Charting a Path to the Utility of the Future
Web Seminar Series

Sustainable Infrastructure — Resiliency, Gray, Green & the Regulatory Regime

NACWA
A Clear Commitment to America's Waters

Today's Speakers

Chris Kloss
Office of Water Green Infrastructure Coordinator
U.S. Environmental Protection Agency, DC

Mo Minkara
City of Chattanooga, TN

Ben Chou
National Resources Defense Council, DC

Carter Strickland
HDR Engineering, Inc., NY

Improving Resiliency with Green Infrastructure

September 2014

Chris Kloss
US EPA Office of Water

Atmospheric CO_2 Concentrations

- Pre-Industrial: 280 ppm
- Current: 397 ppm
- 20th century warming: 0.7°C (1.3°F).
- Proposed 80% reduction in U.S. CO_2 emissions by 2050 (50% global reduction) to stabilize atmospheric concentrations @ 450 ppm.
- Keeps global planetary warming below 2.4°C (4.3°F).
- Potential impacts on water supply and water infrastructure.

Photo courtesy of Columbia University.

Climate Impacts on Water Resources

- Decrease in the duration and extent of snow cover in most of North America
- Increase in the frequency of heavy precipitation events across the U.S.
- Increase in streamflow in the eastern U.S.
- Decrease in annual precipitation in the Central Rockies and Southwest
- Decrease in mountain snow water equivalent in Western North America
- Decrease in runoff and streamflow in the Colorado and Columbia River basins
- Decrease in the proportion of precipitation falling as snow in the West
- Increase in the periods of drought in the West
- Decrease of 25-40% by 2050 and potentially 70-90% 2100 of the Sierra snowpack

Prettyboy Reservoir, Maryland during 2002 drought. *Photo courtesy of National Weather Service.*

Bryson B. Bates, Z.W. Kundzewicz, S. Wu, and J.P. Palutikof, Eds., *Climate Change and Water*, Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva, 2008.

David S. Beckman, N. Garrison, R.C. Wilkinson, and R. Horner, *A Clear Blue Future: How Greening California Cities Can Address Water Resources and Climate Challenges in the 21st Century*, Natural Resources Defense Council, August 2009.

Why the Interest in Green Infrastructure?

- Wet weather events (i.e., stormwater runoff) impair water quality by causing sewer overflows and contributing significant pollutant loads from MS4s.
- Combined sewer systems in more than 700 municipalities in 31 states and the District of Columbia discharge an estimated 850 billion gallons of CSOs each year.
- In 2011, stormwater caused more than 10,950 beach closing and advisory days (47% of total); sewage spills and overflows caused more than 1,500 (6%).
- Investment needs estimated to be several hundred billion dollars.

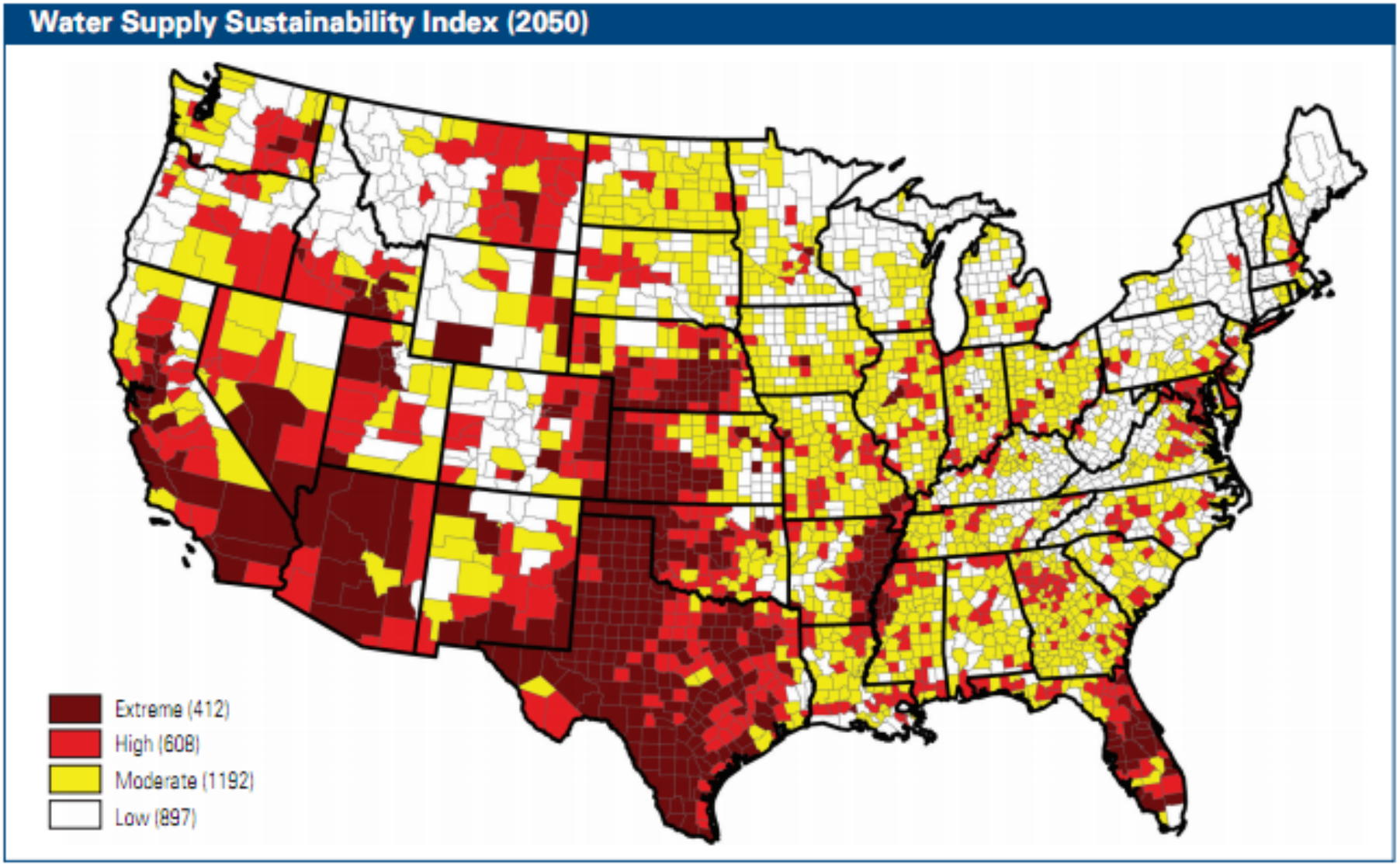
Street flooding after ½" rainfall in Ocean City, NJ, August 9, 2011

American Society of Civil Engineers, (2010), *Report Card for America's Infrastructure*.

U.S. EPA, (2010), *Clean Watersheds Need Survey: 2008 Report to Congress*, Office of Wastewater Management, EPA 832-F-10-010.

Natural Resources Defense Council, *Testing the Waters*, 2012.

Water Supply Sustainability



Source: NRDC, 2010

Population Projections

Projected Population Growth and New Water Demand in the Southwest.

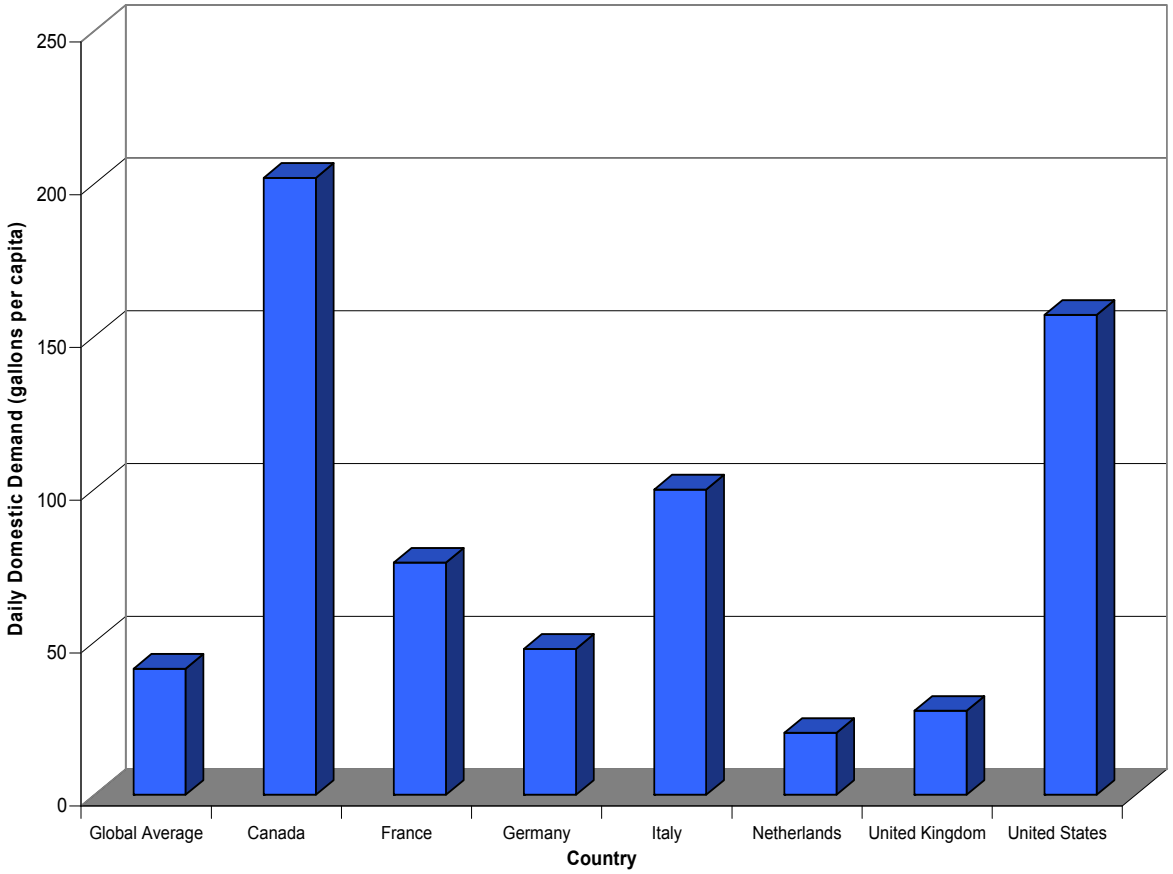
State	Population Change: 2000 to 2030	% Change: 2000 to 2030	% Change Rank	Per Capita Water Demand by State (gal/day)	Projected New Water Demand (Billion gallons/yr)
United States	**82,162,529**	**29%**	**(x)**		
Nevada	2,283,845	114%	1	190	158
Arizona	5,581,765	109%	2	140	285
Utah	1,252,198	56%	5	186	85
California	12,573,213	37%	13	124	569
Colorado	1,491,096	35%	14	121	66
New Mexico	280,662	15%	26	107	11
Wyoming	29,197	6%	44	152	2
TOTAL	**23,491,976**				**1,168**

U.S. Census Bureau, Population Division, Interim State Population Projections, 2005.
Joan F. Kenny, N.L. Barber, S.S. Hutson, K.S. Linsey, J.K. Lovelace, and M.A. Maupin, *Estimated Use of Water in the United States in 2005*, Reston, VA, U.S. Geological Survey Circular 1344, 2009.

New Water Demand: 3.2 billion gal/day (12.1 billion L/day)

U.S. Water Supply

- Universal access to potable water supplies.
- World's 2nd highest per capita use: ~ twice that of Europe.
- Average 100 - >150 gal/day per capita.



A.Y. Hoekstra and A.K. Chapagain, *Water Footprints of Nations: Water Use by People as a Function of Their Consumption Pattern*, Water Resources Management (2007) 21:35-48.

Water Use

Typical Daily Water Use.

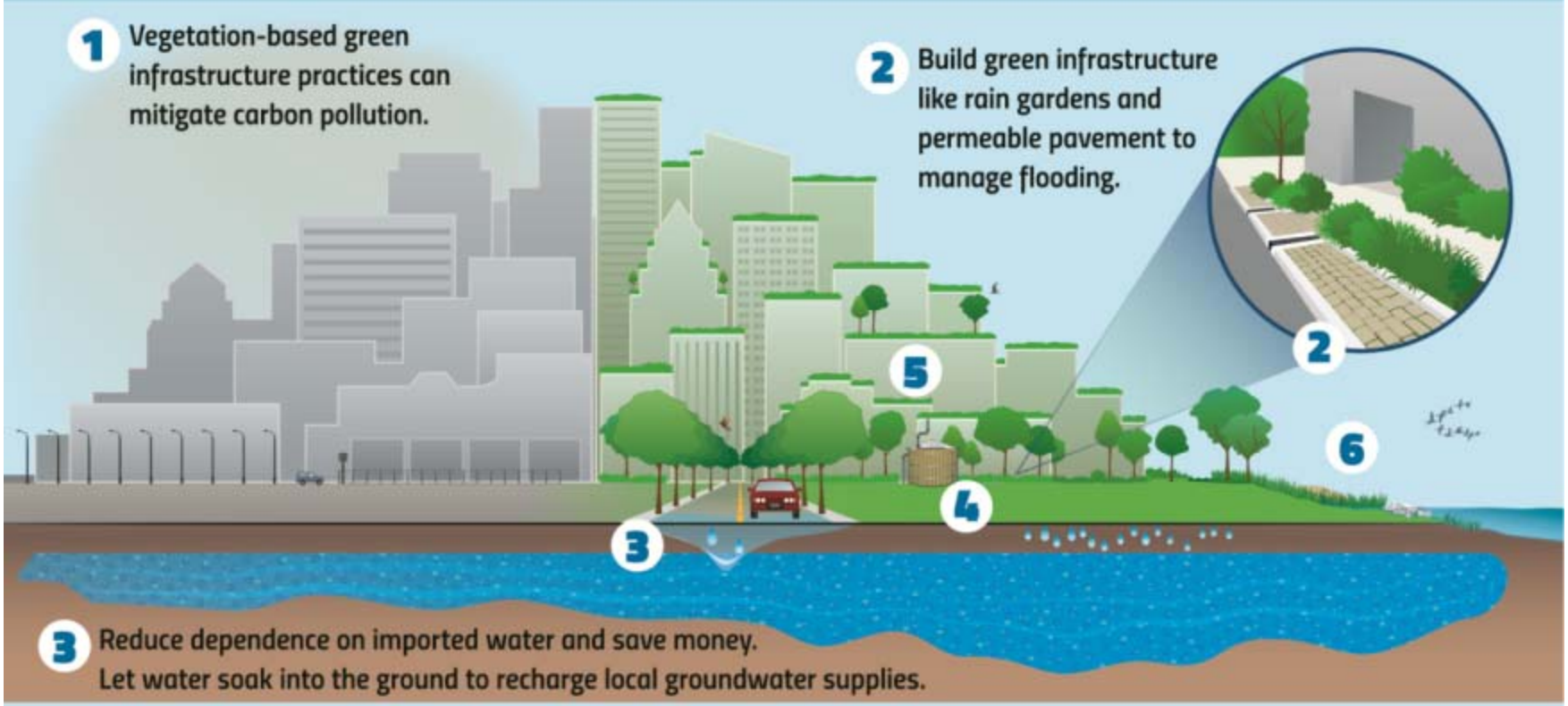
Use	Domestic % of Daily Total (Gallons per Capita)	Office Buildings % of Daily Total
Potable indoor uses		
▪ Showers/Baths	7.8% (12.8)	---
▪ Dishwashers	0.6% (1.0)	---
▪ Kitchen	---	3%
▪ Faucets	6.6% (10.9)	1%
▪ Other uses, leaks	6.7% (11.1)	10%
Subtotal	**21.7% (35.8)**	**14%**
Non-potable indoor uses		
▪ Clothes washers	9.1% (15.0)	---
▪ Toilets/urinals	11.2% (18.5)	25%
▪ Cooling	---	23%
Subtotal	**20.3% (33.5)**	**48%**
Outdoor uses	**58.0% (95.7)**	**38%**
Total non-potable indoor and outdoor uses	**78.3%**	**86%**

*Domestic kitchen use accounted for in dishwasher and faucet categories.

American Waterworks Association Research Foundation (AWWARF), *Residential End Uses of Water*, Denver, CO, AWWARF, 1999.

Pacific Institute, *Waste Not, Want Not: The Potential for Urban Water Conservation in California*, November 2003.

Green Infrastructure Builds Resiliency



3 Reduce dependence on imported water and save money.
Let water soak into the ground to recharge local groundwater supplies.

