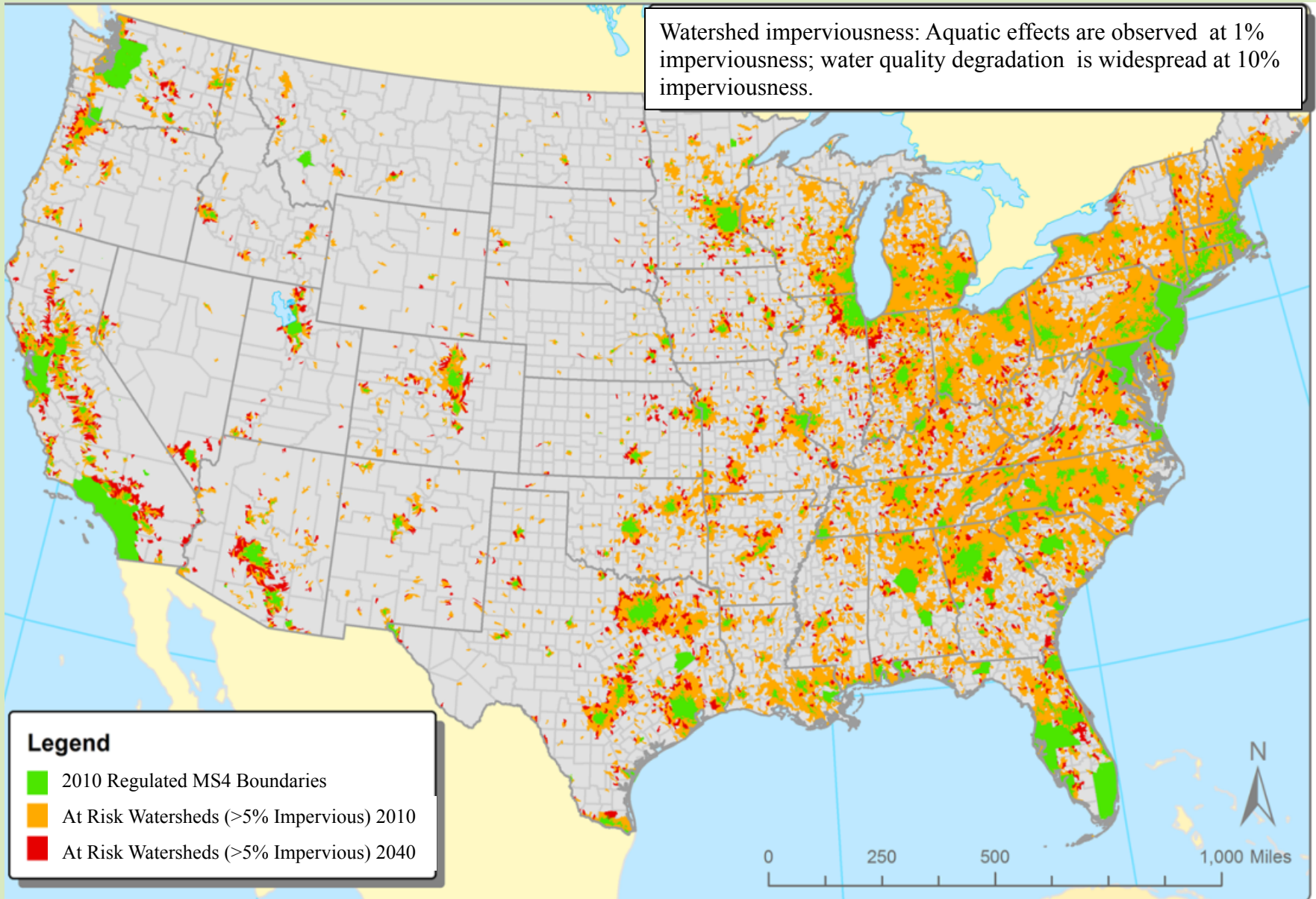


How Do Water Regulations and Policy Drive Sustainable Landscape Design



Map of Problem

Watershed imperviousness: Aquatic effects are observed at 1% imperviousness; water quality degradation is widespread at 10% imperviousness.



Legend

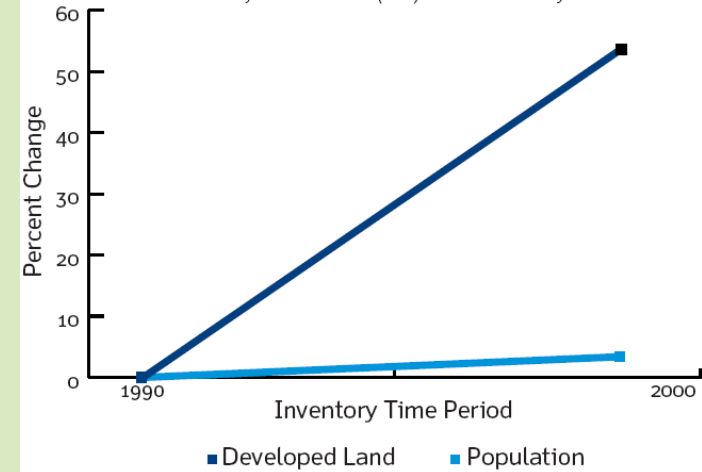
- 2010 Regulated MS4 Boundaries
- At Risk Watersheds (>5% Impervious) 2010
- At Risk Watersheds (>5% Impervious) 2040

The Stormwater Problem is Getting Worse

- Average Acres Developed Annually
 - 2013-2020: 797,717 acres
 - 2021-2030: 1,086,317 acres
 - 2031-2040: 1,509,386 acres
- Cumulative Acres (2013 – 2040): 32,314,761 acres
- Development increases the amount of impervious cover in the landscape
 - Discharge from 1 acre of impervious cover is **16x** the discharge from a 1 acre of undeveloped land
- Small increases in impervious cover in the watershed leads to big impacts in receiving waters
 - Watersheds with <1-2% of impervious land area = biological impacts to surface waters
 - Watersheds with >5-15% of impervious land area = surface water declines rapidly to degraded levels, loss of function; Loss in base flow in streams and groundwater recharge

FIGURE 10 – Rates of Change for Developed Land and Population, 1990 and 2000

Sources: U.S. Census Bureau, National Land Cover Data set (1992) USGS and Pennsylvania Land Cover (2000) Penn State University



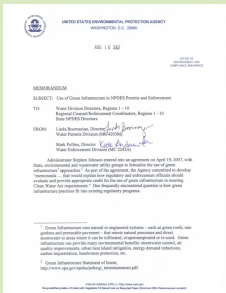
The surrounding area of this stream is approximately 20% impervious cover. Erosion is more severe here due to the absence of vegetation to hold together bank structure.

