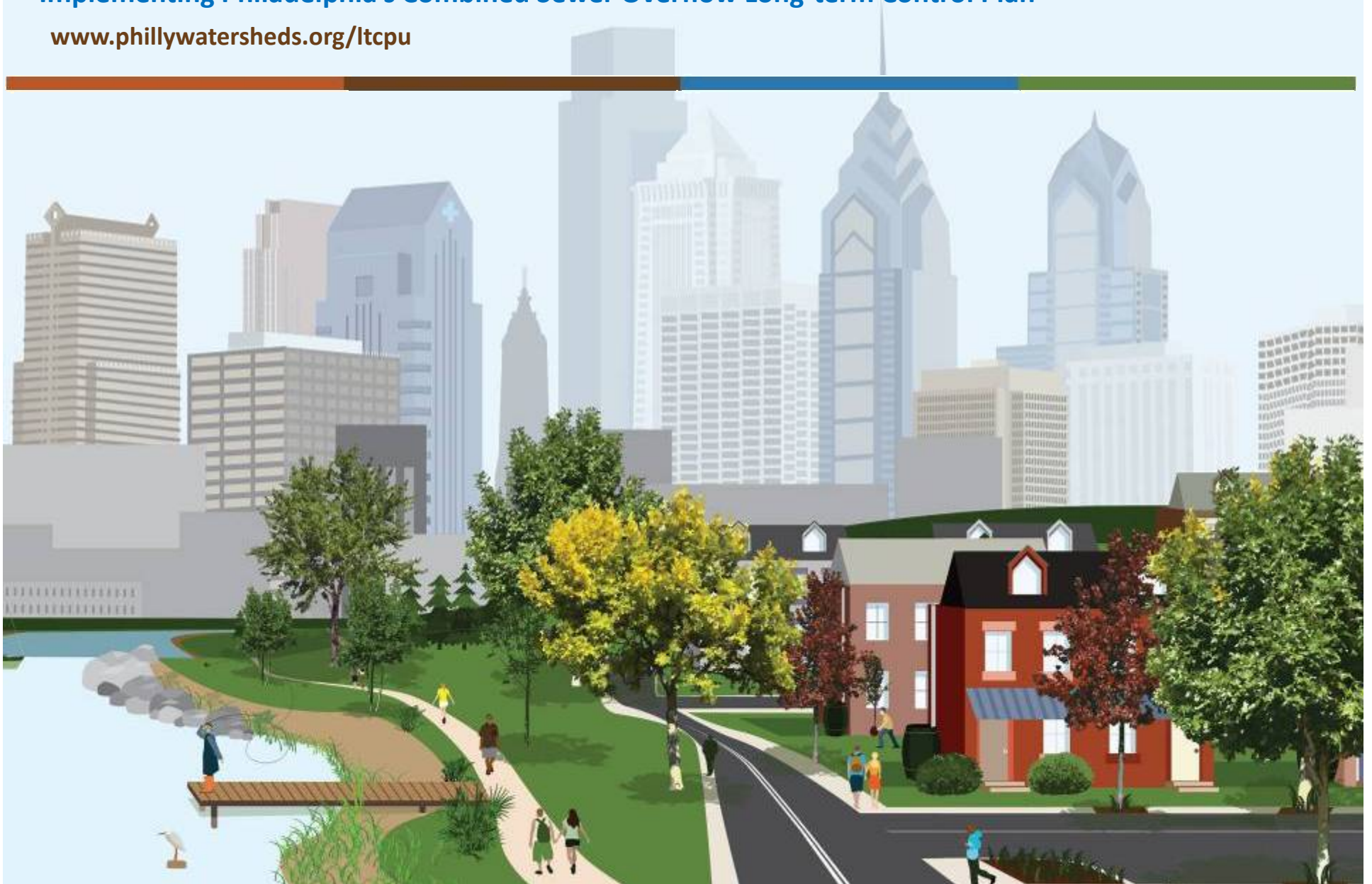


# Green City, Clean Waters

Implementing Philadelphia's Combined Sewer Overflow Long-term Control Plan

[www.phillywatersheds.org/lcpu](http://www.phillywatersheds.org/lcpu)



# Presentation Outline

---

**What** is Green City, Clean Waters?

**Why** the green approach?

**What** is the plan for the next 5 years?

**How** can we green together?



---

# What is Green City, Clean Waters?



---

# GREEN CITY, CLEAN WATERS

- CSO Long Term Control Plan Update to DEP/EPA on Sept. 1, 2009
- Improves water quality
- Advances City-wide Sustainability Program
- Maintains and upgrades one of the nation's oldest infrastructure systems
- Improves public health and neighborhood quality of life
- Transforms river and stream corridors into recreation destinations and green open space for citizens
- Preserves and restores habitat for aquatic species
- Maximizes environmental return on every dollar spent

# GREEN CITY, CLEAN WATERS

Green Stormwater Infrastructure

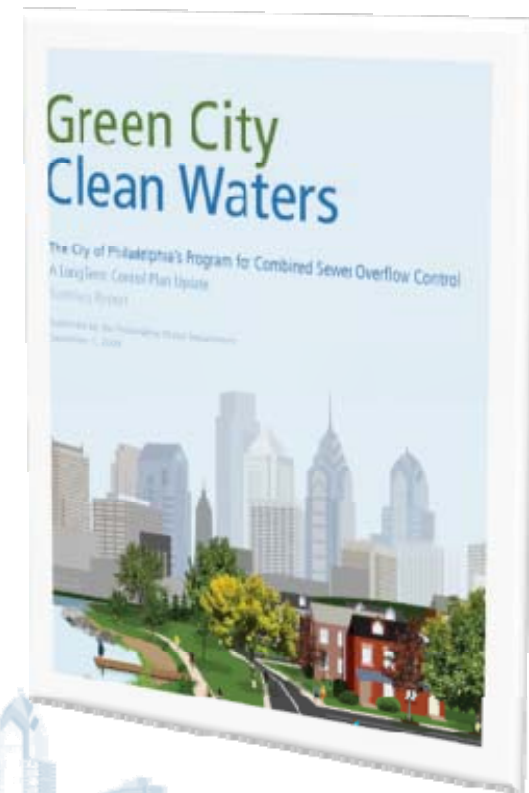
\$800M

Traditional Infrastructure

\$200M

Adaptive Management

\$200M



---

# WET WEATHER WATER QUALITY IMPROVEMENTS



- **Capacity Expansion at all 3 Wastewater Treatment Plants**
  - **Over 1.4 BGD wet weather capacity**
    - 215 MGD wet weather capacity by means of secondary treatment bypass
    - 60 MGD increase in secondary treatment capacity
    - 50 MGD increase in the secondary treatment capacity

---

# DRY WEATHER WATER QUALITY, AESTHETICS, RECREATION

- Trash and Debris Removal; Solids and Floatables Control
- Enhancement of Public Access and Recreation Opportunities
- Sewer Rehabilitation
- Outfall Consolidation and Relocation



---

## GREEN STORMWATER INFRASTRUCTURE

A range of soil-water-plant systems that *intercept* stormwater, *infiltrate* a portion of it into the ground, *evaporate and transpire* a portion of it into the air, and in some cases *slowly release* a portion of it back into the sewer system



Acknowledges the symbiotic relationship between land use and water resources



# POSITIVE PRESS FOR GREEN CITY, CLEAN WATERS

"This is the most significant use of green infrastructure I've seen in the country, the largest scale I've seen."

Jon Capacasa, EPA regional director of water protection

## Breaking ground with a \$1.6 billion plan to tame water

By Sandy Bauers  
INQUIRER STAFF WRITER

Philadelphia has announced a \$1.6 billion plan to transform the city over the next 20 years by embracing its storm water — instead of hustling it down sewers and into rivers as fast as possible.