4 Keep water local. Capture runoff in cisterns and rain barrels to reduce municipal water use.

5 Plant trees and green roofs to mitigate the urban heat island effect.

6 Use living shorelines, buffers, dunes and marsh restoration to reduce the impact of storm surges.

EPA
United States
Environmental Protection
Agency

For more information on green infrastructure, see:
www.epa.gov/greeninfrastructure

Increasing Resiliency with Green Infrastructure

- Flooding
  - Menomonee River revitalized brownfield site now mitigates impacts of localized flooding up to the 100 year storm event.
  - 70 acre stormwater park provides a high-value community recreation asset.

- Groundwater recharge
  - LA study indicated that BMPs could produce benefit of additional groundwater supplies that have a 2005 value of $7.2 billion (Devinny et. al. (2005))

Menomonee River Green Infrastructure Project, Milwaukee, WI.
Photo Courtesy of MMSD.

Lancaster, PA Case Study

Collection & Treatment Savings:

- Using green infrastructure within CSS area is estimated to reduce stormwater inflow into sewer system by 700 MG and CSOs by more than 500 MG.
- Resulting estimated pumping and treatment savings of more than $660,000 annually.

Estimated Value of Avoided Costs for Wastewater Treatment & Storage at 25-Year Implementation*	
Reduced Pumping and Treatment Costs (per year)	$661,000
Reduced Gray Infrastructure Capital Costs	$120,000,000

*Benefits of green infrastructure stormwater reduction outside the CSS area were not included in this analysis

Syracuse War Memorial Arena

The War Memorial project is the first system in the country designed to use harvested rainwater (15,000 gallon cistern system) for a hockey rink and is one of only a handful around the world

Green Infrastructure Collaborative

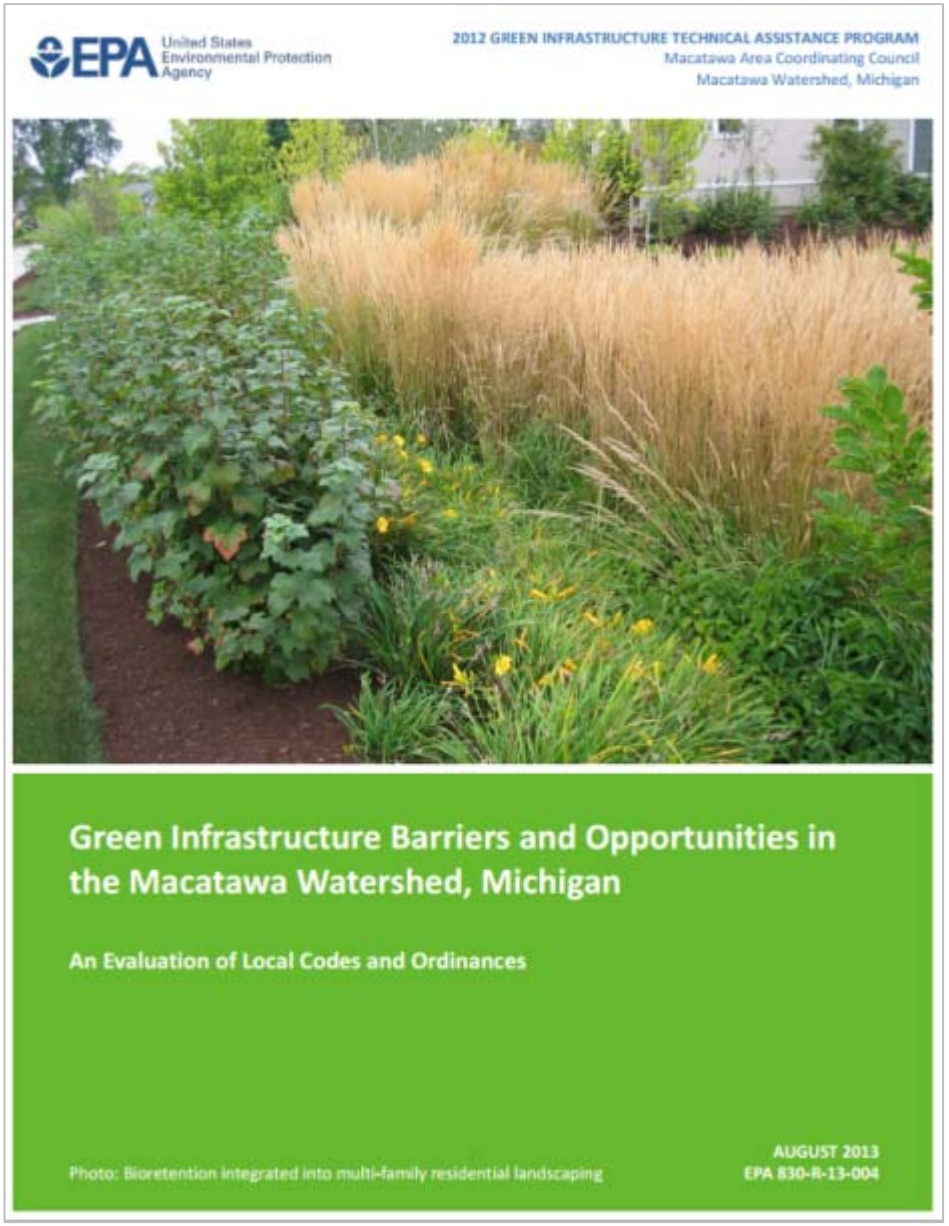
Federal Agency Support for the
Green Infrastructure Collaborative

- Federal letter of support introduced July 16, 2014
- Seven federal agencies identified activities that they will undertake to lead by example and promote local green infrastructure use.

http://water.epa.gov/infrastructure/greeninfrastructure/upload/Federal-Support-for-Green-Infrastructure-Collaborative_508.pdf

Green Infrastructure Technical Assistance

- More than $2 million provided to 39 communities
- 14 communities in 2014
- 3 resiliency projects:
  - Norfolk, VA – coastal flooding and sea level rise
  - Iowa City, IA – riverfront park options to manage flooding
  - Santa Monica, CA – rainwater harvesting for public park irrigation




Thank you.
US EPA Green Infrastructure Program:
www.epa.gov/greeninfrastructure

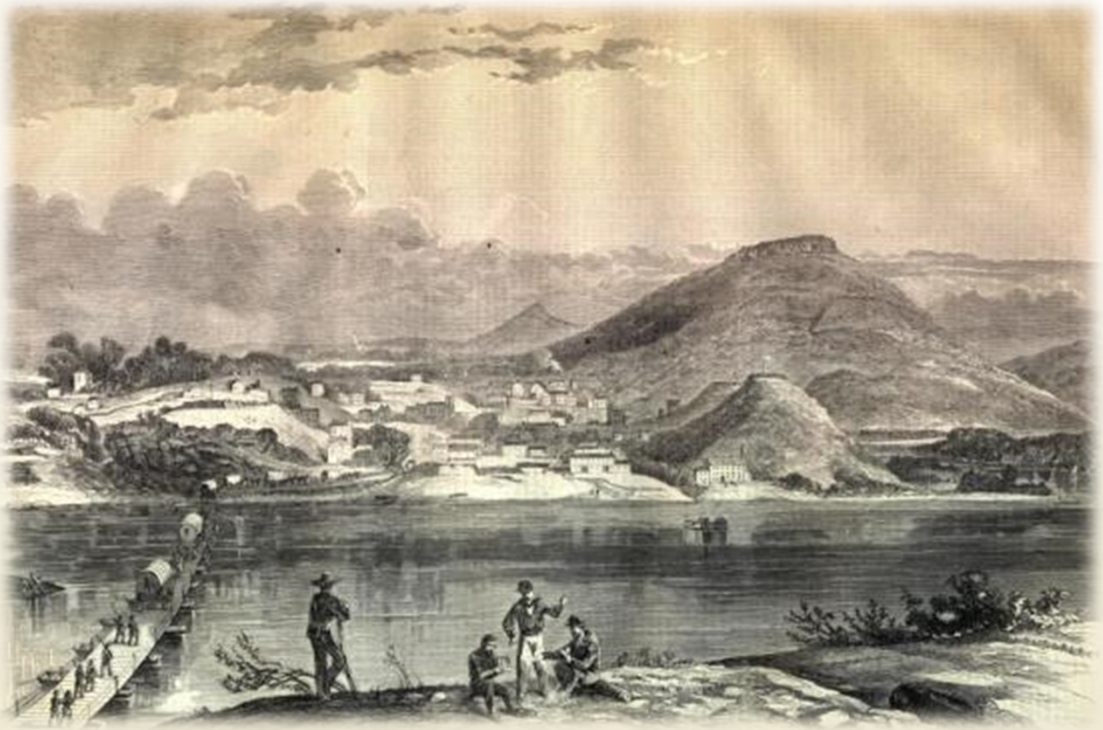
City of Chattanooga

Sustainable Stormwater Utility

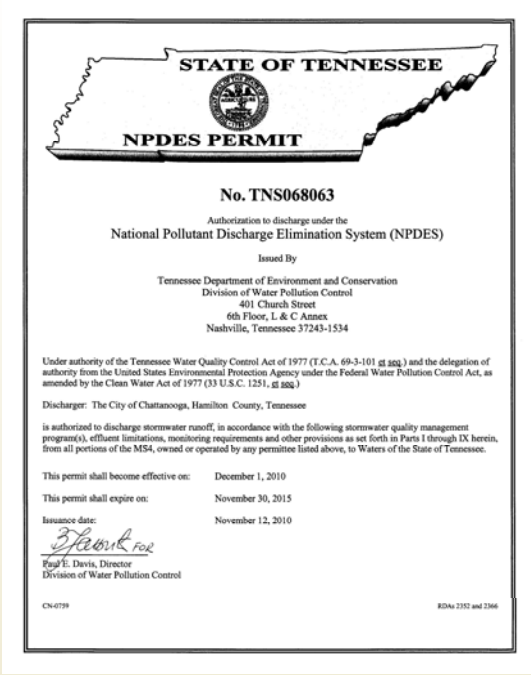
NACWA Webinar

September 16, 2014

Purpose



City of Chattanooga - 1863



STATE OF TENNESSEE

NPDES PERMIT

No. TNS068063

Authorization to discharge under the
National Pollutant Discharge Elimination System (NPDES)

Issued By

Tennessee Department of Environment and Conservation
Division of Water Pollution Control
401 Church Street
6th Floor, L & C Annex
Nashville, Tennessee 37243-1534

Under authority of the Tennessee Water Quality Control Act of 1977 (T.C.A. 69-3-101 et seq.) and the delegation of authority from the United States Environmental Protection Agency under the Federal Water Pollution Control Act, as amended by the Clean Water Act of 1977 (33 U.S.C. 1251, et seq.)

Discharger: The City of Chattanooga, Hamilton County, Tennessee

is authorized to discharge stormwater runoff, in accordance with the following stormwater quality management program(s), effluent limitations, monitoring requirements and other provisions as set forth in Parts I through IX herein, from all portions of the MS4, owned or operated by any permittee listed above, to Waters of the State of Tennessee.

This permit shall become effective on: December 1, 2010

This permit shall expire on: November 30, 2015

Issuance date: November 12, 2010

Paul E. Davis, Director
Division of Water Pollution Control

CN-0759 RDAs 2352 and 2366

Outline

- Chattanooga SW Utility Evolution
- Current Utility Credit Program
- Public Private Partnership (P3) Initiative
- LID Excellence Award / LID Design Challenge
- New Land Development Standards /
- Proposed Incentives

Water Quality Fee

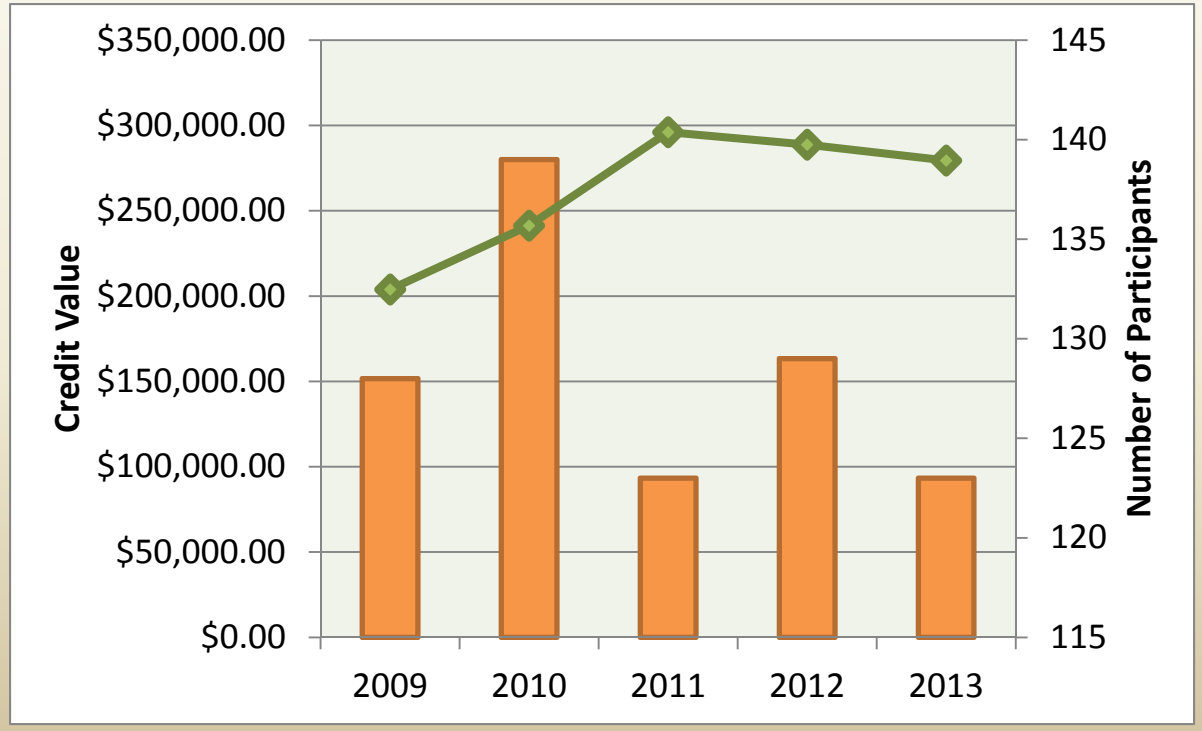
- 1993
  - Landuse based fee
- 2009
  - Impervious area based fee
    - Equivalent Residential Units
      - 1 ERU = 3,200 ft^2
    - $115.20 per ERU
    - 5 yr phase in period
  - Example
    - 34,569 ft^2 = 10.8 (11) ERUs
    - 11 ERUs x $115.20 = $1,267.20 annual WQ Fee

Current Credit System

- Credits
  - Non-Residential users with ≥3 ERUs
  - Based on Type of BMP
  - Credit Cap
    - 65% for non-LID
    - 75% for LID
    - 85% for retrofits
  - Requirements
    - Inspection & Maintenance (yearly)