NPDES Stormwater Municipal Permits Municipal Separate Storm Sewer Systems (MS4s)

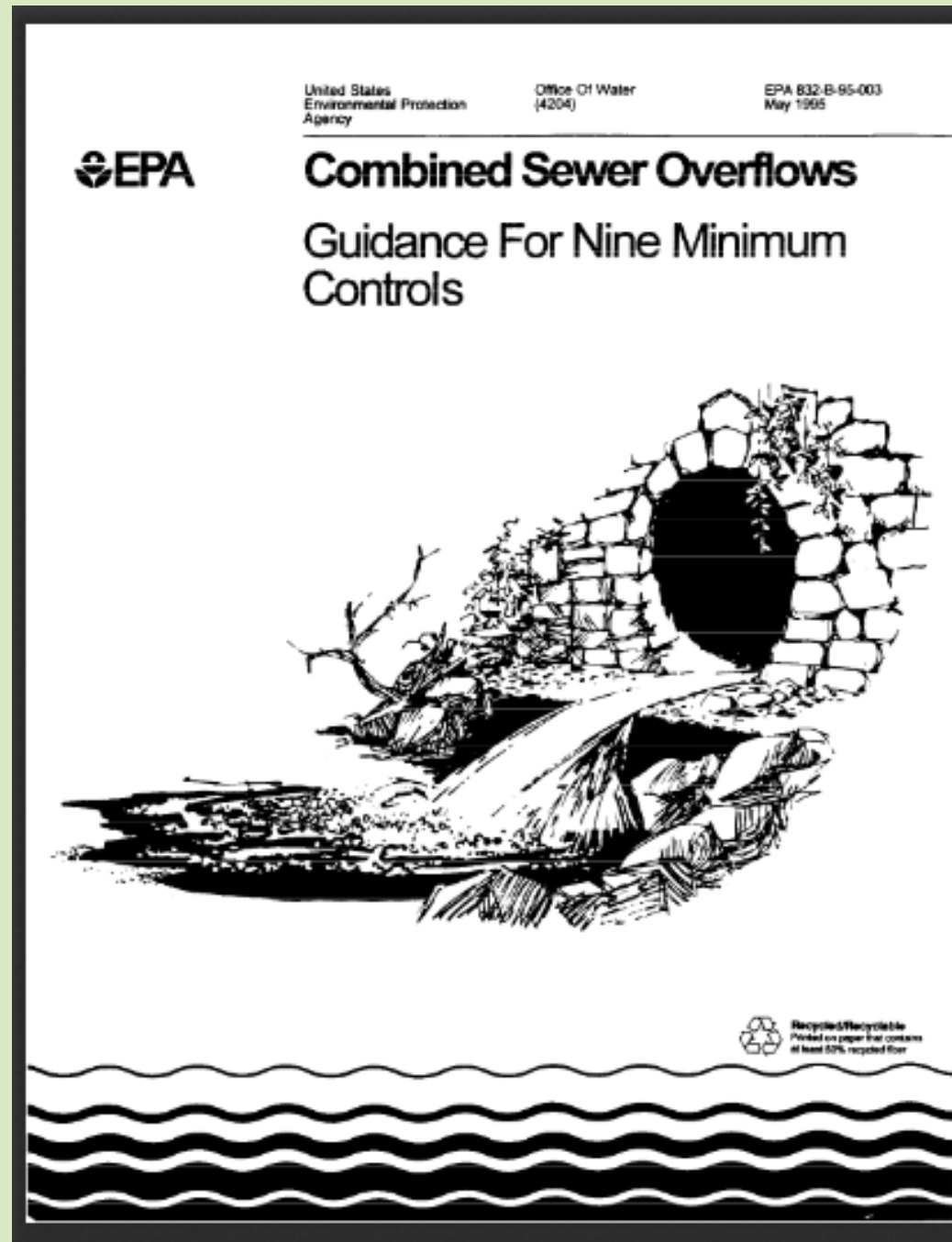
Phase I - populations of 100,000
There are approximately 750 Phase I MS4s.

Phase II - small MS4s in urbanized areas, as well as
designated small MS4s outside the urbanized areas
There are approximately 6,700 Phase II MS4s.

