

Implementing Green Infrastructure in an Urban Setting

Philadelphia's Green City Clean Waters Program



NACWA
2011 Winter Conference

Mark Maimone
Vice President

Marc Cammarata
PWD Office of
Watersheds



February 4, 2011

CDM



Overview

- Combined Sewer Overflows: the problem
- Philadelphia's Green Infrastructure-based Approach for CSO Control
- Overcoming the Challenges of Green Infrastructure in an Urban Setting



PHILADELPHIA'S STORMWATER LEGACY

GREEN CITY, CLEAN WATER

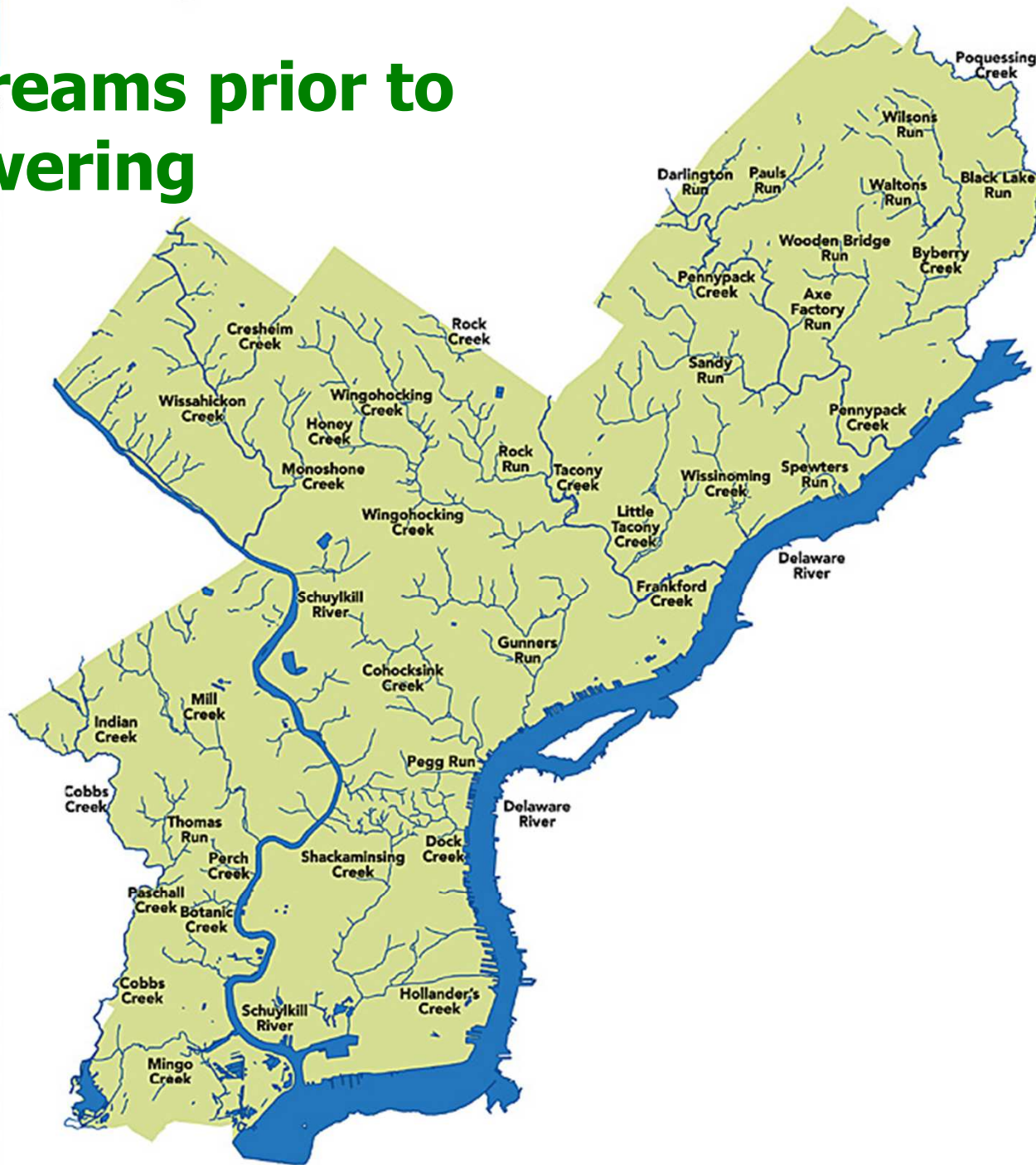
HISTORIC STREAMS OF PHILADELPHIA



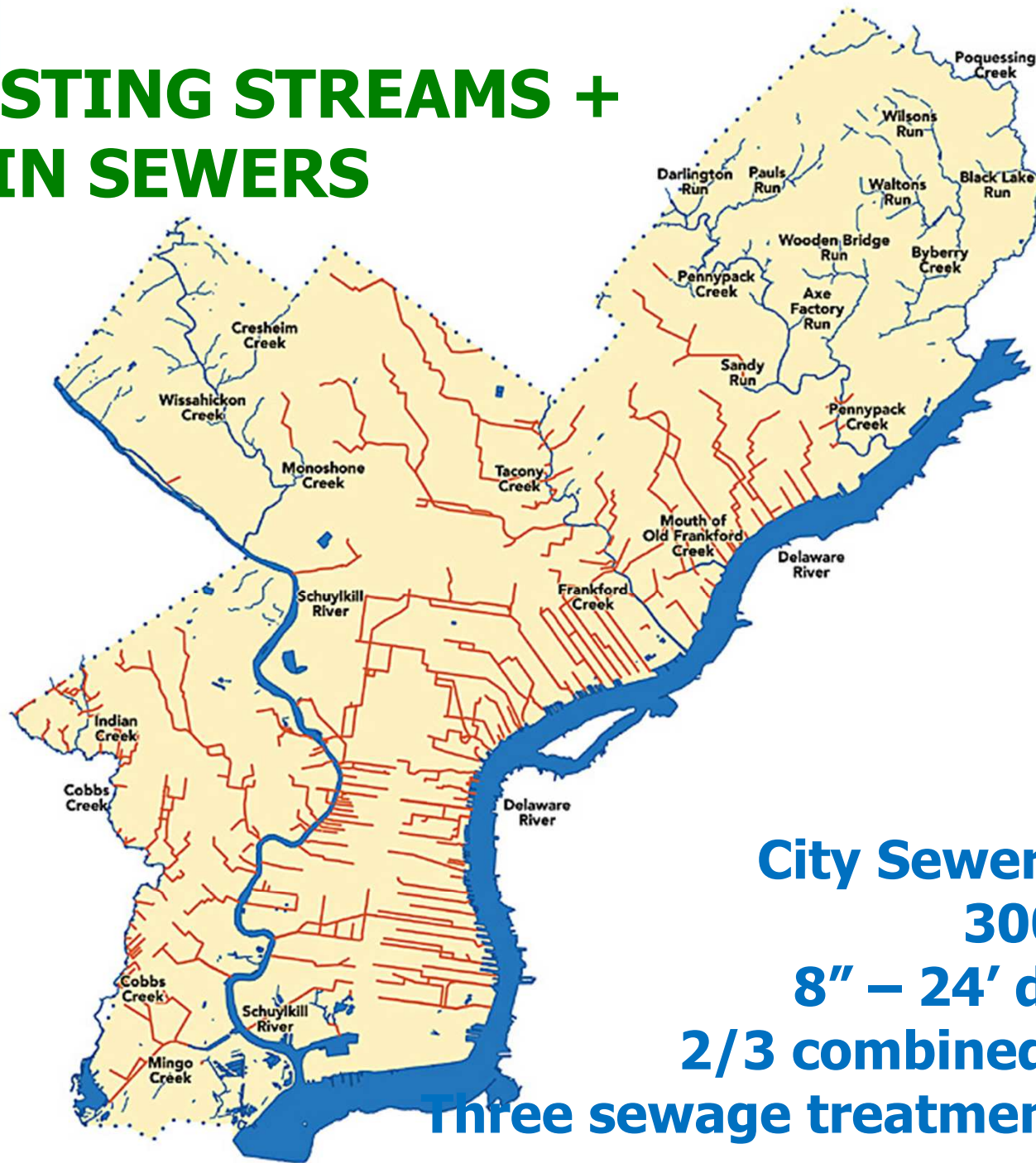
THE OLD APPROACH TO MANAGING WATER



Streams prior to sewering



EXISTING STREAMS + MAIN SEWERS



City Sewer System
3000 miles

8" – 24' diameter

2/3 combined sewers

Three sewage treatment plants



- **Water quality issues**
- **Odors**
- **Low dissolved oxygen**
- **Bank erosion**
- **Lack of channel habitat + biological diversity**
- **Wetland degradation**
- **Poor public access to streams**