Current Credit System

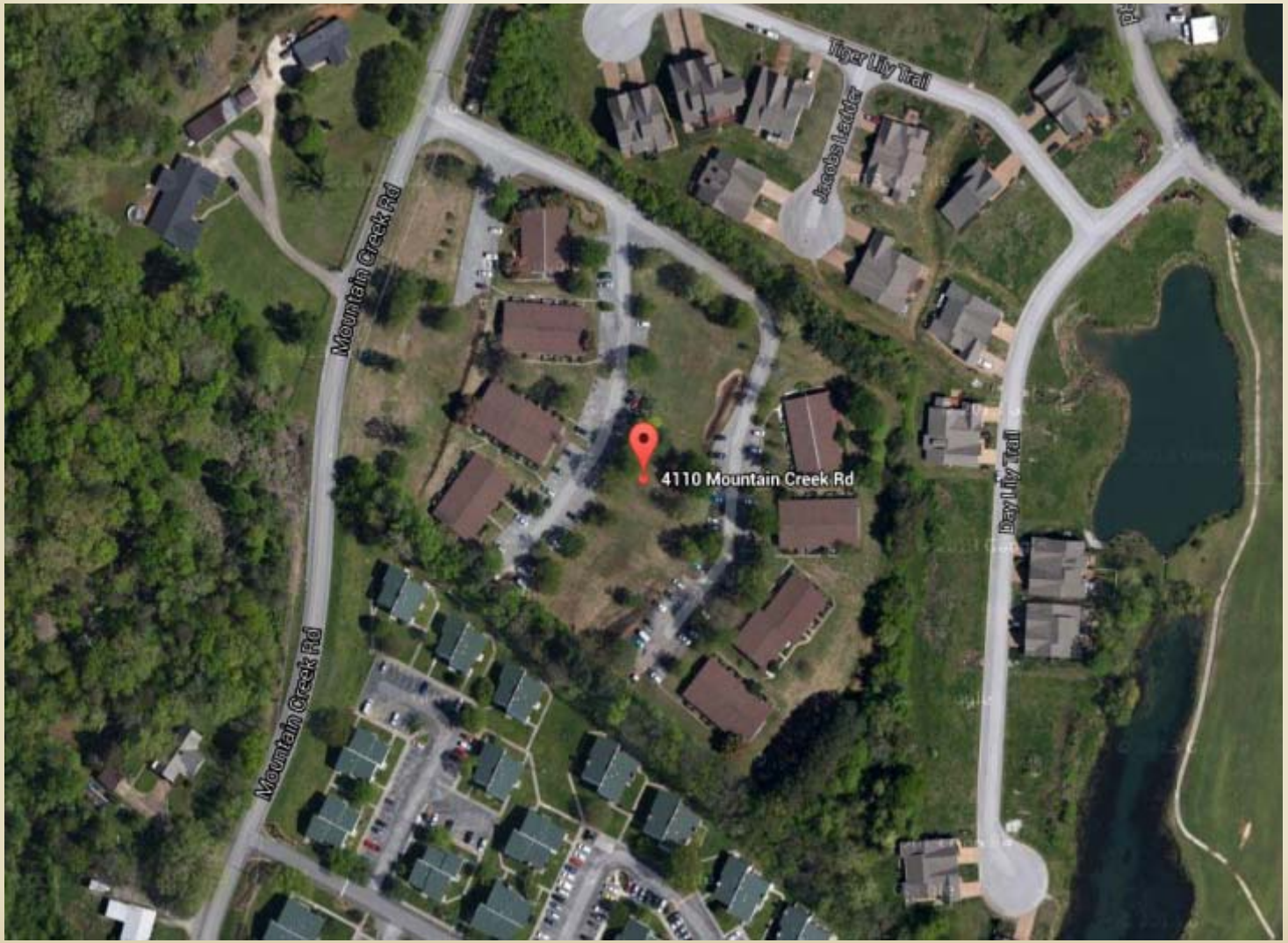
- Utility Credit Participation Rates
  - National average < 0.5%
  - Chattanooga average ≈ 2%



Retrofit Case Study: Apartment Buildings

14 ERUs (44,800 SF of impervious)

Received 85 % reduction in WQ Fee ($3,500 annually)



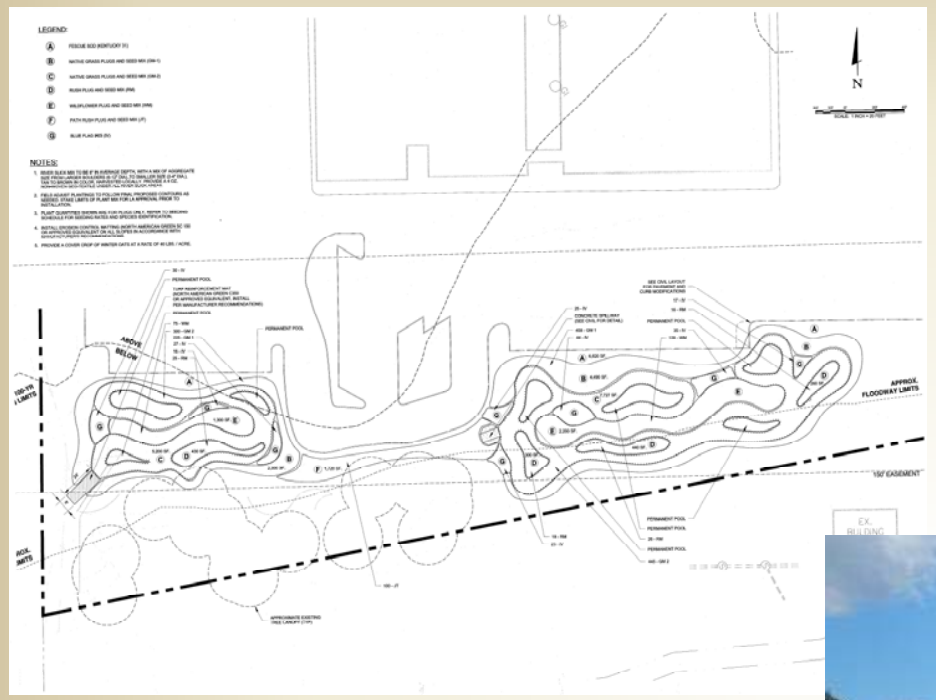
Retrofit Case Study: Installed 3 Rain gardens

Retrofit Case Study: Commercial Office Buildings

36 ERUs (115,200 SF of impervious)

Received 85 % reduction in WQ Fee ($14,500 annually)

Retrofit Case Study: Commercial Office Buildings
Installing Wetlands

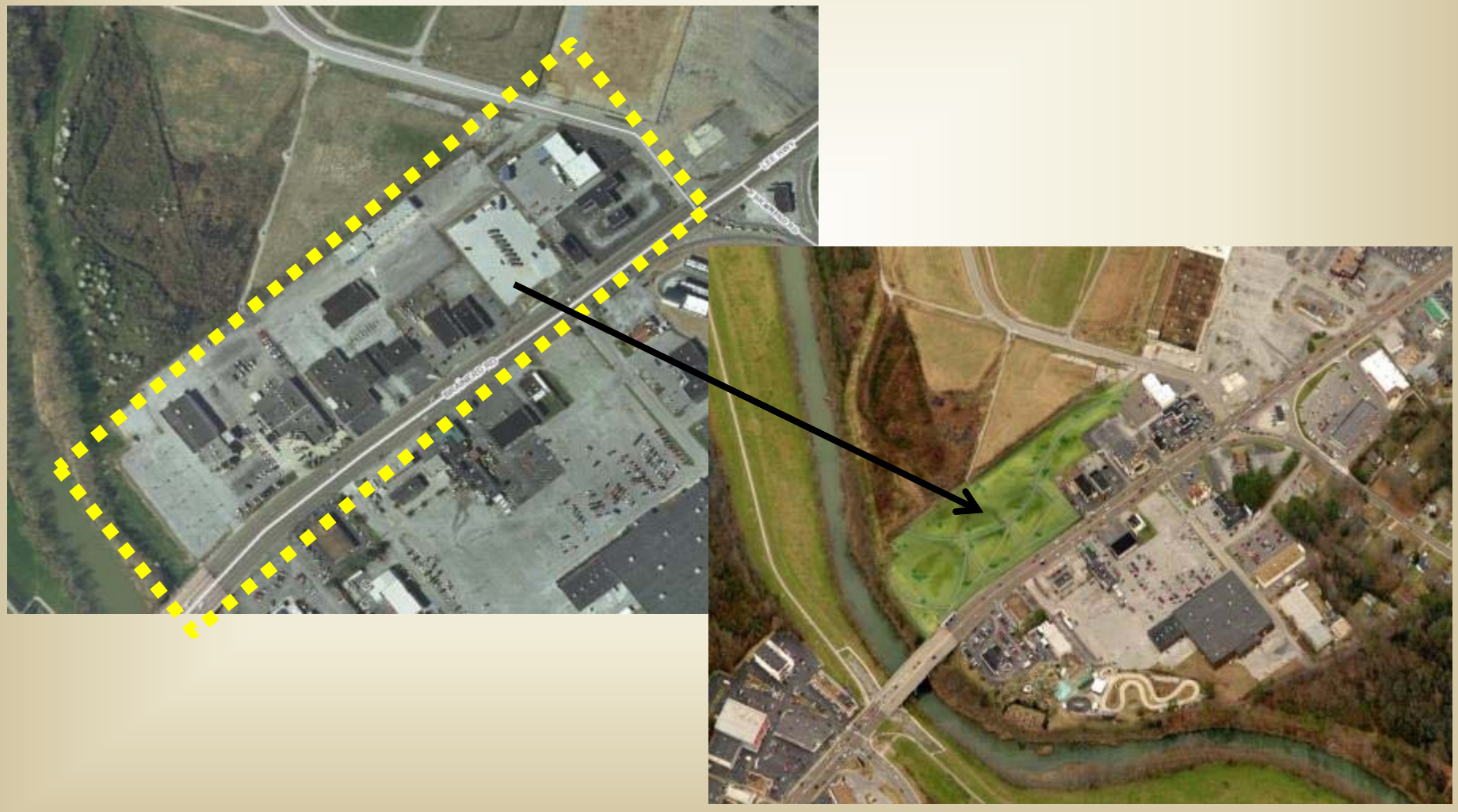


Public Private Partnerships

- The collaboration among various entities has been driven by:
  - A need for infrastructure improvement
  - An increasing stormwater fee
  - A need to offer alternative green solutions
  - Educating on the multiple benefits of green infrastructure, and
  - The need to increase awareness of the importance of green infrastructure.

Public Private Partnerships – Case Study 1

- Brainerd Ave
  - Revitalization of a commercial mid-town



Public Private Partnerships – Case Study 1

Property Transformation

- Regrading
- Soil Amendment
- Veg. Cover
- Interconnected Bioretentions

Public Private Partnerships – Case Study 1

NORMAL PARK
MUSEUM MAGNET

- Historic campuses serving over 800 K-8th grade students
- No stormwater controls onsite

- Community Value
  - Educational component to school curriculum
  - Aesthetically pleasing site
- Water Quality Benefit
  - Groundwater recharge
  - Pollutant Removal
  - Decrease in peak discharge and volume

Public Private Partnerships – Case Study 1

- Normal Park School Partners:
  - City of Chattanooga
  - Hamilton County
  - Tennessee Valley Authority (TVA)
  - Belgard Hardscape
  - AquaShield, Inc.
  - 5 Contractors Provided In-Kind Contributions

Public Private Partnerships – Case Study 2

- Johnson Street
  - Commercial redevelopment and roadway improvement within CSO
    - Traditional pavement section with new SW Infrastructure estimated at $325,000+ and included no WQ or Peak Flow improvements
    - GI design conceived to benefit neighborhood, traveling public, and environment with:
      - Pedestrian & Bicycle Access
      - LEED Certified Buildings
      - Improved SW Quality
      - CSO Reduction

2014 Governor's Environmental Stewardship Award for Green Building

LID Excellence Award

- Awards given to existing LID sites

2nd Place:
$2,000
Jarnigan Medical Center

1st Place:
$10,000
The Crash Pad

LID Design Challenge

- Goals
  - Test City's new RMG
  - Demonstrative cost effectiveness of LID
  - Present real world design challenges
  - Raise awareness about GI & City's new standards

http://vimeo.com/105672772

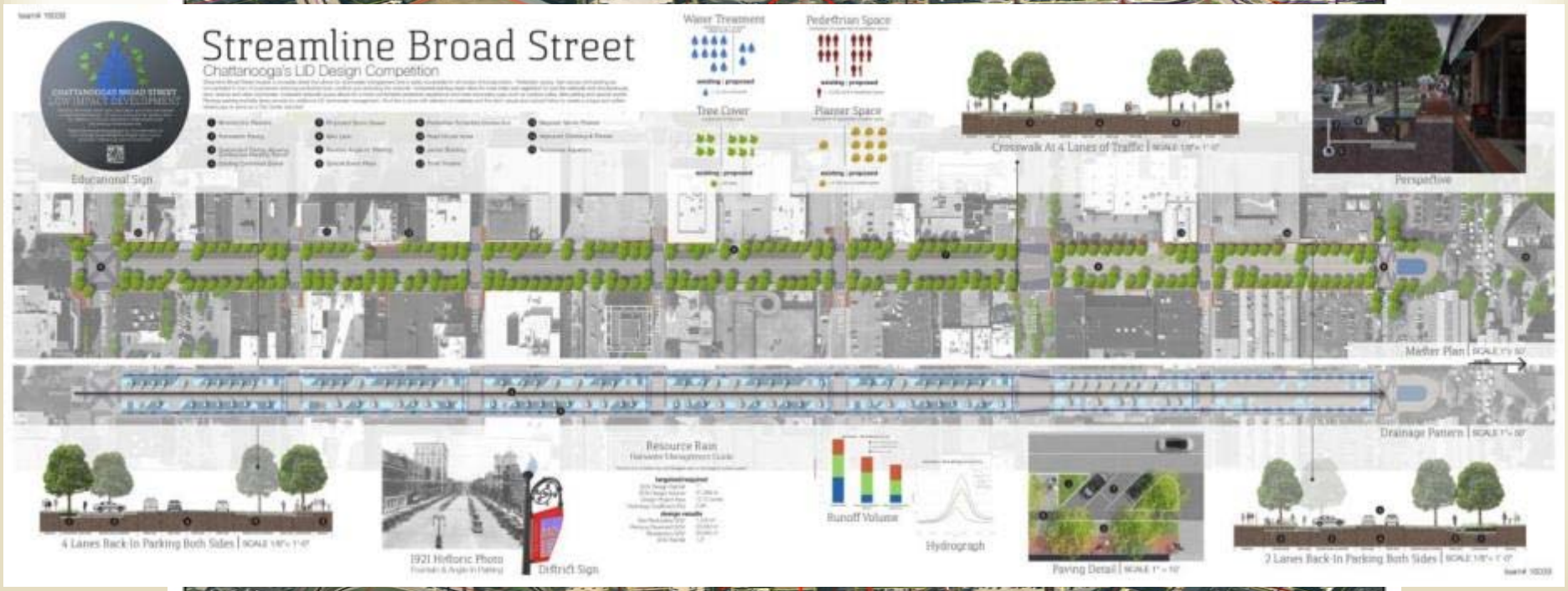
LID Design Challenge

- Categories
  - Cherokee Boulevard
    - Urban arterial connector
  - Northgate Mall
    - 2nd largest retail center in Chattanooga
  - Broad Street
    - Central thoroughfare within the CSO
  - Bonny Oaks Drive
    - Mixed-use/Multi-family development
- Awards
  - 1st Place: $10,000
  - 2nd Place: $3,000
  - 3rd Place: $1,000
  - People's Choice: $2,000

Cherokee Boulevard

Northgate Mall

Broad Street



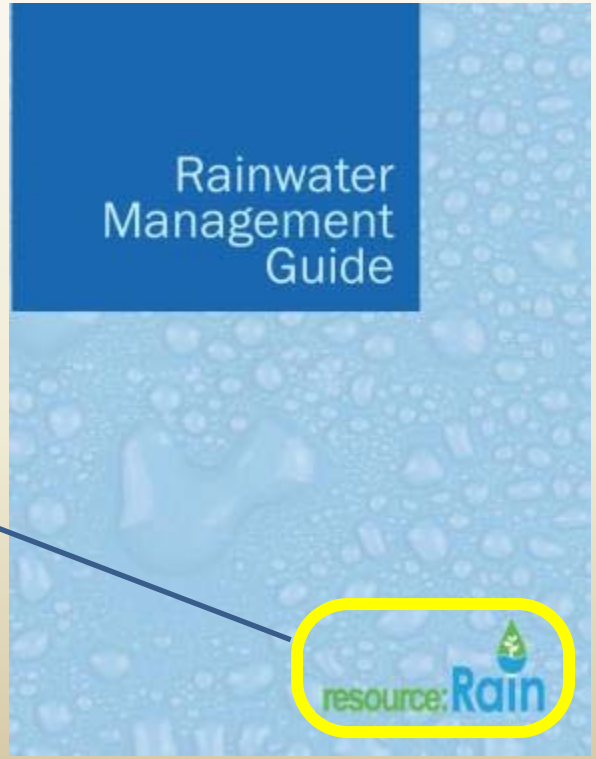
Bonny Oaks Drive

New Development Standards

- Permit states that the City must *"Develop design standards for all new and redevelopment… designed, built, and maintained to infiltrate, evapotranspire, harvest, and/or use, at a minimum, the* ***first inch of rainfall****,* ***with no discharge to surface water****".*

Stay-On-Volume (SOV)

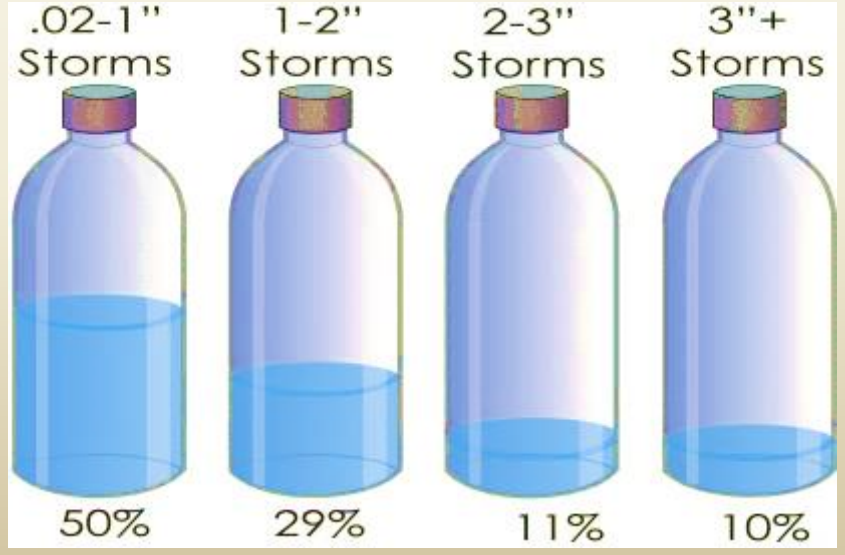
Resource!