2007 Memo Allows the use of Green Infrastructure in
Permits and CSO Long-term Control Plans

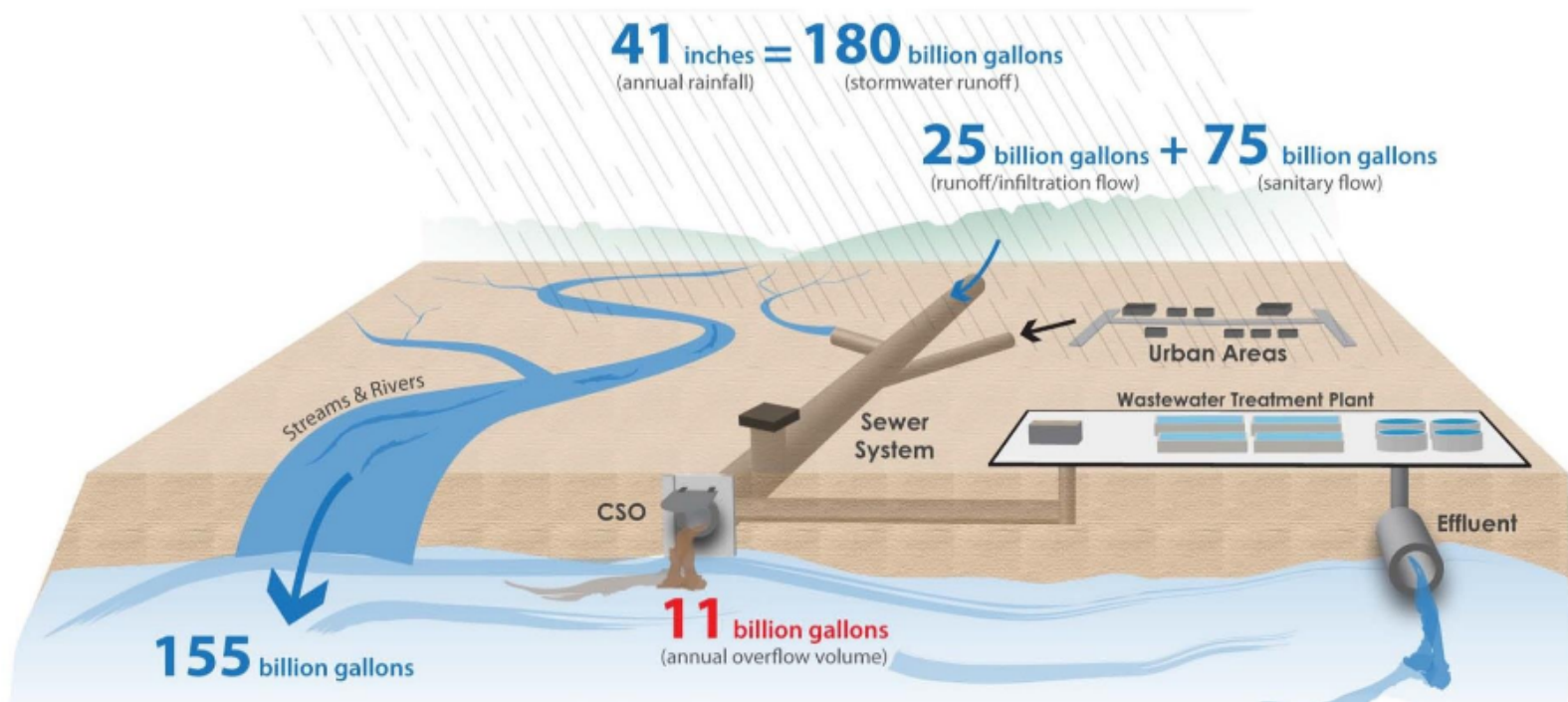


772 CSO communities
9,471 identified CSOs
859 NPDES permits.



Cincinnati's Challenge

Federal Consent Decree requires MSD to reduce sewer overflows into local streams and rivers.



Combined sewers carry both sewage and stormwater in the same pipe.

Federal Mandate – Cincinnati Consent Order Elements

Flexible

Wet Weather Strategy

Source Control
Conveyance & Storage
Product Control

Phased Approach

Phase 1: 2009 – 2019
Phase 2: Schedule to be
submitted by 2017

Strategic

Affordable

Controlled Spending

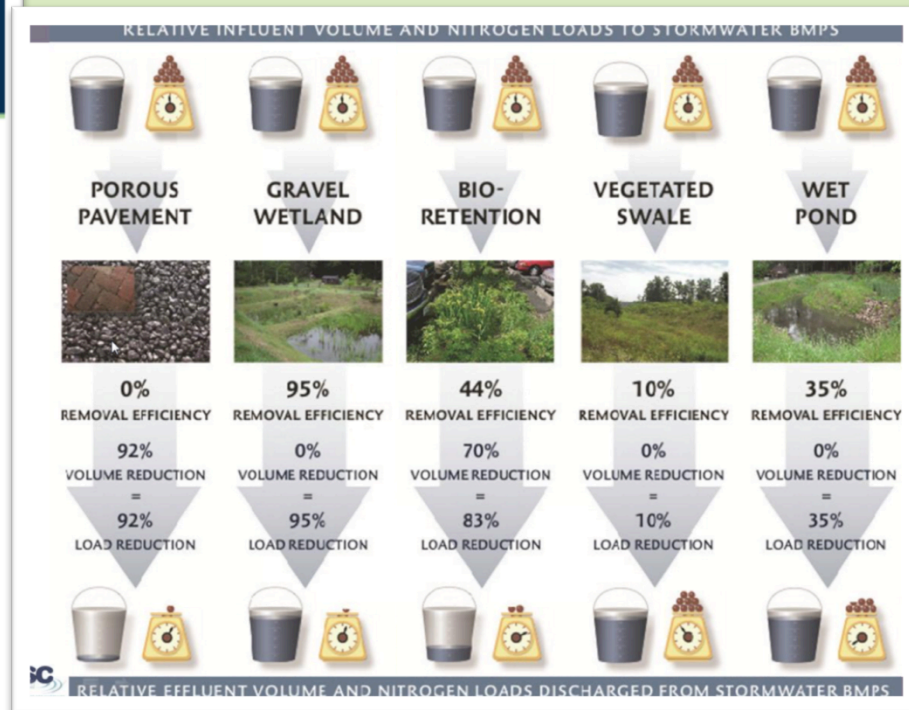
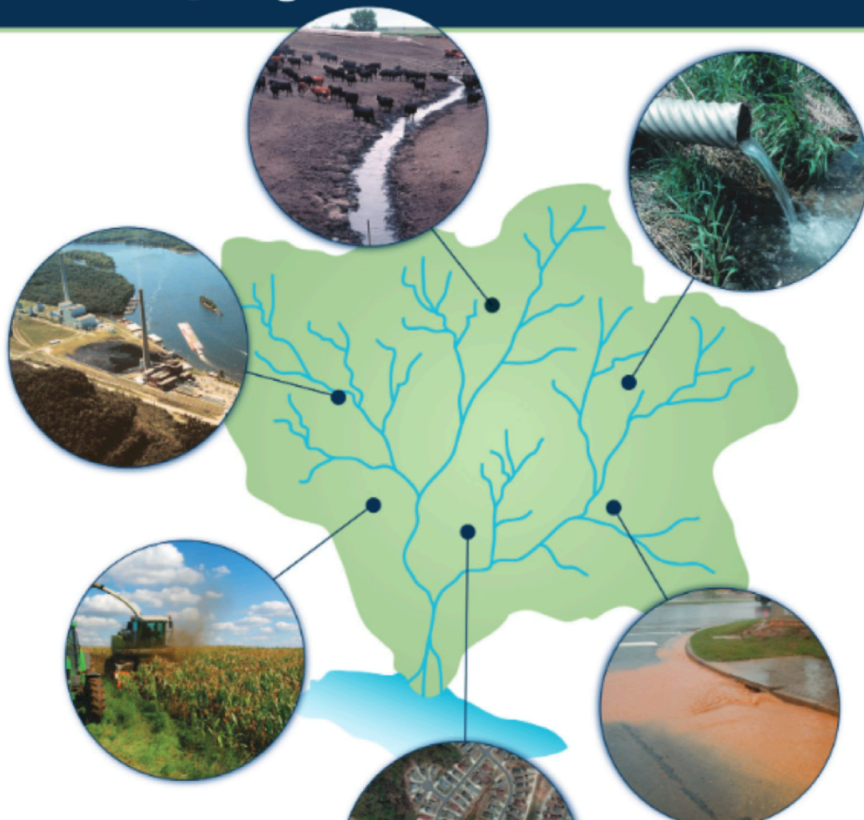
Phase 1: **\$1.145B**
Credit for \$300M
Phase 2: Est. \$2 Billion +

