

# Introducing *Missouri Guide to Green Infrastructure*

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Municipal Stormwater Program



**MISSOURI**  
**DEPARTMENT OF**  
**NATURAL RESOURCES**

Storm Water Information Clearinghouse - DNR

# Missouri Department of Natural Resources

Programs   Forms and Permits   Publications   Laws and Regulations   Online Services

## Water Protection Program

### Stormwater Information Clearinghouse Meeting Missouri's Stormwater Regulations

- [Local Government \(MS4\) Programs.](#)
- [Industrial Permits.](#)
- [Land Disturbance Permits.](#)
- [Stormwater Internet Map Viewer](#)
- [MS4 Program Plan Public Notice.](#)
- [Phase II Background, Highlights and Governance.](#)
- [Other Water Related Construction Site Permits.](#)
- [Announcing \*Missouri Guide to Green Infrastructure: Integrating Water Quality into Municipal Stormwater Management\*.](#)



Programs  
About Us  
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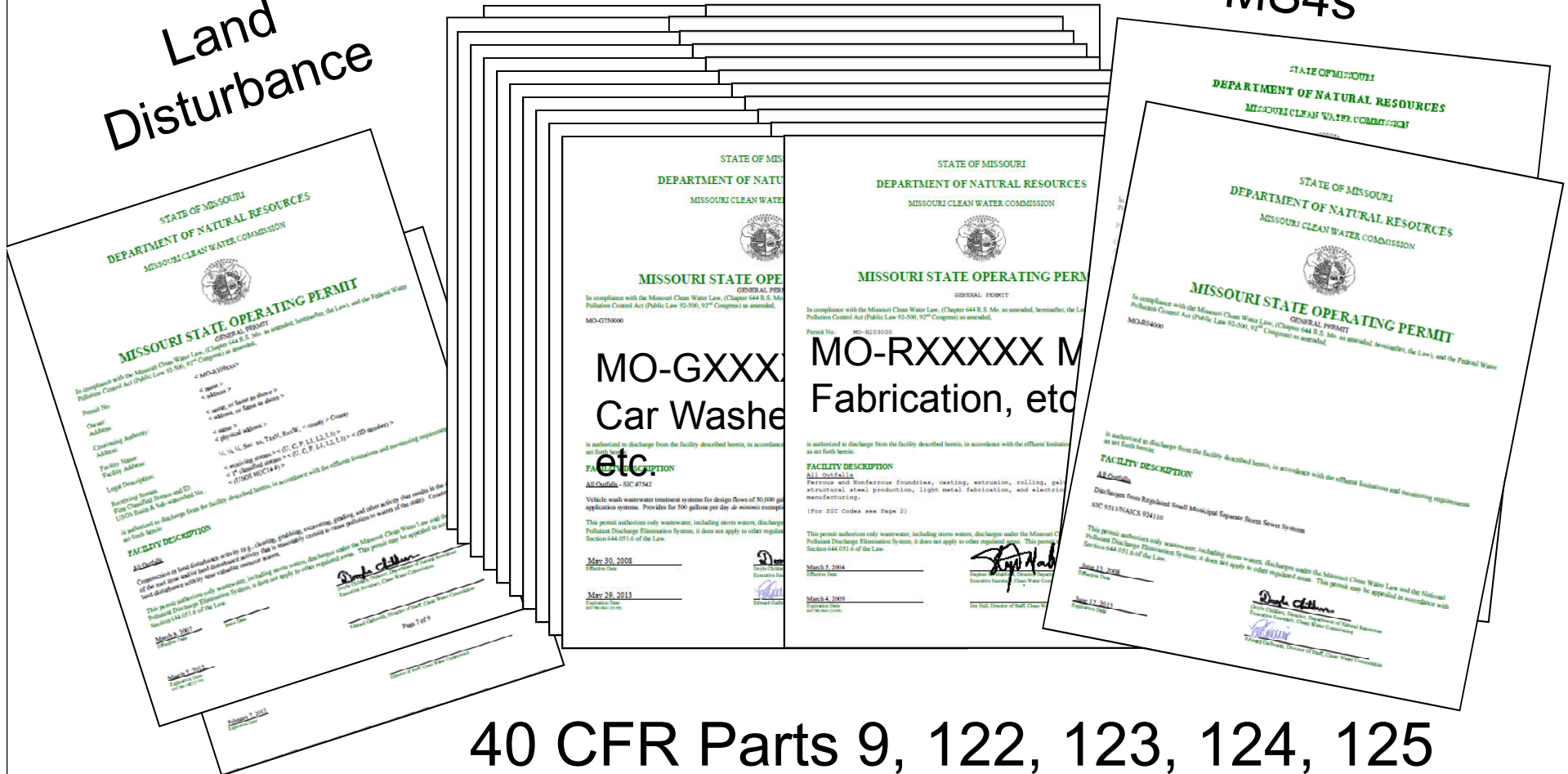
<http://dnr.mo.gov/env/wpp/stormwater/sw-local-gov-programs.htm>