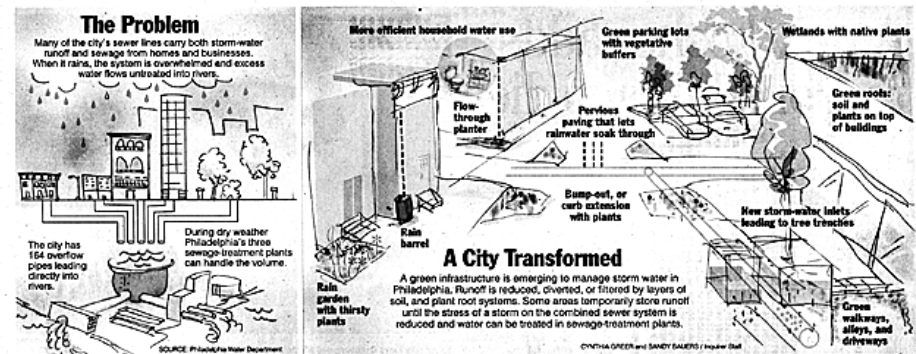
The proposal, which several experts called the nation's most ambitious, reimagines the city as an oasis of rain gardens, green roofs, thousands of additional trees, porous pavement, and more.

All would act as sponges to absorb — or at least stall — the billions of gallons of rainwater that overwhelm the city sewer system every year. The plan's complex funding formula would raise rates somewhat but also attract grants and encourage private investment. Further, the Water Department says the city's greening would result in more jobs, higher property values, better air

See **STORMWATER** on A14

# The Philadelphia Inquirer

Sunday, Sept. 27, 2009 ★ Locally Owned & Independent Since 2006 ★ \$1.75



## A green plan to embrace any deluge

Featured in more than 40 local, national and international media outlets:

American City and County

The Economist

Governing

Living Architecture Monitor

Natural Resources Defense Council

Philadelphia Business Journal

Philadelphia GRID

WHYY, WNYC

Planning — March 2011

## Green Infrastructure Storms

Cities are using cost-effective, environmentally superior stormwater.

By Cary Buckwalter Benko

How are cities coping with costly and decaying conventional big ways, Philadelphia expects to spend \$1.6 billion on its 2010 green infrastructure plan points to a complete management system. And throughout the U.S. smaller dollars by making similar — if more modest — changes

Many cities — including Portland, Oregon; Philadelphia gone green as part of their combined sewer overflow satisfy Clean Water Act and other regulations. And to and engineers have used techniques such as swales, wetlands to solve stormwater management issues to



---

# Why the green approach?

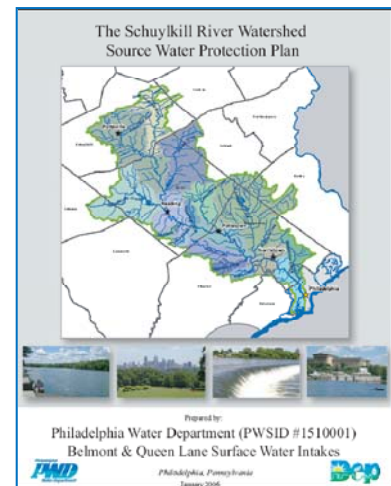
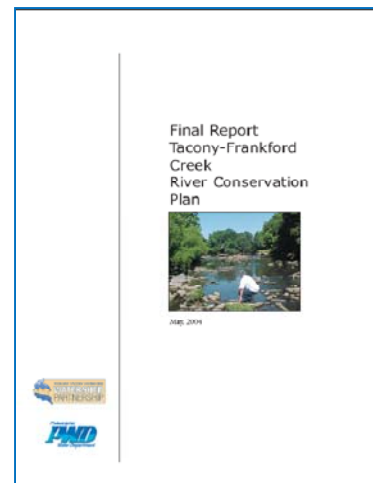
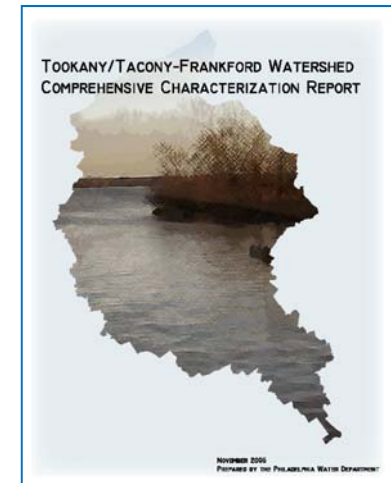
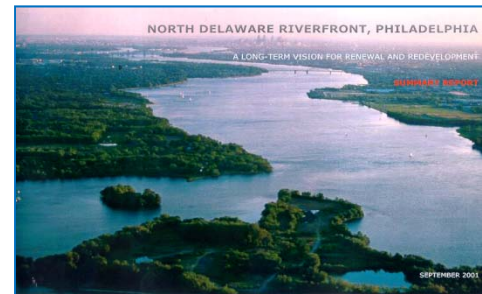
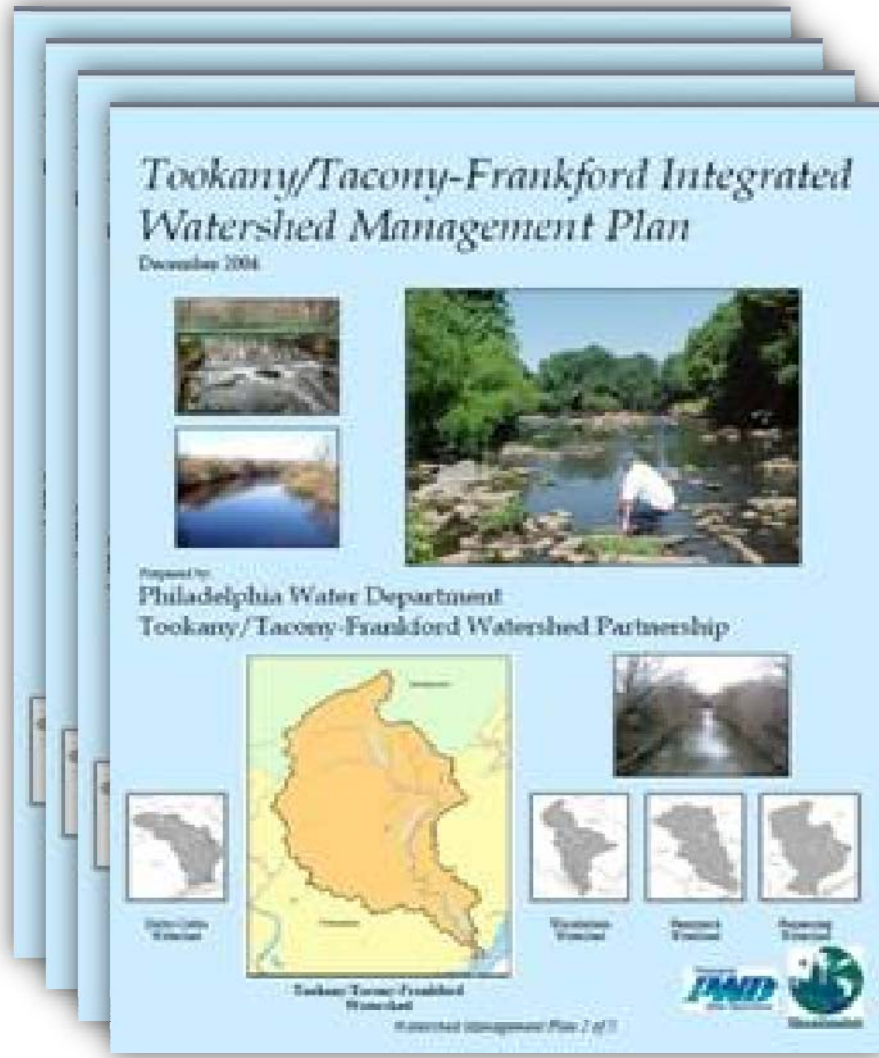


# WATERSHED-WIDE ISSUES

- Water Quality
- Wetland Degradation
- Poor Public Access to Streams
- Lack of Channel Habitat and Biological Diversity
- Dumping and Trash
- Bank Erosion
- Odors
- Vandalism