Examples of Green Infrastructure Components in Settled EPA Clean Water Act Enforcement Cases

- Prioritize GI projects where they: will **help reduce flooding** and basement backups; can be readily accommodated as permanent stormwater control measures, **vacant parcels that can be retrofitted into "stormwater parks," which would store and infiltrate or reuse rainfall and runoff and also be an amenity for local residents**; and can improve socio-economic conditions in the MWRD service area where the need is greatest, specifically by improving conditions in areas impacted by environmental justice concerns.
- The "Clean Rivers, Green District" agreement outlines collaborative steps to support GI to achieve sustainable stormwater management, **more livable communities, and other environmental improvements** in the District.
- MSD is installing a variety of GI practices at various scales including **lot, block, and neighborhood, focusing on abandoned and blighted properties on the north side of St. Louis. MSD will focus on implementing GI in areas that drain to the Mississippi River and particularly in areas impacted by environmental justice concerns**

Watershed Restoration is a Driver for Community Enhancement

Handbook for Developing Watershed TMDLs



2015 - 42,417 Impaired Waters
74,769 Causes of Impairment

Energy Independence and Security Act of 2007

- **“Sec. 438. Storm Water Runoff Requirements for Federal Development Projects.** The **sponsor** of any **development or redevelopment** project involving a Federal facility with a footprint that exceeds 5,000 square feet shall use site planning, design, construction, and maintenance strategies for the property to maintain or restore, to the maximum extent technically feasible, the **predevelopment hydrology** of the property with regard to the temperature, rate, volume, and duration of **flow.**”



STORMWATER RETENTION STANDARDS

- An increasing number of states and communities are relying on retention standards to reduce impacts of stormwater from impervious cover
- Retaining stormwater near where it falls reduces:
 - Pollutants
 - Volume and velocity
 - Flooding
- Retention standards are cost-effective
 - It is more cost-effective to incorporate sustainable controls as development occurs and prevent the need for costly retrofits or restoration
 - For new development, these standards can save money because smaller detention ponds and less gray infrastructure would be used

18 states and DC
have standards
based on
retention of a
certain volume of
stormwater
(as of 2011)



April 24, 2007

Stormwater Management Act of 2007" (Act) – Maryland

The Act requires that **Environmental Site Design (ESD)**, through the use of nonstructural Best Management Practices (BMPs) and other Better Site Design techniques, be implemented to the Maximum Extent Practicable (MEP)



Correcting local polluted runoff problems with nature-based solutions in the Potomac River Watershed. Source: National Geographic



A Guide to Local Government Policy Changes to Implement Environmental Site Design to the Maximum Extent Practicable:

Maryland & Washington, D.C.



Fall 2014

Municipal Codes and Voluntary Standards are Influencing Sustainable Landscape Designs

- LEED
- SITES (Sustainable Sites Initiative)
- NAHB/ANSI/ICC
- Green Globes
- ASHRAE
- ASTM
- IGCC – Intl. Green Construction Code

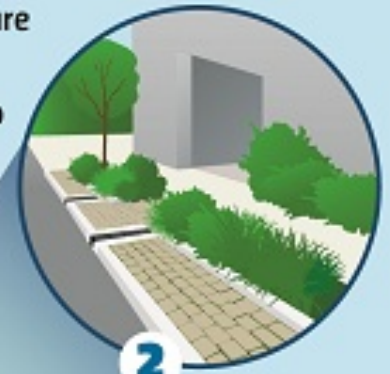


Climate Change Adaptation

Green Infrastructure Builds Resiliency

1 Vegetation-based green infrastructure practices can mitigate carbon pollution.

2 Build green infrastructure like rain gardens and permeable pavement to manage flooding.



3

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

5

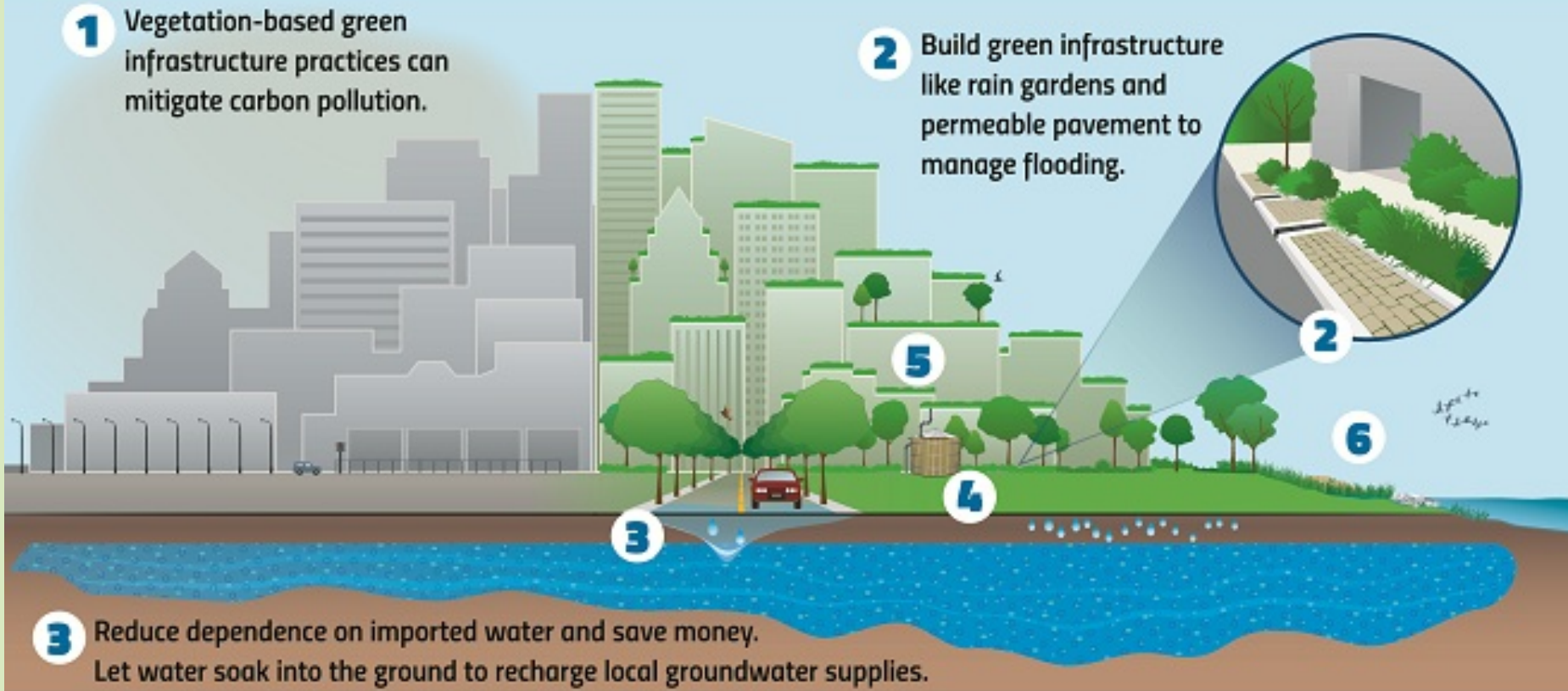
5 Plant trees and green roofs to mitigate the urban heat island effect.