# ~14,000 NPDES PERMITS

Industrial

MS4s

Land Disturbance



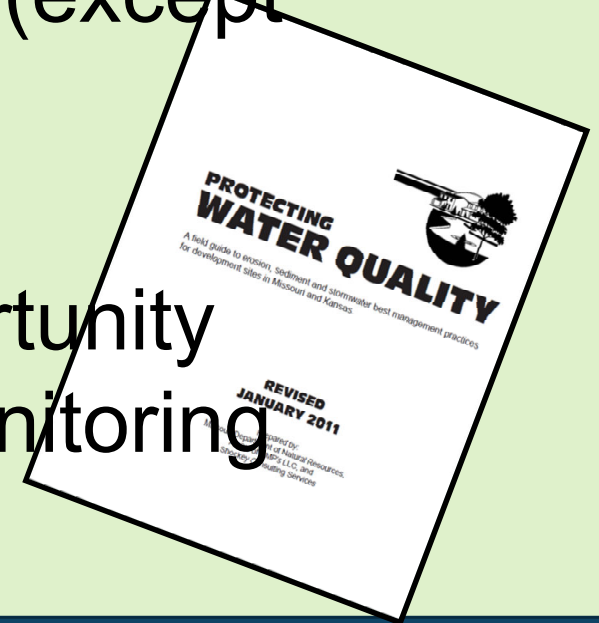
40 CFR Parts 9, 122, 123, 124, 125  
10 CSR 20-6.200