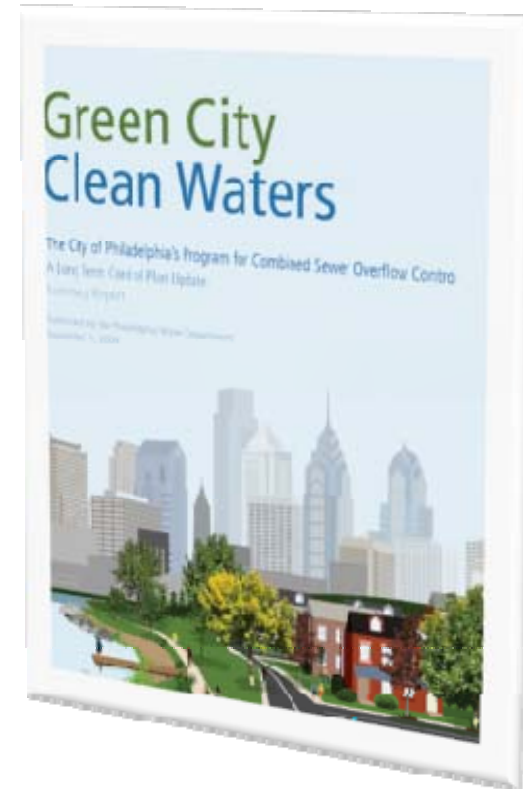
# INTEGRATED WATERSHED MANAGEMENT PLANNING



---

# 2009 CSO LONG-TERM CONTROL PLAN

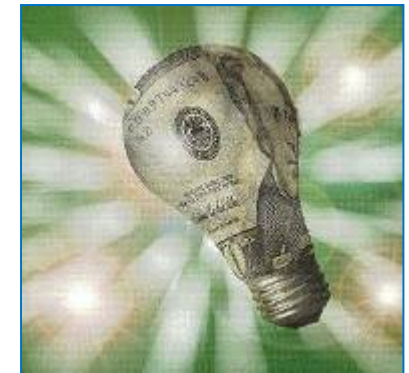
- Section 1:** Introduction and Background
- Section 2:** Public Participation
- Section 3:** System Characterization
- Section 4:** Problem Analysis and Goal Setting
- Section 5:** Methods and Procedures
- Sections 6, 7, 8:** Potential Control Measures
- Section 9:** Alternatives Development and Evaluation
- Section 10:** Final Selection and Development of Recommended Plan, LTCP Water Quality Approach, Implementation Schedule
- Section 11:** Financial Capability Analysis and Financing Plan
- Section 12:** Post-Construction Compliance Monitoring Proposal



# TRIPLE BOTTOM LINE

## Economic/Environmental/Social Benefits

- Economic Benefits
  - Costs
  - Jobs
  - Property Value
- Environmental Benefits
  - Ecological Benefits
  - Air Quality
  - Energy Savings
  - Carbon Footprint
- Social Benefits
  - Recreation
  - Heat Stress Mortality
  - Aesthetics



# CHANGES SINCE 2009 SUBMITTAL CONSENT ORDER & AGREEMENT

## Consent Order & Agreement

- Pollutant Mass Approach
- Stream/Wetland restoration removed
- \$200M additional funds
- 25 yr program
- \$1.2Billion (current value)
- 34% → 43.5% 'Greening'
- Approximately 12 'Deliverables'



