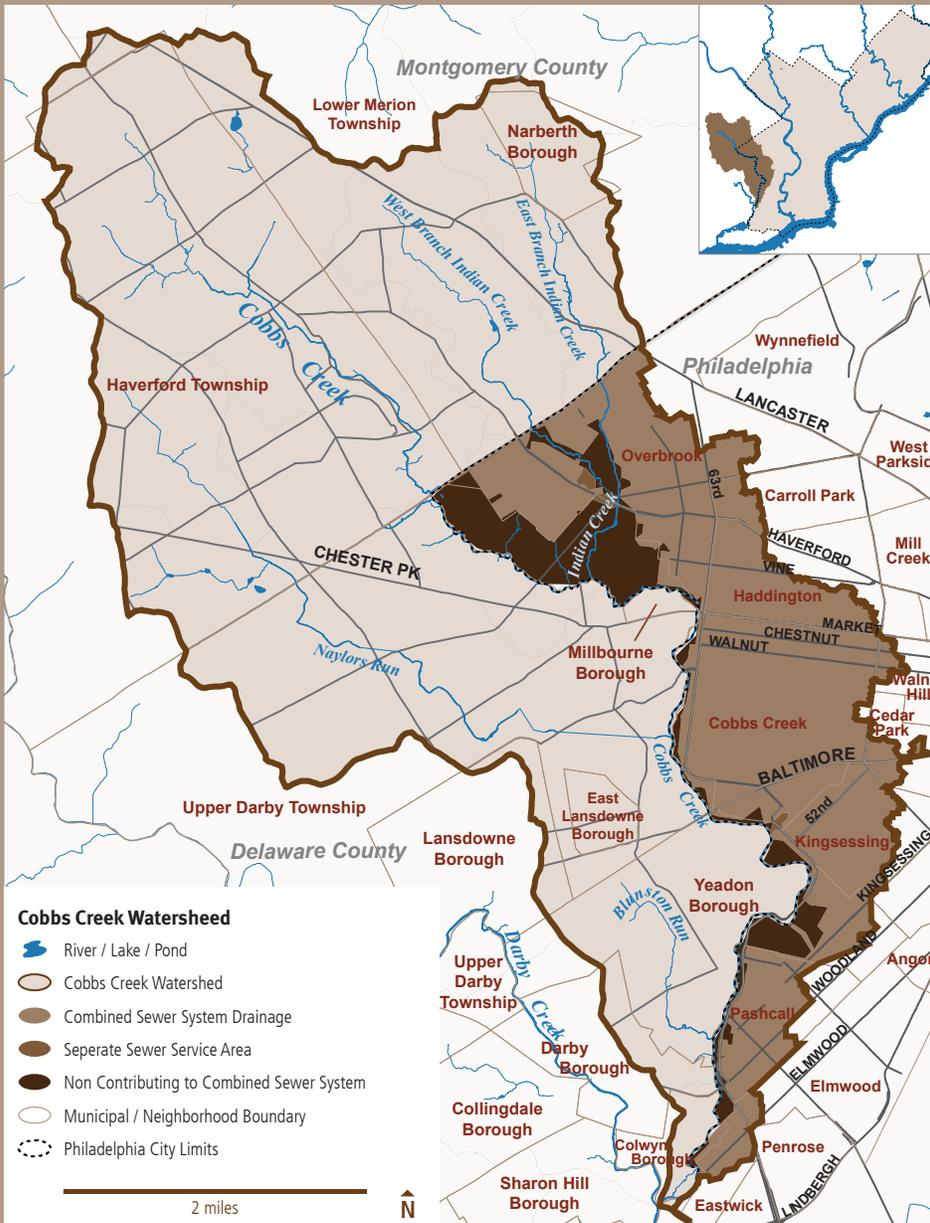
David Burke, Pennsylvania Department of Environmental Protection



cooperation among residents and other stakeholders. PWD offers the residents and stakeholders a number of resources, as this multifaceted planning approach requires a tremendous amount of coordination, characterization and planning, which the watershed stakeholders build on through the watershed-based planning process.

PWD's watershed plans are built upon a solid, scientific foundation composed of water quality monitoring (including

both wet and dry weather samples), benthic invertebrate (bug) and fish bioassessments, physical stream surveys (fluvial geomorphology as well as streamside infrastructure) and hydraulic and hydrologic computer modeling of stormwater flows and pollutant loading. Based on these extensive physical, chemical and biological assessments, the plans explore the nature, causes, and severity of water quality impairments in the watershed and opportunities for improvement.



### Cobbs Creek Watershed Integrated Watershed Management Plan

In 1999, the PWD formed its first watershed partnership, the Darby-Cobbs Watershed Partnership in an effort to connect residents, businesses, and government as neighbors and stewards of the watershed. Since then, the Partnership has been active in developing a vision for the watershed and guiding and supporting subsequent planning activities within the watershed. The Partnership functions as a consortium of proactive environmental groups, community groups, government agencies, businesses, residents and other stakeholders who have an interest in improving the Darby-Cobbs Watershed.

The mission of the Darby-Cobbs Watershed Partnership is to improve the environmental health and safe enjoyment of the Darby-Cobbs Watershed by sharing resources through cooperation of the residents and other stakeholders in the Watershed. The goals of the initiative are to protect, enhance, and restore the beneficial uses of the Darby-Cobbs waterways and riparian areas.

**Implementation Commitment to Date:** The Cobbs Creek Integrated Watershed Management Plan (CCIWMP), completed in 2004 included a longterm commitment to implementation measures to address dry and wet weather water quality goals, and stream and habitat restoration goals. The first 5-year implementation plan for the CCIWMP (2006–2011) included a commitment from PWD of roughly \$16 million.

PWD and a number of the Darby-Cobbs Watershed Partners have successfully secured funding for and implemented multiple demonstration projects within the watershed. These projects stretch from the headwaters in Delaware and Montgomery Counties through the City of Philadelphia. The watershed partnership has worked over the years to understand where the information gaps exist within the community so that they could target demonstration projects that would not only achieve water quality and habitat related benefits, but also spread these demonstration projects geographically such that they would reach a diversity of community audiences educating residents about their various benefits.



A snapshot of projects implemented and/or underway within the Darby-Cobbs Watershed in 2008

PWD's watershed-based plans present logical and affordable pathways to restore and protect the beneficial and designated uses of these urban waterways.

Through an integrated approach to watershed management, PWD has reached across municipal boundaries and closely listened to its ratepayers. The wishes of our watershed partners are clear—they unanimously desire communities where there is opportunity for fishing, hiking and birding

in a safe park—along a clean creek—surrounded by a healthy stream buffer which can protect rich and diverse aquatic life in their streams. These are the tenets that watershed partners believe will result in watersheds that attain water quality and water quantity improvements, a healthier natural environment and a better quality of life for the people who live, work and play in the watersheds.

Below: Two examples of the Integrated Watershed Management Plan

### Tookany/Tacony-Frankford Creek Watershed Integrated Watershed Management Plan

PWD initiated the second watershed-based plan development process in the Tookany/Tacony-Frankford (TTF) Watershed in 2000. The TTF Watershed drains 29 square miles in Philadelphia and Montgomery Counties. The City of Philadelphia occupies almost 52% of the watershed drainage. The creek is referred to as the Tookany Creek until it enters Philadelphia at Cheltenham Avenue; then as the Tacony Creek from the Montgomery County border until the confluence with the historic Wingochocking Creek in Juniata Park; and finally the section of stream from Juniata Park to the Delaware River is referred to as the Frankford Creek. This planning endeavor in the TTF Watershed took roughly 4 years to move from watershed characterization to plan completion.

In 2005, under PWD's leadership, the Tookany/Tacony-Frankford Partnership transformed from a loose partnership into a formally incorporated independent non-profit organization, composed of environmental professionals, community groups, government entities, and other watershed stakeholders. The Partnership has embarked on implementing the Tookany/Tacony-Frankford Integrated Watershed Management Plan (TTFIWM) and is active in advancing a wide range of initiatives for the good of the watershed.

**Implementation Commitment to Date:** The TTFIWM, completed in 2005, included a long-term commitment to implementation measures to address dry and wet weather water quality goals, and stream and habitat restoration goals. The first 5-year implementation plan for the TTFIWM (2006-2011) included a commitment from PWD of roughly \$18 million.

Not only has this watershed partnership celebrated the success of transitioning from a loosely affiliated informal partnership structure to an independent nonprofit organization with the mission of implementing the recommendations of the IWM, but in its first few years of existing as a non-profit, this organization has secured funding for and implemented a number of demonstration projects throughout the watershed area. On an annual basis, PWD works with the Watershed Partnership to feature a number of the on-the-ground accomplishments from the previous year and share them with our watershed stakeholders in celebration of all we have achieved.

**WHAT'S HAPPENING IN YOUR NEIGHBORHOOD?**

- A. Creek Clean Up Effort 10/26 & 11/26/08**  
Residents in 11 neighborhoods along the creek, their dogs, and their kids joined together for a community cleanup on October 26th and November 26th. The effort resulted in over 1,000 pounds of trash being removed from the creek banks.
- B. Frankford Creek Greenway Plan**  
The Frankford Creek Greenway Plan is a 1.5-mile long trail that will provide a safe and scenic route for walking, jogging, and biking. The plan includes a mix of paved and unpaved paths, as well as green spaces and water features.
- C. Flower Tree Plantings**  
Flower trees are a beautiful addition to any landscape. They provide shade, attract pollinators, and add color to the neighborhood. PWD has planted several flower trees along the creek banks.
- D. Street Tree Planting**  
Street trees improve the urban environment by providing shade, reducing air pollution, and beautifying the neighborhood. PWD has planted several street trees along the creek banks.
- E. Stream Restoration (10/21 Run at 27 and 68th St)**  
Stream restoration projects aim to improve the health of the stream and its habitat. PWD has installed several stream restoration structures along the creek banks.
- F. Tacony Parkway Streambank Stabilization**  
Streambank stabilization projects help prevent erosion and improve the stability of the stream banks. PWD has installed several streambank stabilization structures along the creek banks.
- G. Tacony Parkway Streambank Stabilization**  
Streambank stabilization projects help prevent erosion and improve the stability of the stream banks. PWD has installed several streambank stabilization structures along the creek banks.
- H. Tacony Parkway Streambank Stabilization**  
Streambank stabilization projects help prevent erosion and improve the stability of the stream banks. PWD has installed several streambank stabilization structures along the creek banks.
- I. Cheltenham Parkway Streambank Stabilization**  
Streambank stabilization projects help prevent erosion and improve the stability of the stream banks. PWD has installed several streambank stabilization structures along the creek banks.
- J. Tacony Parkway Streambank Stabilization**  
Streambank stabilization projects help prevent erosion and improve the stability of the stream banks. PWD has installed several streambank stabilization structures along the creek banks.



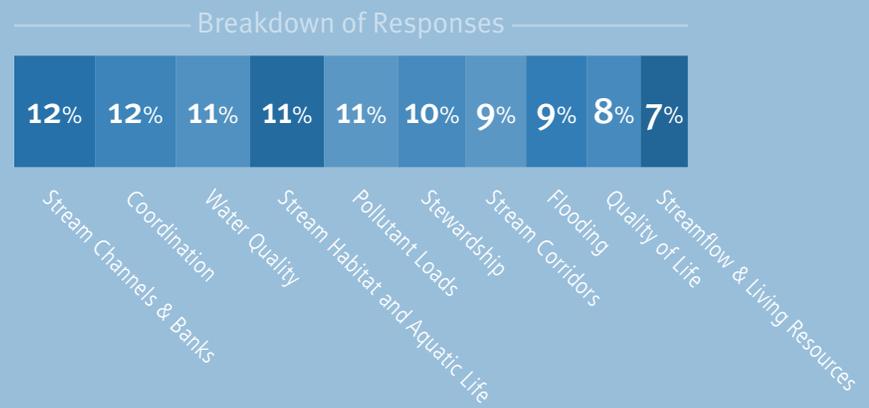
A snapshot of projects implemented and/or underway within the Tookany/Tacony-Frankford Watershed in 2008

## Planning Goals from the Integrated Watershed Management Plan

Over the past ten years, the watershed-based goal-setting process initiated through IWMP development has taught PWD that our watershed stakeholders generally consider all watershed management goals of almost equal importance; there is no goal of clear “higher rank” than others. The Green City, Clean Waters program aligns with this equal prioritization by addressing all aspects of watershed management instead of focusing solely on selected in-stream water quality parameters.