Rainfall & Runoff Volume

Annual Rainfall for Chattanooga, TN = 52 inches per year

Storm Depth	Number of Events	Event Frequency	Precipitation Volume (in)	Annual Precip. Volume (in/yr)	% Rainfall Volume	% Runoff Volume
0.02" - 1"	4471	86%	1224.8	26.08	50%	35%
1" - 1.6"	439	8%	550.9	11.73	22%	20%
0.02" - 1.6"	4910	94%	1775.7	37.81	72%	55%



Program Comparisons

- Current System
  - Credits (discounts) only
  - Annual discounts to the water quality fee
    - 5%-85% discount
  - Not volume based (i.e. doesn't align with RMG)
    - BMP Based
  - No mitigation credits
  - No offsite mitigation
  - No In-lieu-fee element
  - Credits given for meeting a standard (or less)
- Proposed Program
  - Credits & Incentives
  - Annual discounts to the water quality fee
    - 10%-80% discount
  - Volume based (i.e. SOV exceedance)
    - Performance Based
  - Mitigation Credits
  - Offsite Mitigation
  - In-lieu-fee Established
  - Credits given for exceeding a standard

Questions?

Mounir Minkara
Water Quality Manager
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Building Climate Resilient Communities with Water-Smart Policies and Funding

Ben Chou

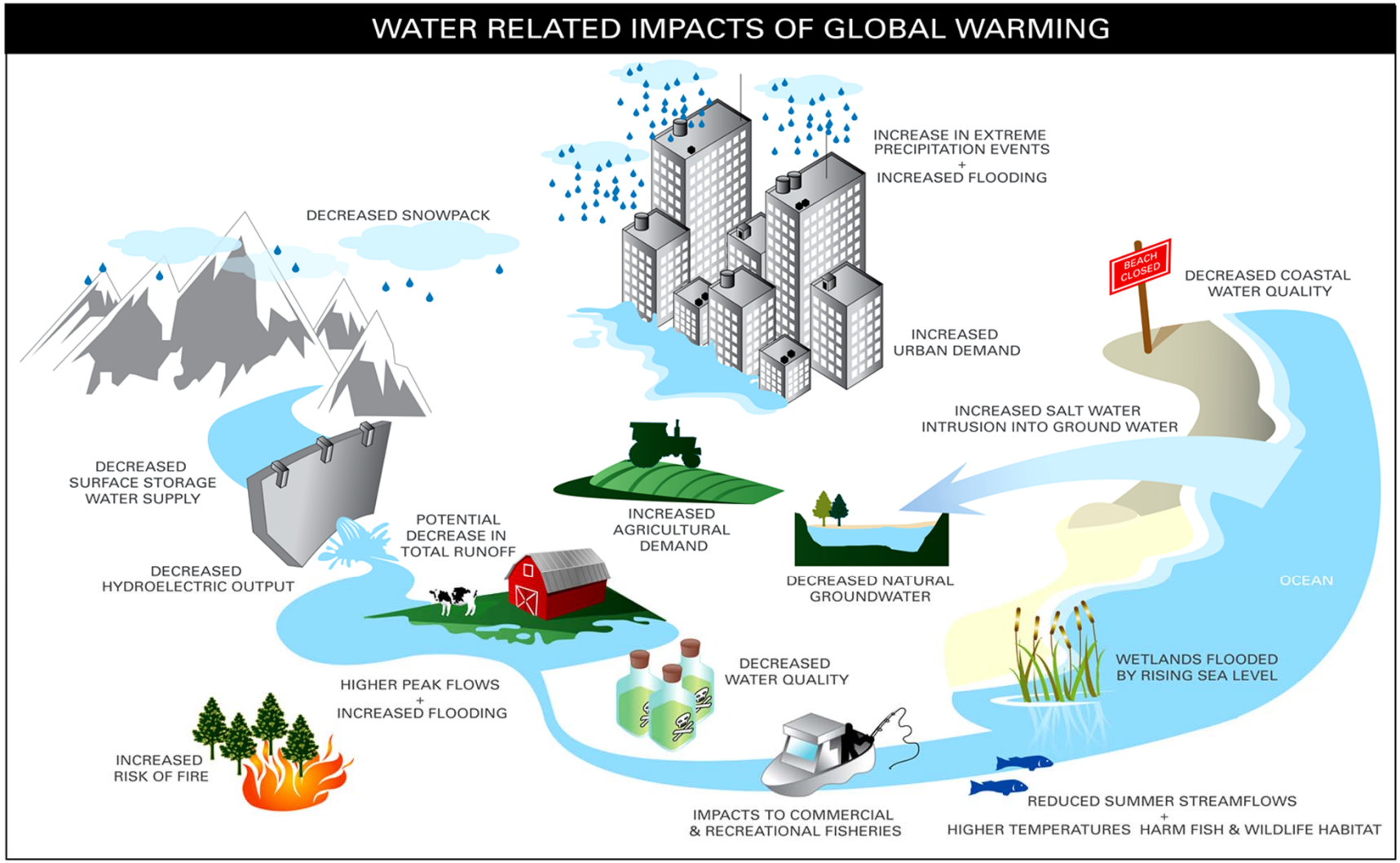
NRDC Water Program

NACWA Utility of the Future Series

Web Seminar 2

September 16, 2014

Why do communities need to prepare?



Sewage + Stormwater:
Combined Sewer Overflow

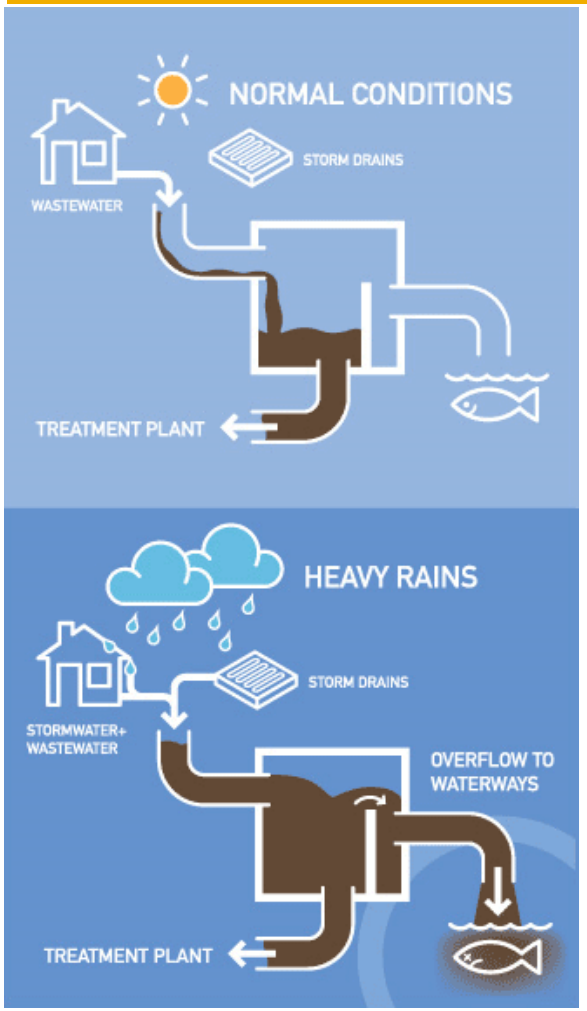


Image: Seattle Public Utilities

Newtown Creek, New York City
Image: Riverkeeper

Urban Stormwater Runoff: *Pollution*

Ballona Creek, Los Angeles (California Coastal Commission)

Los Angeles River (City of Los Angeles)

Water Infrastructure Needs

Photo Credit: Jaime Moore

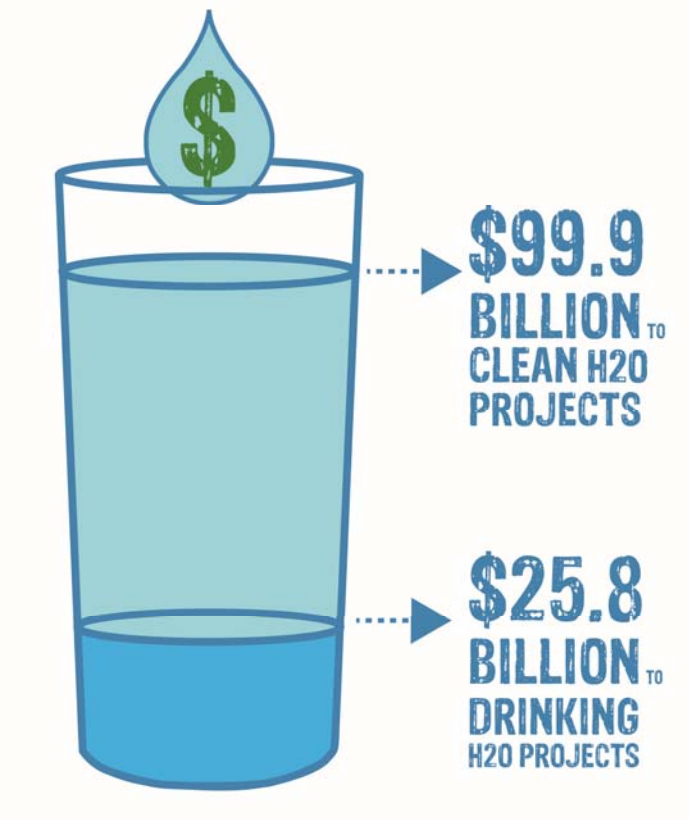
- **ASCE gives nation's drinking water and wastewater infrastructure a grade D**
- **More than $630 billion needed over next 20 years**
- **NACWA and AMWA estimate additional $448 to $944 billion needed by 2050 to prepare for climate change**

Using SRFs to Support Climate Resilience

- http://www.nrdc.org/globalwarming/state-revolving-funds.asp

What are the SRFs?

- Clean Water SRF and Drinking Water SRF
- Managed by the states but capitalized through federal funds and required state match
- Loan repayments and interest returned to fund
- More than $125 billion in low-interest loans and grants to communities



NRDC Policy Recommendations

- SRFs can better support and encourage projects that incorporate
  - Water Conservation and Efficiency
  - Green Infrastructure
  - Flood Resiliency

Photo Credit: Gregory P. Smith

Integrating Water Efficiency into SRFs

Photo Credit: Paul Schattenberg

- Promote eligibility of water conservation plans, projects, programs for funding
- Require utilities to adopt water conservation plans, policies, programs as condition of funding
- Projects evaluate/include water conservation measures
- Ensure infrastructure designs incorporate declining per capita water demand

Water Efficiency: Local Strategies

- Indoor:
  - Water efficient fixtures & appliances
  - Rebates, consumer incentives, direct replacement, ordinances
  - Graywater/blackwater reuse
  - Improved metering
  - Pricing

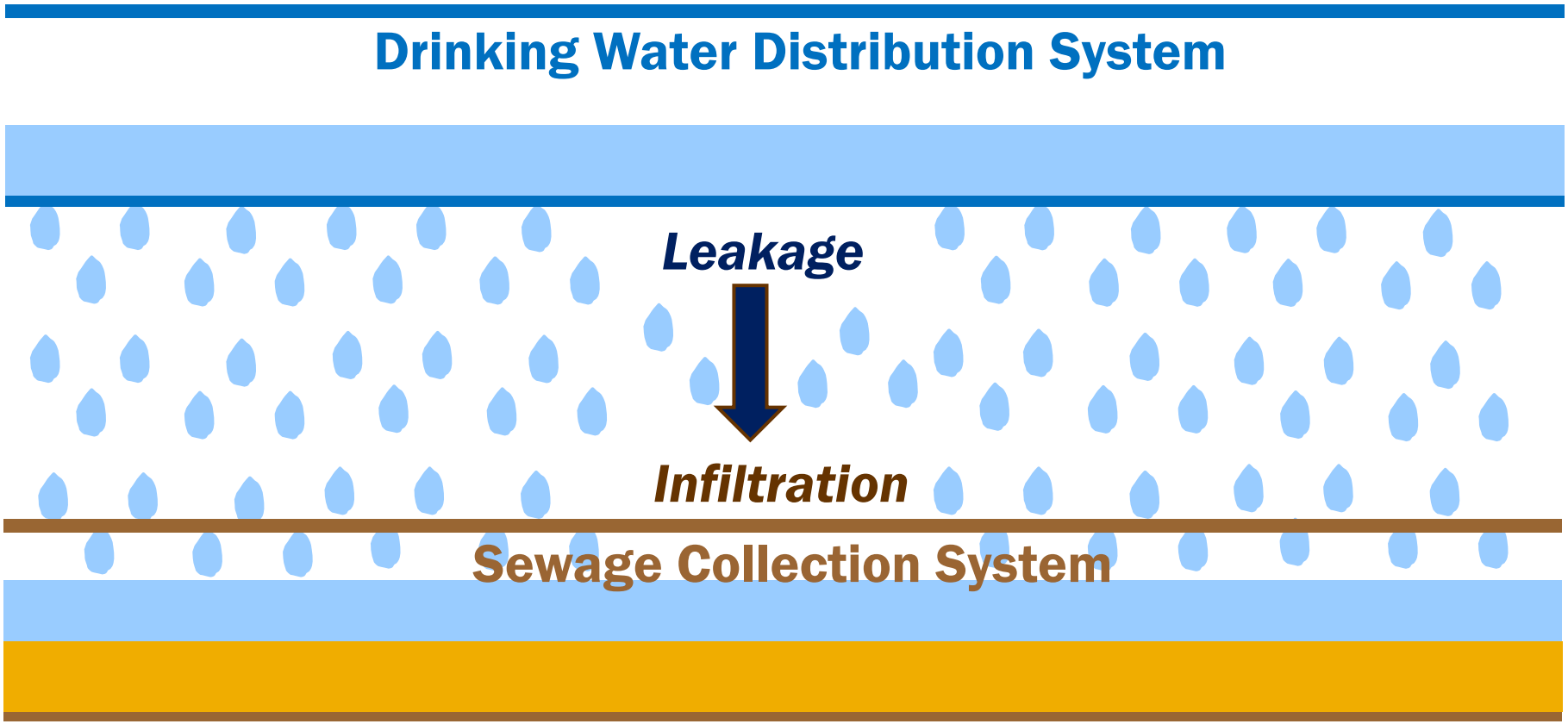
- Distribution system:
  - Annual water loss audits
  - Leak repair
- Outdoor:
  - Green infrastructure policies and programs
  - Graywater/rainwater use for landscape irrigation

Water Efficiency = Clean Water Goals

- **Reduce Indoor Water Use:**
  - Reduce strain on sewage collection/treatment systems
  - Improve pollution control performance (wet weather & dry weather)
  - Reduce compliance costs (capital and O&M)

- **Reduce Outdoor Water Use & Enhance Groundwater Supply:**
  - Native landscapes & rainwater harvesting are "green" stormwater infrastructure
  - Regional groundwater recharge facilities capture runoff

Water Efficiency = Clean Water Goals
Leak Detection & Repair



Water Efficiency = Clean Water Goals
Right-Sizing Infrastructure

- U.S. per-capita/household indoor usage declining:
  - Fixture/appliance efficiency standards
  - WaterSense market share
- Existing/planned local conservation efforts:
  - 25% of 328 drinking water utilities nationwide predict at least a 15% reduction in demand
  - 6.5 % utilities predict 30% or more in reduction

Don't over-build wastewater infrastructure based on outdated demand assumptions

Water Efficiency = Clean Water Goals
Local Examples

- **San Antonio :**
  - Conservation program has allowed the city to avoid up to $2.7 billion in additional water supply costs
  - Also avoided $1 billion in expanded wastewater treatment capacity costs
- **Los Angeles:**
  - Motivated by pressure on wastewater & water supply
  - Fixture retrofits in existing buildings and “ultra-low flush” toilets in all new buildings
  - Maintained water use level as pop. surged by 1 million
  - Large-scale stormwater capture and infiltration planned to reduce polluted runoff
- **New York:**
  - Rebates and regulations used to promote water-efficient toilets
  - Deferred billions in wastewater treatment expansion, by reducing dry-weather flows by 17% over five years
  - Future water conservation gains will reduce 1.7 billion gallons (or 8%) of annual sewage overflow