June 1, 2011

25-year Program

June 1, 2036

---

**What is the plan for  
the next 5 years?**





---

# Implementation and Adaptive Management Plan

Delivery: December 1, 2011

Metric: All

A strategy for the first years of Implementation

Adaptive Management

Capital Projects Planning

Policy and Streamlining

Operations and Maintenance

Program Monitoring

Public Outreach

Inflow and Infiltration Reduction



# Comprehensive Monitoring Plan

Delivery: December 1, 2012

Metric: Greened Acres

Monitoring, Modeling and Inspections

## Natural Environment Monitoring

Tidal

Tributary

Groundwater

Rainfall

## Sewer System Monitoring

Sewer System  
Flows

CSO Discharge

Model Outputs

## Green Infrastructure Performance

Soil and Vegetation

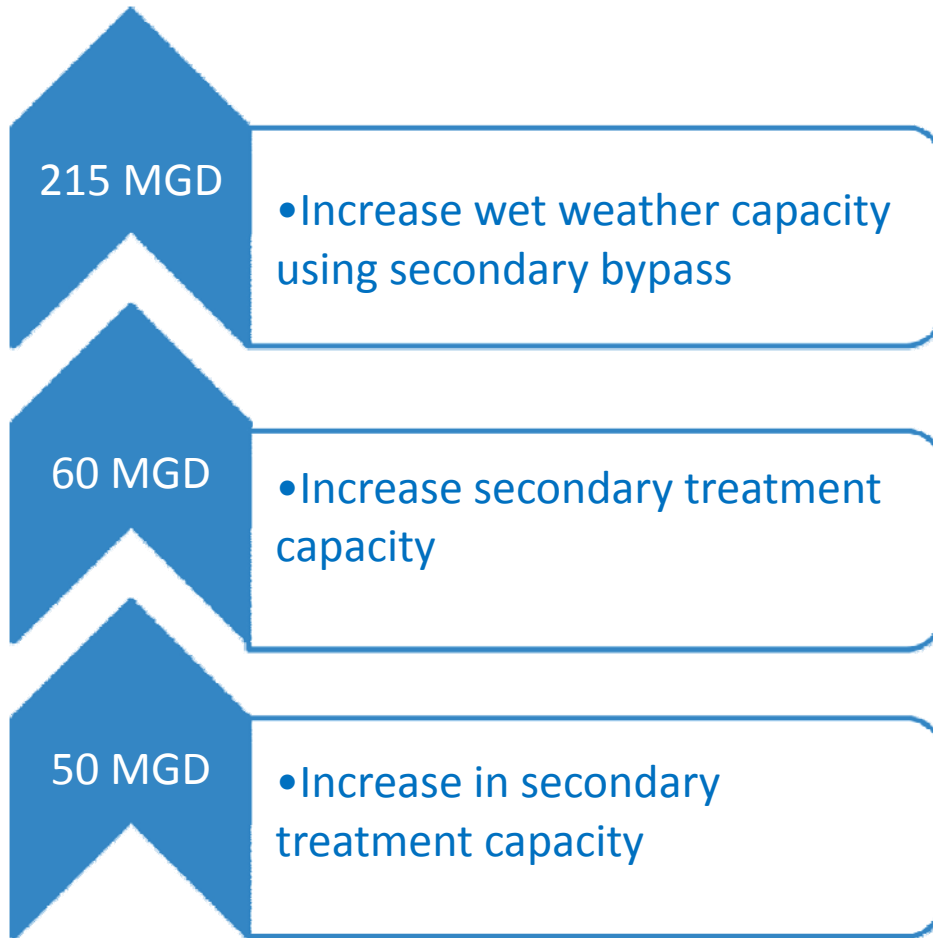
Underground Infrastructure

# Facility Concept Plans for Plant Expansion

Delivery: June 1, 2013

Metric: Overflow Reduction

Increase wet weather treatment capacity to over 1.4 billion gallons per day

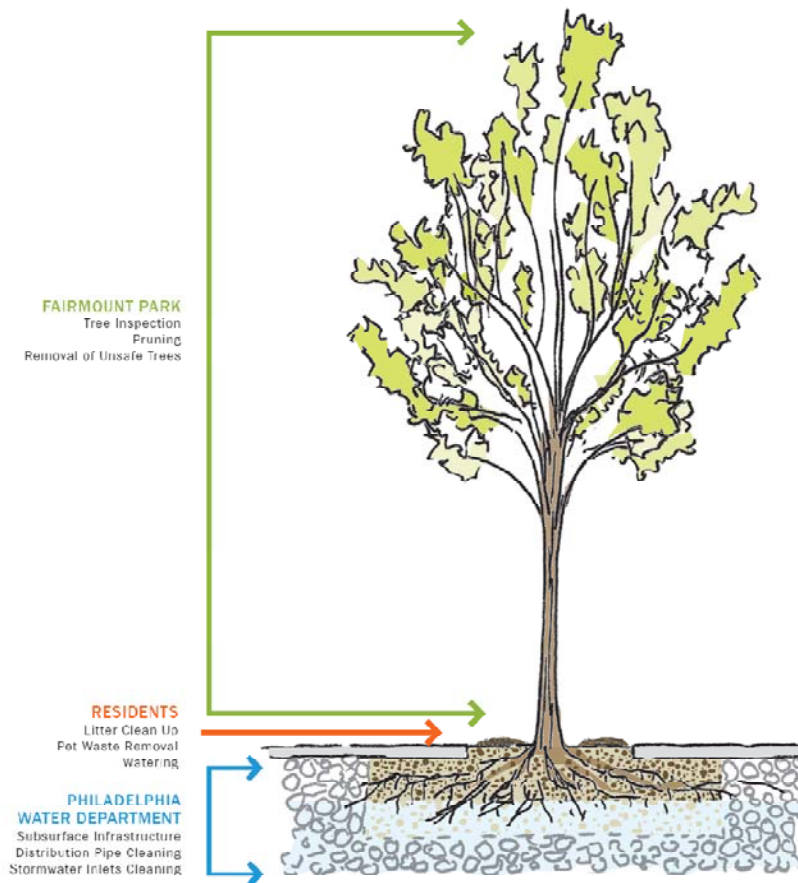


# Green Infrastructure Maintenance Manual

Delivery: June 1, 2014

Metric: Greened Acres

## STORMWATER TREE TRENCH: Maintenance Responsibilities



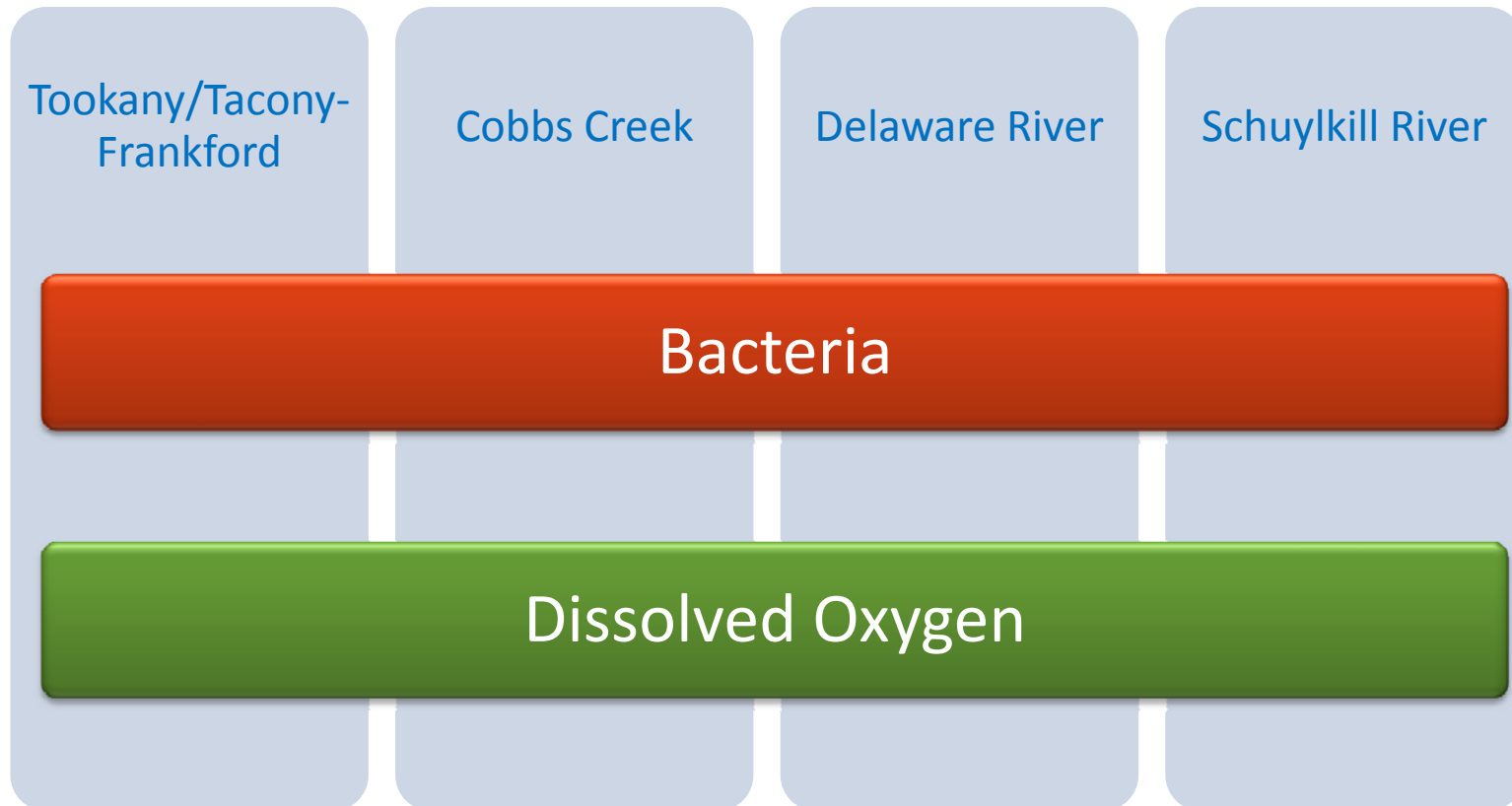
Defining maintenance activities, frequency and efficiencies for long-term success of each type of green stormwater infrastructure