*Source: Data based on the goal-setting process for the development of the Cobbs Creek Integrated Watershed Management Plan, 2003*

Watershed Goals as Prescribed by Watershed Partners



**It is our goal to accomplish as many environmental improvements as possible, as quickly as feasible. We see the greatest immediate benefit to the public coming from an aggressive implementation of all the targets.**

### Environmental Targets

In an ideal world, flowing streams and rivers would remain in harmony with the surrounding environment. Banks would remain stable with lush, vegetative protection. Fish and benthic invertebrates (bugs) would thrive within their in-stream habitat. The floodplains surrounding the streams would be accessible, and within them one would find a mix of wetlands and mature forest cover.

Unfortunately, for the urban waterways of the Philadelphia area, streams have fallen victim to years of the effects of urbanization. As population and development have increased within and surrounding Philadelphia, so has impervious cover. This has resulted in a significant increase in stormwater runoff to be managed by existing infrastructure, ultimately making its way to these urban streams. This increase has created a “flashy” flow regime in these urban streams, meaning that they go from very low streamflows during dry weather to extremely high flows during rain events. This effect has devastated the stream systems, causing erosion and scouring of streambanks such that habitat has been all but destroyed for benthic invertebrate and fish populations.

Development of watershed planning goals through the stakeholder-led integrated watershed management planning process resulted in the establishment of three implementation targets for watershed improvement and restoration, based on consideration of ecology and human health. Targets help us to break the overwhelming end goal of “significantly improving watershed conditions” into three distinct measurable pieces on which we can consistently assess our performance during the implementation period.

### Improvement of Stream Quality, Aesthetics and Recreation During “Dry” Weather:

Our focus is on achieving water quality standards in the stream during dry weather periods, which is when we believe that our stakeholders are most likely to be recreating streamside. In a given year, dry weather conditions are observed close to 65% of the time. Achievement of this target would involve the elimination of dry weather discharges to the stream from outfalls, removal of trash and litter from the waterway, improvement of public access to the waterways, as well as enhancement of streamside recreational opportunities including streamside trails and open space.

### Preservation and Enhancement of Healthy Living

**Resources:** Part of what makes a stream so valuable is its healthy aquatic environment which results in diverse benthic invertebrate (bug) and fish populations. Implementation projects to achieve this lofty target are aimed not only at restoration of habitat, but also at measures to provide the opportunity for these organisms to seek refuge and avoid the high velocities of streamflow during storms. Achievement of this target will increase the population, health, and diversity of our benthic invertebrate and fish species within the stream.

### Improvement of Wet Weather Water Quality and

**Quantity:** During rainstorms a great deal of stormwater is piped to our streams—resulting in abrupt changes in water quantity and quality. Through the use of Green Stormwater Infrastructure tools, we seek to reduce the impact of these abrupt changes by managing stormwater where it hits the ground, thereby reducing the amount of stormwater that reaches the waterways.

## Green Stormwater Infrastructure

The use of sustainable and natural design, called green stormwater infrastructure, will bring about the renewal and expansion of the urban form. This approach has been shown to be the most environmentally beneficial and economically favorable way to remediate the effect of more than 200 years of urbanization on the City's waterways.

By investing in green stormwater infrastructure and other innovative, cost-saving strategies to manage stormwater, we are not only ensuring the rebirth of our ecological resources but are also striving to provide a host of other environmental, social and economic benefits that will catalyze our success in achieving the sought after reality of "Greenest City in America."

Acknowledging the symbiotic relationship between land use and water resources, our definition of green stormwater infrastructure includes a range of soil-water-plant systems that intercept stormwater, infiltrate a portion of it into the ground, evaporate a portion of it into the air, and in some cases release a portion of it slowly back into the sewer system.

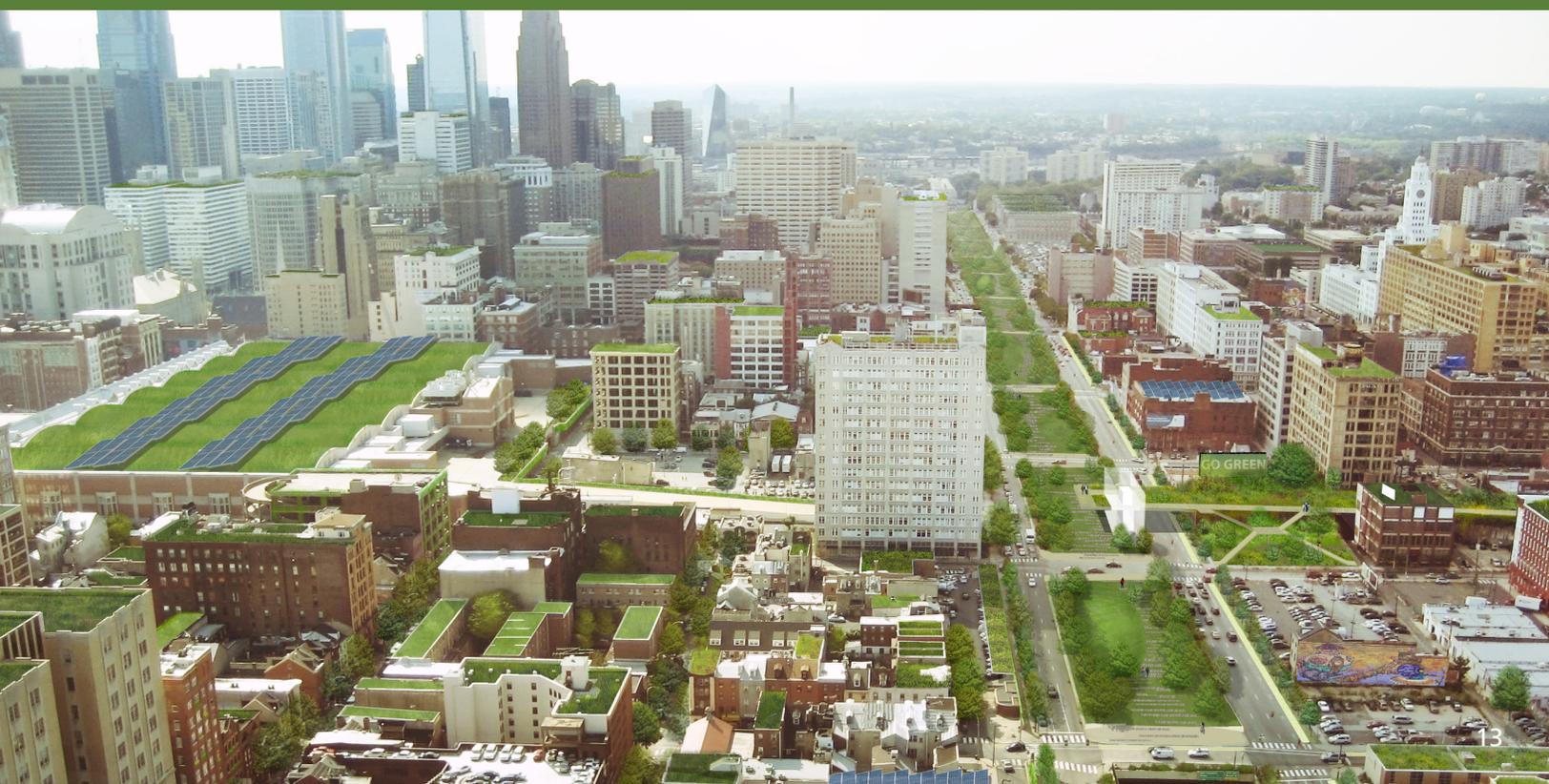
Green stormwater infrastructure examples include bioretention planters in sidewalks and parking lots, green roofs, and roof leaders that run off into lawns and rain gardens. These vegetated features manage rain where it hits the ground similar to the way a natural system such as a forest or a meadow would handle the rain runoff. We sincerely believe in the efficacy of using nature's own designs in which rainwater is an essential component for a thriving ecosystem. When rainwater is removed from the natural system, it is only a matter of time before the natural system fails. The reduction

of baseflow in urban streams is the unintended consequence of traditional infrastructure that pipes rainwater away from where it hits the ground before it has a chance to infiltrate.

Green stormwater infrastructure also involves the restoration of physical habitats in stream channels, along stream corridors, and on riverfronts. Restoration of stream habitats and riverfronts can also be combined with commitments to improve public access and amenities along the stream corridors. Public stewardship can only be guaranteed when the public is given the opportunity to see, touch and experience the streams healed by our efforts. These practices are critical to PWD's larger restoration vision; without them, the ecosystem damage resulting from two centuries of urbanization will not be reversed.

As green stormwater infrastructure becomes the standard practice, we will systematically reduce the amount of stormwater runoff from the City's built environment every time we re-create or renew the urban landscape and streetscapes. When we complete a public land transformation, the new green stormwater infrastructure will manage the first inch of rainfall which would normally flow along its street gutters and into its storm drains. We now look at our City's streets with an eye that seeks opportunities to peel back the existing concrete and asphalt and replace it with a new landscape, rich with vegetation that welcomes the rain—storing, draining and cleaning it. Our focus is on creating new standards of sustainable urban design that will guide the development and redevelopment of American cities in the 21st century.

**We now look at our City's streets with an eye that seeks opportunities to peel back the existing concrete and asphalt and replace it with a new landscape, rich with vegetation that welcomes the rain—storing, draining, and cleaning it.**



## Integrating with Local and National Policy

**The *Green City, Clean Waters* program is designed so that every dollar spent provides a maximum return in benefits to the public and the environment.**

In a hallmark challenge to make Philadelphia “[The Greenest City in America](#),” Mayor Michael Nutter has committed to reducing the City’s exposure to rising energy prices, to limiting the City’s environmental footprint, and repositioning the workforce and economic development strategies to leverage an enormous competitive advantage in the emerging green economy. He has created the new cabinet-level Office of Sustainability and a Sustainability Advisory Board representing public, private, and nonprofit interests from across the metropolitan area. In April 2009, the City launched “GreenWorks,” an innovative action plan focusing on Energy, Environment, Equity and Economy, with ambitious targets to be addressed within the next five years.

PWD’s *Green City, Clean Waters* program integrates management of Philadelphia’s watersheds into this larger context. It is designed to provide many benefits beyond the reduction of combined sewer overflows, so that every dollar spent provides a maximum return in benefits to the public and the environment. Philadelphia’s program is a unique and fresh approach that supports numerous EPA initiatives at a time when our nation’s cities need 21st Century solutions to aging infrastructure problems. EPA Administrator Lisa Jackson identified five priorities for the Administration, including:

1. Protecting America’s water;
2. Improving air quality;
3. Reducing greenhouse gas emissions;
4. Cleaning up hazardous-waste sites; and
5. Managing chemical risks.

PWD’s *Green City, Clean Waters* program will directly address four out of five of these priorities.

The City of Philadelphia’s LTCPU has been devised in light of the recent green stormwater infrastructure guidance and policy documents developed by the United States Environmental Protection Agency (EPA). The EPA signed the “Green Stormwater Infrastructure Statement of Intent” in April 2007 and followed with the production of two memos, including “Using Green Stormwater Infrastructure to

Protect Water Quality in Stormwater, CSO, Nonpoint Source and other Water Programs” and “Use of Green Stormwater Infrastructure in Permits and Enforcement”. These EPA memos strongly support the use of green stormwater infrastructure approaches in lieu of traditional infrastructure when possible by encouraging state and federal policy to integrate green stormwater infrastructure into permitting and enforcement activities.