Integrating Green Infrastructure into SRFs

Photo Credit: Dan Reed

- Prioritize GI projects
- Sewer overflows and stormwater management projects evaluate/implement GI
- Promote eligibility of GI projects and programs
- Set aside dedicated funding for GI projects

Examples - Green Infrastructure

- Higher Priority Scoring
  - Kentucky, Indiana, Kansas, Maine, New Hampshire
- Dedicated grant programs
  - Illinois
  - New York

Rain gardens - Aurora, IL

Downspout Disconnection – Syracuse, NY

Reducing Flood Risks for SRF Projects

Photo Credit: Chris Bentley

- Promote eligibility of flood protection measures
- Avoid infrastructure projects in the 500-year floodplain
- Require protection against the 500-year flood or highest historical flood event
- Require coastal projects to consider SLR-related risks
- Use natural/green infrastructure solutions

Examples – Flood Resiliency

- New Jersey
  - Avoid 500-year floodplain or protect against 500-year flood level by elevating or floodproofing
- Priority scoring
  - Missouri, Virginia
- Consideration of sea level rise & coastal flooding
  - California, Maryland

Photo Credit: Augie Ray

Water Resources Reform and Development Act (WRRDA) of 2014

- Projects required to maximize water use efficiency and reuse and energy efficiency beginning FY 2016
- Stormwater management, wastewater recycling, water conservation measures now explicitly eligible for SRF support
- Water efficiency and stormwater management projects eligible for "additional subsidization"
  - Principal forgiveness
  - Negative-interest loans
  - Grants

Full Reports Available Online:

- ***Using State Revolving Funds to Build Climate-Resilient Communities***

www.nrdc.org/globalwarming/state-revolving-funds.asp

- ***Waste Less, Pollute Less: Using Urban Water Conservation to Advance Clean Water Act Compliance***

www.nrdc.org/water/clean-water-act-urban-conservation.asp

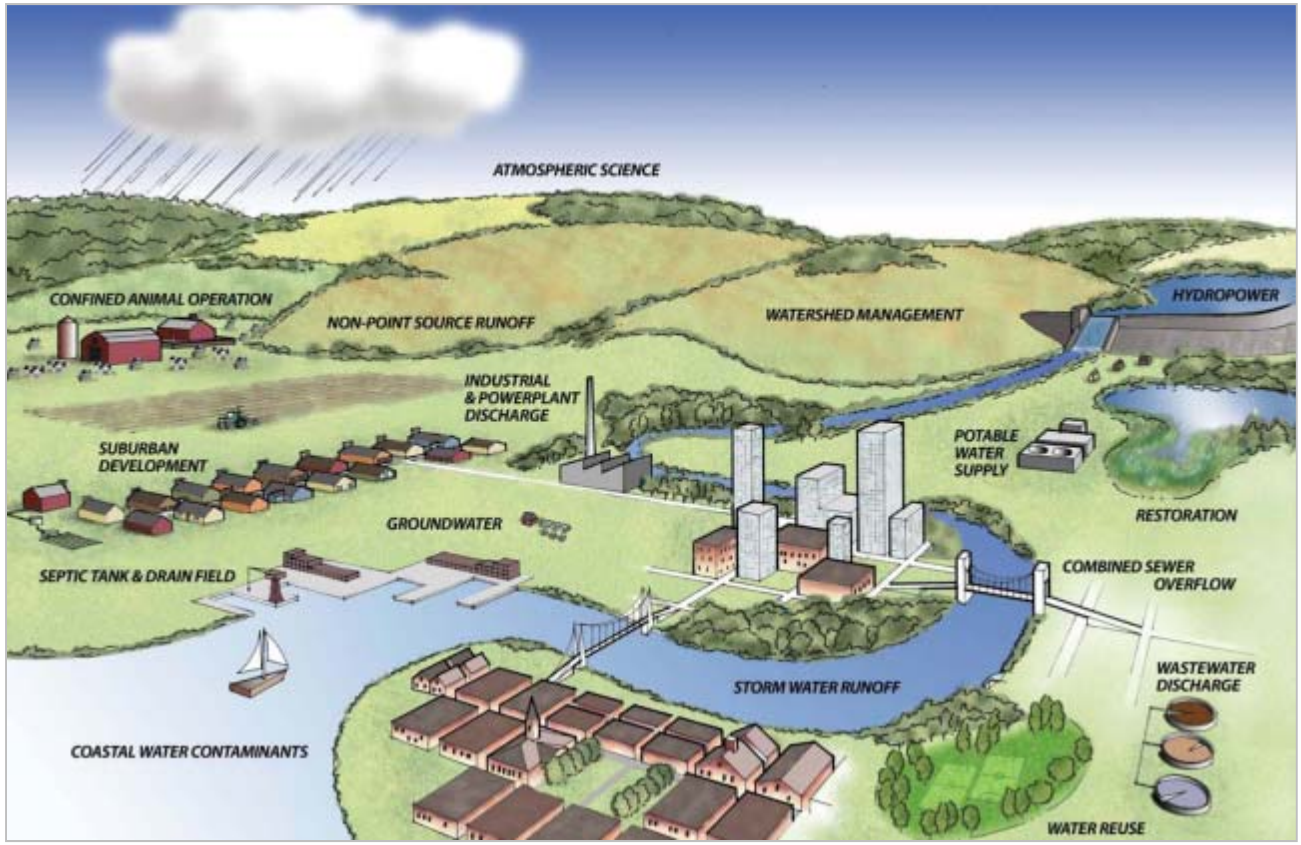
Questions?

- **Ben Chou, Policy Analyst**
  - bchou@nrdc.org
  - 310-434-2300

Green Infrastructure: A Planning Approach in the Regulatory Context

Land Use, Climate, and Wet Weather Discharges

- Hydrologic Changes
  - Land use patterns
  - Higher intensity rain
- Flooding and other quality of life issues
- Effect felt in programs to address to wet weather
  - CSOs
  - SSOs
  - MS4



Federal v. Municipal Control of Land Use

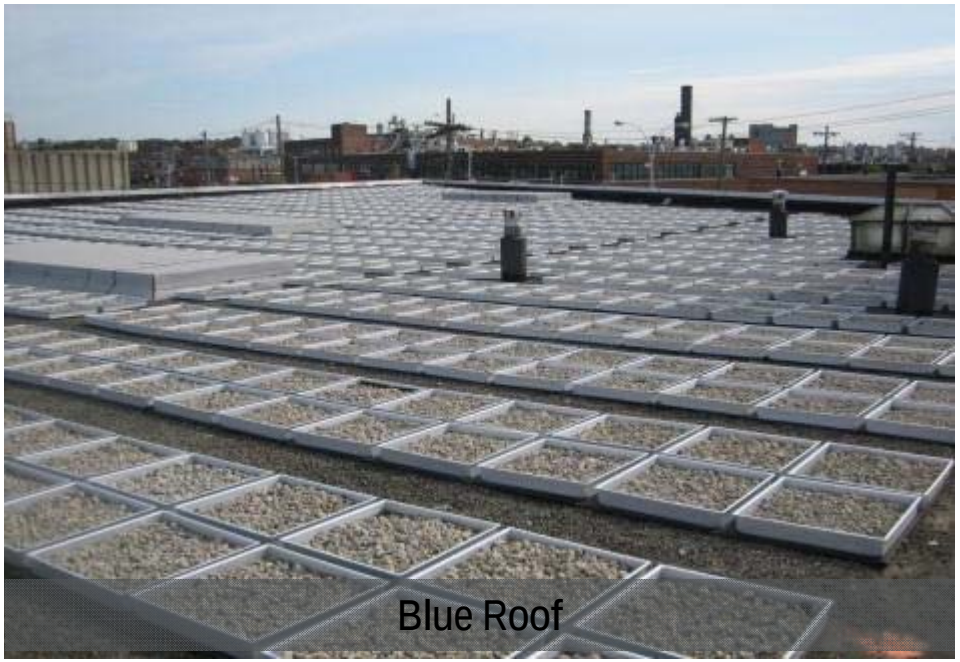
EPA Stormwater Rulemaking
Deferred Indefinitely (March 2014 Update)

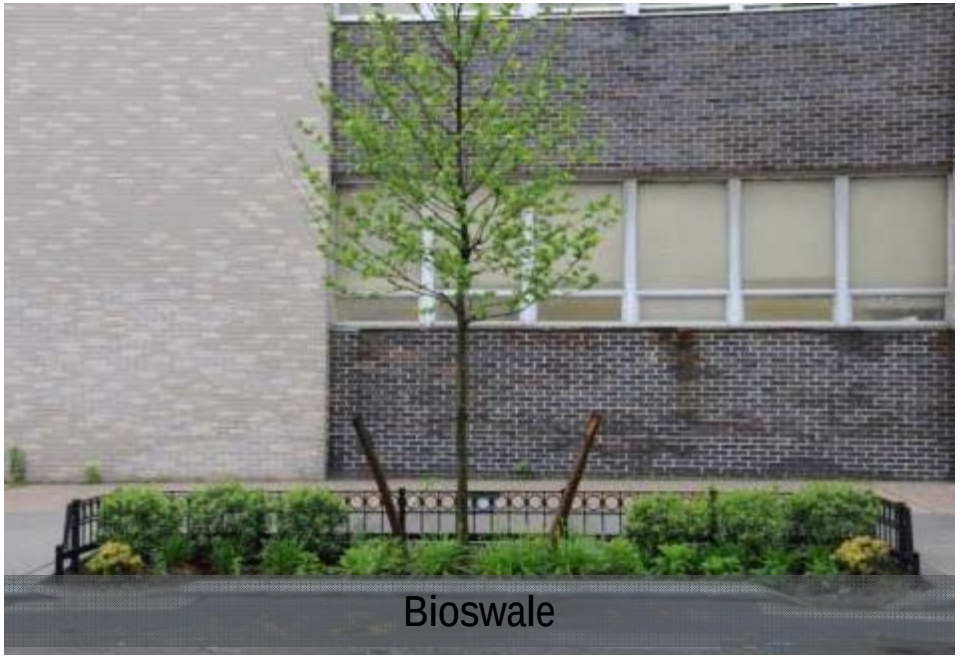
- "EPA is updating its stormwater strategy to focus now on pursuing a suite of immediate actions to help support communities in addressing their stormwater challenges and deferring action on rulemaking to reduce stormwater discharges from newly developed and redeveloped sites or other regulatory changes to its stormwater program."

- "EPA will provide incentives, technical assistance, and tools to communities to encourage them to implement strong stormwater programs; leverage existing requirements to strengthen municipal stormwater permits; and continue to promote green infrastructure as an integral part of stormwater management."

Green Infrastructure Addresses Root Causes


Green Roof


Blue Roof


Bioswale


Porous Pavement

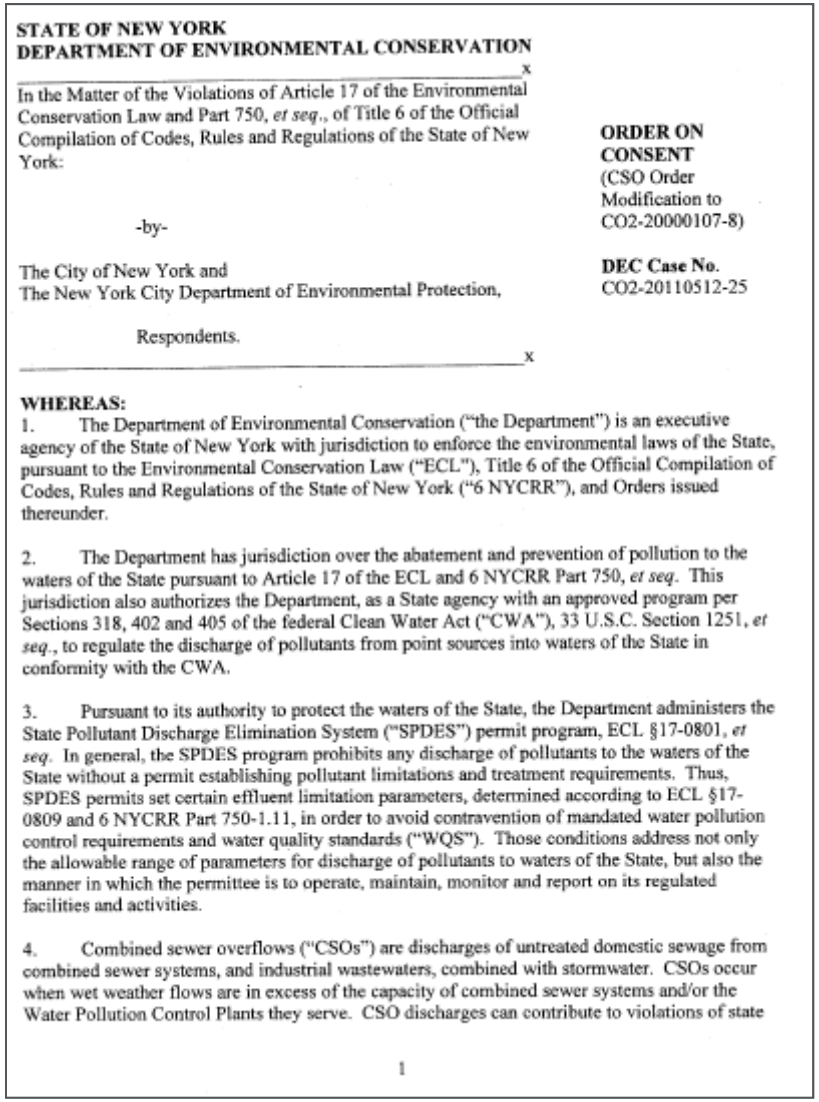
NYC CSO Consent Decree Modification (2012)

Benefits

- $1.4 billion in savings from substituted green and grey infrastructure
- $2 billion in grey infrastructure deferred

Key elements

- Over $187 million in green infrastructure through 2015
- 3 neighborhood scale pilot projects to be monitored
- 5 year milestones and overall commitment to managing 10% of CSS area for 1” storm by 2030
- Adaptive management structure



STATE OF NEW YORK
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

In the Matter of the Violations of Article 17 of the Environmental Conservation Law and Part 750, *et seq.*, of Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York:

ORDER ON CONSENT
(CSO Order Modification to CO2-20000107-8)

-by-

The City of New York and
The New York City Department of Environmental Protection,

Respondents.

DEC Case No.
CO2-20110512-25

WHEREAS:

1. The Department of Environmental Conservation (“the Department”) is an executive agency of the State of New York with jurisdiction to enforce the environmental laws of the State, pursuant to the Environmental Conservation Law (“ECL”), Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York (“6 NYCRR”), and Orders issued thereunder.

2. The Department has jurisdiction over the abatement and prevention of pollution to the waters of the State pursuant to Article 17 of the ECL and 6 NYCRR Part 750, *et seq.* This jurisdiction also authorizes the Department, as a State agency with an approved program per Sections 318, 402 and 405 of the federal Clean Water Act (“CWA”), 33 U.S.C. Section 1251, *et seq.*, to regulate the discharge of pollutants from point sources into waters of the State in conformity with the CWA.

3. Pursuant to its authority to protect the waters of the State, the Department administers the State Pollutant Discharge Elimination System (“SPDES”) permit program, ECL §17-0801, *et seq.* In general, the SPDES program prohibits any discharge of pollutants to the waters of the State without a permit establishing pollutant limitations and treatment requirements. Thus, SPDES permits set certain effluent limitation parameters, determined according to ECL §17-0809 and 6 NYCRR Part 750-1.11, in order to avoid contravention of mandated water pollution control requirements and water quality standards (“WQS”). Those conditions address not only the allowable range of parameters for discharge of pollutants to waters of the State, but also the manner in which the permittee is to operate, maintain, monitor and report on its regulated facilities and activities.