4

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

6

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



Designing to Achieve The Triple Bottom Line

Economic



Social



Environmental



Factors Driving Change Towards More Sustainable Landscape Design

- Single purpose designs do not provide enough benefits – move toward multi-functional designs
- Diminishing budgets and fiscal constraints
- Increased number of goals and competition for funding, e.g., climate change resiliency
- Demand for more livable communities
- Environmental justice and equity issues
- Need to stimulate community redevelopment and attract investments
- Job Creation
- Aesthetics



EPA GI Cost-Effectiveness Study

Table 2. Summary of Cost Comparisons Between Conventional and LID Approaches^a

Project	Conventional Development Cost	LID Cost	Cost Difference ^b	Percent Difference ^b
2 nd Avenue SEA Street	\$868,803	\$651,548	\$217,255	25%
Auburn Hills	\$2,360,385	\$1,598,989	\$761,396	32%
Bellingham City Hall	\$27,600	\$5,600	\$22,000	80%
Bellingham Bloedel Donovan Park	\$52,800	\$12,800	\$40,000	76%
Gap Creek	\$4,620,600	\$3,942,100	\$678,500	15%
Garden Valley	\$324,400	\$260,700	\$63,700	20%
Kensington Estates	\$765,700	\$1,502,900	-\$737,200	-96%
Laurel Springs	\$1,654,021	\$1,149,552	\$504,469	30%
Mill Creek ^c	\$12,510	\$9,099	\$3,411	27%
Prairie Glen	\$1,004,848	\$599,536	\$405,312	40%
Somerset	\$2,456,843	\$1,671,461	\$785,382	32%
Tellabs Corporate Campus	\$3,162,160	\$2,700,650	\$461,510	15%

^a The Central Park Commercial Redesigns, Crown Street, Poplar Street Apartments, Prairie Crossing, Portland Downspout Disconnection, and Toronto Green Roofs study results do not lend themselves to display in the format of this table.

^b Negative values denote increased cost for the LID design over conventional development costs.

^c Mill Creek costs are reported on a per-lot basis.

Integrate Projects at the Landscape Scale



Strategic planning

FROM BROWN TO GREEN:
*A Revitalization Strategy for the Downtown Rome
Brownfield Opportunity Area*

THE CITY OF ROME ROD MILL REUSE STRATEGY

Final Draft Report
September 2010



Prepared For:
City of Rome, New York
Department of Community & Economic Development

Prepared By:
Bergmann Associates
Camoin Associates

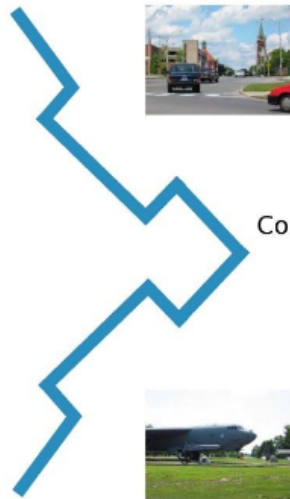
*This document was prepared for the City of Rome and New York State Department of State with
funds provided under Title 11 of the Environmental Protection Fund.*



FINAL NOMINATION STUDY

SEPTEMBER 2012

Submitted By:
City of Rome, New York
Department of Community & Economic Development



**City of Rome
Comprehensive Plan**



Action Plan

RIVER STREET
PLANNING & DEVELOPMENT



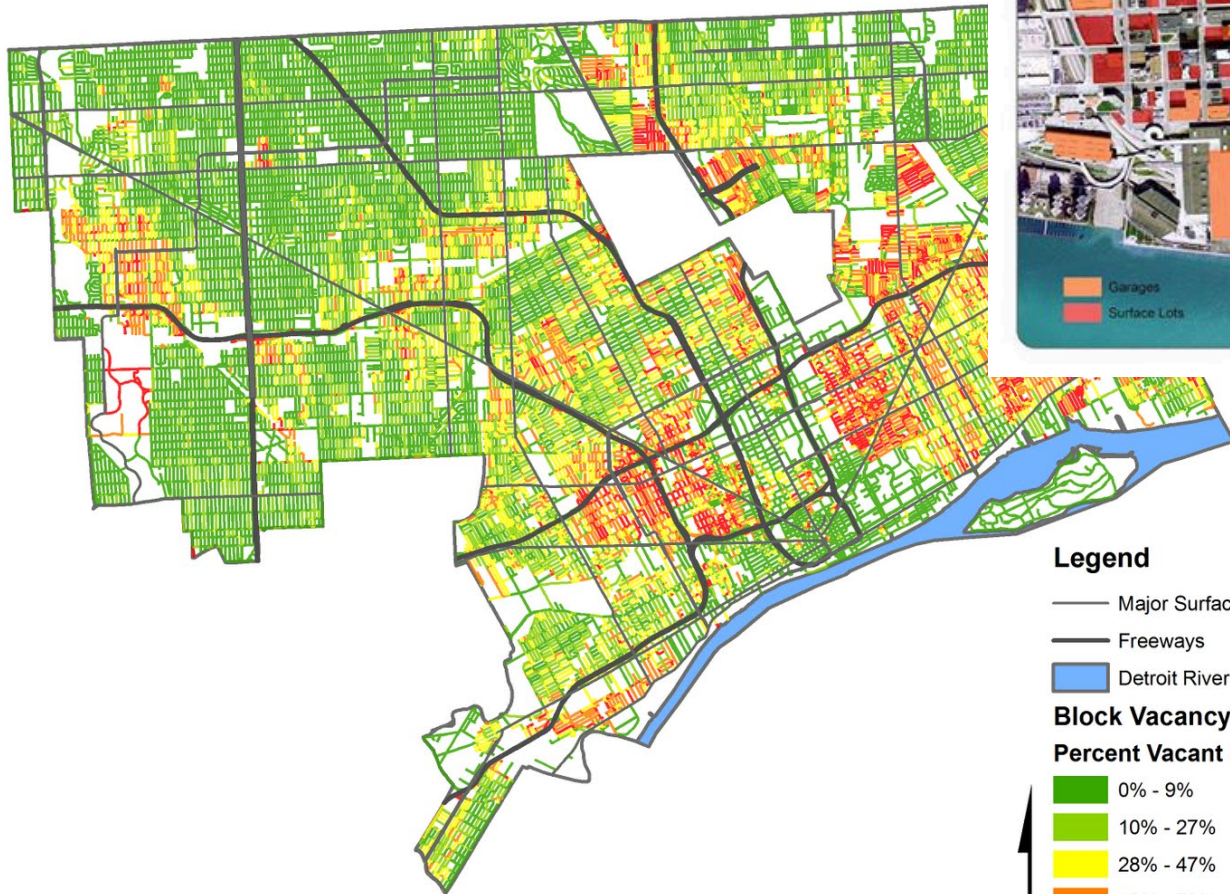
live. work. play.
ROME New York
INCORPORATED 1870