- **Flooding**



The background of the slide features a stylized landscape. The lower two-thirds of the image is a solid, vibrant green, representing rolling hills or a field. The top third of the image is a gradient of blue, representing the sky, with a thin, wavy line separating the green from the blue, suggesting a horizon or a path. The overall aesthetic is clean and modern.

A New Approach

GREEN CITY, CLEAN WATER

Green City, Clean Waters

- Combined Sewer Overflow (CSO) Long Term Control Plan Update (LTCPU)
- \$1.2 billion, 25 yr program
- Proposal to “green” 40% of the city’s impervious cover in CSO area in 25 years, upgrade all three WWTPs

Green City, Clean Waters

- Only Proposed CSO Program relying primarily on Stormwater Source Control instead of storage

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

HOW SHALL WE ADDRESS OUR COMBINED SEWER SYSTEM ISSUES?





The background of the slide features a series of overlapping, wavy lines in various shades of blue, creating a sense of movement and depth. The lines are more pronounced at the top and fade out towards the bottom.

Challenges and Opportunities of Green Infrastructure in an Urban Setting

GREEN CITY, CLEAN WATER



Southwest Philadelphia (67th & Essington), photo by Andrew Dobshinsky




Pier 70 Plaza (Delaware River), photo by Andrew Dobshinsky



James Elverson Middle School (13th & Susquehanna)



Southest Philadelphia (10th & Moyamensing), photo by Andrew Dobshinsky



New Approach = Significant Challenge

- *Green approach less a design problem, more a policy challenge*
- Primary policy challenges:
 - Identifying, motivating, and coordinating multiple implementers
 - Overcoming bureaucratic, regulatory, and institutional barriers
 - Setting targets and demonstrating success at achieving targets to the satisfaction of regulators



Getting Started

- Identify implementation mechanisms
- Identify potential partners
- Identify Barriers and Solutions