Delivery: 2013-2015

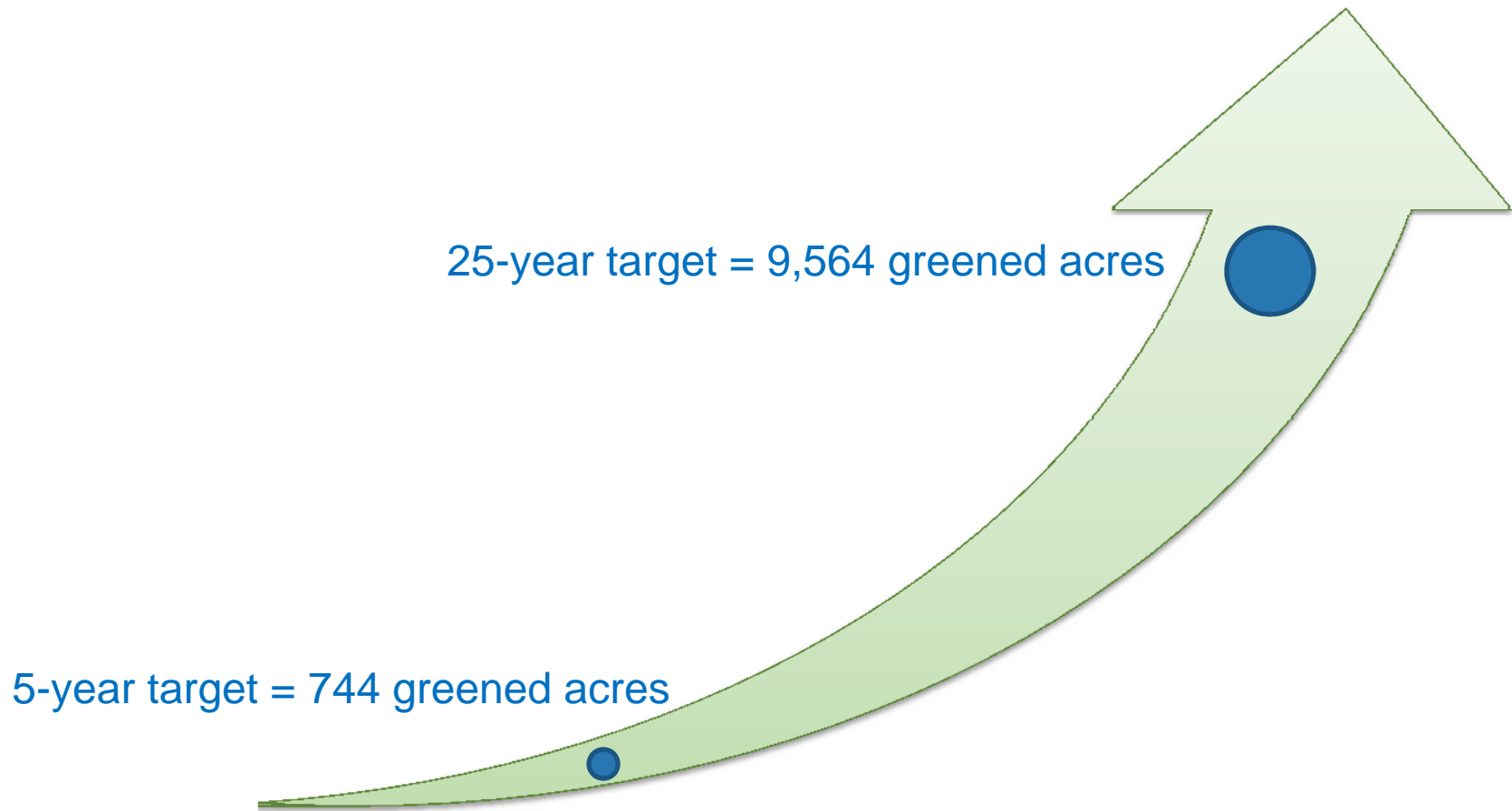
# Water Quality Modeling

Progress Evaluation Tool

Assess the program and evaluate alternative implementation options



# TOTAL GREENED ACRE METRIC



| Metric              | Units         | Year 0 | Year 5 | Year 10 | Year 15 | Year 20 | Year 25 |
|---------------------|---------------|--------|--------|---------|---------|---------|---------|
| Total Greened Acres | Greened Acres | 0      | 744    | 2,148   | 3,812   | 6,424   | 9,564   |

# 9,500+ IMPERVIOUS ACRES CONVERTED TO “GREENED ACRES”

- Enforce strong stormwater regulations on development
- Create stormwater billing structure that rewards good practices
- Direct eight ambitious and innovative Green Programs to invest in green stormwater infrastructure



### Rain Garden



Wissahickon Charter School Philadelphia, PA

### Pervious Pavement



Mill Creek Basketball Court Philadelphia, PA

### Stormwater Wetland



Saylor Grove, Philadelphia, PA

### Stormwater Tree Trench



West Mill Creek, Philadelphia, PA

### Stormwater Planter



Columbus Square, Philadelphia, PA

### Stormwater Bump-out



NE Siskiyou Street, Portland, OR

### Green Roof



PECO Building, Philadelphia, PA

### Rain Barrel



Row home, Philadelphia, PA

### Flow-Through Planter



New Seasons Market Portland, OR



---

## WHAT IS A GREENED ACRE?

**Greened Acre:** acre of impervious cover that is retrofitted to utilize *green stormwater infrastructure* which manages stormwater using source controls such as infiltration, evaporation, transpiration, decentralized storage and reuse.

$$GA = IC * Wd$$

- **IC** is the impervious cover utilizing green stormwater infrastructure (acres). This quantity can include the area of the stormwater management feature itself, as well as the area that drains to it.
- **Wd** is the depth of water over the impervious surface that can be physically stored in the facility (inches). Green stormwater infrastructure designs will be aimed at controlling at least 1.0 inch of runoff, and up to 1.5 inches of runoff, unless otherwise deemed feasible by engineering design.
- One Greened Acre is equivalent to one inch of managed stormwater from one acre of drainage area or 27,158 gallons of managed stormwater.

# EIGHT GREEN PROGRAMS

## Public Lands

- Streets
- Schools
- Public Facilities
- Open Spaces



Springside School "Water Wall" and Rain Garden

Saylor Grove Stormwater Wetland



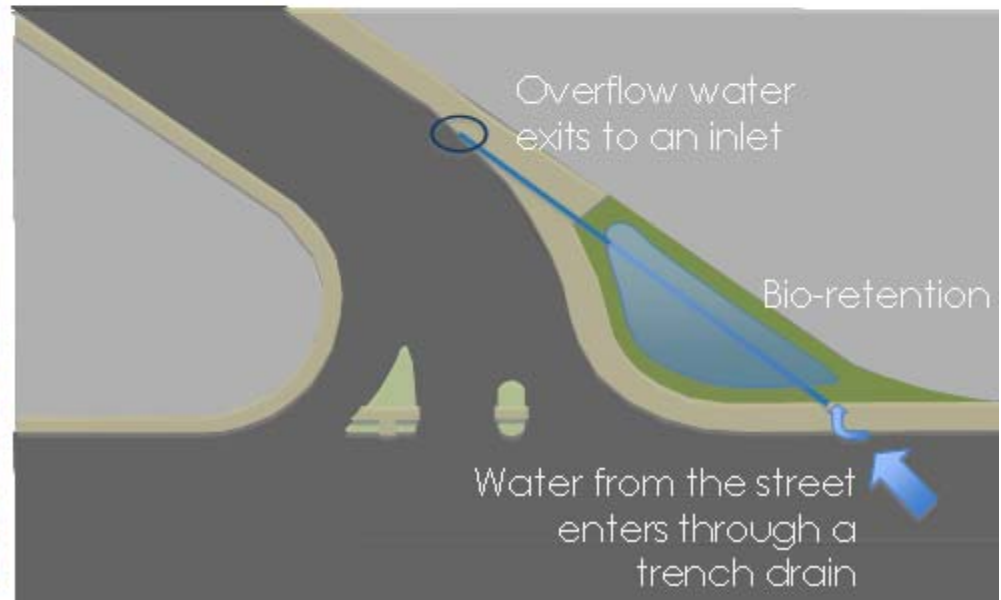
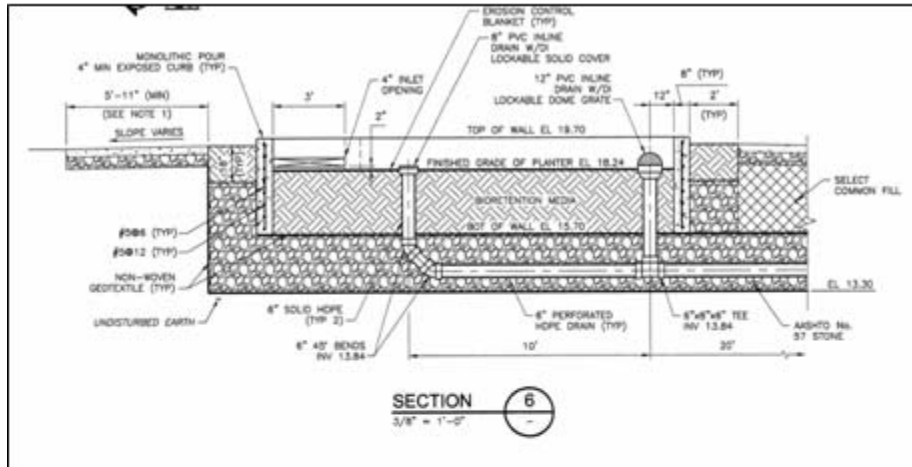
## Private Lands

Friends Center Green Roof



- Industrial/Commercial/Institutional
- Homes
- Parking
- Alleys, Driveways and Walkways