In March 2009, Administrator Jackson charged the EPA Office of Water with leading a new Urban Waters Initiative. The focus of this program will be to promote stewardship of urban waterways in the communities that surround them, especially in areas not historically targeted by environmental outreach. The goals of the Urban Waters Initiative are to achieve water quality goals of fishable/swimmable/drinkable rivers, improve public health and the environment and quality of life, and sustain community improvements over multiple generations. This initiative will help restore urban waterways in Environmental Justice communities. [The \*Green City, Clean Waters\* Program embodies the intent of this Urban Waters Initiative.](#) PWD will follow this initiative as it develops and will seek opportunities for partnership synergies.

Also, the EPA has recently joined forces with the US Department of Housing and Urban Development and the Department of Transportation through an Interagency Partnership for Sustainable Communities, focusing national attention to improve access to affordable housing, more transportation options, and lower transportation costs while protecting the environment in communities nationwide. Philadelphia’s unique approach to meeting CSO requirements helps promote their goal of livable communities by investing in healthy, safe and walkable neighborhoods and coordinates all levels of policy to support our existing communities. This is yet another initiative that would dovetail with the *Green City, Clean Waters* program, presenting opportunities to partner and where possible, leverage dollars such that both agencies are able to stretch their limited funding further and are able to get more out of each investment.

## LTCPU Implementation Alternatives Evaluated

In order to compare the costs and benefits for multiple implementation approaches, we performed a comprehensive alternatives analysis on a number of implementation approaches (listed below). Each infrastructure alternative was analyzed in detail for each watershed. Green Stormwater Infrastructure with Targeted Traditional Infrastructure was clearly the best alternative for several reasons. First, this alternative reduced combined sewer overflow in a cost-effective manner. Second, it meets the broader goals of PWD’s Integrated Watershed Management Approach while maximizing environmental, social, and economic benefits. Third, this alternative is the only one that meets all watershed goals without causing severe economic hardship for PWD’s ratepayers. Finally, public feedback has expressed a clear and unambiguous preference for an alternative focused on green stormwater infrastructure.

	Affordable	Scalable	Meets Combined Sewer Overflow Policy Goals	Meets Watershed-based Planning Goals	Economic Benefits			Social Benefits			Environmental Benefits		
					Creates Jobs; Reduces Social Cost of Poverty	Enhances Recreation	Improves Community Quality of Life	Reduces Effects of Excessive Heat	Restores Ecosystems	Improves Air Quality	Saves Energy and Offsets Climate Change	Public Support	Benefits Accrual Method
<b>Complete Sewer Separation</b> <ul style="list-style-type: none"> <li>construct new sanitary sewer infrastructure</li> <li>convert existing combined sewers to a municipal separate storm sewer system (MS4)</li> <li>separate combined sanitary and storm laterals on private property</li> <li>reconnect private properties to new system</li> <li>reconstruct streets and sidewalks to their existing conditions</li> </ul>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	at completion
<b>Large-scale Storage (Tunnels)</b> <ul style="list-style-type: none"> <li>construct traditional tunnel storage to temporarily store combined sewage</li> <li>dewater stored sewage when capacity at water pollution control plants is available</li> </ul>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	at completion
<b>Plant Expansion, Satellite Treatment</b> <ul style="list-style-type: none"> <li>construct decentralized satellite treatment facilities</li> <li>construct new consolidation sewers to convey waste water to new satellite facilities</li> </ul>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	at completion
<b>Green Stormwater Infrastructure with Increased Transmission and Treatment</b> <ul style="list-style-type: none"> <li>implement large-scale application of green stormwater infrastructure</li> <li>construct new interceptors to increase capacity</li> <li>increase wet weather wastewater treatment capacity</li> </ul>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	immediate incremental
<b>Green Stormwater Infrastructure with Targeted Traditional Infrastructure</b> <ul style="list-style-type: none"> <li>implement intensive large-scale application of green stormwater infrastructure</li> <li>increase wet weather wastewater treatment capacity in targeted locations</li> </ul>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	immediate incremental

## Why This Approach is Best for the City of Philadelphia

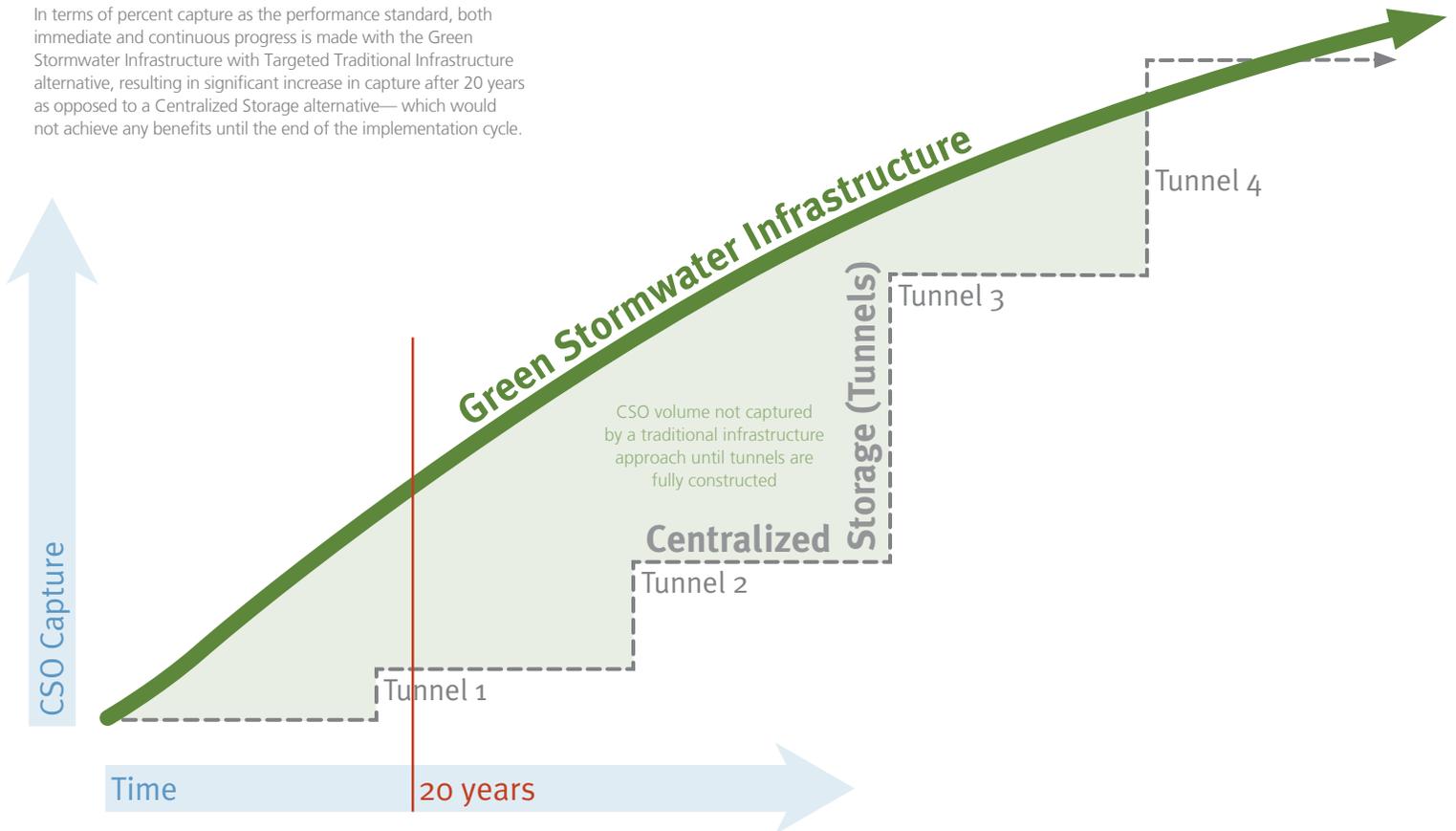
**PWD considered it critical to embed the CSO program in the larger context of the various economic, social, and environmental challenges.**

Multiple alternatives for meeting program objectives were developed and initially compared for their effectiveness and efficiencies in reducing combined sewer overflows. In selecting the best alternative for meeting the City’s obligations for controlling CSO events, PWD considered it critical to embed the CSO program in the larger context of the various economic, social, and environmental challenges. These challenges require that government agencies break out of their traditional roles of providing narrowly defined services and seek to work together toward larger goals. PWD’s LTCPU rightly focuses on significantly reducing CSOs, thereby making Philadelphia’s creeks and rivers cleaner and healthier. *But as the single largest investment of environmental dollars in the City over the next 20 years, it presents a unique opportunity to be much more than just a water quality improvement program and reverse the decline in the physical infrastructure in the City. It must be designed to provide additional benefits beyond the reduction of CSOs, so that every dollar spent provides a maximum return in benefits to the City.*

After more than two years of significant engineering and economic analyses, the “Green Stormwater Infrastructure with Targeted Traditional Infrastructure” alternative was shown to be the most attractive alternative due to the many environmental, social, and economic benefits that can be realized, its ability to improve all four watersheds and remain within affordability guidelines, and the fact that benefits begin accruing immediately—thereby producing benefits for City residents long before the traditional infrastructure approach would. Because the alternative is implemented gradually, it is also adaptable to changing conditions and uncertainty. By comparison, due to limited financial capability, PWD could only afford a partial tunnel solution, meaning that only one watershed would benefit from this traditional infrastructure program within the 20-year implementation horizon. Instead, we chose a green and decentralized program that is adaptable over the 20-year implementation program and produces benefits throughout the combined sewer system drainage area.

Conceptual Comparison of CSO Capture Over Time for Alternatives Evaluated by the City of Philadelphia

In terms of percent capture as the performance standard, both immediate and continuous progress is made with the Green Stormwater Infrastructure with Targeted Traditional Infrastructure alternative, resulting in significant increase in capture after 20 years as opposed to a Centralized Storage alternative— which would not achieve any benefits until the end of the implementation cycle.



# The Investment in Sustainability: Triple Bottom Line

## ECONOMIC BENEFITS

About 250 people employed in Green Jobs per year

**\$500 million**

## SOCIAL BENEFITS

Increase of over 1 million recreational user-days per year

Reduction of approximately 140 fatalities caused by excessive heat over the next 40 years

Increase in property values of 2–5% in greened neighborhoods

**\$1.3 billion**

## ENVIRONMENTAL BENEFITS

1.5 billion pounds of carbon dioxide emissions avoided or absorbed

Air quality benefits on average leading to 1–2 avoided premature deaths, 20 avoided asthma attacks, and 250 fewer missed days of work or school per year

Water quality and habitat improvements including 5-8 billion gallons of CSO avoided per year, 190 acres of wetland restored or created, and 11 miles of stream restored

Reduction of approximately 6 million kW-hr of electricity and 8 million kBTU of fuel used per year

**\$400 million**

“Green infrastructure offers a tremendous opportunity to tackle multiple issues simultaneously. Greening the city is not only a way to address stormwater management and combined sewer overflow problems, but is also an investment in communities—improving air quality, reducing heat island effect, and beautifying neighborhoods.”

Rachel Vassar, Outreach Coordinator for Philadelphia Citizens for Pennsylvania's Future (PennFuture)

An important advantage of *Green City, Clean Waters* is that it lays the groundwork for the revitalization of our City in areas of public health, recreation, housing and neighborhood values. [Philadelphia is the first city to fully adopt this approach for the CSO program which accumulates multiple social benefits in addition to complying with Philadelphia's Clean Water Act responsibilities.](#)

To fully understand these benefits, PWD has undertaken a Triple Bottom Line analysis of the environmental, social, and economic benefits of the program. This triple bottom line accounting means expanding the traditional financial reporting framework to take into account ecological and social performance so that the total benefits can be evaluated against the financial investment. Triple Bottom Line accounting attempts to describe the social and environmental impact of PWD's proposed infrastructure

investment such that they can account for not only the water quality benefit that the infrastructure would produce, but also the additional environmental and societal benefits generated by the various alternatives evaluated.