Potential Implementation Mechanisms

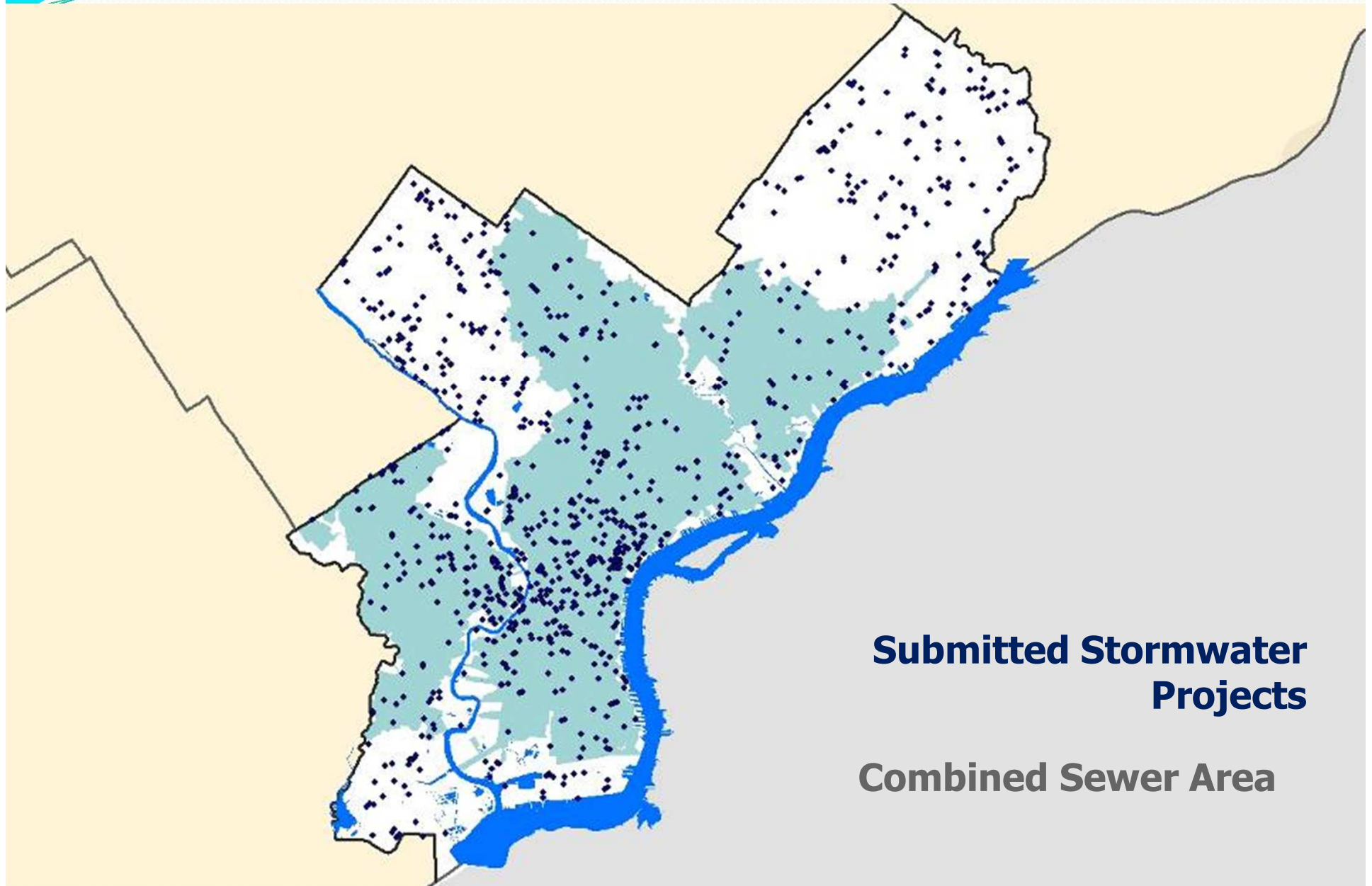
- PWD Stormwater Regulations
- Parcel-Based Stormwater Billing
- Amended Code/Regulations/Specs



Stormwater Regulations

- Control 1st inch
 - All new and re-development disturbing more than 15,000 square feet
- Proving Mechanism of control is critical
 - Infiltration: soil and water table data needed
 - Storage and Slow release (must be modeled)
 - EvapoTranspiration: difficult to measure and/or estimate in tree pits/swales etc.

PHILADELPHIA'S NEW STORMWATER REGS



An aerial photograph of a city, likely New York City, showing a large blue translucent volume that represents 1.2 billion gallons of water. The volume is shaped like a large, irregular prism, covering a significant portion of the city's area. The text "1.2 billion gallons" is written in white, bold font on the right side of the volume. The background shows various city buildings, streets, and a body of water in the distance.

**1.2 billion
gallons**

**1 billion
gallons**



Parcel Based Billing

- Set rates based on stormwater production
- Key challenges:
 - Rates increase must allow credits for stormwater controls
 - Cost of controls must have reasonable pay-back period based on rate differential to act as incentive
 - Rate change will be very controversial (winners and losers)
 - As credits given, overall rates must increase



NEW STORMWATER PARCEL BASED
BILLING SYSTEM *will impact 80,000 properties*

Current annual stormwater bill:

\$5,000

New annual stormwater bill:

\$30,000

An aerial photograph of a dense urban area, likely in New York City, showing several tall, multi-story buildings with many windows. The buildings are packed closely together, and the streets below are visible with some traffic. The overall scene is a high-angle view of a city block.