# **NON-NPDES**

- DNR 401
- COE 404
- Dam Safety
- Sand & Gravel Mining
- COE Section 10

# Land Disturbance Permitting

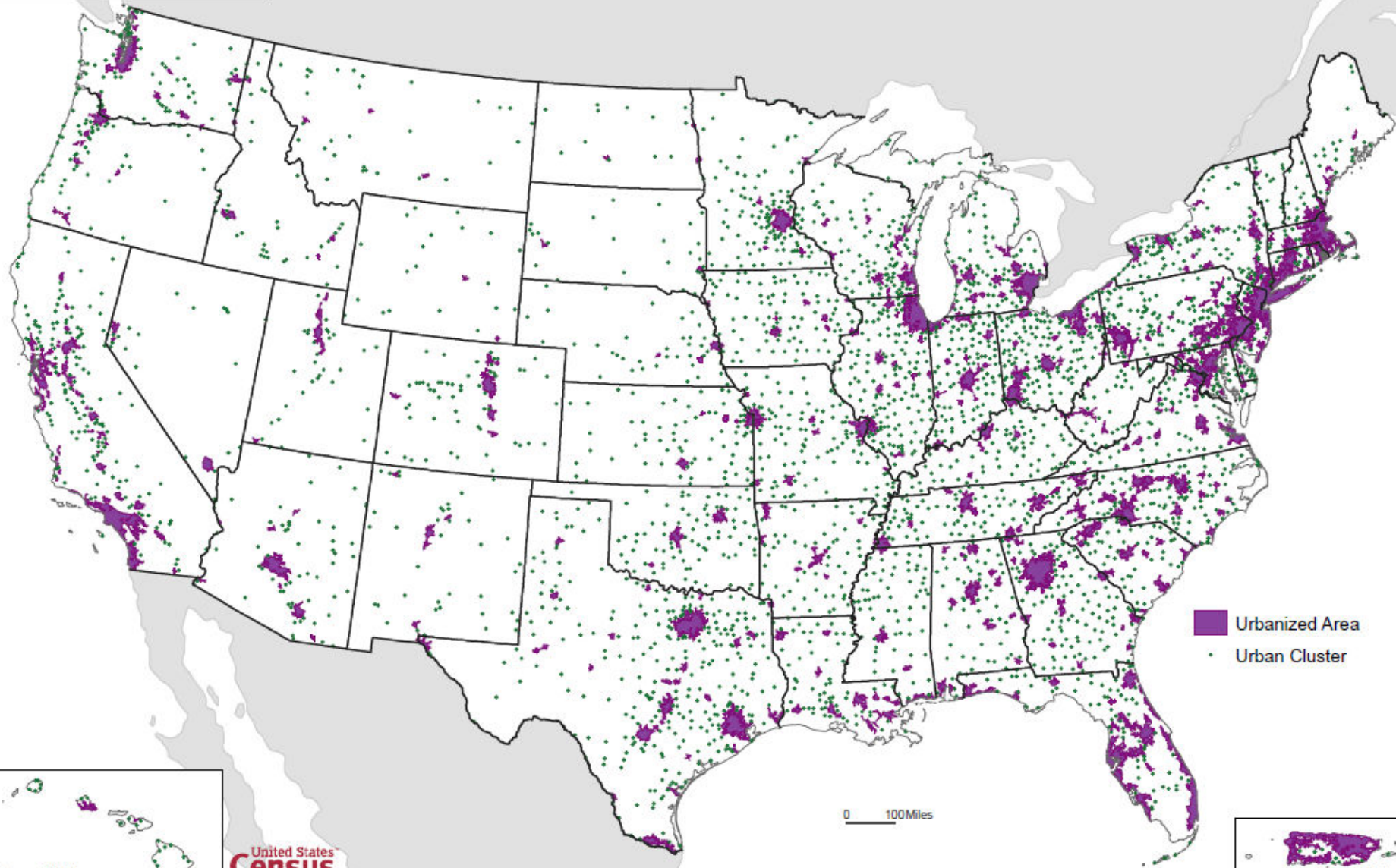
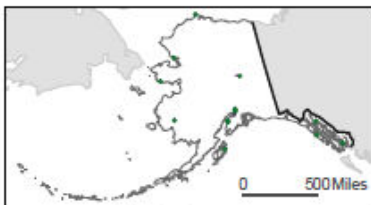
- E-permitting went live June 25, 2012
- No paper applications will be accepted after September 1<sup>st</sup> (except for MOR100 and Site-specific permits).
- Planning to expand this opportunity for submittal of Discharge Monitoring Reports (DMRs)



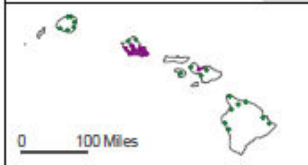
# Industrial Stormwater Permitting

- Rule being revised to clarify existing benchmark provision.
  - Numeric benchmark exceedance requires BMP improvement and SWPPP revision.
  - Numeric limits exceedance means violation of permit.
- Permit Assistant  
<http://dnr.mo.gov/mopermitassistant/index.jsp>