Although these environmental, social, and health benefits are extremely difficult to quantify, PWD felt it was important to analyze these “triple bottom line” benefits in an attempt to compare the green approach with other traditional infrastructure alternatives. [Understanding the full societal costs and benefits is important in justifying the program with the ratepayers, who will ultimately pay for this initiative.](#) With the help of leading environmental economists, PWD compared the alternatives to help quantify the social benefits. After 40 years, the *Green City, Clean Waters* program will create more than two dollars in benefits for every dollar invested by PWD.

**After 40 years, the *Green City, Clean Waters* program will create more than two dollars in benefits for every dollar invested by PWD.**

# Triple Bottom Line Benefits

## Economic Benefits

### **Green Stormwater Infrastructure Jobs Reduce the Social Cost of Poverty.**

Governments at all levels incur significant costs in coping with poverty, and Philadelphia is no exception. Green stormwater infrastructure creates jobs which require no prior experience and are therefore suitable for individuals who might be otherwise unemployed and living in poverty. These new jobs create a benefit to society in reduced poverty-related costs, in addition to the wages paid to the individual workers. The stabilizing and transforming effects of green stormwater infrastructure in neighborhoods further reinforce and support the benefits of providing employment to a population that is outside the labor force. Green stormwater infrastructure is not by itself the solution to poverty, but could serve as a valuable tool in poverty reduction.

Annually, about 250 people employed in Green Jobs.

## Social Benefits

Increase of up to 10% more recreational and stream-related visits to Fairmount Park.

### **Green Stormwater Infrastructure Enhances Recreation.**

Throughout the Fairmount Park system, residents enjoy recreation along Philadelphia's stream corridors and waterfronts, but some areas do not live up to their full potential. Improved access, appearance, and opportunities in these areas will make them more desirable destinations for the public. Recreation also will be more desirable along newly greened neighborhood streets and public places. Today, many Philadelphians enjoy recreation along our stream corridors and waterfronts such as the Forbidden Drive along the Wissahickon Creek and The Schuylkill River Trail. *Green City, Clean Waters* will improve aquatic habitat and accessibility to the Tacony Creek and the Cobbs Creek to enhance their appeal as passive recreational locations as well.

Increase of \$390 million in property value of homes near parks and green areas over the next 40 years.

### **Green Stormwater Infrastructure Improves Community Quality of Life.**

Trees and parks are an important part of the recipe that together can transform an urban neighborhood into an inviting, exciting place to live, work and play. Residents clearly recognize and value this quality of life benefit of urban vegetation. One way to estimate a value is to study property values in areas that are close to parks and greenery. In Philadelphia, green stormwater infrastructure is expected to raise property values by approximately 2–5%.

Reduction of approximately 140 fatalities caused by excessive heat over the next 40 years.

### **Green Stormwater Infrastructure Reduces Effects of Excessive Heat.**

Heat waves are a fixture of summers in Philadelphia, including some severe enough that they have resulted in over 100 premature deaths (Summer of 1993). These events may be more frequent and severe in the future due to climate change. Green stormwater infrastructure (trees, green roofs, and bioretention sidewalks) reduces the severity of extreme heat events in three ways—by creating shade, by reducing the amount of heat absorbing pavement and rooftops, and by emitting water vapor—all of which cool hot air. This cooling effect will be sufficient to actually reduce heat stress-related fatalities in the City during extreme heat wave events.

## Environmental Benefits

**Green Stormwater Infrastructure Improves Air Quality.** Like many major cities in the United States, EPA currently classifies the Philadelphia metropolitan area as exceeding federal air quality standards for both ozone (smog) and fine particles (soot). Known health impacts of these air pollutants include premature death, hospitalization for respiratory diseases, heart attacks, and lost work and school days. Green stormwater infrastructure will improve Philadelphia's air quality in two ways—by reducing emissions of pollutants (such as SO<sub>2</sub>) and by removing ozone and particulates from the air. Reductions in energy and vehicle use will reduce emissions of pollutants. Once in the air, some ozone is taken into the leaves of trees as they “breathe.” Leaves also trap additional fine particulates, which then wash off in the rain or fall with the autumn leaf drop.

**Green Stormwater Infrastructure Saves Energy and Offsets Climate Change.** Green stormwater infrastructure reduces energy use, fuel use, and carbon emissions in two ways. First, the cooling effects of trees and plants shade and insulate buildings from wide temperature swings, decreasing the energy needed for heating and cooling. Second, rain is managed where it falls in systems of soil and plants, reducing the energy needed for traditional systems to store, pipe, and treat it. Growing trees also act as carbon “sinks”, absorbing carbon dioxide from the air and incorporating it into their branches and trunks.

**Green Stormwater Infrastructure Restores Ecosystems.** Green stormwater infrastructure improves ecosystems in two ways. First, by allowing rain to soak into the ground and return slowly to streams, thereby restoring a water cycle more similar to a natural watershed. This provides a natural water quality filter and limits erosion of stream channels caused by high flows, both of which benefit aquatic species. Second, PWD's green stormwater infrastructure approach includes physical restoration of stream channels and streamside lands, including wetlands, to restore habitat needed for healthy ecosystems.



Before and after a stream restoration of exposed interceptor pipe along Marshall Road in the Cobbs Creek Watershed.

Air quality benefits from fully-grown trees will on average lead to (each year):

**1-2 avoided premature deaths**  
**20 avoided asthma attacks**  
**250 fewer missed days of work or school**

**1.5 billion lbs of carbon dioxide emissions avoided or absorbed.**  
**This is equivalent to removing close to 3,400 vehicles from the roadways each year.**

**\$8.5 million in water quality and habitat improvements over the next 40 years including:**

**45 acres of wetland restored**  
**148 acres of wetlands created**  
**7.7 mi of stream restored in the Cobbs Creek Watershed**  
**3.4 mi of stream restored in the Tookany/Tacony-Frankford Watershed**



A vision of Cobbs Creek looking toward Woodland Avenue Dam illustrating habitat restoration and recreation enhancements.

## The *Green City, Clean Waters* Approach

PWD's \$1.6 billion investment over the next 20 years will not only make our waterways cherished and thriving destinations, but will also leverage our citizen investment in a way that provides multiple additional community benefits that further Mayor Nutter's GreenWorks Plan and supports the vision of numerous civic and community partners for a truly sustainable city.

Green Stormwater Infrastructure

\$1.01 billion

Stream Corridor Restoration and Preservation

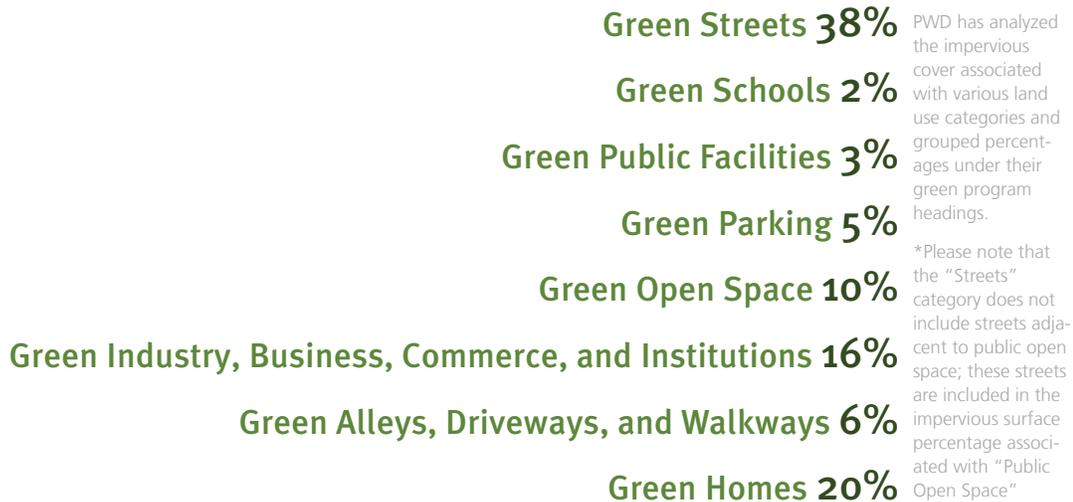
\$290 million

Wet Weather Treatment Plant Upgrades

\$320 million

# Green Stormwater Infrastructure

## Breakdown of Impervious Cover within the Combined Sewer System Drainage by PWD’s Green Programs



### PWD’s Green Stormwater Infrastructure Commitment

This commitment sets in motion a plan for converting one-third of the impervious cover within the combined sewer drainage area to Greened Acres. PWD has developed a number of “Green Programs,” each with a number of associated implementation tools—including policy changes, regulatory tools, funding commitments and incentives through which the transformation from impervious acre to Greened Acres will occur.

What follows are descriptions of each of our green program elements along with a potential implementation range from 0 Greened Acres to the roughly 4,000 Greened Acres that PWD has determined as feasible within the 20-year implementation horizon.

Key to the success of PWD’s strategy is that immense opportunity exists for implementation on publicly-owned land, such as City-owned properties, streets and rights-of-way, which constitute 45% of the impervious land area of the City. With that in mind, the initial approach to achieving management of impervious cover is to focus efforts on publicly owned impervious cover and the larger, more commercial properties, and to use programs addressing impervious cover on smaller private properties to increase the level of control as needed. Over the course of the implementation horizon, additional programmatic elements will be explored and developed.

An important performance goal used throughout this document is the achievement of a Greened Acre. This Greened Acre includes the area of the stormwater management feature itself and the area that drains to it (or the stormwater feature’s own “little” watershed).

Each Greened Acre will manage the first inch of runoff from one impervious acre of the combined sewer service area. One acre receives 1 million gallons of rain each year. Today, if the land is impervious, it all runs off into the sewer and becomes polluted. A Greened Acre will stop 80–90% of this pollution from occurring.

We have some clear ideas and have implemented many of the solutions through a variety of demonstration projects with the assistance of our partners, although deciding the precise application will be an evolving process. What is truly exciting about this plan is that it has the power to change forever the way our City renews its streets and neighborhoods. Many of these green technologies have been proven successful, but are untried on such a city-wide scale. Our plan contains built-in “milestones” that allow us to measure our progress with each element every few years and adapt as necessary. Where less progress is measured with the use of a given tool, another will be implemented. Because of the numerous possible tools available for greening acres, the plan is by its very nature adaptive.

## Green Stormwater Infrastructure Tools

The Green Programs described on the following pages will each utilize a unique mix of green stormwater infrastructure tools. The majority of these examples have been implemented locally, demonstrating the use of green infrastructure in Philadelphia. The additional examples are located in Portland, Oregon, as noted.

### Stormwater Tree Trench



Often taken for granted, trees encompass a remarkable spectrum of interests! They create shade to reduce heat stress in urban areas, filter pollutants in the air, act as a buffer for noise pollution, contribute to the charm and character of a neighborhood, restore natural water infiltration conditions, and reduce stormwater runoff. To realize all of these aforementioned benefits, individual or multiple trees can be planted in a stormwater tree trench, which connects trees to temporary underground stormwater storage.

West Mill Creek, Philadelphia, PA

### Stormwater Wetland



A stormwater wetland is designed to capture and store urban stormwater generated in a catchment area before it is discharged into the nearest creek or river. The primary function of this wetland is to treat the stormwater. The effort to improve source water quality and reduce the impacts of storm-related flooding is to maintain the integrity of riparian ecosystems.

Saylor Grove, Philadelphia, PA

### Green Roof



These resourceful, plant-based roof systems serve several purposes. One major advantage specific to stormwater management is a green roof's ability to act as a pervious surface to absorb and filter rainwater. Accumulated rainwater can be stored as grey water used for irrigation and plumbing fixtures. Ultimately, the amount of stormwater runoff that enters storm drains is reduced, thus mitigating urban flooding and alleviating pressure on the sewer system capacity. Another benefit of green roofs is the added building insulation. This reduces the demand on a building's heating and cooling systems for interior spaces, thus saving energy. Likewise, air temperatures outside are cooler as the heat island effect in urban areas is reduced.