**Department of Community
& Economic Development**



Detroit

Vacant Lots As A Percentage Of All Parcels, By Block,



0 1 2 4 6 8 Miles

Legend

- Major Surface Streets
- Freeways
- Detroit River

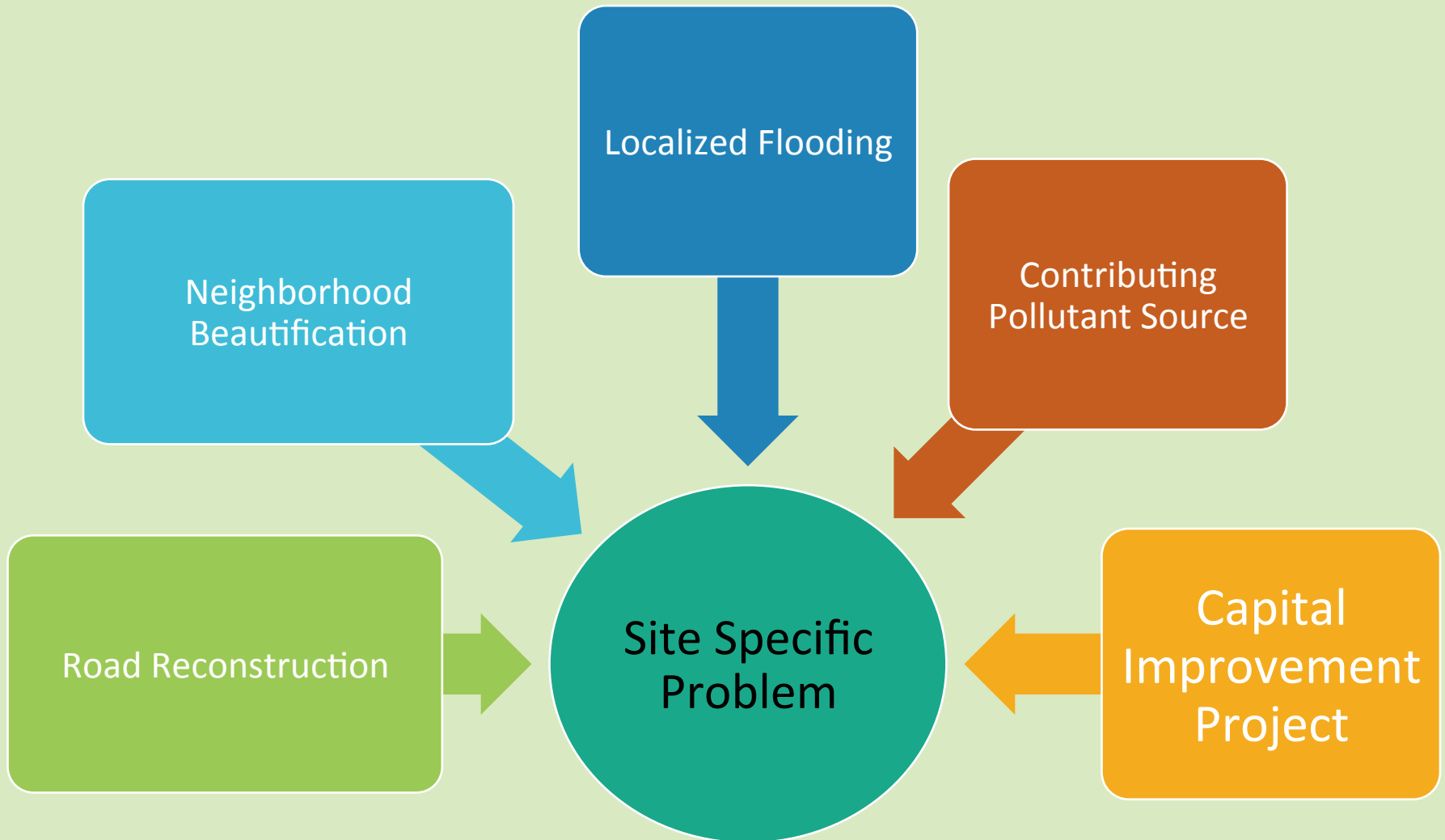
Block Vacancy Rate Percent Vacant Lots

- 0% - 9%
- 10% - 27%
- 28% - 47%
- 48% - 72%
- 73% - 100%



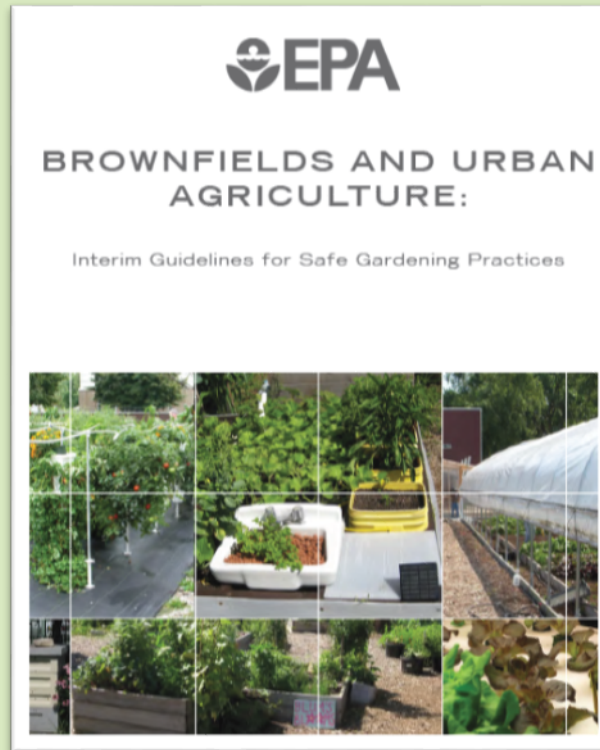
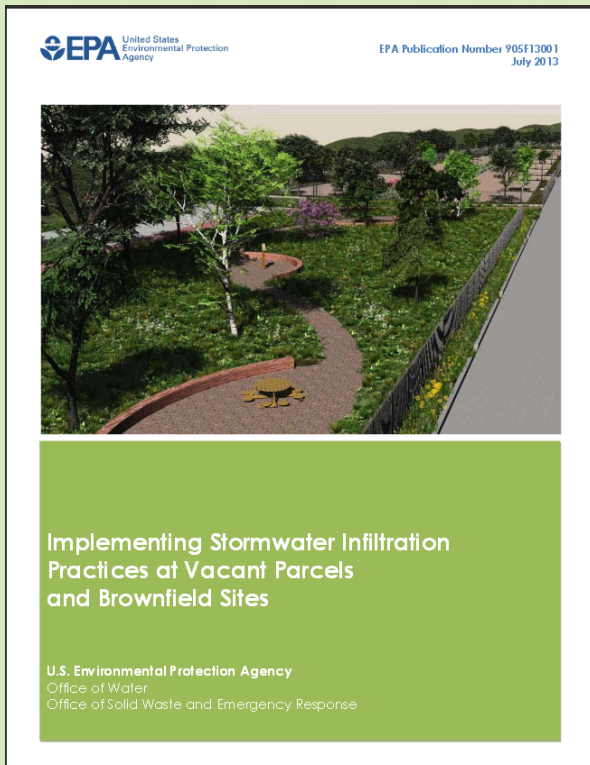
- Garages
- Surface Lots

2. Drivers for Specific Project



Brownfields

Opportunities to Transform Landscapes



http://water.epa.gov/infrastructure/greeninfrastructure/upload/brownfield_infiltration_decision_tool.pdf

http://www.epa.gov/brownfields/urbanag/pdf/bf_urban_ag.pdf

GREEN INFRASTRUCTURE PARKS AND COMMUNITY AMENITIES REDUCE LOCALIZED FLOODING & BUILD RESILIENCY

Milwaukee, WI

- 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



Menomonee River Stormwater Park

GREEN INFRASTRUCTURE POLICIES AND PARTNERSHIPS ENHANCE RESILIENCY TO DROUGHT & FLOODING

Pima County, AZ

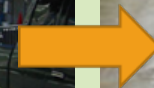
- Using green infrastructure to mitigate flooding, improve water quality, and augment the supply of water
- City of Tuscon partners with NGOs to install green infrastructure on roads and has adopted an internal policy that all public streets must integrate green streets concepts into initial designs.



*Parking lot designed to infiltrate runoff in Tuscon, AZ
Photo Credit: Watershed Management Group*

Right of Ways and Green Streets

Green our Transportation Systems



Green Street Projects (incomplete)



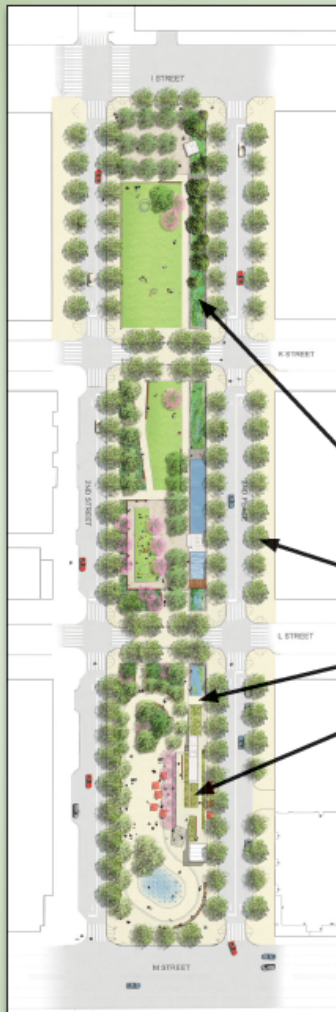




Rethink How We Manage Parks Parks as Stormwater Management Systems

Case Study – The Use of Green Infrastructure in Parks

Canal Park, Washington DC







Key Themes

- ✓ Brownfield Redevelopment
- ✓ Public-Private Partnership
- ✓ Neighborhood Stormwater Management