4. Combined sewer overflows (“CSOs”) are discharges of untreated domestic sewage from combined sewer systems, and industrial wastewaters, combined with stormwater. CSOs occur when wet weather flows are in excess of the capacity of combined sewer systems and/or the Water Pollution Control Plants they serve. CSO discharges can contribute to violations of state

1

Keys to Success

Acceptance by stakeholders

- Proactive communication
- Sound economics
- Co-benefits

Acceptance by regulators

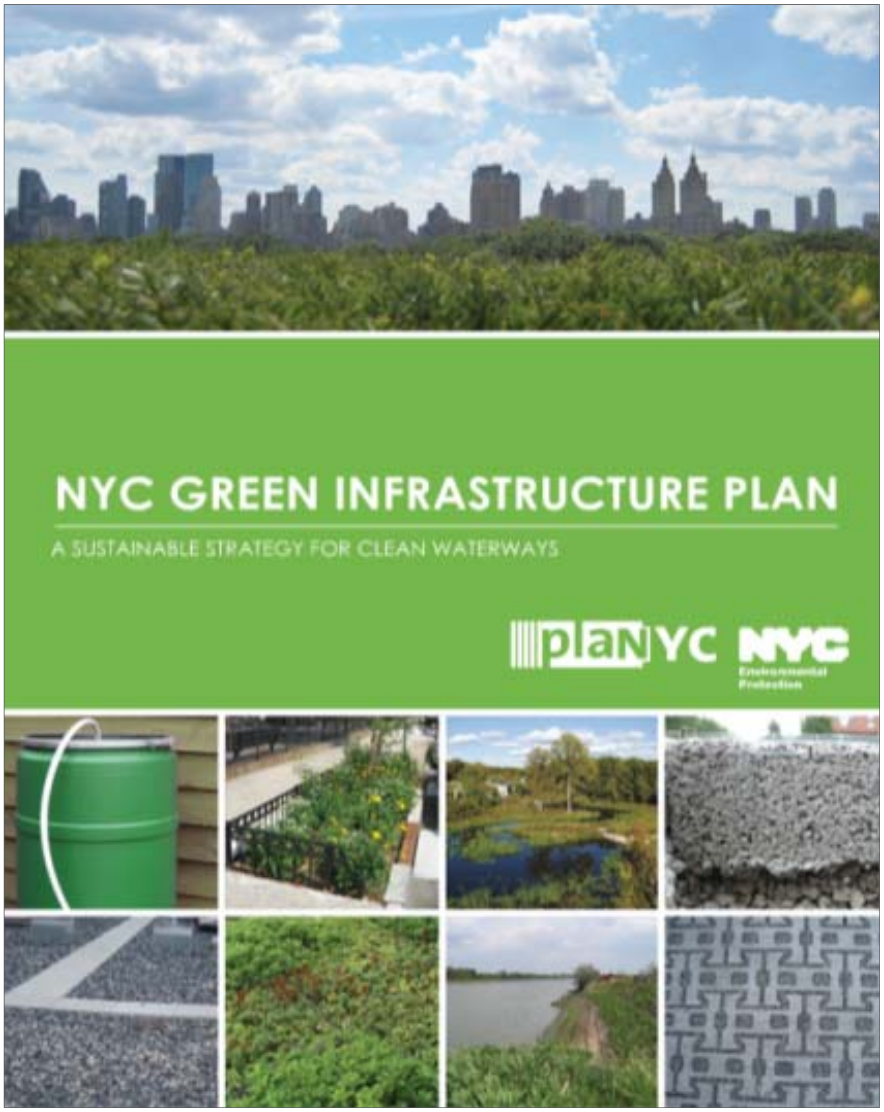
- Proactive communications
- Sound science (baseline data, monitoring, modeled alternatives)
- Strong commitment
- Feedback mechanisms