# Urbanized Areas and Urban Clusters: 2010

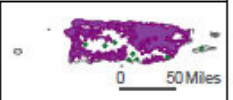


Urbanized Area  
Urban Cluster



United States  
**Census**  
Bureau

0 100 Miles



Source: U.S. Census Bureau, 2010 Census Urban Area Delineation Program



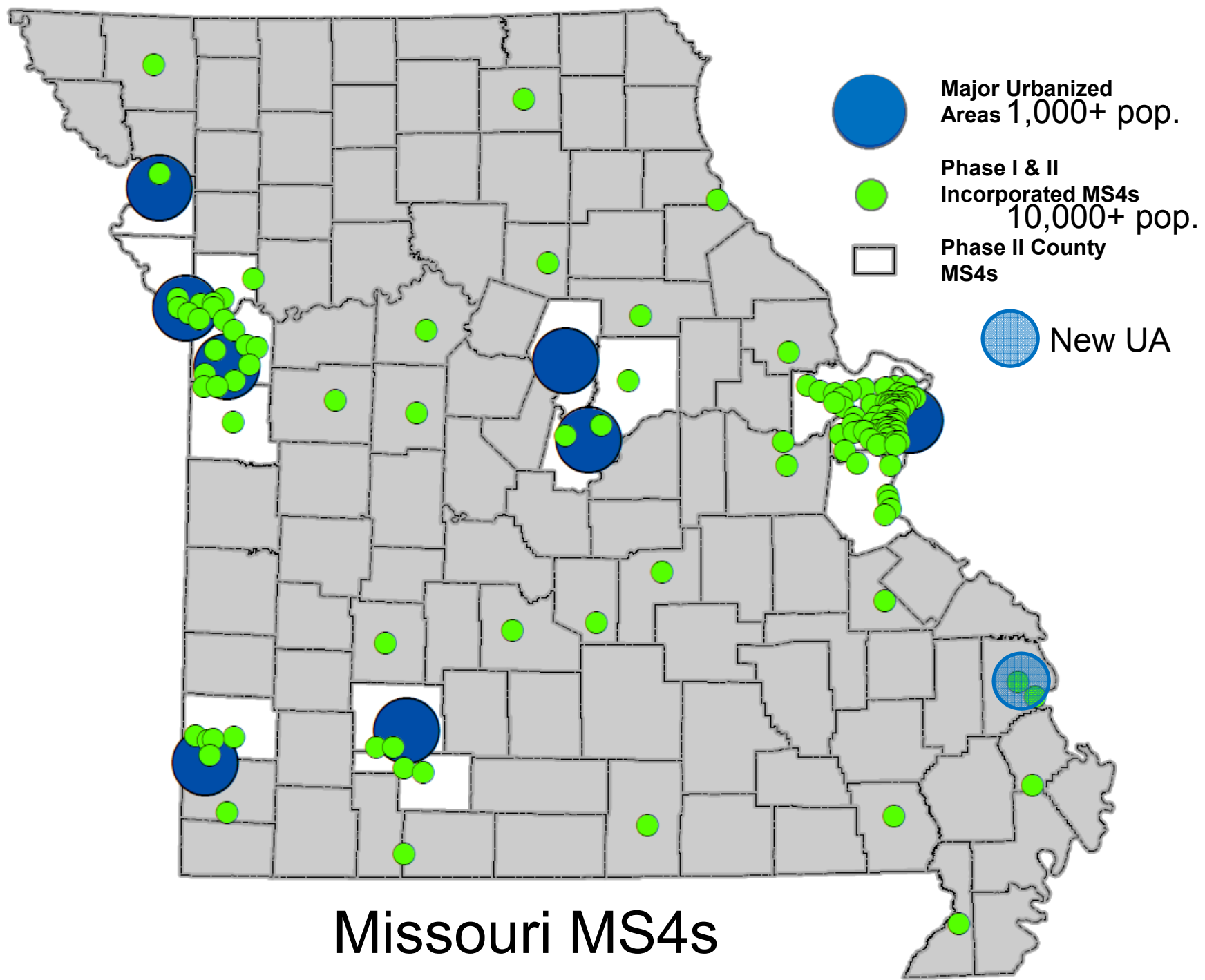
Arnold	Columbia	Holts Summit	North Kansas City	St. John
Ballwin	Cool Valley	Independence*	<u>Northwoods</u>	St. Joseph
Battlefield	<u>Cottleville</u>	Jackson, City of	Norwood Court, Town of	St. Louis (MSD)
Bellefontaine Neighbors	Country Club, Village of	Jackson County (Salem E)	Oak Grove	St. Louis County
<u>Bel-Nor, Village Of</u>	Crestwood	Jasper County	Oakland	St. Martins
<u>Bel-Ridge, Village Of</u>	Creve Coeur	Jefferson City	O'Fallon	St. Peters
Belton	Crystal City	Jefferson County	<u>Olivette</u>	<u>Strafford</u>
Berkeley	<u>Dardenne Prairie</u>	Jennings	<u>Oronogo</u>	Sugar Creek
Black Jack	<u>Dellwood</u>	Joplin	Overland	Sunset Hills
Blue Springs	Des Peres	Kansas City*	Ozark	<u>Troy</u>
<u>Bolivar</u>	Duquesne	Kennett	<u>Pagedale</u>	Town And Country
Boone County	<u>Eureka</u>	Kirksville	Parkville	U.S. Medical Center for Federal
<u>Branson</u>	Ellisville	Kirkwood	Pevely	Prisoners
Breckenridge Hills	Excelsior Springs	Ladue	<u>Peculiar</u>	Town And Country