# GREEN STREETS



# GREEN SCHOOLS



Greenfield Elementary  
Center City



Wissahickon Charter  
East Falls

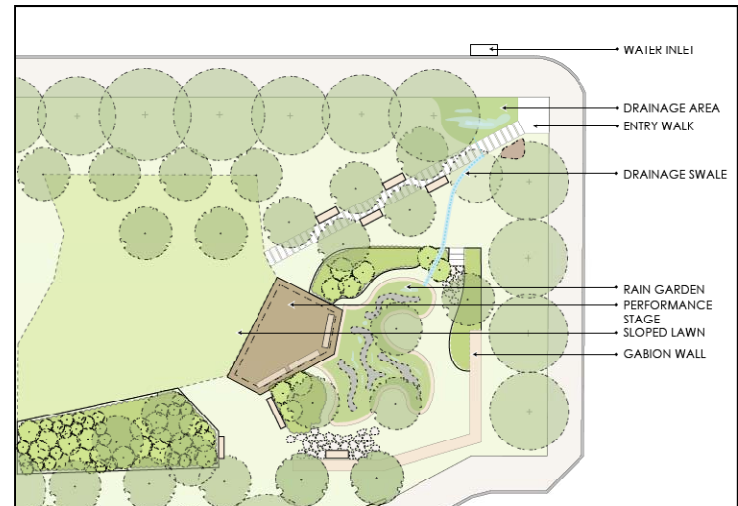
# GREEN PUBLIC OPEN SPACES



Liberty Lands Park  
Northern Liberties



Cliveden Park  
East Mount Airy



# GREEN PUBLIC OPEN SPACES



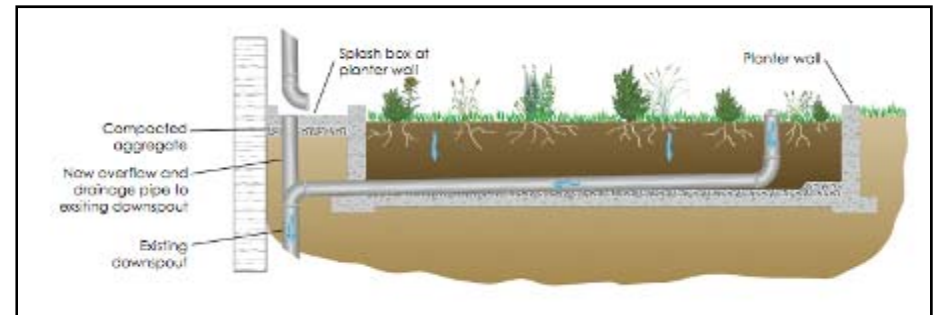
Herron Playground  
Pennsport



# GREEN PUBLIC FACILITIES



**Green Roof:**  
Free Library, Central Branch  
Center City



**Downspout Planter:**  
Waterview Recreation Center  
Germantown



# GREEN HOMES



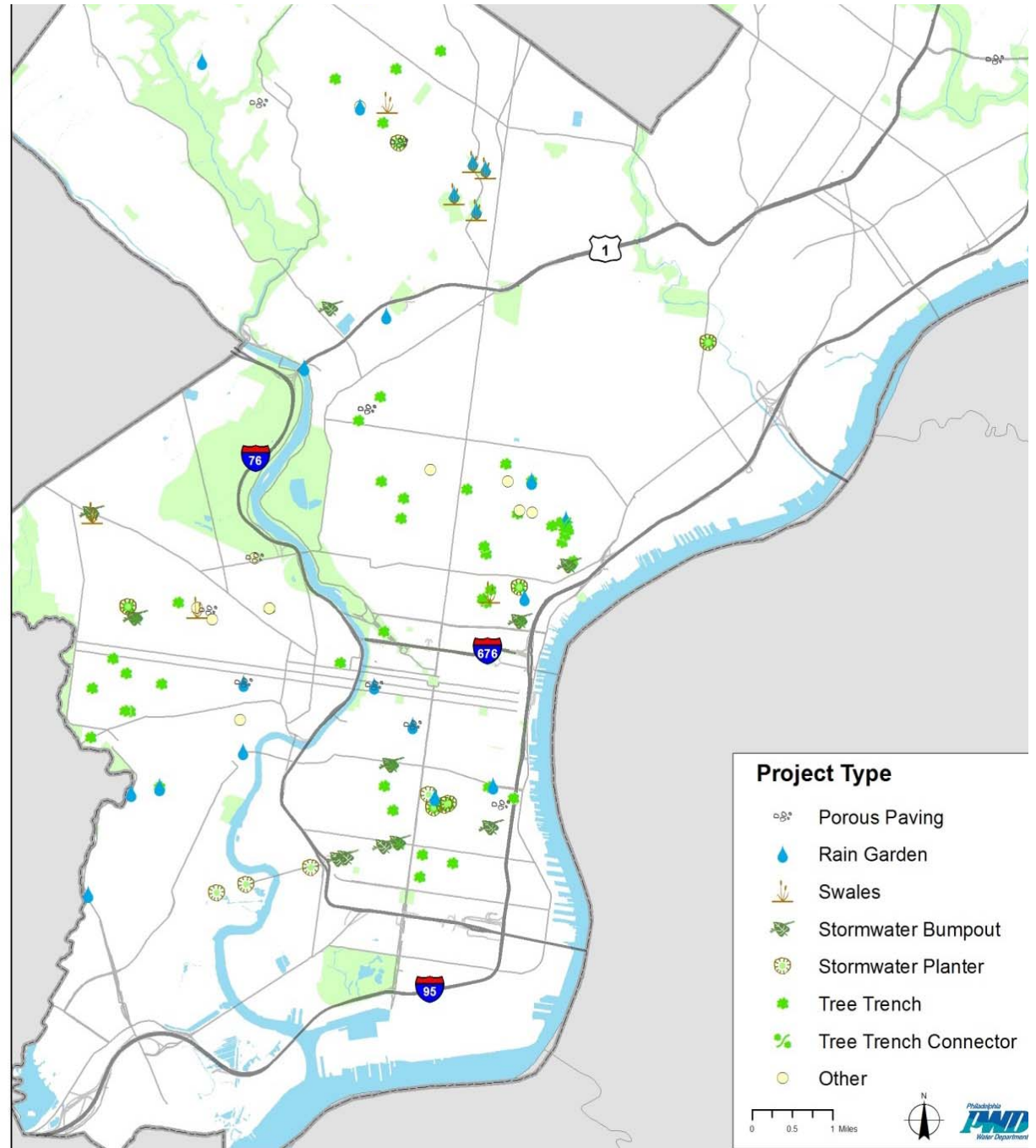
Barry Lewis





# PROJECTS AND FUNDING

- \$30M PennVest loan (SFR Loan)
  - Spread out over 5 phases between 2009 and 2012
  - 93 Sites and over 200 Blocks
- In the future, will have \$30M+ annually from Capital budget for Green Infrastructure projects
- Construction costs typically range from \$200k to >\$1M

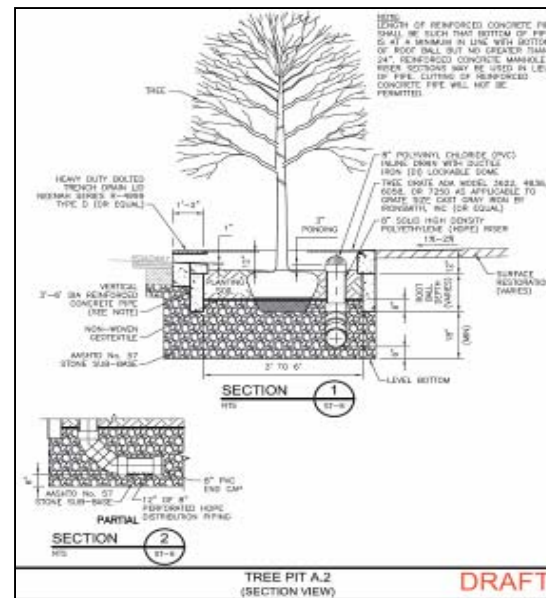
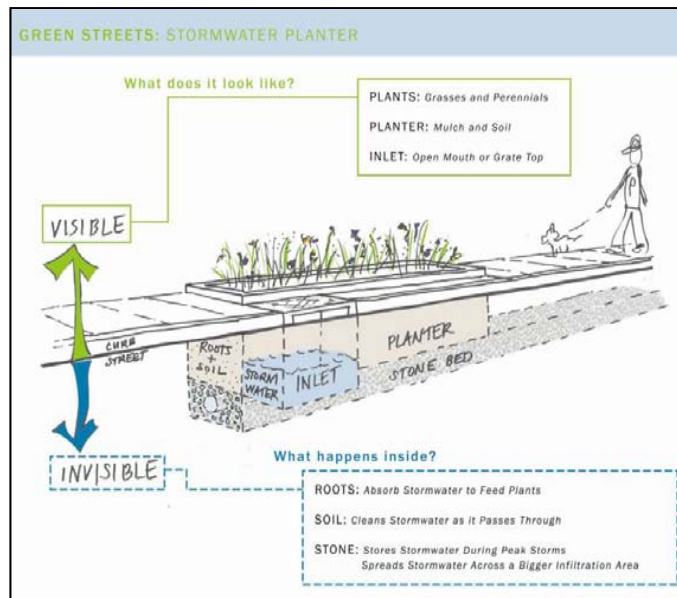