REWARDING DENSE URBAN REDEVELOPMENT

Current annual stormwater bill: \$4,700

New annual stormwater bill: \$120



New Design Manuals

- Intent: set a “green standard” for all streets within the city
 - variety of approaches for all types of streets
 - simple: increasing tree cover
 - more complex: pervious sidewalks and stormwater planters
 - full retrofit: pervious sidewalks, planters, and underground infiltration/ evapotranspiration/retention facilities
- PWD/Streets cooperating on a new Street Design Manual



Amended Codes and Regulations

- Plumbing Code
 - Allow disconnection of rain leaders to new stormwater control infrastructure
 - Allow use of Rain Barrels
- Building Code
 - Building code regarding roof live- and dead-load requirements and the relationship to green roofs



Amended Codes and Regulations

- Zoning Code
 - Buffers, setbacks, tree canopy, parking requirements, and/or planted spaces
- Streets Department Specifications
 - Porous asphalt and pavements
 - Turning radius
- PWD Regulations
 - Inlet Design, property restrictions



New Initiatives

- “Green University” with Temple, Drexel Sustainable Stormwater Initiative
 - Pilot green stormwater infrastructure
 - Intense, site scale monitoring and reporting
 - Piloting of larger scale pilot area and assessment of CSO reductions



New Initiatives

- “PWD – PennDOT cooperation
 - long-term, multi-phase infrastructure initiative to improve and rebuild I-95 in Philadelphia
 - PWD stormwater regulations apply for highway
- PennDOT agreed to install oversized outfall pipes to allow for disconnection of all properties between highway and river

The background of the slide is a light blue gradient. At the top, there are several wavy, layered lines in various shades of blue, creating a sense of movement and depth, reminiscent of water or a stylized horizon.

CHANGING CITY PRACTICES

GREEN CITY, CLEAN WATER



Five Year Proof of Concept

- Assess results of Proof of Concept Phase
- Monitoring and Modeling is key:
 - Site scale monitoring of GI
 - Small sub-shed scale flow monitoring
 - New Techniques of Modeling to incorporate GSI impact on CSOs
 - Stream and Estuary modeling of program effectiveness