Brentwood	Farmington	<u>Lake Lotawana</u>	Platte County	<u>Union</u>
Bridgeton	Fenton	Lake St. Louis	Pleasant Valley	<u>University City</u>
Buchanan County	Ferguson	<u>Lake Winnebago</u>	Poplar Bluff	University of Missouri-Col
Byrnes Mill	Festus	<u>Lakeshire</u>	Raymore	Valley Park
Callaway County	Florissant	Lebanon	Raytown	Vinita Park
Calverton Park, Village of	Fort Leonard Wood	Lee's Summit	<u>Republic</u>	Warrensburg
Cape Girardeau City	Frontenac	Liberty	Richmond Heights	<u>Warson Woods</u>
<u>Cape Girardeau County</u>	Fulton	Manchester	Riverside	Washington
Carl Junction	Gladstone	Marlborough, Village of	Riverview, Village of	<u>Weatherby Lake</u>
Cartersville	Glendale	Marshall	Rock Hill	Webb City
Carthage	Grain Valley	Maryland Heights	Rolla	Webster Groves
Cass County	Grandview	Maryville	Sedalia	Weldon Spring
<u>Charlack</u>	Green Park	Mexico	Shrewsbury	Wentzville
Chesterfield	Greene County	<u>MoDOT</u>	Sikeston	West Plains
Christian County	Greenwood	Moberly	<u>Smithville</u>	Wildwood
Clarkson Valley	Hanley Hills, Village Of	Moline Acres	Springfield*	Winchester
Clay County	Hannibal	Neosho	St. Charles	Woodson Terrace
<u>Claycomo, Village of</u>	<u>Harrisonville</u>	Newton County	St. Ann	
Clayton	Hazelwood	Nixa	St. Charles County	
Cole County	Herculaneum	Normandy	<u>St. George disincorporated</u>	164 Total