# GREEN STREETS MANUAL

- Partnership with Mayor’s Office of Transportation and Utilities, Streets Department and PWD
- Standardizes green stormwater infrastructure when:
  - Water and sewer lines are replaced
  - Streets are re-surfaced



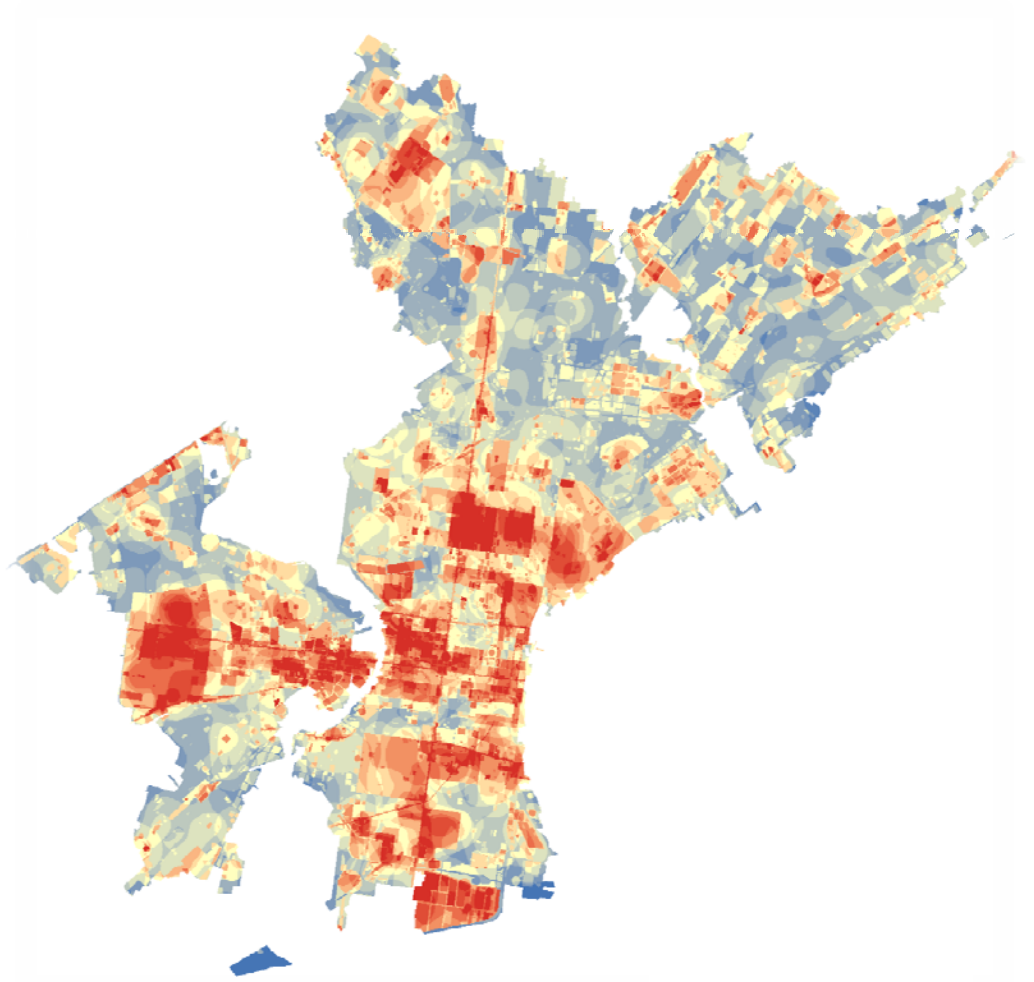
**STREETS**  
PHILADELPHIA



---

# EARLY ACTION AREAS

- Potential Stormwater Management Enhancement Districts
- Alternatives analysis for integrated implementation
- Potential leveraging of limited funding
- Innovative collaboration



---

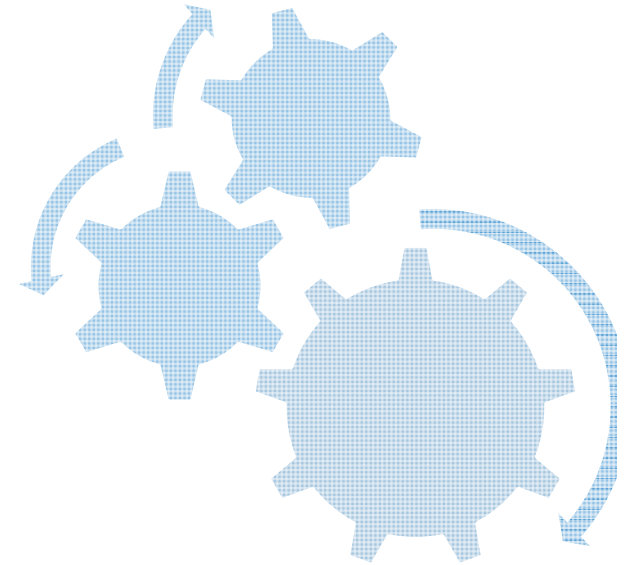
# How can we green together?