Saylor Grove



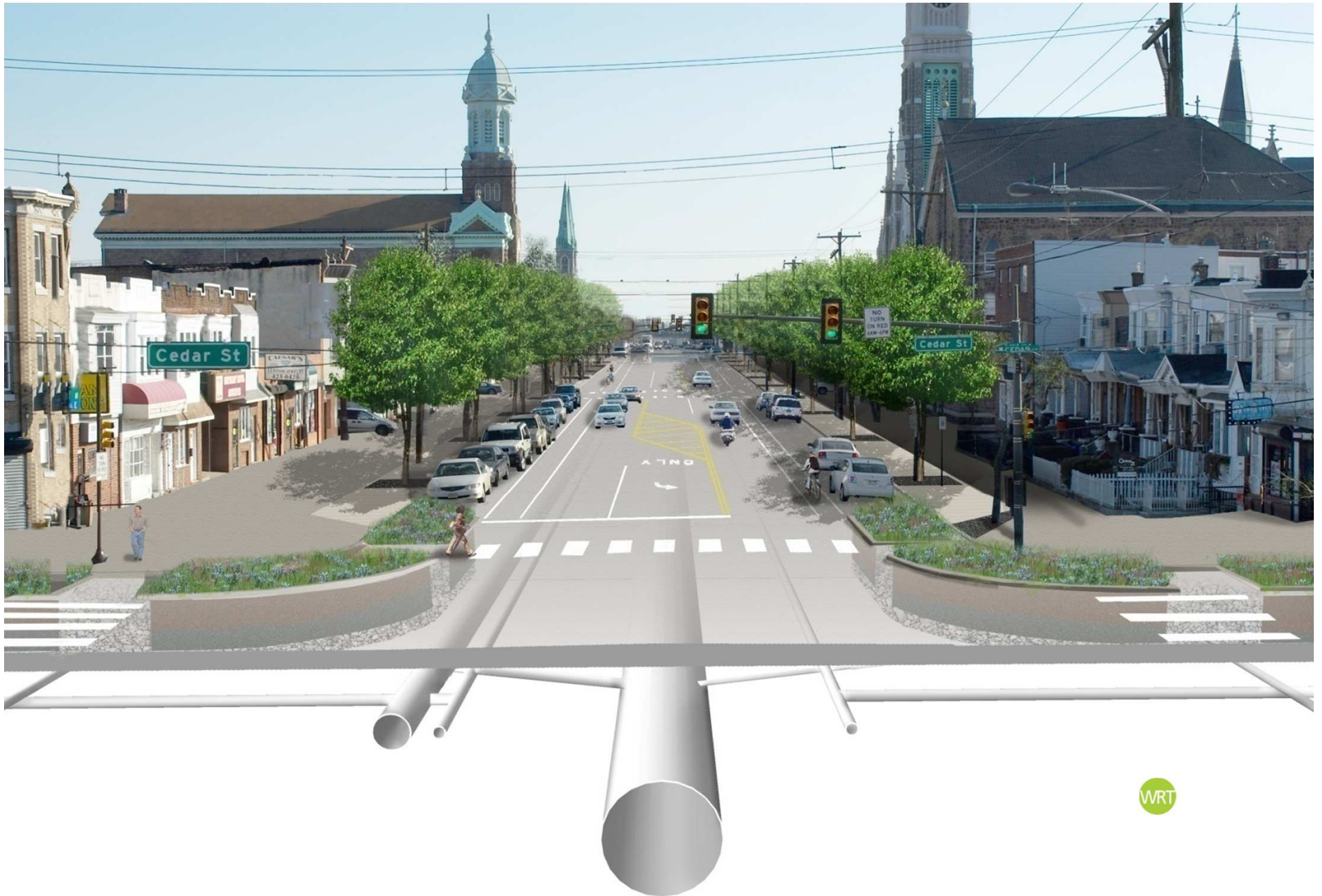
Saylor Grove



Marshall Road, Cobbs Creek



Allegheny Ave. + Cedar St.



Allegheny Ave. + Cedar St.







47th and Gray's Ferry Ave.





Free Library, Central Branch



Rag Flats



E-Flats,



Thin Flats



Center City (Carlton & Race)

Selling Philadelphia's Approach

- City and rate payers:
 - Sustainable
 - Adaptable (Climate Change)
- Regulatory Agencies
 - Triple Bottom Line Tracking
 - For every \$1 spent on Green get \$1.50 of additional benefits

The Triple Bottom Line

Economic/Environmental/Social Benefits

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



COST/BENEFIT ANALYSIS

(one square mile tests)

COST-BENEFIT ANALYSIS

TREES



South
Philadelphia

30% canopy
(+61,439 trees)

ANNUAL COSTS

CAPITAL/O&M - \$ 1,590,656

ANNUAL BENEFITS

AIR QUALITY +\$ 482,294

STORMWATER MGMT +\$ 1,560,543

ENERGY CONSUMPTN +\$ 504,289

OPPORTUNITY COSTS +\$ 103,831

NET ANNUAL BENEFIT

+\$1,060,302

ONE-TIME BENEFIT

REAL ESTATE +\$122,877,414



WRT



Reasons for Optimism

- National trends toward higher-density, energy-efficient, transit-oriented, walkable communities
- GreenWorks commitment to become “greenest city in America”
- *Green City, Clean Waters* approach is flexible and adaptable to changing economic conditions and climate conditions
- Regulatory agencies are beginning to accept this approach