Newly designated 10K+ communities based on 2010 Census.

Newly designated communities <10K based on 2010 Census and redefined Urbanized Areas.

\*Phase I communities with populations of 100,000+ at time of 1990 census.





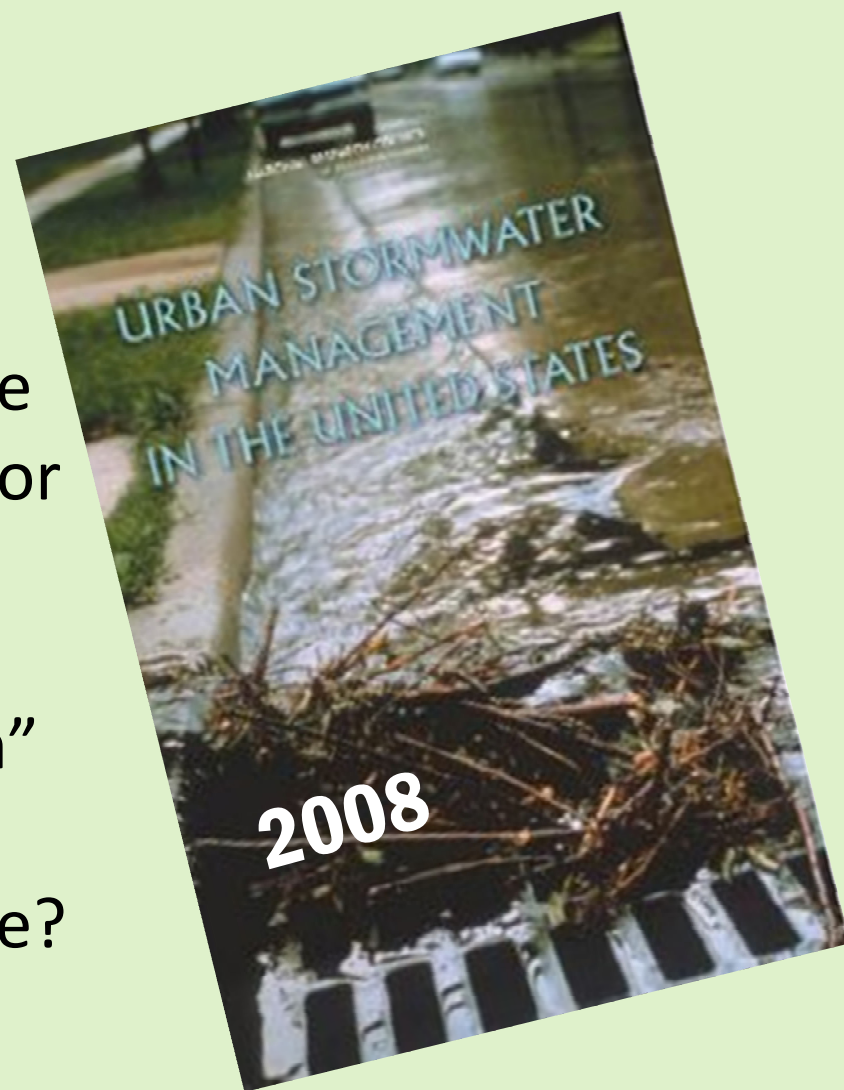
# Urban Pollutants of Concern

- Sediment
- Nutrients
- Chloride
- Bacteria
- Metals
- PAHs
- Oils & Greases
- Thermal

# MS4 Program Requirements

- Public Education & Outreach
- Public Participation
- Illicit Discharge Detection and Elimination
- Active Construction Program
- **Post construction program for new development and redevelopment sites  $\geq$  1 acre general requirement**
- Pollution Prevention/Good Housekeeping
- Maximum Extent Practicable (MEP)

- EPA's current approach is not meeting stormwater management goals
- Appropriately emphasizes the role of managing hydrology for reducing pollutant loads
- Some have asserted that the NRC report is a call to “retain” stormwater on site
- MEP: narrative to prescriptive?



# Natural Resources

## Small Storms are Significant

- Up to 0.5 inch rain events = bacterial discharges – can contain on site (os)
- 0.5 to 1.5 in. = about 75% of the urban runoff pollution – can contain/treat os
- > 1.5 in. (avg) = drainage design storms
  - Rate reduction more cost beneficial
  - Smaller storm treatment helps reduce pollution from these events
- Once-in-a-Blue Moon events should be conveyed in “secondary” drainage systems.

# Federal NPDES Rulemaking

- Propose Draft – June 2013 -Emphasis on Post-construction
- Final Stormwater Rule – December 10, 2014
- Missouri Phase II General Permit Renewal June 2013

# Federal Rule Considerations

- Expand Universe of Regulated Discharges
- Establish Minimum Post-Construction Standards for New and Redevelopment Goal is Pre-Development Water Balance
- Retention Requirements (85-95% )?, Treated Discharges?
- New vs. Redevelopment
- Develop Single Set of Consistent Requirements
- Address Retrofit Requirements for Existing Development
- Additional Requirements for Chesapeake Bay and other Sensitive Waters