Foundations of a Watershed Planning Approach

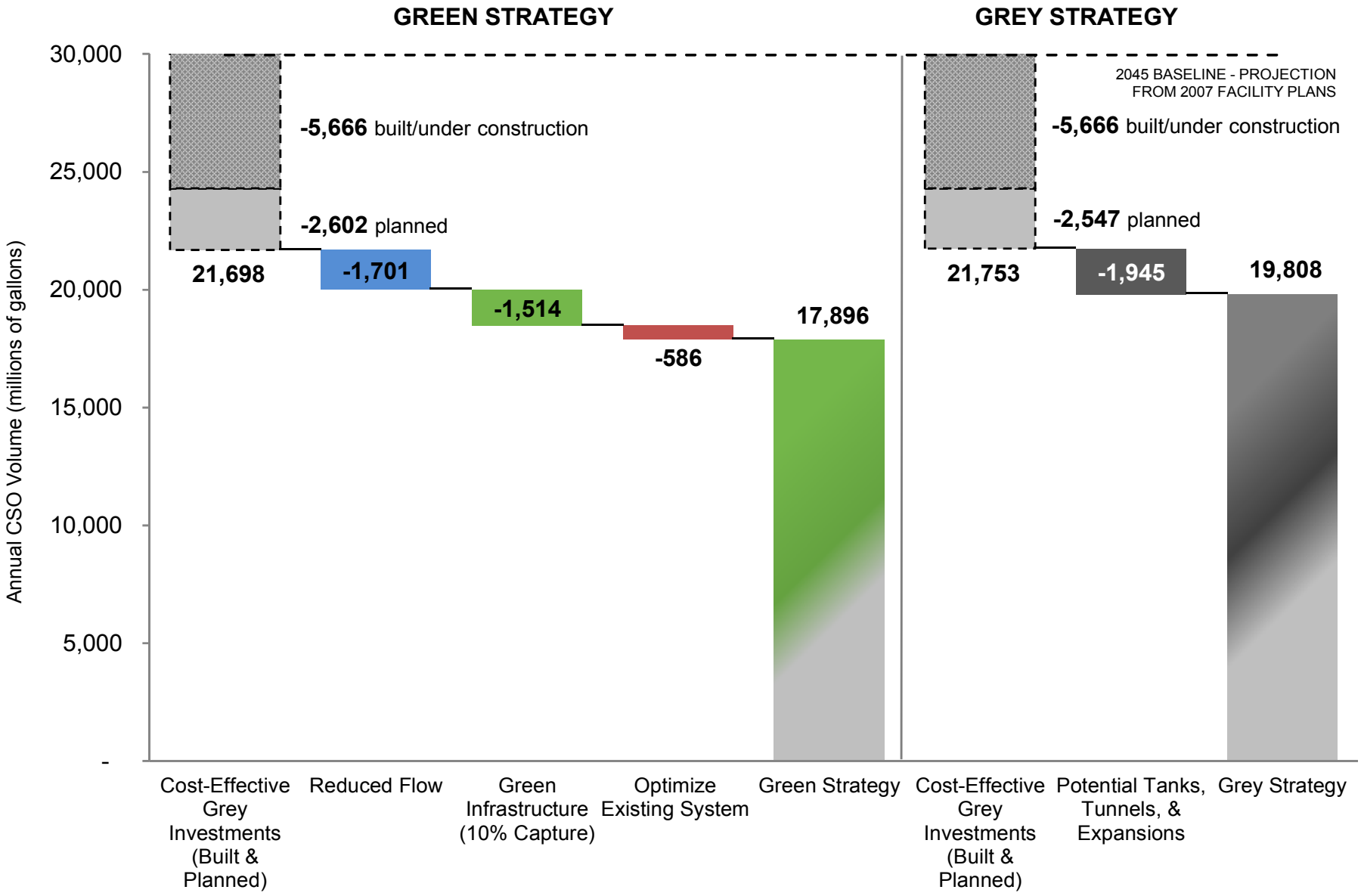
NYC Source Water
Protection Program

NYC Bluebelts
Stormwater System

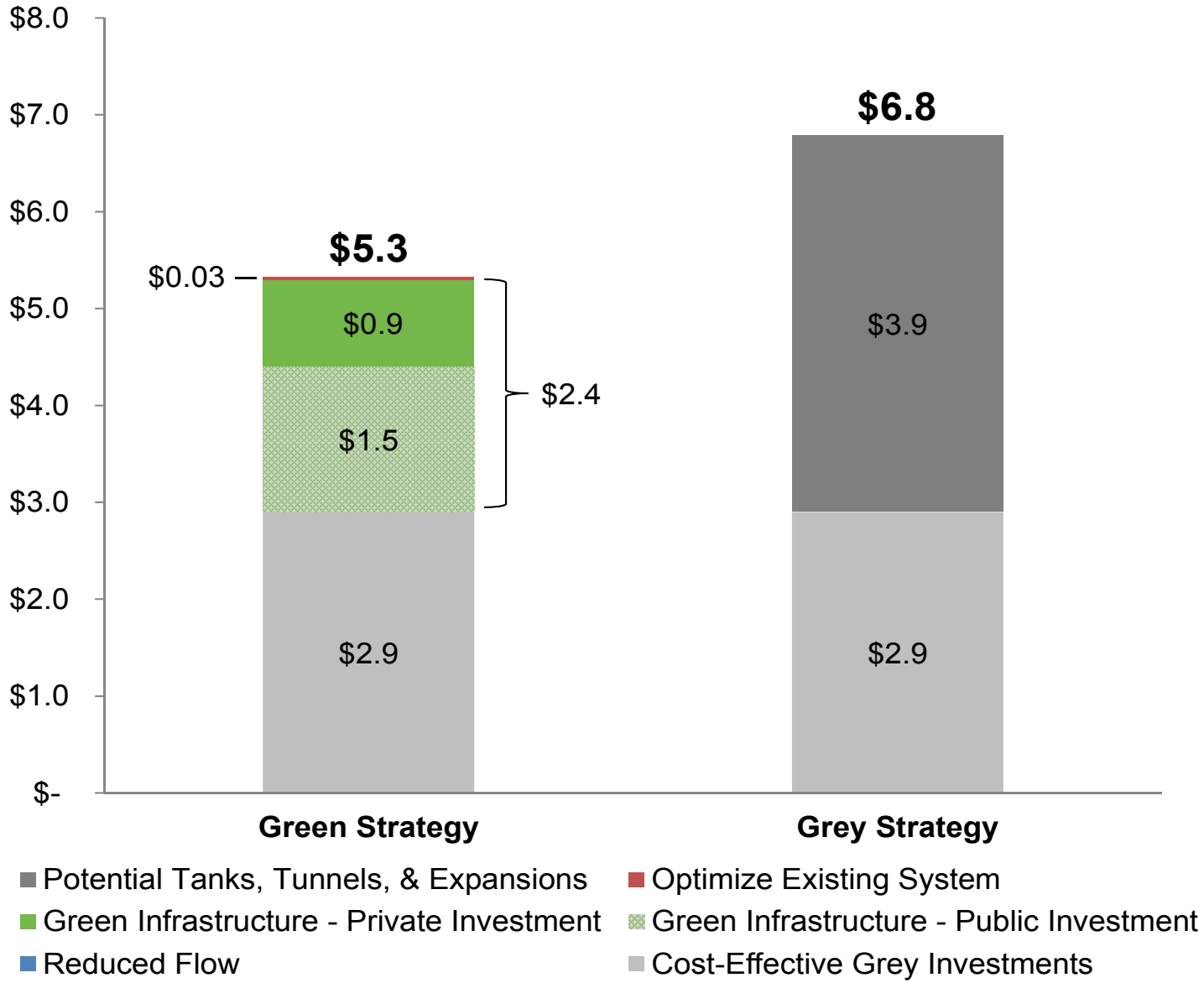
Comprehensive Sustainability Planning



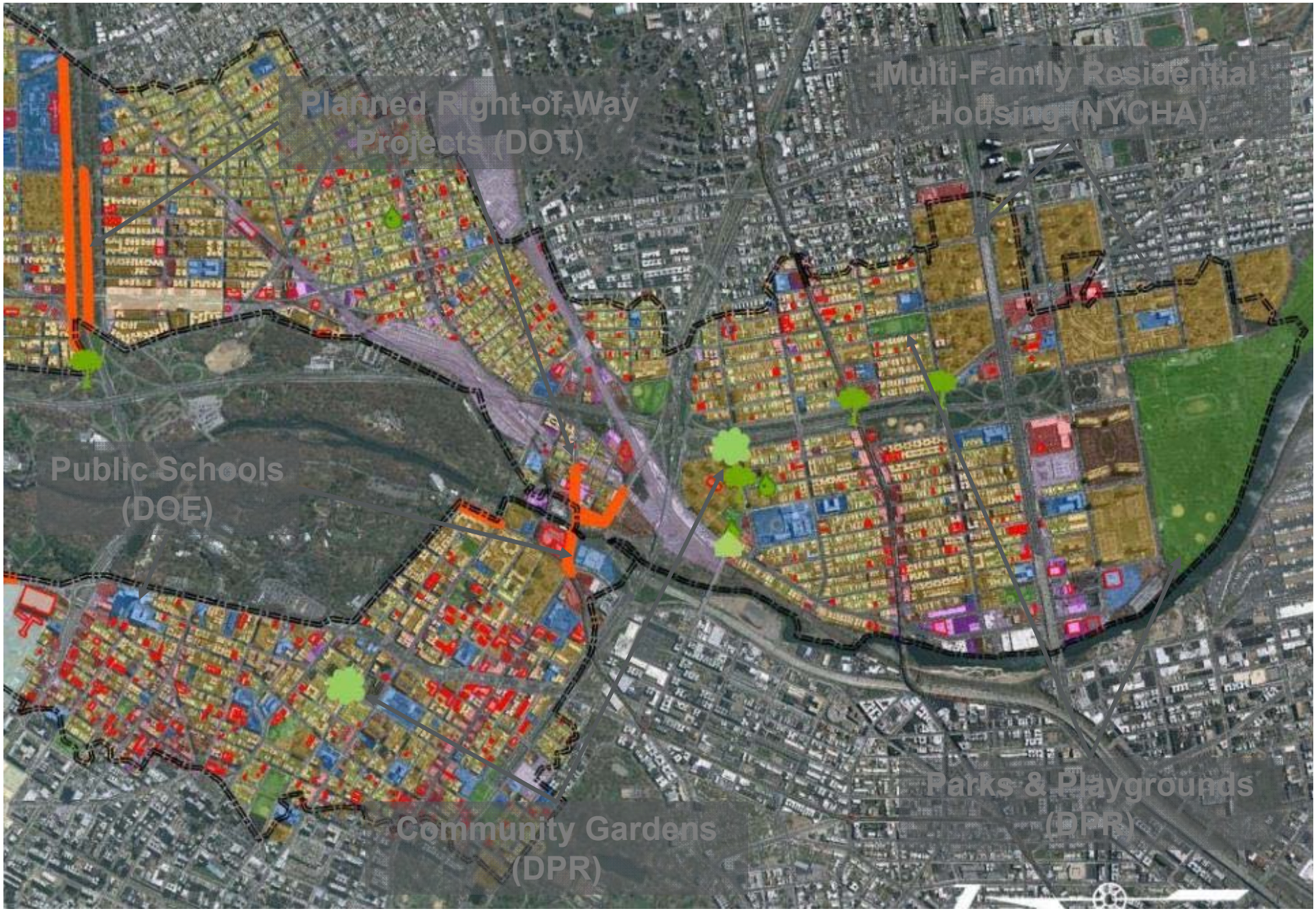
Modeling Performance of Alternatives



Estimating Costs of Alternatives



Watershed Implementation Plans

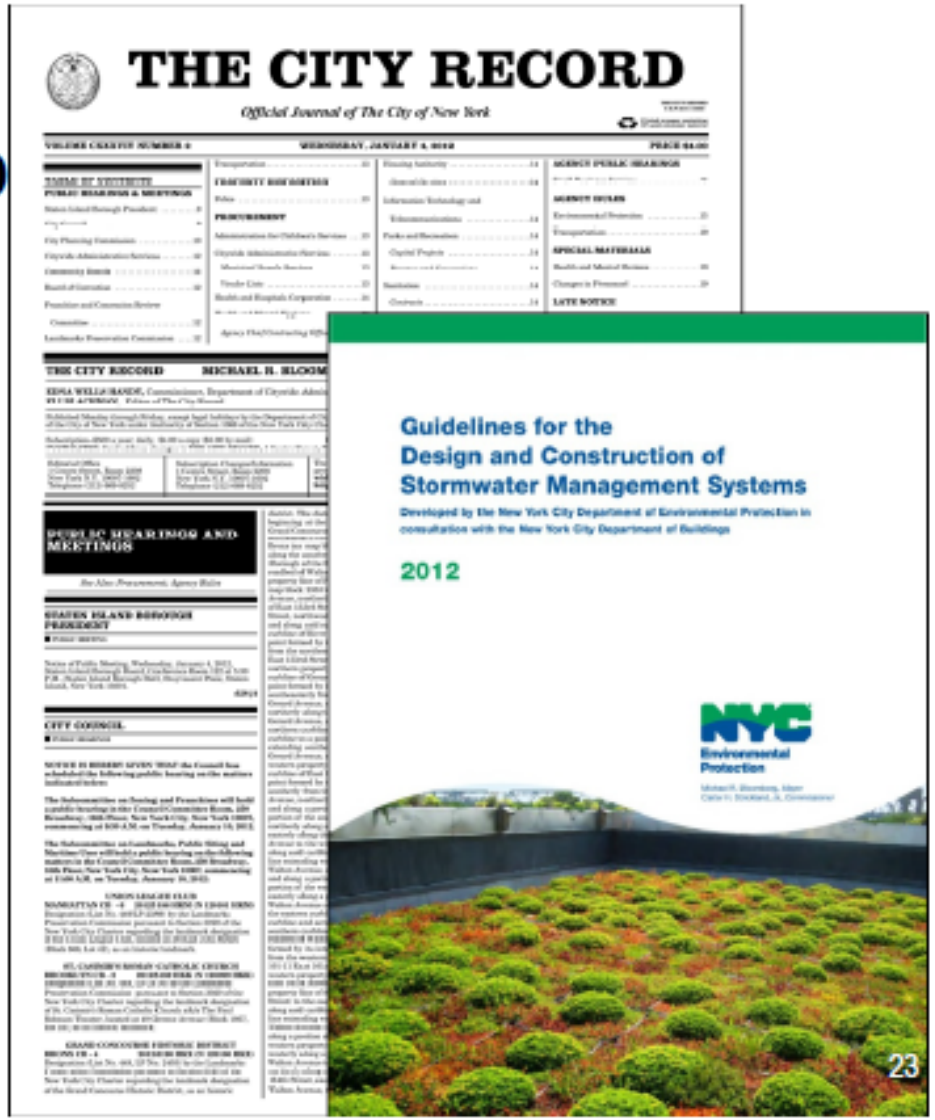


Performance Standards

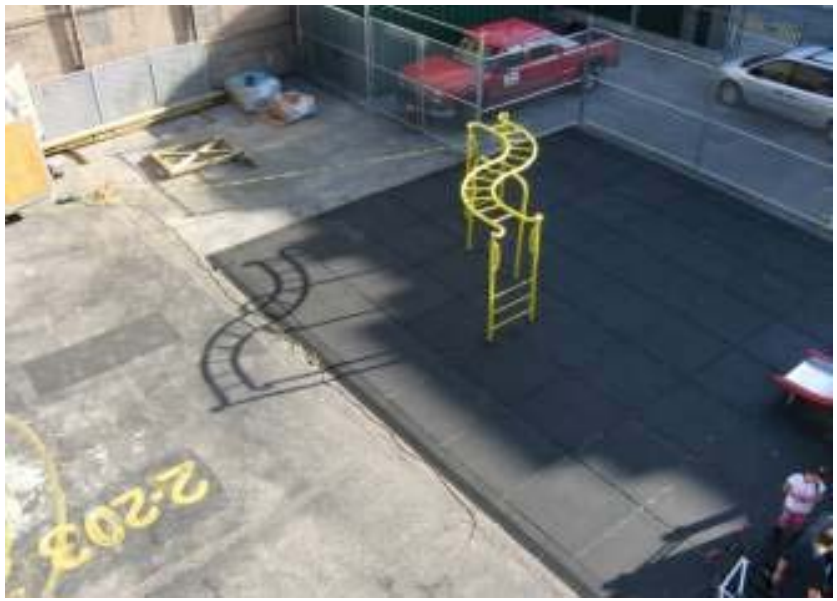
NYCDEP'S STORMWATER PERFORMANCE STANDARD

Affecting New/Redevelopment

- Effective July 4, 2012 as amendment to Chapter 31, Title 15 of Rules of the City of New York
- Decreases the "allowable" flow rate of to the city's combined sewer system for new and existing development, as part of sewer availability and connection approvals
- Provides incentives for green infrastructure, including recycling and infiltration systems



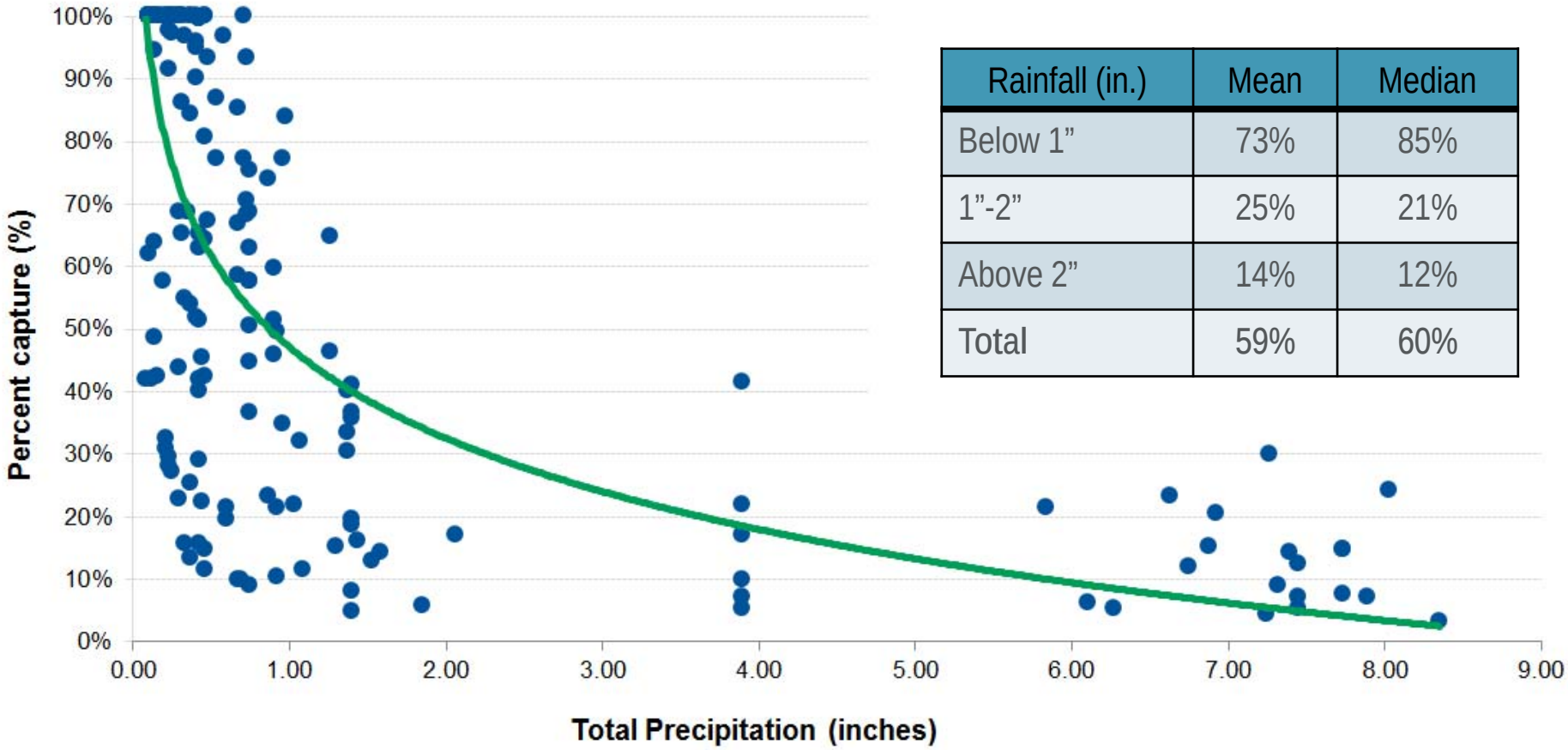
Co-benefits: Schoolyards to Playgrounds



Co-benefits: Right of Way Bioswale

Co-Benefits: Grant Program

Verifying Models: Bioswale Monitoring

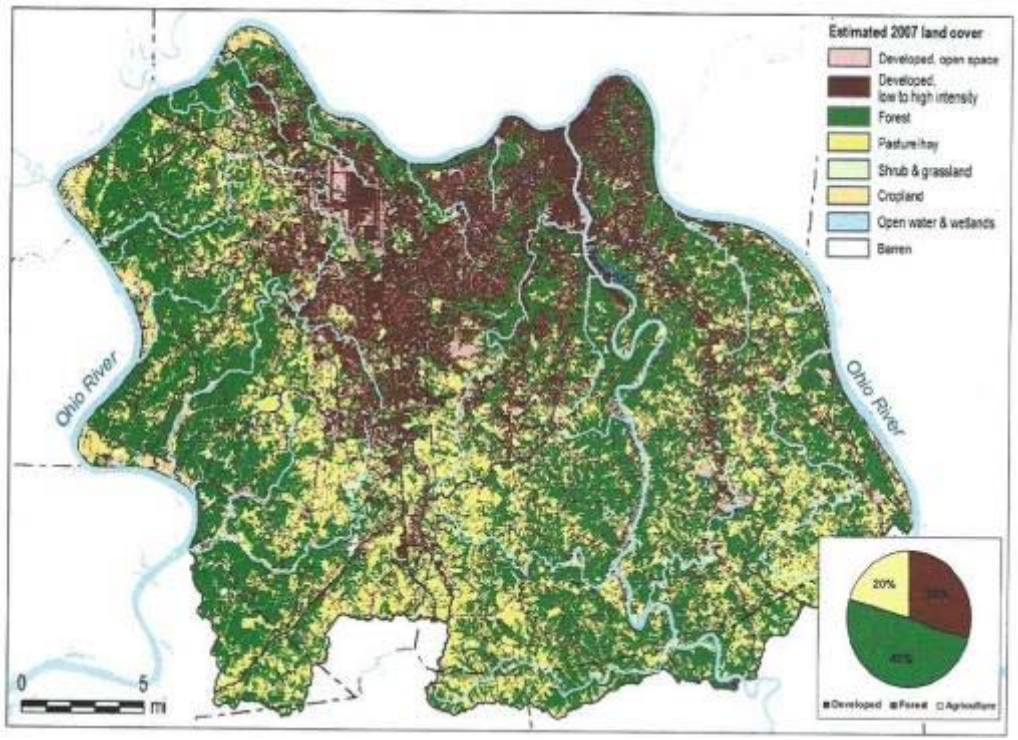


Percent Capture of 10 Bioswales

Rainfall (in.)	Mean	Median
Below 1”	73%	85%
1”-2”	25%	21%
Above 2”	14%	12%
Total	59%	60%

Northern KY Sanitation District No. 1

- Consent Decree was entered in Federal Court on April 18, 2007
- Requires SD1 to improve water quality, eliminate SSOs and comply with the CSO Policy by 2025
- Watershed-based approach considers pollution sources beyond sewer overflows and addresses:
- Iterative Assessment Process
  - Investigate new technologies
  - Evaluate/Update based on Initial 5 years

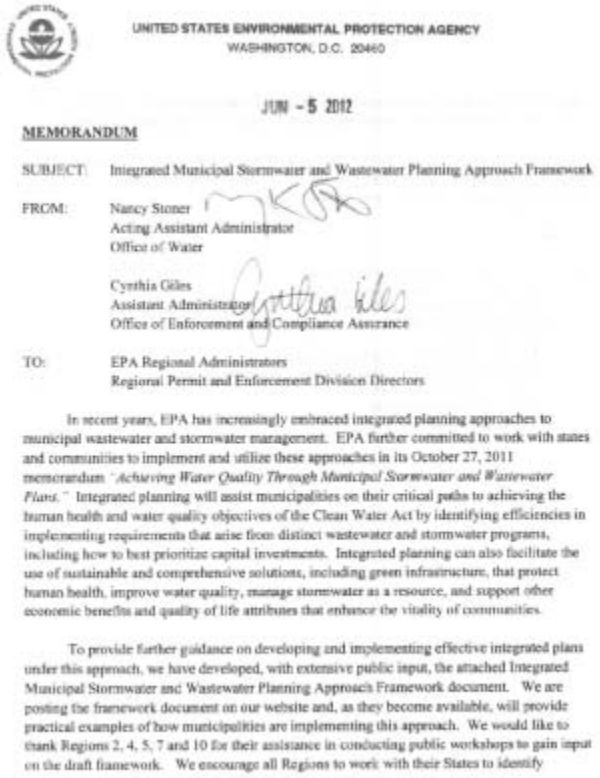


EPA's Integrated Planning Framework

History and Issues

- U.S. Conference of Mayors
- NACWA
- EPA Memo: "Achieving Water Quality Through Municipal Stormwater and Wastewater Plans" Oct 27, 2011
  - Facilitate use sustainable and comprehensive solutions, including green infrastructure to improve water quality

EPA Framework June 5, 2012



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUN - 5 2012

MEMORANDUM

SUBJECT: Integrated Municipal Stormwater and Wastewater Planning Approach Framework

FROM: Nancy Stoner
Acting Assistant Administrator
Office of Water

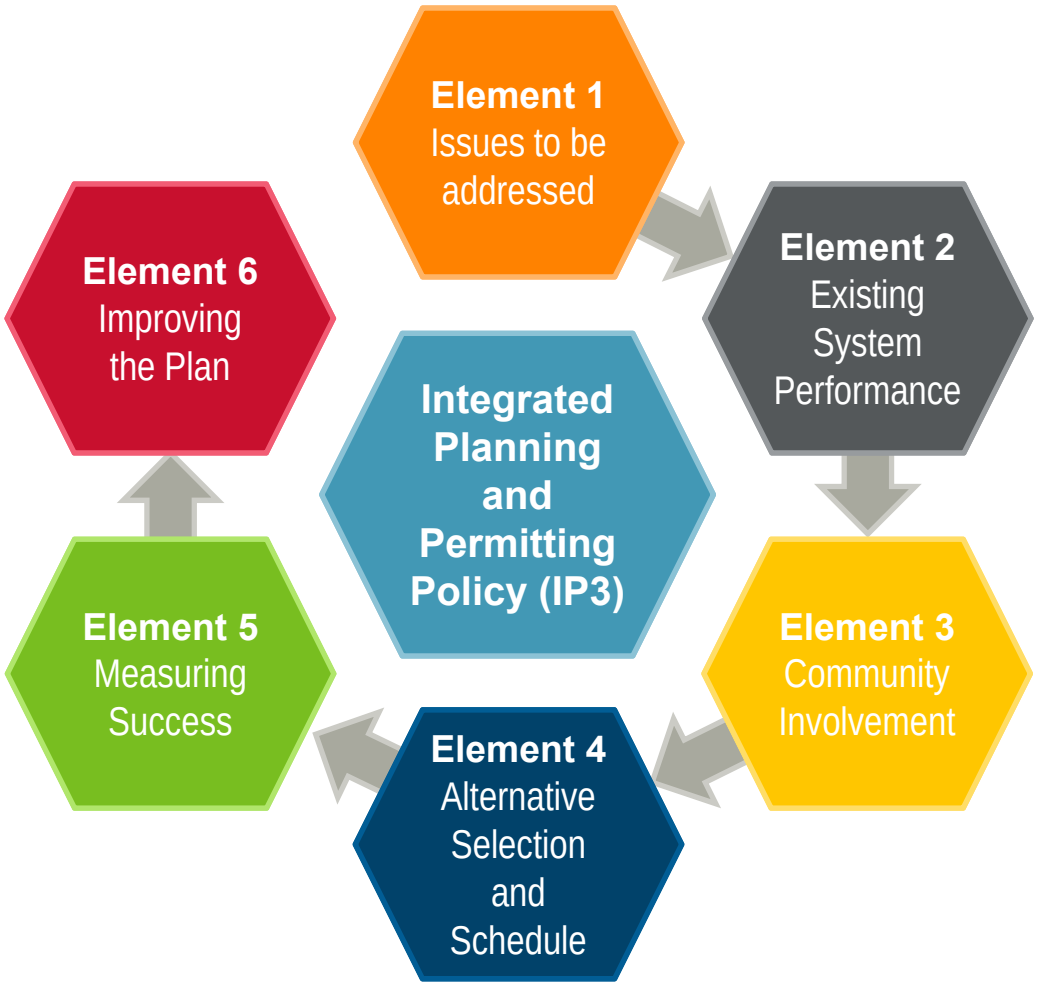
Cynthia Giles
Assistant Administrator
Office of Enforcement and Compliance Assurance

TO: EPA Regional Administrators
Regional Permit and Enforcement Division Directors