Canal Park serves as both an urban park and neighborhood stormwater management area to capture, infiltrate, treat, and use runoff collected from a 4.08 drainage area including both onsite and adjacent residential and commercial properties. The three-acre park provides open space and amenities including a café with outdoor seating, an interactive fountain, an ice skating path, and play and performance areas.

Green Infrastructure Design Elements/BMPs

-  7,500 square feet of **rain gardens** distributed around the edges of the site
-  41 **tree planters** located along the park perimeter collect street runoff through curb cuts
-  Two 40,000 gallon **cisterns** to store pre-treated runoff and filtered stormwater
-  a **green roof** located on top of the café and accessible by visitors

Annual Benefits

- ↳ **Meet 66% of the park's non-potable water demand using captured runoff** for irrigation, bathroom facilities, and outdoor amenities such as the ice skating rink and fountains. (estimated to be 99% when adjacent parcels are developed to provide another source of stormwater)
- ↳ **Avoid the cost** of treating and delivering 1.5 MG of potable water.
- ↳ **Reduce the amount of stormwater** by up to 2.35 MG annually



Encourage More Sustainable Management of Private Lands

Sacred Grounds
National Wildlife Federation
Wildlife-Friendly
Communities of Faith Certification



<http://www.nwf.org/how-to-help/garden-for-wildlife/sacred-grounds.aspx>

Sacred Grounds™ Program Elements

- *Connecting environmental stewardship to faith through service, teaching, or prayer*
- *Educating and Inspiring the Congregation to get involved within the community*
- *Reaching Beyond the Congregation to encourage communal environmental stewardship regardless of faith*

Sacred Grounds™ gives congregations an opportunity to receive recognition for undertaking landscaping projects that attract wildlife and reduce stormwater runoff along with elements uniquely relevant to the grounds owned by religious institutions.\