Friends Center, Philadelphia, PA

### Rain Barrel



Rain Barrels are an easy and effective way to collect and store stormwater runoff from rooftops. Downspouts carrying roof runoff are disconnected from the sewer system and redirected into a temporary holding container called a rain barrel. Through detaining runoff, rain barrels add capacity to the city's sewer system during rain events and reduce sewer overflows. This method of rainwater harvesting can simultaneously satisfy irrigation needs for lawns, gardens, window boxes, or street trees.

A more sophisticated rainwater harvesting tool is a cistern, which is capable of storing larger volumes of water mainly used for irrigation and sometimes, water quality permitting, for cooking and washing.

Philadelphia, PA

### Pervious Paving



Nonporous materials like asphalt and concrete prevent water from infiltrating the ground, which contributes to urban flooding problems. Pervious paving, however, allows water to percolate through areas that would otherwise be impervious. By permitting stormwater to infiltrate the ground below, pervious paving more closely mimics the natural hydrologic cycle and helps reduce urban flooding.

Mill Creek, Philadelphia, PA



igned to treat a portion of  
n the sewershed before it is  
eek or stormwater inlet. The  
reat stormwater runoff in a  
quality while also minimizing  
ows on aquatic and structural  
s.

### Bump-out



A bump-out is a form of a curb extension that can be applied midblock or at street intersections. Existing curb lines become the back walls and new curbs that extend into the street become the front walls of a stormwater planter designed to intersect stormwater volumes flowing down a street and encourage natural ground infiltration. At an intersection, a bump-out includes pedestrian ramps to cross the street. Since the bump-out extends into the street, it provides an added benefit to pedestrians of shortening the distance required to cross the street.

Siskiyou, Portland, OR

### Stormwater Planter



A stormwater planter is a contained area typically comprised of native vegetation that collects and treats stormwater. Acting as a bioretention system, these planters accumulate and filter stormwater through the layers of soil and root systems where pollutants are retained, broken down and absorbed.

Stormwater planters are an appropriate and efficient application for city streets, parking lots, as well as public and private properties, stormwater planters can add aesthetic appeal within an economy of space.

People's Food Coop, Portland, OR



alt, concrete, or other forms  
rainwater from naturally infil-  
tributes to stormwater runoff  
however, allows precipitation  
t would traditionally inhibit  
nwater to soak into the soil  
losely mimics the pre-devel-  
elps treat stormwater.

### Rain Garden



A rain garden can enhance the aesthetic of landscaping while effectively managing stormwater. Native plants act as a discrete basin for stormwater to slowly infiltrate, preventing large volumes from flowing directly into the nearest storm drain, creek or river.

Swales are a type of rain garden designed to capture runoff and facilitate infiltration by distributing it horizontally across the landscape. A common swale configuration is in the form of shallow, trough-like earth depression—often created parallel to natural contours in the landscape—which helps to direct excess flow to stormwater inlets.

Awbury Arboretum, Philadelphia, PA

### Flow-through Planter



Unlike a stormwater planter that allows runoff to infiltrate the ground, a flow-through planter is an impervious basin. It collects and treats stormwater while directing it through vegetation and soil and ultimately into a perforated pipe that leads to existing conveyance infrastructure. When the capacity of the planter is exceeded, excess water flows into an overflow pipe and into existing stormwater infrastructure.

In site conditions with poor drainage typically caused by denser soils, a flow-through planter is an ideal implementation tool to facilitate drainage. Any remaining stormwater that cannot infiltrate the ground is slowly discharged into a combined sewer and sent to a water pollution control plant.

Waterview Recreation Center, Philadelphia, PA



Above: Street runoff is captured at this Rain Garden at 47th St. and Gray's Ferry Ave. in the Combined Sewer Area within the Schuylkill River Watershed.



Above: The West Mill Creek Green Streets demonstration project in the Schuylkill Watershed includes a tree trench, permeable pavers and modified street inlets to divert stormwater into a subsurface infiltration bed.



## Green Streets

Streets and sidewalks are by far the largest single category of public impervious cover, accounting for roughly 38% of the impervious cover within the combined sewer service area. (Note: impervious cover associated with streets in front of parks was not included in this percentage; these streets are included in the “Green Public Open Space” program). A green street acts as a natural stormwater management system, capturing rain or melting snow (runoff), allowing it to soak into soil, filtering it and at the same time, reducing the amount of stormwater that would otherwise make its way into Philadelphia’s combined sewer pipes.

PWD’s Green Streets designs will provide stormwater management functions while still maintaining the primary function of the street for vehicles and pedestrians. These Greened Acres will provide additional societal benefits on our streets, such as shading, cooling, traffic calming, and visual enhancement.

Some of the green stormwater infrastructure tools in our green streets tool box include street trees and the “pit” they are planted in, sidewalk trenches and planters, sidewalk bump-outs and bulb-outs (sidewalk extensions), and porous pavement. Street tree pits and trenches capture the flow of stormwater from the street and sidewalk and allow it to soak into the soil to water the trees. They provide shade, improve air quality, absorb noise and beautify the neighborhoods.

Through the use of sidewalk planters, stormwater runoff from the street and sidewalk is directed to the planter through a curb opening, allowing stormwater to be absorbed by the plant and soil materials. Sidewalk planters help protect our waterways by filtering and reducing stormwater runoff.

The use of porous pavement allows the stormwater runoff to soak right through our sidewalks, while providing the same structural support as traditional pavement. This is a tool that at the surface might not look “green”, but still provides stormwater management benefits.

PWD is working to align its green stormwater infrastructure practices with street greening programs associated with GreenWork’s ambitious greening goals. Coordination of PWD’s program with other city programs will encourage maximum effectiveness. Ultimately, the Green Streets program should result in setting a “green standard” for streets within the City. Partners include PennDOT and the City of Philadelphia Streets Department as well as special service districts to help with maintenance.

Since implementation of the *Green City, Clean Waters* program will depend highly on green streets, PWD has already started collaborating with the Streets Department and other utilities so that all projects will become streamlined and coordinated. PWD will design tree trenches and bumpouts to streets already slated for improvements. When both utility and road work can be done on each street at the same time, it lessens the project costs and the inconvenience to residents.

Additionally, Fairmount Park already has an extensive street tree program. PWD will build on a successful history of working together with the park system by designing street tree trenches to be installed as street trees are installed or replaced. Not only will these trenches increase the life expectancy of the trees, they will capture even more urban runoff in the underground drainage system. The same efficiencies can be realized by installing curbside green stormwater infrastructure such as bump-outs when the City replaces or installs Americans with Disabilities Act mandated ramps on the sidewalks.

PWD has begun to prepare standard designs, and is working on appropriate regulations and incentives to retrofit streets whenever the opportunity arises. Thus, simple green designs (e.g. street trees) will be available for use where possible when streets are affected by:

- PWD infrastructure repair/replacement
- PWD storm flood relief related construction
- Cable/Gas/Phone infrastructure repair/replacement
- Routine repaving by either the Philadelphia Streets Department or PennDOT



Up to 250 acres of green schools managed

### Green Schools

Schools make up 2% of all impervious cover in the combined sewer drainage area but are highly visible, thereby offering excellent opportunities to educate the local community on green stormwater infrastructure. An array of stormwater measures can be implemented on school properties, such as rain gardens, green roofs, porous pavement, trees, rain barrels and cisterns. For example, porous pavement and trees on both parking and recreational facilities on school campuses can transform what are now heat-trapping asphalt surfaces into more welcoming, cooler, green havens.



Right: Harmony Garden enhances the school yard and curriculum at Wissahickon Charter School. Green stormwater infrastructure features here include rain gardens, pervious pavers and a subsurface infiltration system.



Up to 250 acres of public facilities managed



### Green Public Facilities

Public parcels make up 3% of impervious cover in the combined sewer drainage area. The value in retrofitting them with green stormwater infrastructure is primarily to lead by example. This cannot be underestimated, both for establishing the credibility of the program in the eyes of the public, and to demonstrate the effectiveness of the measures to still skeptical individuals within the development community. PWD is leading this initiative by evaluating opportunities for the greening of its own facilities. Additionally, PWD also encourages the installation of green streets surrounding major public facilities to maximize the potential stormwater management benefits.

Left: Green roof being planted on the Free Library of Philadelphia in the Schuylkill Watershed.





Up to 250 acres of parking managed

### Green Parking

Parking lots, at 5% of the impervious cover, present a great opportunity to reduce stormwater runoff. Parking lots have a significant visual impact on the City, and green parking lots can contribute to the overall improvement in the appearance of the City's commercial and business districts. A variety of stormwater measures can be used to renovate parking lots, including vegetative strips, infiltration beds (which temporarily store runoff and clean it), trees, porous pavement, sand filters, and even green roofs on parking garages.

City-owned parking facilities will be targeted as a demonstration of the City's commitment to green stormwater infrastructure. Additionally, the incentives provided by PWD's Parcel Based Billing Initiative, which resulted in a reallocation of stormwater fees should make retrofits aimed at reducing stormwater fees more attractive such that private parking lots might begin to seek opportunities for retrofit. The City may also consider an ordinance to mandate a green buffer around all parking facilities that also function as a stormwater infiltration measure.



Above: A vegetated swale collects and infiltrates stormwater from an employee parking lot at the Philadelphia International Airport in the Schuylkill Watershed.





Up to 100 acres of public open space managed



### Green Public Open Space

Public Open Space with the inclusion of streets adjacent to parks makes up about 10% of the City's impervious cover. Impervious cover associated with the park lands itself is quite low, but PWD sees opportunities for utilizing the streets surrounding these parcels to route and manage stormwater from the surrounding areas where this can be done without adversely impacting the quality of the public land itself.

PWD has worked with greening recreational centers that are already community focal points and often in need of restoration or upgrade.

Above: The stormwater demonstration project at Cliveden Park captures runoff from adjacent streets and uses the park's natural topography to detain and infiltrate stormwater in the Tookany/Tacony Frankford Watershed.



Up to 750 acres of industries, businesses, commerce, and institutions managed

## Green Industry/Business/Commerce/Institutions

The combined Green Industry, Business, Commerce, and Institutions program makes up about 16% of the City's impervious cover. Philadelphia's industrial, business, commerce, and institutional properties hold significant opportunities for green stormwater infrastructure implementation. Generally, because implementation of this program is within the control of private entities, PWD will undertake a supporting role in seeing it developed programmatically. Many industries, businesses and commercial buildings would be expected to face upgrades and renovations within the 20-year time frame, making a high rate of compliance with stormwater regulations a reasonable expectation. Also, one clear incentive for private entities to consider installation of green stormwater infrastructure will be PWD's new Parcel Based Billing Initiative, which ties impervious cover to the stormwater fee. PWD anticipates that this will result in many existing large private, non-residential entities retrofitting their properties with stormwater management infrastructure in order to receive a credit in the stormwater portion of their bill.

A program to target properties and buildings owned by churches, hospitals, universities, and sports stadiums presents another highly visible opportunity for green stormwater infrastructure. Much like large commercial or industrial properties, this program will rely on compliance with the City's Stormwater Regulations for new facilities as well as the incentive for retrofit of existing facilities provided by the Parcel Based Billing Initiative. In addition, many major universities, including the University of Pennsylvania, have embarked on ambitious sustainability initiatives. Where possible PWD will seek to partner with these entities in order to produce synergies and stretch limited dollars. This may present opportunities to work with each university to separate all stormwater from the sewer system for onsite, green solutions.

Other opportunities might include greening the large areas of impervious cover associated with the sports stadium complexes and the Convention Center, which attract millions of visitors each year. When certain large facilities are renovated or constructed anew, complete separation of the facility's sanitary and storm sewers might be possible, and could even be combined with green measures.



Up to 200 acres of alleys, driveways, and walkways managed

### Green Alleys/Driveways/Walkways

Philadelphia has many smaller alleys located behind houses and commercial buildings that are currently impervious and drain to the storm and combined sewers via stormwater inlets. Though this program only makes up about 6% of all impervious cover in the City, it may offer relatively inexpensive solutions for infiltration or collection of roof runoff. These often underutilized areas present an opportunity to either use the alleys for infiltration, or to convey stormwater to green stormwater infrastructure located at the end of an alley. In addition to the alleys, there are often walkways providing access to backyards of homes, and driveways for single family homes and row houses that present other opportunities for onsite stormwater controls.