# A municipal how-to guide for post-construction

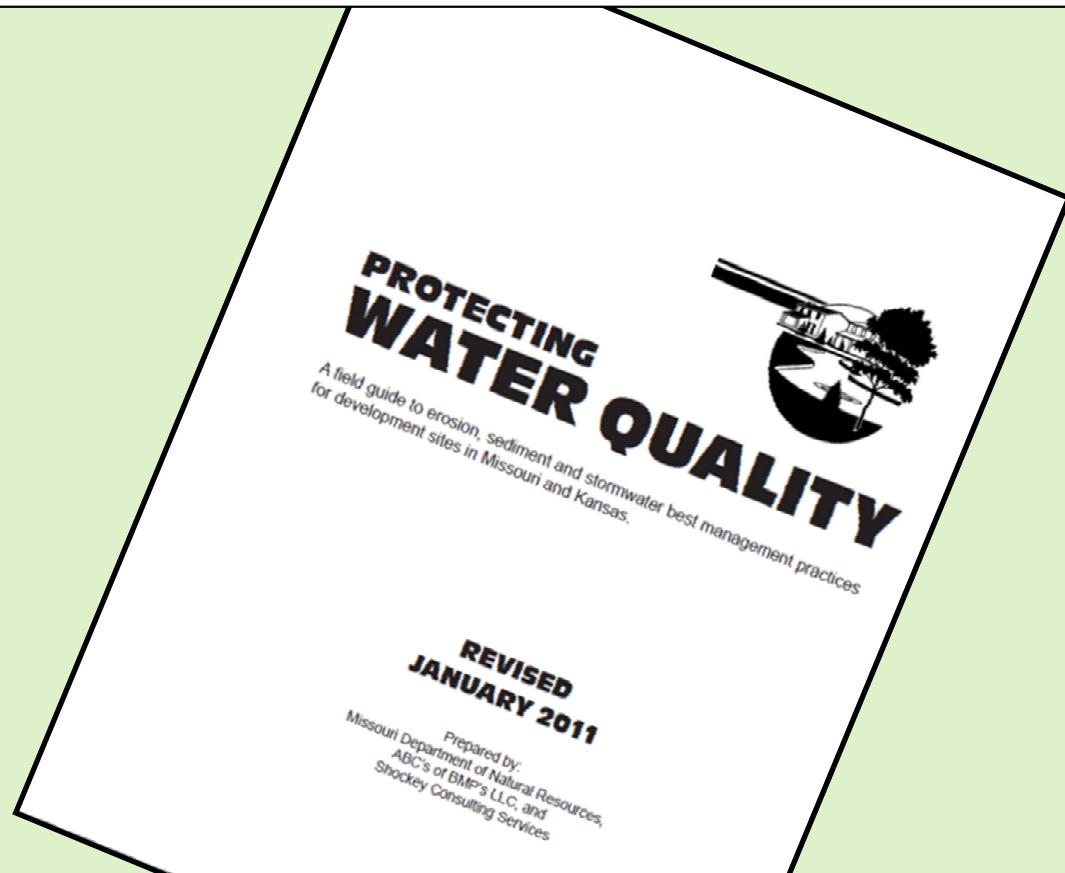


**May 2012**

[http://dnr.mo.gov/env/wpp/  
stormwater/mo-gi-guide](http://dnr.mo.gov/env/wpp/stormwater/mo-gi-guide)



Companion to PWQ Guide, which is useful when developing MS4 Construction Site Runoff Management Program



<http://dnr.mo.gov/env/wpp/wpcp-guide.htm>

## **GI Guide Purpose**

- For municipalities and their development communities.
- How to integrate green infrastructure into the local development program in a cost-effective manner to:
  - address community goals
  - aid stormwater compliance with post-construction requirements
- Funded by EPA

## **Caveats**

- Not a design manual
- Not a regulatory document

## **Emphasis Areas of the Guide**

- Integrating Green with Grey
- Triple Bottom Line, cost considerations
- Ordinances & Legal Impediments
- Sustainable Site Design
- Two-pronged approach
  - Design storm. Up to 90<sup>th</sup> percentile storm.
  - Continuous Simulation Modeling
- Midwest Case Studies & references

# SWMP Function

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Olivette, MO rain garden. Source: David A. Wilson, East-West Gateway Council of Governments.