Faith Elements and Engagement:

- **Congregation leader speaks** on habitat connection to faith doctrine to full congregation
- **Use area as a sacred space** (worship service, religious school classes, etc.)
- **Host a planting day/workshop** for congregation members
- **Host a garden tour** for communities and different congregations

Four Elements of Habitat:

- **Food sources** (seeds, nuts, berries, fruits, nectar, supplemental feeders)
- **Water Sources** (bird bath, water garden, lakefront, stream, spring)
- **Cover** (wooded area, dense shrubs, ground cover, meadow/prairie, burrows)
- **Places to raise young** (mature trees, dead trees, meadow/prairie, caves, nesting boxes)

Sustainable Grounds Practices

- **Water practices** (rain garden, bioswale, permeable paving, green roof, mulching)
- **Controlling exotic species** (removing invasive plants)
- **Organic practices** (reduce or eliminate chemical pesticides, herbicides, and fertilizers)
- **Habitat maintenance** (create on-going maintenance plan for upkeep, monitor wildlife over time) |

Municipal Opportunities

Green Infrastructure Opportunities that Arise During Municipal Operations



EPA 842-R-15-002

January 2015



Office of Wetlands, Oceans and Watersheds
National Estuary Program



OPPORTUNITIES TO INTEGRATE GREEN INFRASTRUCTURE

Fact Sheet 1:
Green streets and alleys to reduce community liability and manage stormwater



Fact Sheet 4:
Design public safety features to manage stormwater and improve aesthetics

Fact Sheet 2:
Build or retrofit parking facilities to be greener



Fact Sheet 5:
Create stormwater microgrants



Fact Sheet 3:
Build rain gardens at public facilities

Fact Sheet 6:
Promote public-private partnerships to stimulate greener development and redevelopment projects

Loans
Low interest loans may be secured but are generally used for planning and capital projects

Taxes/General Funds
Funds raised through property, income, or sales taxes that are paid into a general fund

State and Federal Grants
State and federal grants provide additional funding for water quality improvements

Public-Private Partnerships
Contractual agreements between a public agency and a private sector entity that allow for private sector participation in the financing, planning, design, construction, and maintenance of stormwater facilities

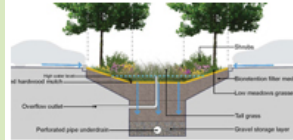
Bonds
Bonds are not a true revenue source but are a means of borrowing money. Green bonds are a new source of funding dedicated to environmentally-friendly projects, including clean water projects

Fees
Funds raised through charges for services such as inspections and permits. Funds raised through developer impact fees are one-time charges linked with new development

Stormwater Utility
Generates revenue through user fees, which go into a separate fund that only can be used for stormwater services

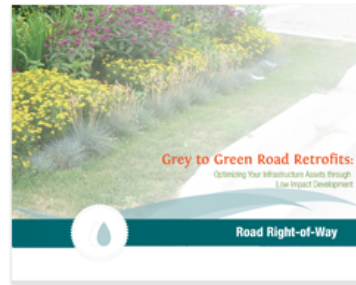


Low Impact Development Guidance Documents



Grey to Green – Retrofits

These guides provide step-by-step guidance on how to retrofit existing properties to incorporate LID stormwater management technologies. Guides are tailored to specific land-uses, including road right-of-ways, private lands, public lands, residential lands and an overarching guide to assist municipalities on how to implement city-wide retrofit programs.



Grey to Green Road Retrofits: Optimizing your Infrastructure Assets Through Low Impact Development

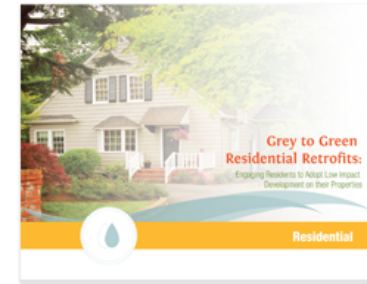


Grey to Green Business and Multi-Residential Retrofits: Optimizing your Bottom-line Through Low Impact Development

Making The Case For LID – Business cases, Discussion Papers and Articles.



Grey to Green Grey to Green Public Lands Retrofits: Optimizing Parks, Public Buildings, Schools and Places of Worship through Low Impact Development



Grey to Green Residential Retrofits:



Grey to Green Enhanced Stormwater Management Master Planning:

Roads and rights of way
Business and multi-residential properties
Residential properties
Public lands retrofits

<http://www.creditvalleyca.ca/low-impact-development/low-impact-development-support/>



Achieve Multiple Goals with “Greening” Connect People and Places Invest in the Public Spaces You Already Have

- Think beyond the environmental benefits, and remember investments can bolster local economies and provide more choices for moving around.
- Connect residents and visitors to natural and cultural amenities through improved access and more transportation options. Also, connect people to natural processes.
- Focus on and invest in existing streets, parks, and plazas to revitalize neighborhoods and engage nearby businesses and residents.

Urban Waters Federal Partnership

Powerful Inter-Agency Platform supported by WH CEQ and DPC
Breaking down federal program silos; Engaging communities first.



What can a local Urban Waters Partnership initiative achieve?

Imagine...

- All waters clean for fishing and recreation and for cleaner intake water for drinking
- All Urban Waters locations with economic progress in communities that surround them, including distressed communities
- That people's lives are better in communities surrounding urban waters
- The people in urban, suburban and rural communities on the same river or lake collaborating to clean up the river or lake and connect culturally



Imagine that People's Lives are Better in Communities Surrounding Urban Waters



We could have better physical surroundings in neighborhoods with:

- New refurbished housing
- Clean streets
- New green infrastructure for green streets, green playgrounds, green sidewalks, green buildings/roofs
- New trails, trees and parks
- Weatherized public housing or housing for middle-class families
- Green schools
- Green restored vacant lots with trees and parks

Imagine Economic Progress in *All* Communities that Surround Urban Waters Locations

- New businesses and projects, like green infrastructure, green streets, playgrounds & roofs are driving new jobs for urban residents
- Water-friendly manufacturing businesses are opening or expanding near urban rivers and lakes and supplying new middle-class paying jobs because businesses want to be near beautiful urban waters
- New projects and jobs for urban residents are being created near urban waters to build public housing, weatherize old buildings, build trails, establish urban farms and food distribution, re-green vacant lots, plant trees, establish orchards



Robert Goo
Office of Water
US Environmental Protection
Agency
202-566-1201
goo.robert@epa.gov