Up to 500 acres of homes managed

### Green Homes

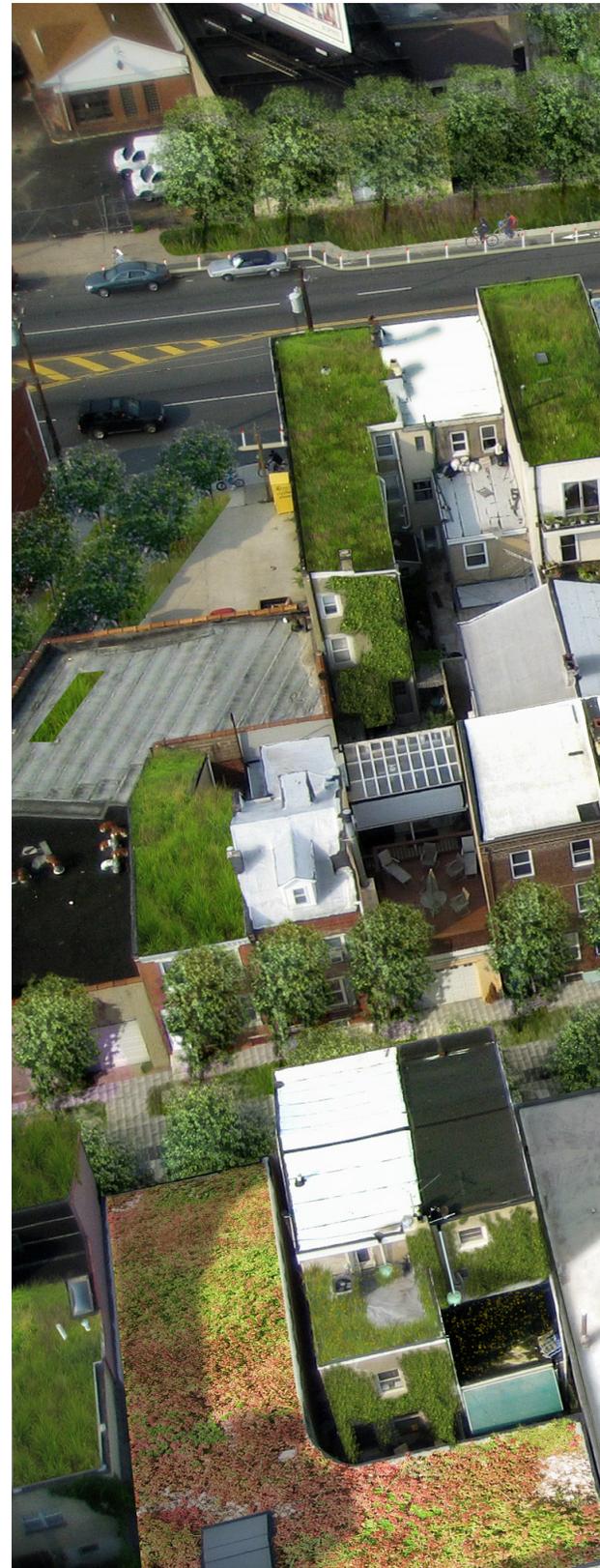
Residential roofs make up 20% of all impervious cover in the City. The key to success for this program may lie in the simplicity of smaller scale stormwater management solutions on homeowner's properties.

Homeowners can carry out these solutions themselves and achieve benefits at a minimal cost. Projects, such as the use of rain barrels, have already proven popular in pilot programs, and if implemented on a larger scale, can ultimately affect a significantly larger amount of impervious cover. Additionally, more ambitious (and somewhat more costly) measures should also be considered, including the installation of a green roof or capturing stormwater in larger cisterns for reuse.

Public education is a key to increasing participation in residential stormwater measures such as:

- Installing rain barrels to collect roof runoff
- Disconnecting downspouts to direct runoff to pervious areas (rain garden) or small drywells
- Using site slopes to direct stormwater runoff to rain gardens

Below: Rain barrel collecting porch roof runoff, installed in front of a Philadelphia rowhome in the Schuylkill Watershed.





## Stream Corridor Restoration and Preservation

Restoration and Preservation of riverfronts, stream habitats and corridors can be combined with efforts to improve public access and amenities along the water corridors. Implicit in this effort are aspirations to re-connect Philadelphians with our extensive river network. Included in PWD's recommended approach is a commitment to restoration of 7.7 miles of the stream corridor along the Cobbs Creek and 3.4 miles of stream corridor along the Tacony Creek. Where applicable, wetland preservation, enhancement and creation within these corridors will offer additional benefits, including mitigation of adverse impacts of stormwater runoff and increases in the ecological connectivity within the region.

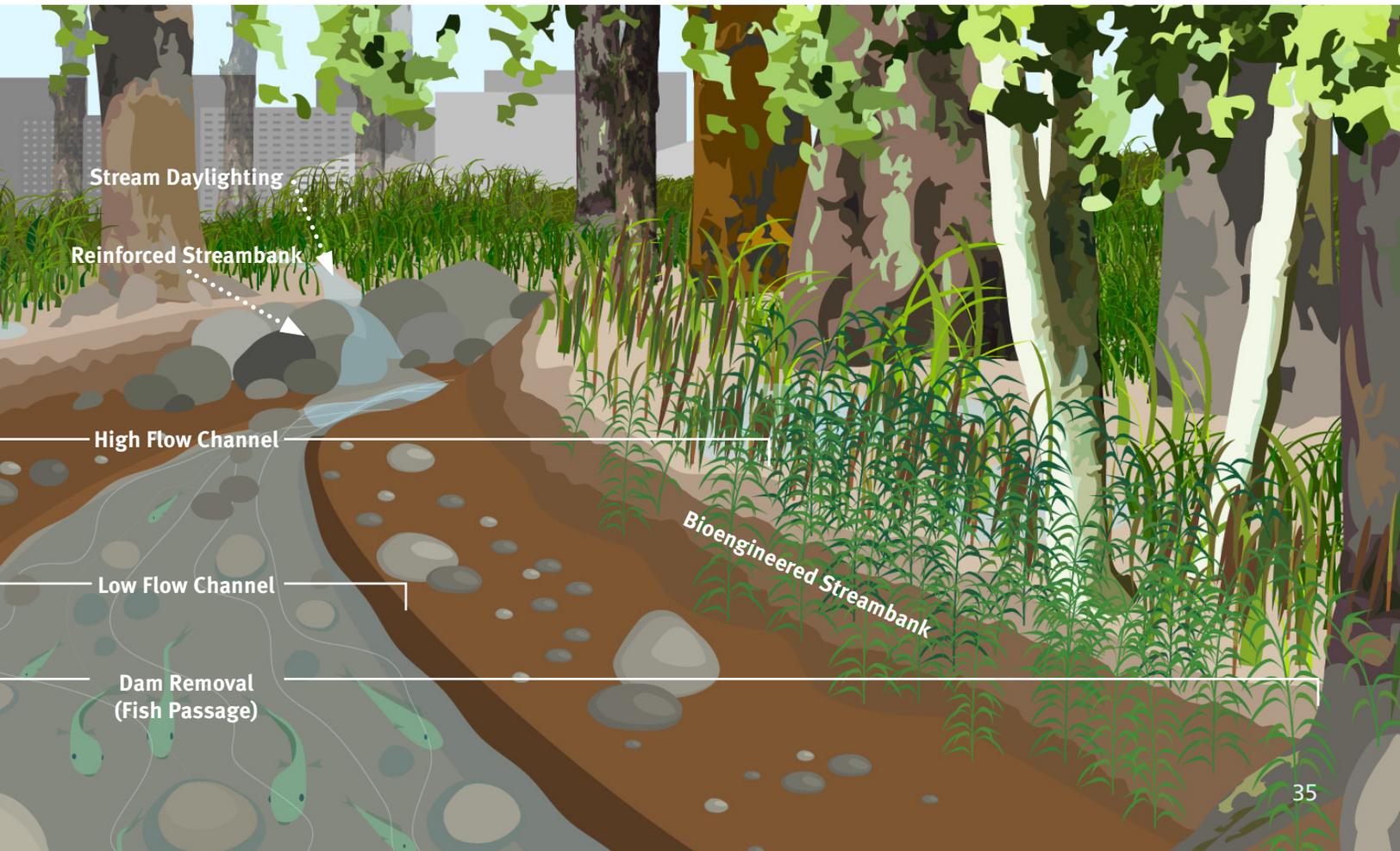
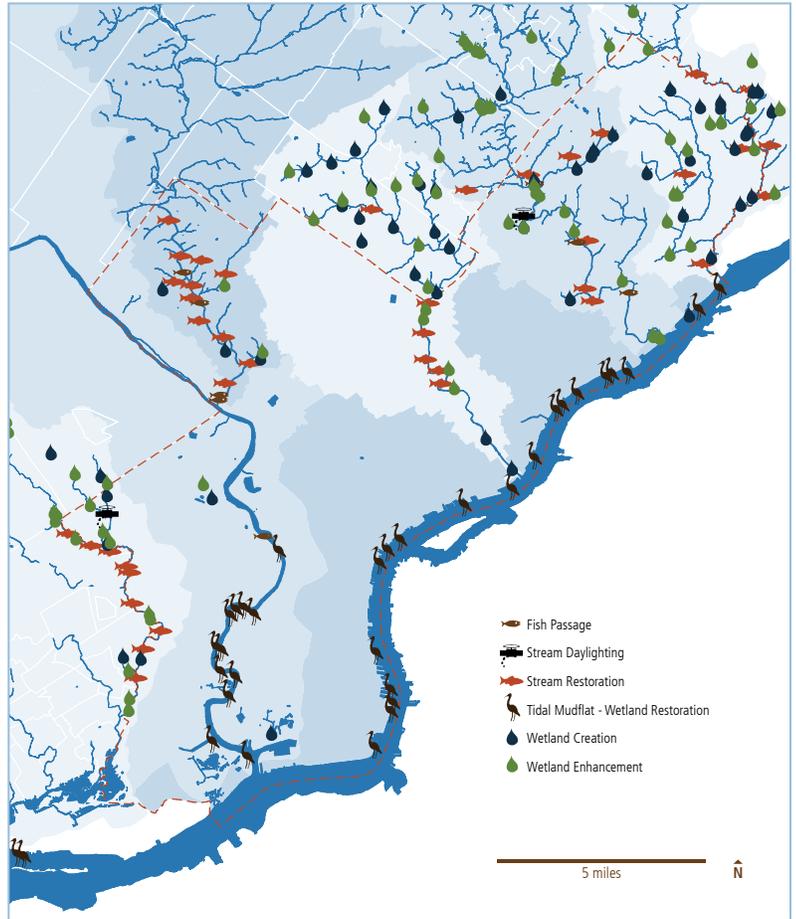
The Delaware and Schuylkill Valleys serve as important junctions for anadromous fish and avian migratory activities. As such, efforts by PWD to commit to the restoration of tidal wetlands along the Schuylkill and Delaware Rivers will have ecological impacts that extend outside the region to the Delaware Bay and beyond. Additionally, in order to facilitate recreation on the Delaware River, PWD will support local efforts to increase public riverfront access and recreation by moving or consolidating CSO outfalls to eliminate odors and improve aesthetics.

PWD will seek to identify locations where CSO outfalls may be consolidated or extended in order to enhance recreational opportunities



## Restoration and Preservation Opportunities in Philadelphia Watersheds

In another innovative initiative, PWD is currently assembling a Watershed Project Registry to identify and study areas for future stream restoration, wetland creation, wetland enhancement (including invasive plant management), tidal wetland creation/restoration, stream daylighting and preservation projects. This effort will help to leverage PWD funds with developer mitigation funds to ensure a steady progression towards the greater goal of making Philadelphia one of the greenest cities in the country as well as realizing the full ecological potential of the Fairmount Park system, which could one day serve as the model for urban forestry and river management.