---

## AN IMPLEMENTATION APPROACH THAT “EVOLVES” OVER TIME, HARNESSING THE RESOURCES OF:

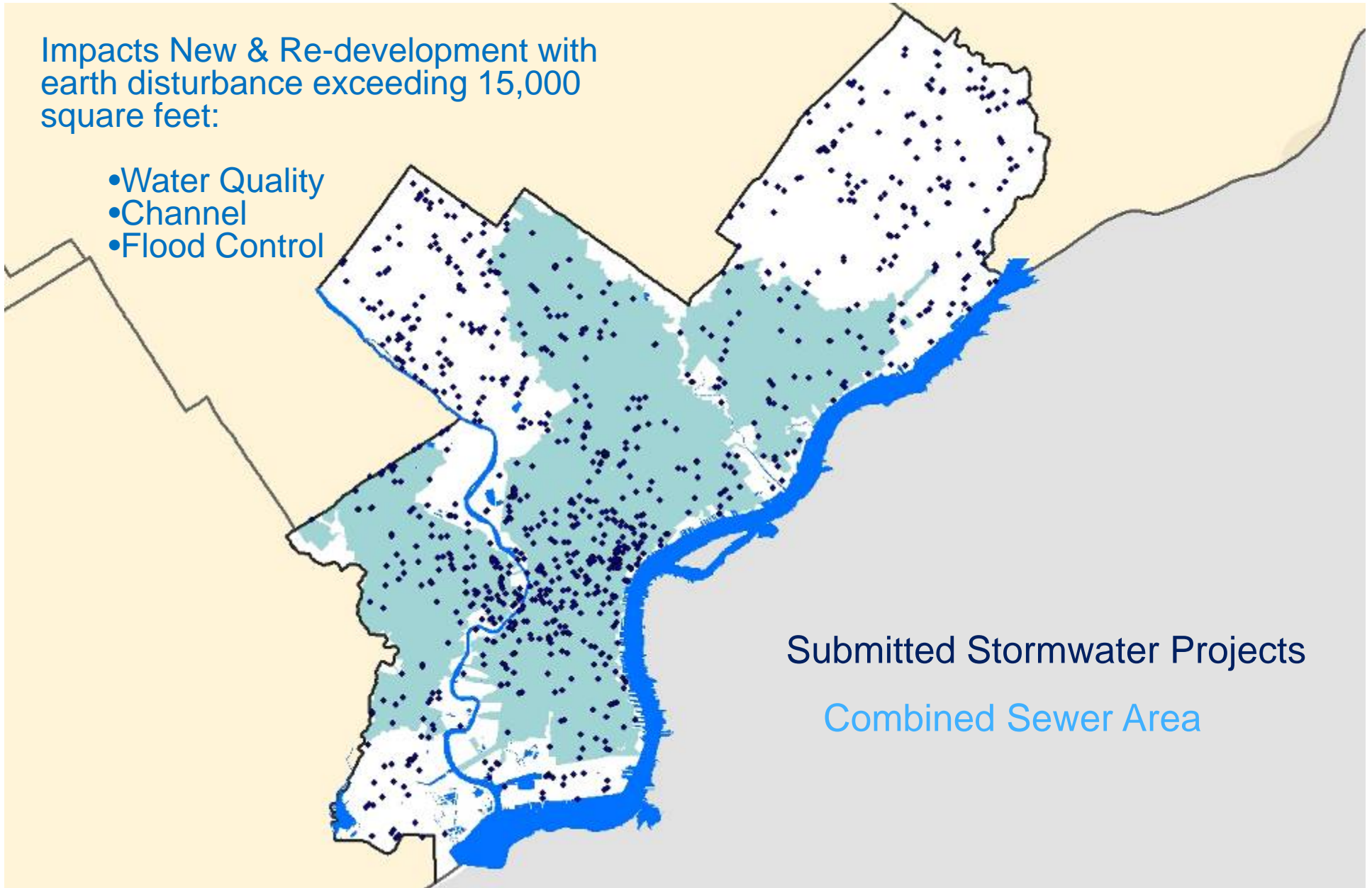
- PWD
- Other City departments and agencies
- Public and private landowners
- The development community
- New or re-aligned not-for-profit groups
- Foundations
- Federal /state agencies
- Community



# Philadelphia Stormwater Regulations

Impacts New & Re-development with  
earth disturbance exceeding 15,000  
square feet:

- Water Quality
- Channel
- Flood Control



# STORMWATER MANAGEMENT: CHANGING HOW WE CHARGE

## Traditional method -- Fee based on size of the water meter

- Not ideal proxy for runoff potential, but only method available in the 1970s
- 40,000 stormwater customers not billed because they didn't have a water meter

## Parcel-based billing based on:

- Gross Area (20%)
- Impervious Cover (80%)



# REWARDING URBAN DEVELOPMENT



Gross Area = 24,000  
Impervious Area = 24,000

Existing Charge = \$ 4,700  
New Charge = \$ 120

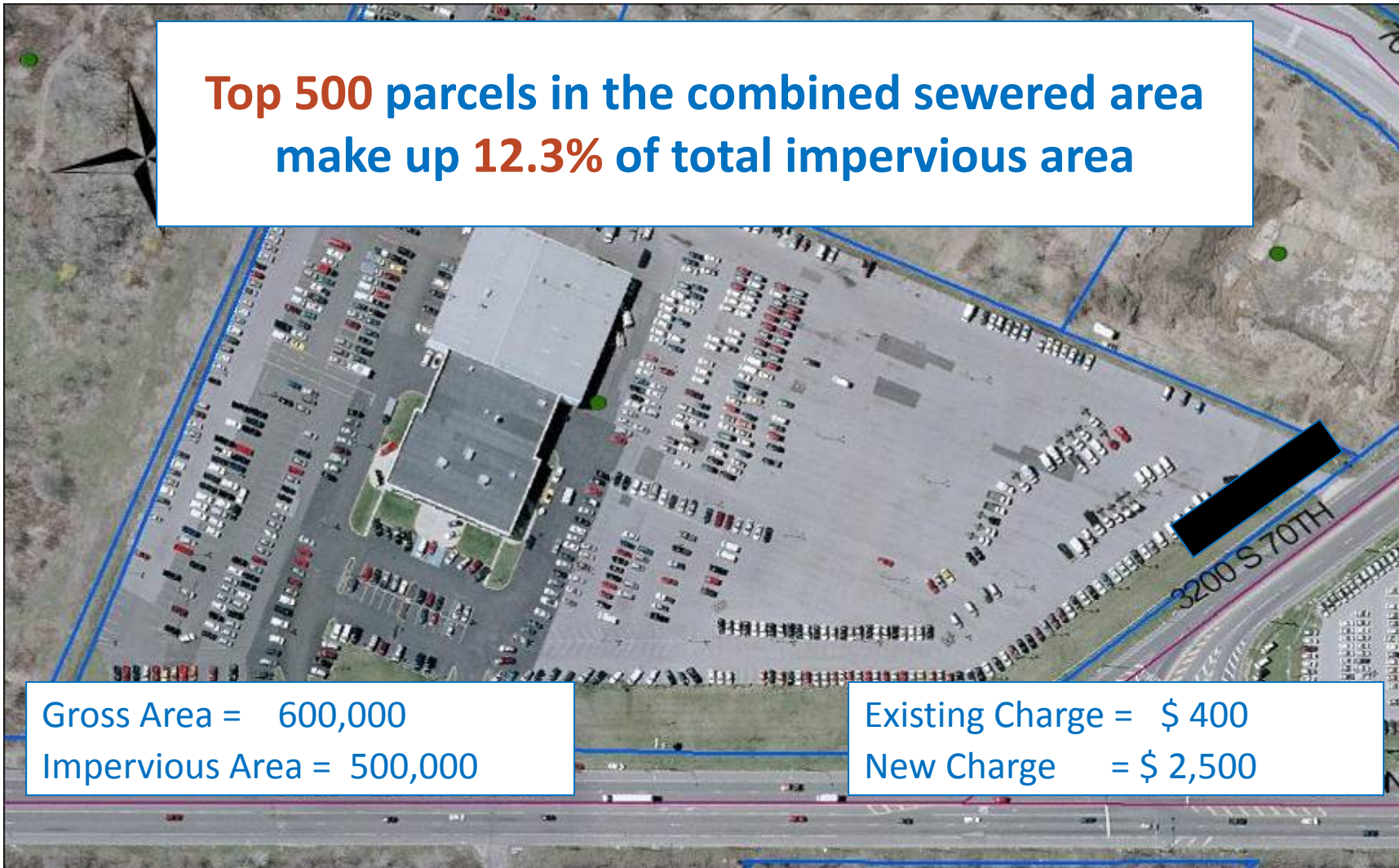


# CREATE FINANCIAL INCENTIVES FOR BETTER LAND MANAGEMENT

**Top 500** parcels in the combined sewered area  
make up **12.3%** of total impervious area

Gross Area = 600,000  
Impervious Area = 500,000

Existing Charge = \$ 400  
New Charge = \$ 2,500



# CITY-WIDE PLANNING INITIATIVES





# CASE STUDY: THE BIG GREEN BLOCK



Front Street, Norris Ave, Frankford Ave and Palmer Street



# ALIGNING RESOURCES AND CREATING PARTNERSHIPS





Kensington Arts High School, photo by Paul Rider



# BEYOND THE BIG GREEN BLOCK

- Connections to neighborhood amenities
- Columbia Avenue corridor to Penn Treaty Park
- Waterfront connection
- Integration of local art
- Promotes awareness



Photo credit: NKCDC





---

[www.phillywatersheds.org](http://www.phillywatersheds.org)

Marc.Cammarata@phila.gov  
questions@phillywatersheds.org