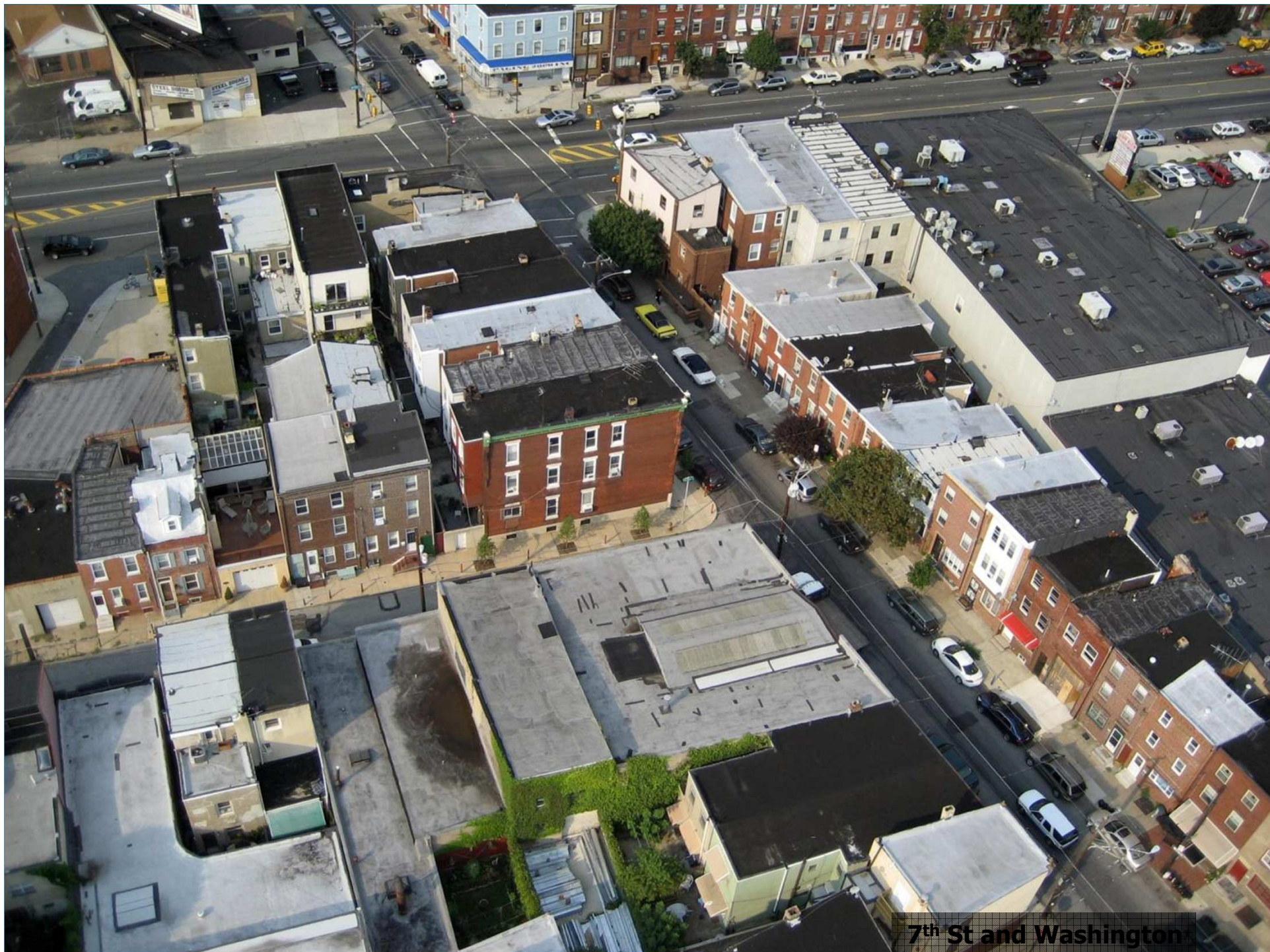
Front Street, Norris Ave, Frankford Ave and Palmer Street

KENSINGTON CREATIVE + PERFORMING ARTS HIGH SCHOOL
PHILADELPHIA WATER DEPARTMENT
DEPARTMENT OF PARKS + RECREATION
PHILADELPHIA STREETS DEPARTMENT
PENNSYLVANIA HORTICULTURAL SOCIETY
NEW KENSINGTON CDC
SEPTA











The background of the slide is a light blue gradient. At the top, there are several wavy, horizontal lines in various shades of blue, creating a sense of movement or water. The word "Questions?" is centered in the middle of the slide in a white, sans-serif font.

Questions?

GREEN CITY, CLEAN WATER