# Wet Weather Treatment Plant Upgrades

The City's recommended alternative includes some traditional infrastructure to maximize the combined sewer overflow reduction benefits of the program. The expansion of wet weather treatment capacity at all three of PWD's existing water pollution control plants is recommended and includes the following commitments:

- Expansion of the Northeast Water Pollution Control Plant to include a 215 million gallon/day secondary treatment bypass.
- Expansion of the Southwest Water Pollution Control Plant to include a 60 million gallon/day increase in secondary treatment capacity.
- Expansion of the Southeast Water Pollution Control Plant to include a 50 million gallon/day increase in the secondary treatment capacity through process and hydraulic improvements.

These plant expansions will allow PWD to better utilize the existing sewer infrastructure to capture and treat sewage.

These are complex projects that PWD has spent several years evaluating through the use of hydraulic and hydrologic computer modeling and facilities planning. Thus far PWD has obtained preliminary designs for these upgrades, but will work over the coming years to develop the necessary final designs, including detailed surveying and geotechnical investigations in order to move forward with construction of these upgrades.

Below: Image of PWD's Southwest Water Pollution Control Plant



## Our Next Five Years

The first five years of this implementation commitment are the most critical. These first years will focus on establishing the framework for the programs and building the momentum that will cross City agencies and develop a new everyday standard. This is changing history as we know it.

The most critical component of PWD's initial five year commitment is to meet the 5-year benchmark for Greened Acres. This means that between 1600 and 1700 acres of impervious cover within the combined sewer drainage must be converted to Greened Acres during this timeframe. This very closely aligns with the GreenWorks Plan put forth by the City's Office of Sustainability. The GreenWorks Plan committed to greening 3200 acres of impervious cover city-wide by 2015, coincidentally PWD's 5-year benchmark.

PWD will evaluate LEED Certification and their allocation of credits to the various components of the certification program in order to assess whether they believe that enough weight is being given to the stormwater management component. If determined insufficient, PWD will work with the Delaware Valley Green Building Council (DVGBC) to evaluate the potential for redistributing these credits in order to make stormwater management a more important component of this certification.

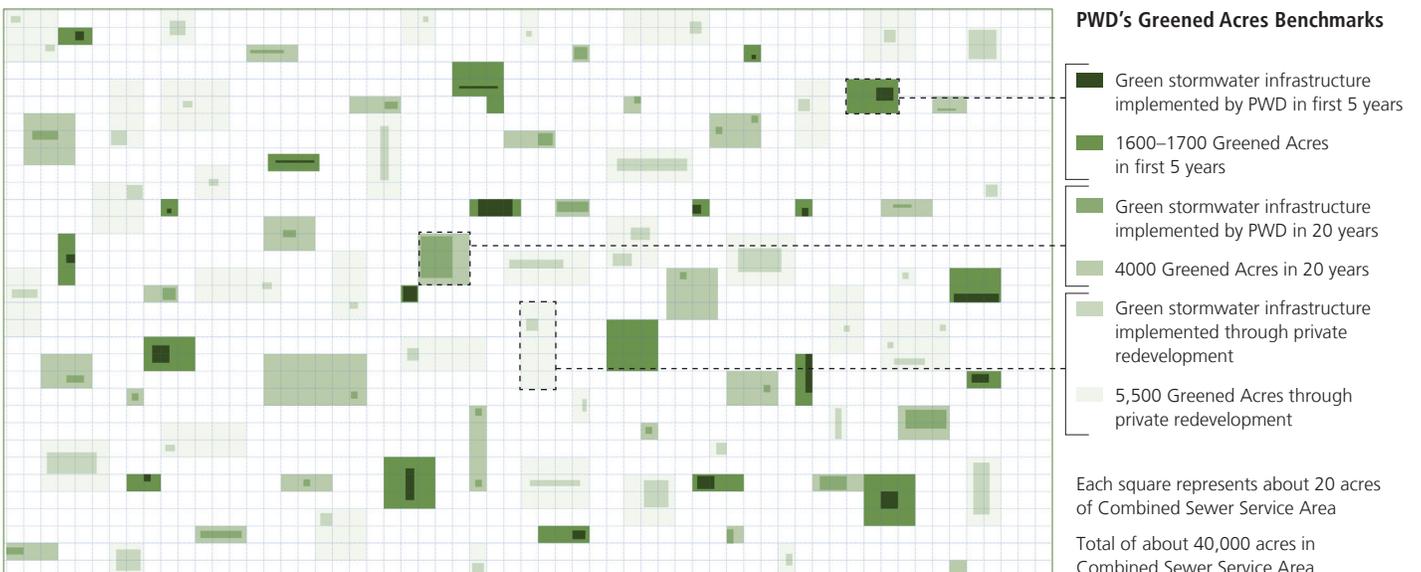
One of the benefits of having previously established watershed partnerships is that PWD already has trusted

relationships with their suburban neighbors. This should prove beneficial as the City begins to explore opportunities for regional cooperation and permitted/contractual relations are updated. Another component might involve further evaluation of the City's wholesale contracts for accepting wastewater from outside communities in light of potential Infiltration & Inflow issues that affect our CSOs.

Within this initial 5 years of the implementation period, PWD must also study the risk associated with recreational use of the City's waterways as they relate to CSO discharges. The City must not only evaluate currently utilized recreational locations, but also areas likely to become recreational locations in the future as the riverfronts are redeveloped and public access is improved. Related to this investigation, PWD may initiate a Water Quality Standards Attainment Review, but will do this in a way that respects the public's very basic desire for attractive streams that are free from odors.

PWD must begin to evaluate the regulatory and policy related changes that will be needed over the coming years in order to support the envisioned greening of the City. This includes the evaluation of the City's Plumbing Code, Zoning Code, Licenses and Inspections, and Planning Department requirements. PWD will also consider working more closely with the development community to better understand current obstacles to green development within the City.

**These first years will focus on establishing the framework for the programs and building the momentum to change history as we know it.**



## Cost and Affordability

**PWD has become a national leader in its quest to demonstrate how to protect and restore stream water quality without the expenditure of billions on new pipes, tunnels and treatment systems.**

To meet the requirements of the National Combined Sewer Overflow Policy, PWD is proposing an approach that relies heavily on stormwater source-control measures and green stormwater infrastructure. Indeed, PWD has become a national leader in its quest to demonstrate how to protect and restore stream water quality without the expenditure of billions on new pipes, tunnels and treatment systems. Philadelphia is partnering with other urban centers, national environmental organizations and the EPA to recognize the value of urban infrastructure renewal and expansion using the more sustainable approach that focuses on the use of green stormwater infrastructure. **This approach has been shown to be the most environmentally and economically favorable way to remediate the effects of urbanization on the City's waterways and help make the City of Philadelphia the Greenest City in America.**

PWD currently spends upwards of \$150 million each year renewing and upgrading its existing facilities. In addition to these recurring costs, Philadelphia anticipates spending additional funds over the coming years to meet evolving drinking water quality goals and stormwater management criteria under the Clean Water Act. Under the current economic climate, securing capital funding for our existing, on-going programs, much less new initiatives, is a challenge. That is why, when money does become available, it is ever more critical to ensure that every dollar is leveraged to address the myriad of issues facing our water utility.

A financial capability assessment for the City of Philadelphia's LTCPU was prepared using criteria suggested by the EPA. The EPA's approach calls for an evaluation of costs of the proposed improvements against Philadelphia citizens' median household income. In general, the EPA considers wastewater costs above 2% of median household income to be an unacceptable cost burden to ratepayers. Dollars spent for implementing the Long Term Control Plan Update are estimated to be \$1.6 billion at the end of the twenty year implementation period. Based on this estimate and implementation schedule, the affordability assessment determined that the LTCPU would result in a cost to City of Philadelphia residents above the upper limit of EPA's median household income affordability criteria.

**PWD is ready to invest \$1.6 billion over the next 20 years (\$1.0 billion in 2009 dollars) to not only make our waterways cherished and thriving destinations, but also to use our citizen investment in a way that provides multiple additional community benefits that further Mayor Nutter's GreenWorks Plan and supports the vision of numerous civic and community partners for a truly sustainable city.**

## Leveraged Dollars

Because of the preliminary policy structures put in place over the past 10 years since the original LTCP was adopted by the City of Philadelphia, PWD is able to leverage a great deal of funding toward their Clean Water Act commitments. These are structures that PWD instituted and programmatically supports, but for which the majority of Greened Acres will not be paid for by PWD's rate payers.

The first and most significant source of leveraged dollars comes from the development community. Because of the City's updated stormwater regulations adopted in January, 2006, every development/redevelopment project initiated within the City limits with an area of disturbance greater than 15,000 square feet must manage the first inch of runoff from the site—which is the same measure that PWD is utilizing for our Greened Acres concept. With a city-wide redevelopment rate of roughly 1% annually, PWD sees an additional roughly \$1.1 billion investment in current day dollars being applied toward the City's greening goals.

Another policy-related tool that will help to achieve additional Greened Acres city-wide is the Parcel Based Billing Initiative, which will be phased in over the coming years. This initiative will impact some customers much more than others—at times causing the monthly water bill to increase fourfold or more. PWD has been targeting these customers with a program aimed at evaluating the top 50 parcels affected by the initiative to evaluate them for potential achievement of "stormwater credits" resulting from retrofits on the property to manage the first inch of runoff. This program involves the offer of free design assistance and site evaluation by a PWD contractor in order to identify potential stormwater management opportunities that might exist on the site—and to perform a cost-benefit analysis in order to help the property owner to weigh the cost of the retrofit against the annual savings on the water bill. PWD believes that the Parcel Based Billing Initiative will result in many of these large parcels being retrofitted to manage the first inch of runoff—producing additional Greened Acres.

Vacant land presents a unique opportunity for stormwater management. There are over 40,000 vacant parcels of land in the City. These present an opportunity for green redevelopment. In addition, there are many areas of the City ready for redevelopment, including areas of abandoned or sub-standard housing, abandoned industrial areas, or outdated commercial facilities. High priced and ever scarcer energy is changing the way Americans live, making older urban centers more and more attractive places to live and work. With a rate of redevelopment in the City that is expected to impact 1% or more of the City's impervious cover each year, vacant lands will likely become targeted focal points for redevelopment. Ensuring that all redevelopment projects contribute to a greener city will be critical to meeting ambitious green stormwater infrastructure goals.

Over the past 5 years, hundreds of millions of dollars have been awarded to fund green initiatives in the City of Philadelphia by organizations such as the William Penn Foundation as well as grant awards from Growing Greener (PA DEP and PA DCNR), the Army Corps of Engineers, and US EPA, among others. As the recipient of numerous grants and funding allocations aimed at establishing demonstration projects throughout the region, PWD has been leveraging dollars toward the implementation of green stormwater infrastructure for a number of years. Through this work, PWD has developed strong working relationships with partner organizations doing similar work and when possible has worked with those organizations to stretch dollars even further. It is estimated that over the 20 year implementation period, close to \$1 billion additional dollars will be allocated by these agencies for further implementation of green stormwater infrastructure.



**Vacant Land Example**

The above image shows a mixed industrial and residential section of a Philadelphia neighborhood with vacant properties highlighted in yellow. This neighborhood has an 11% vacancy rate. Due to the large number of vacant properties, this neighborhood has many opportunities for neighborhood revitalization, which can lead to an expansion of the PWD customer base. The vacancies also provide placement for the installation of green stormwater infrastructure technology.

## Achieving The Vision Together

"Despite Philadelphia's falling revenues, the Philadelphia Water Department's Green Cities, Clean Waters promises serious attention to storm water runoff while maximizing the impact of every consumer and taxpayer dollar. Green Cities, Clean Waters adds real substance to Philadelphia's Greenworks sustainability plan."