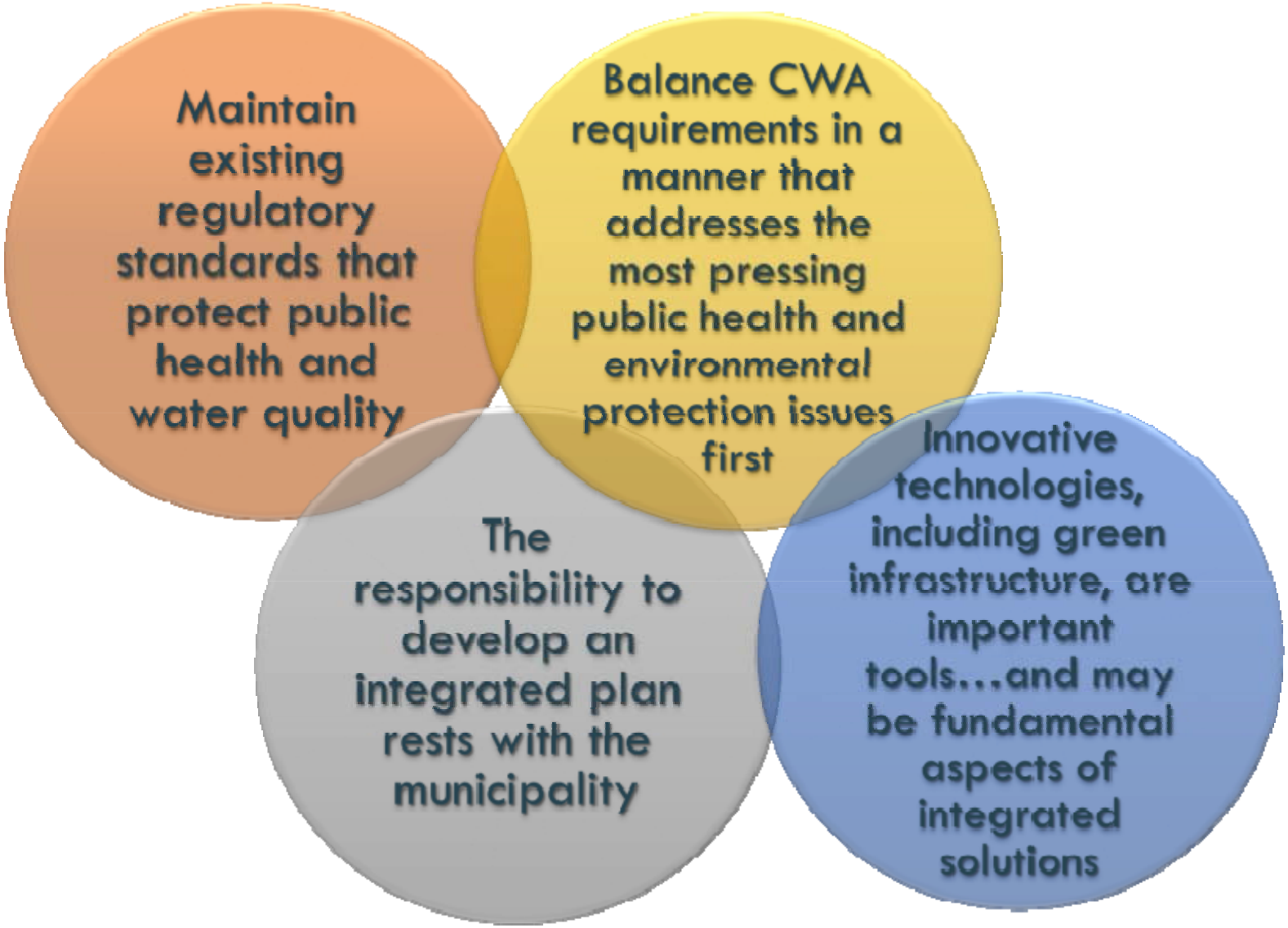
In recent years, EPA has increasingly embraced integrated planning approaches to municipal wastewater and stormwater management. EPA further committed to work with states and communities to implement and utilize these approaches in its October 27, 2011 memorandum *"Achieving Water Quality Through Municipal Stormwater and Wastewater Plans."* Integrated planning will assist municipalities on their critical paths to achieving the human health and water quality objectives of the Clean Water Act by identifying efficiencies in implementing requirements that arise from distinct wastewater and stormwater programs, including how to best prioritize capital investments. Integrated planning can also facilitate the use of sustainable and comprehensive solutions, including green infrastructure, that protect human health, improve water quality, manage stormwater as a resource, and support other economic benefits and quality of life attributes that enhance the vitality of communities.

To provide further guidance on developing and implementing effective integrated plans under this approach, we have developed, with extensive public input, the attached Integrated Municipal Stormwater and Wastewater Planning Approach Framework document. We are posting the framework document on our website and, as they become available, will provide practical examples of how municipalities are implementing this approach. We would like to thank Regions 2, 4, 5, 7 and 10 for their assistance in conducting public workshops to gain input on the draft framework. We encourage all Regions to work with their States to identify

Integrated Planning: Elements



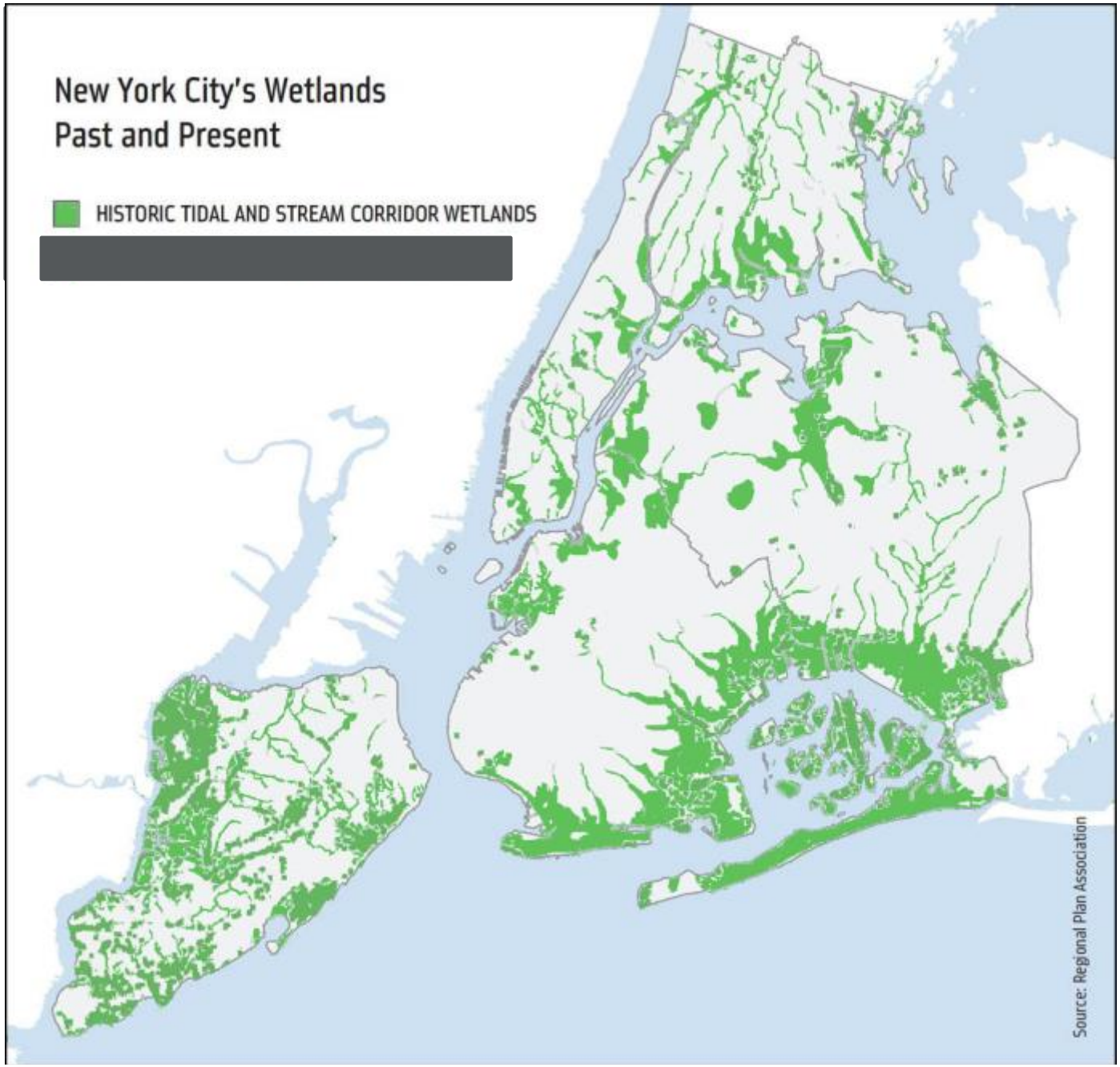
Integrated Planning: Overarching Principles



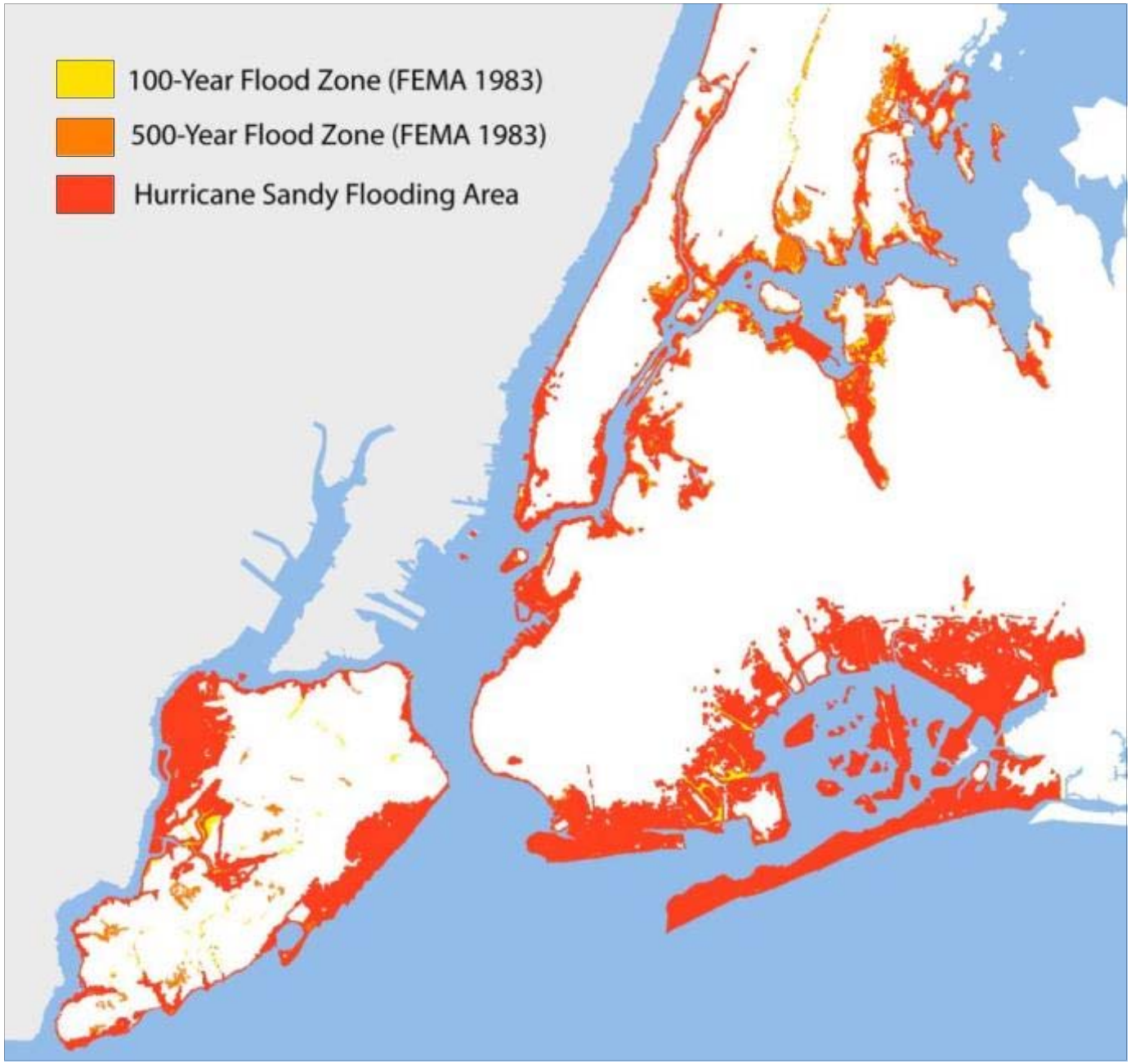
Meeting Future Challenges

	Baseline (1971-2000)	2020s		2050s	
Scenario		(25^{th}-75^{th} percentile)	(90^{th} percentile)	(25^{th}-75^{th} percentile)	(90^{th} percentile)
Average Temperature	54°F	+ 2.0 to 3.0 F	+ 3.0 F	+ 4.0 to 5.5 F	+ 6.5 F
Precipitation	50.1 in.	+ 0 to 10%	+ 10%	+ 5 to 10%	+ 15%
Sea Level Rise	0	+ 4 to 8 in.	+ 11 in.	+ 11 to 24 in.	+ 31 in.

Historic Wetlands in NYC



Hurricane Sandy Flooding Area



Resilient Natural Systems

Gerritsen Creek,
Jamaica Bay

Before Restoration

After Restoration

Day after Hurricane Sandy

Rebuilding Strategies Are Key to Resilience

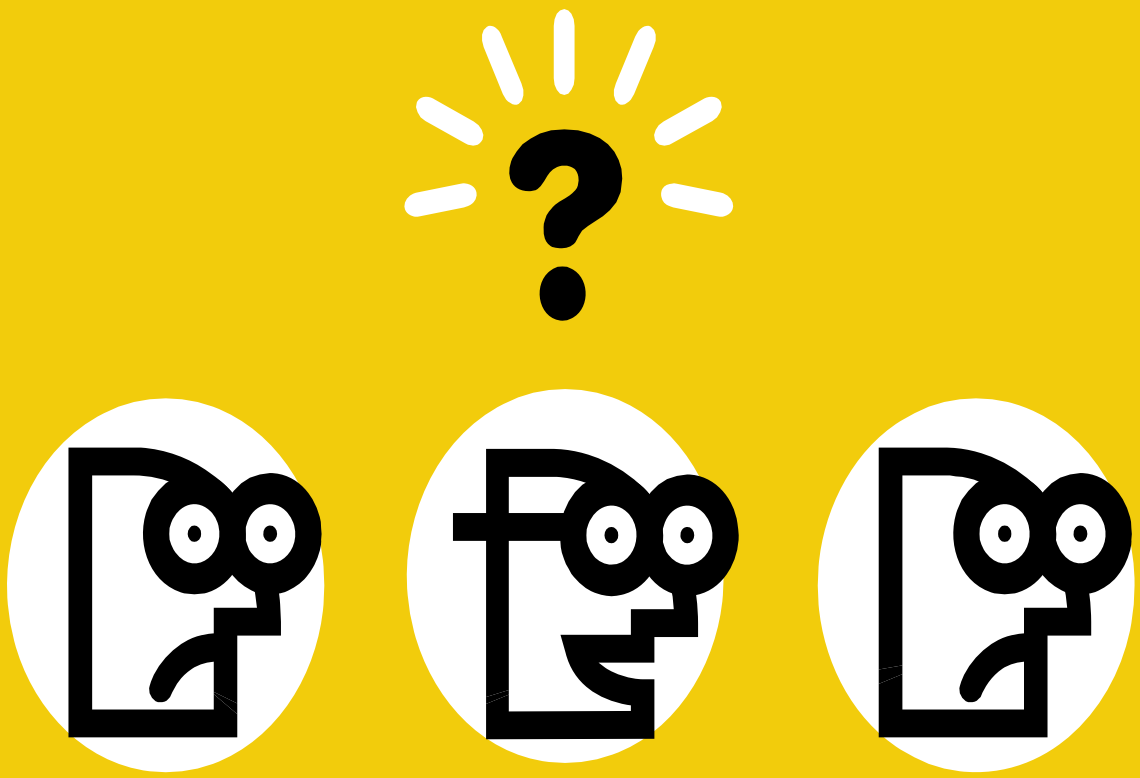
VA Hospital
Manhattan

LIRR Substation
Long Beach

Metro-North RR
NY and CT

PATH Station
NJ

Fourth Ward Park, Atlanta, GA



It's QUESTION TIME!!

Join Us Next Week!

September 23, 2014

2:00 – 3:30 ET

Innovative Financing & Rates — Finding New Revenue & Stretching Each Dollar

Tom Kunetz
Metropolitan Water Reclamation District of Greater Chicago

Andrew Sawyers
U.S. Environmental Protection Agency

Peter Lucchetti
Table Rock Capital LLC

Mark Kim
DC Water