Dennis R. Winters,  
Chair of the Pennsylvania Chapter  
of the Sierra Club

PWD plays a critical role in helping the City of Philadelphia achieve its goal to be the Greenest City in America. The City currently has the necessary building blocks for a greener future; it is a City of neighborhoods with walkable streets, a regional transit structure, a huge park system, already observed successes in revitalization of vacant lands and historically significant and ecologically valuable rivers. But we cannot implement this green stormwater infrastructure program in a vacuum. **Given the number of events that are coming together at this pivotal time in the history of Philadelphia and this utility, we now need to accelerate the pace of change to cross traditional boundaries and envision a new relationship between the City, its government, water, the environment and its citizens.**

These events include:

- The release of PWD's LTCPU
- City-wide stormwater regulations that redefine the way the City addresses stormwater
- The release of GreenWorks Philadelphia with specific targets and goals for a Sustainable City over the next 6 years
- The release of the new Zoning Reform Commission Report
- The release of several significant new visioning and planning documents describing the revitalization and rebuilding of Philadelphia's riverfronts
- The interest of Mayor Nutter in seeing a new way for Government agencies to work in unison to solve common problems

Together these inter-related initiatives will help realize Philadelphia's ambitious green vision. The co-benefits of these programs—human health, aesthetics, ecological restoration, economic growth and a more vibrant City—are significant and real. It is time to accelerate the pace of change at the utility by creating interrelationships between our needs, actions and strategies and those of the City of Philadelphia.

Our challenge is to instill our programs and needs into design, construction, operation and maintenance of our City systems (transit, streets, universities, schools); the growth and nurturing of our natural systems (parks, rivers, streams, wetlands); and the protection of public health systems.

Our opportunity is to use controlled change through a slow evolution of our City to the 21st Century sustainable model described in GreenWorks Philadelphia. By re-thinking how our systems work, their purpose and value to us, we can begin to integrate modifications in design of our capital facilities to meet multiple goals. By re-thinking the business of water, we can repurpose funds for water infrastructure, playgrounds, street reconstruction and transportation to leverage scarce capital dollars.

Although PWD has many green stormwater infrastructure projects already in the ground, we recognize that retrofitting a street or public facility is certainly more costly than building new infrastructure as a component of a complete renewal project. As it grows its green identity, Philadelphia will plant the seeds for a true city-wide partnership. Working together will result in an incredibly innovative, cost-effective and transformative incremental approach to how City departments revitalize neighborhoods to make them healthier and more sustainable places in our little corner of the biosphere.

PWD is laying the groundwork for partnerships with the Philadelphia Housing Authority, the Office of Housing and Commercial Development, the Streets Department, and private developers. At minimum, the current stormwater regulations ensure all new large development will move towards our goal of Greened Acres, but building partnerships will help us exceed minimal standards and look for cost-effective opportunities to maximize green elements. With each new development, the vision of how green it can be will keep growing. Assuming a redevelopment rate of 1% per year, an estimated 5,000 to 6,000 acres within the combined sewer system drainage will become greened during the 20 year program.

Another important partnership that will develop as a result of this program is between PWD, Philadelphia Industrial Development Corporation (PIDC), Department of Commerce and Special Service Districts such as Center City District. These partnerships will help transform the commercial corridors and business parks in the City. Adding stormwater management to the existing beautification projects will reduce overall maintenance costs and allow more restored corridors. The greener, safer corridors draw new customers

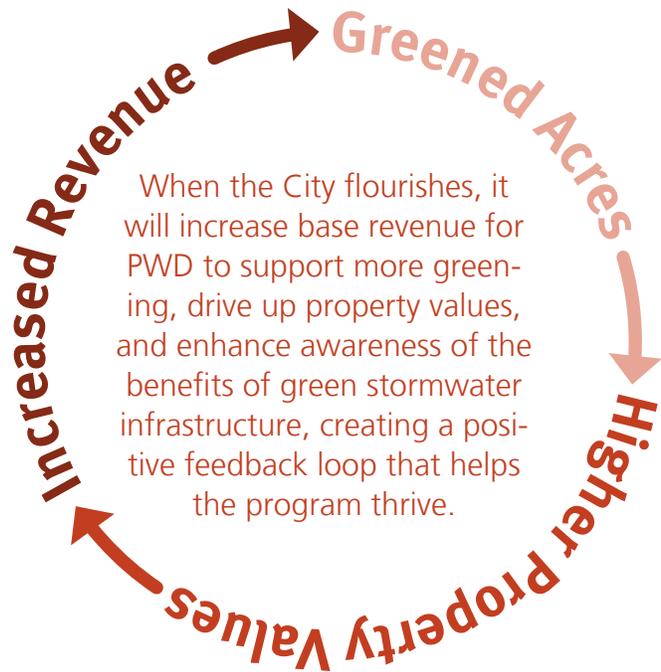
and retailers, creating additional local and green jobs which also in turn promote safety in the City.

The largest landowners in Philadelphia are often institutions of health, learning, and worship. These campuses such as hospitals, universities and churches have already been leading the field of environmental sustainability. Not only can they easily incorporate greening into their mission, they are often willing to go far beyond required stormwater management. This means a few property owners can transform the City in a big way.

These are just a few examples of the many exciting developments and synergistic relationships budding in Philadelphia. As the City grows its green identity, more residents will be drawn to move into Philadelphia. When the City flourishes, it will increase base revenue for PWD to support more greening, drive up property values, and enhance awareness of the benefits of green stormwater infrastructure, creating a positive feedback loop that helps the program thrive. The greening of Philadelphia benefits the environment as a whole. Since existing cities can provide homes to a greater number of people with an overall smaller ecological footprint, it protects further development in areas in the headwaters of our watersheds.

The time is now. Never before have such opportunities aligned and a sustainable solution been so clear. If the EPA approves the City of Philadelphia's *Green City, Clean Waters Plan*, it will be the first of its kind, launching the transformation of Philadelphia as it leads the way for other urban areas to become 21st Century Sustainable Cities.

For more information and to stay involved with the developments of *Green City, Clean Waters*, visit the websites: [www.phillyriverinfo.org](http://www.phillyriverinfo.org) and [www.phillywatersheds.org](http://www.phillywatersheds.org) and our facebook page at <http://www.facebook.com/green.cities.clean.waters>



## Overwhelming Public Support

The participants in the PWD's *Green City, Clean Waters* public participation program have expressed overwhelming support for green stormwater infrastructure as the preferred approach to reducing CSOs in Philadelphia. Over ninety-two percent of the more than 700 survey respondents responded positively to the green stormwater infrastructure approach. All stakeholders, from suburban watershed partners to City residents living within the CSO drainage area desire an approach that promotes multiple community benefits and creates truly sustainable watersheds and cleaner, safer and more accessible waterways.

### Partnerships, Plans and Participation

This support for green stormwater infrastructure is echoed throughout all components of PWD's *Green City, Clean Waters* public participation program and confirms the wishes expressed over the past ten years by PWD's long-standing watershed partners during the watershed management planning process.

PWD believes that its commitment to its diverse watershed partners, including the residents of the City, is critical to the success of the LTCPU. PWD has offered a variety of education and outreach programs over the past twenty years that target the residents of the City and foster public awareness and facilitate public involvement. In addition to the public meetings required by the CSO program

guidance, PWD has initiated several innovative CSO-related outreach programs, including the Model Neighborhoods program by partnering with civic organizations, the "Green Cities, Clean Waters" Art Exhibit, featuring artwork by local artist Bill Kelly, in addition to informational posters on the LTCPU and its green alternatives. The "Green Neighborhoods through Green Streets" survey is circulating throughout the City and on on-line blogs, gauging attitudes and opinions on green streets, while educating survey-takers on the green stormwater infrastructure elements highlighted in the survey. "Friends" abound on PWD's *Green City, Clean Waters* Facebook wall, where approximately 200 members can find public meeting announcements, view images of Green Streets and provide feedback.

### The Demand

In recent months, PWD has seen the desire for green stormwater infrastructure rapidly evolve into a demand by residents of CSO-impacted areas. Through PWD's Model Neighborhoods initiative, PWD has received approximately 750 signatures to date (from March – July 2009), from residents petitioning for Green Streets. These residents want PWD to install green stormwater infrastructure on their block, in order to serve as a model green neighborhood in the City.

**"I love the idea!**

**Please give us a greener Philadelphia.**

**It would make us healthier  
and happier all around."**

Response on the PWD's  
"Green Neighborhoods through  
Green Streets Survey."  
The question asked,  
"Are you in favor of greening?"

**"We are proud to be a model neighborhood...  
initiative, which demonstrates the  
environmental, aesthetic, and economic  
benefits of stormwater management  
at the block level."**

Matt Ruben, Northern Liberties  
Neighbors Association

## Demonstrating the Vision Throughout Philadelphia Model Neighborhoods

The Model Neighborhoods initiative is a new program (as of January, 2009). It is the result of the PWD's partnership with Citizens for Pennsylvania's Future (PennFuture), the Next Great City Coalition, the Fairmount Park Commission (FPC), Pennsylvania Horticultural Society (PHS) and a diverse number of civic representatives, among other City department staff and environmentally-minded partners. The goal of the initiative is to transform the neighborhoods of Philadelphia into model green communities that manage stormwater in innovative ways. These neighborhoods will showcase green stormwater infrastructure elements such as street tree trenches, sidewalk planters, and vegetated bump outs/curb extensions. The program is currently targeting four blocks in approximately thirteen willing neighborhoods in the City of Philadelphia, helping these communities become models for green stormwater infrastructure projects.

Design and construction of the green stormwater infrastructure elements will take place in the first year of the program for the first three targeted neighborhoods—Northern Liberties, Passyunk Square and Awbury/Cliveden, where every resident on the block has signed a petition in favor of greening their street. Currently, the demand for Green Streets is so high that it is beginning to exceed PWD's capacity to implement them. This initiative is a

true testament to the overwhelmingly positive response the City is receiving from its citizens regarding green stormwater infrastructure. In time, after all the model neighborhoods have been greened, these practices will become a standard part of PWD's procedure in installing green stormwater infrastructure.

LOCATION	CIVIC PARTNER
Passyunk Square	Passyunk Square Civic Association
Awbury/Cliveden	Tookany/Tacony-Frankford (TTF) Watershed Partnership
Northern Liberties	Northern Liberties Neighbors Association
Pennsport	Pennsport Civic Association
New Kensington/ Fishtown	New Kensington CDC
Point Breeze	South Philadelphia Homes, Inc./ Newbold/Redevelopment Authority (RDA)
North Philadelphia	Asociación Puertorriqueños en Marcha (APM)
Manayunk	Manayunk Development Corp/ Roxborough CDC
East Falls	East Falls Development Corporation
Lower Moyamensing	Lower Moyamensing Civic Association
Cobbs	Cobbs Creek CDC
Haddington	Haddington CDC
Gray's Ferry	South of South Neighborhood Association (SOSNA)
Allegheny West	Allegheny West Civic



## **Acknowledgements**

We would like to thank the members of the *Green City, Clean Waters* Advisory Committee for their investment of time and energy over the past year as we have worked through this planning process.

### **Active CSO LTCPU (*Green City, Clean Waters*) Advisory Committee Members**

Community Legal Services

Sierra Club

PennFuture/Passyunk Square Civic Association

Delaware River City Corp

Northern Liberties Neighbors Association

Washington West Civic Association

Passyunk West Civic Assoc.

Pennsylvania Environmental Council

Tookany/Tacony-Frankford Watershed Partnership

PA Dept. of Environmental Protection

Fairmount Park

Please send us your comments on our Plan!

**Email:** [questions@phillywatersheds.org](mailto:questions@phillywatersheds.org)

**Fax:** 215.685.6043

**Mail:** Office of Watersheds  
Philadelphia Water Department  
1101 Market Street, 4th Floor  
Philadelphia, PA 19107

**Website:** <http://www.phillyriverinfo.org>  
[www.phillywatersheds.org](http://www.phillywatersheds.org)

**Facebook:** <http://www.facebook.com/green.cities.clean.waters>

This document was printed on recycled paper, certified by the Forest Stewardship Council, a product group from well-managed forests, controlled sources, and recycled wood or fiber.





clothes