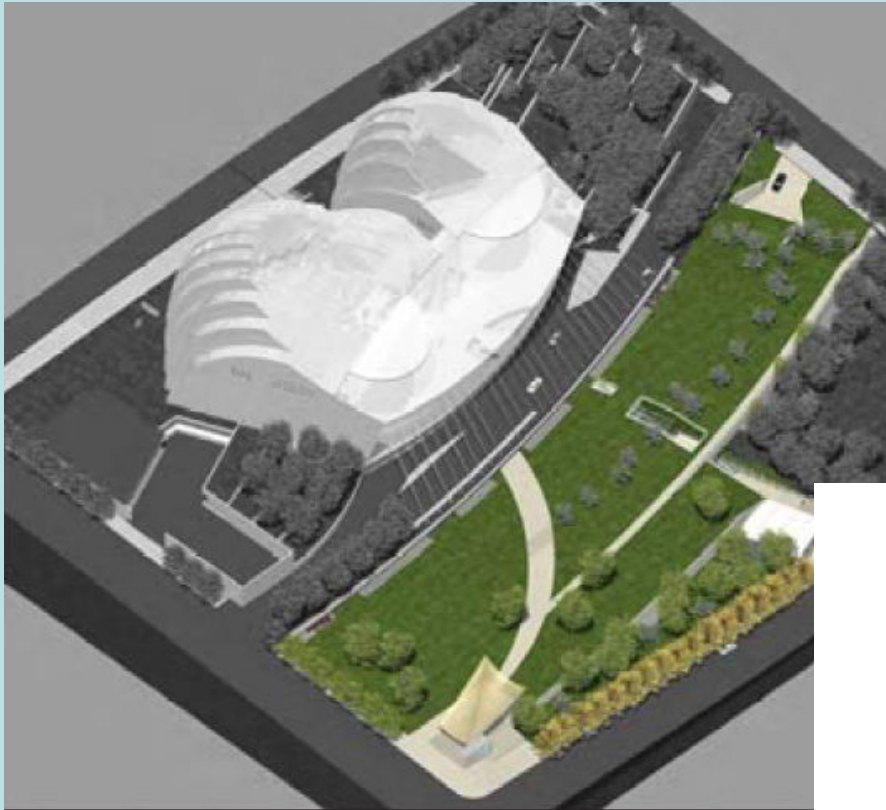


Pervious alley in St. Louis City. Source: Metropolitan St. Louis Sewer District (MSD)



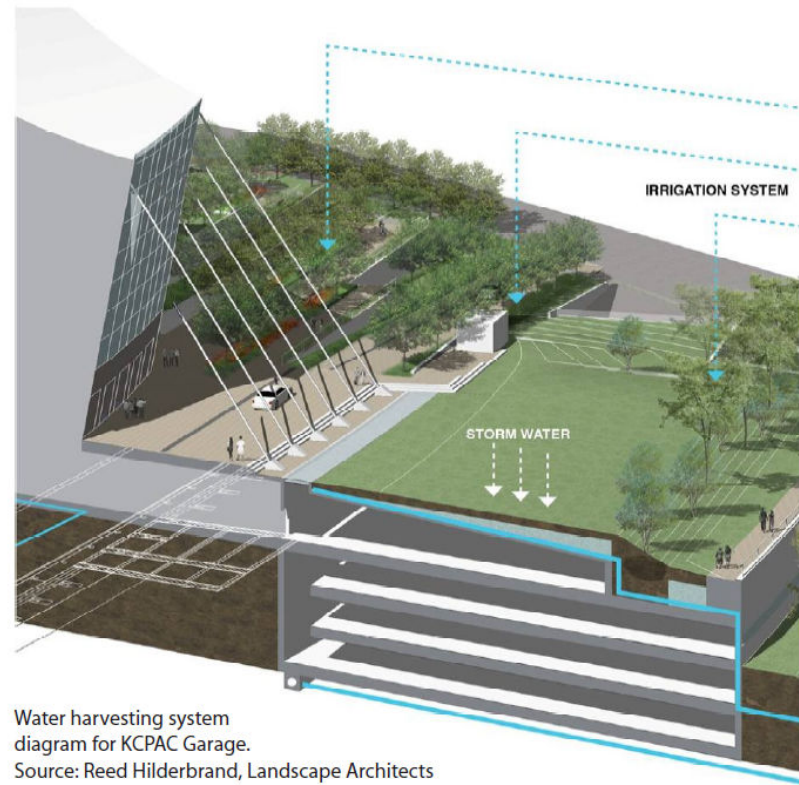


Porous asphalt alley, St. Louis, MO. Source:  
Metropolitan St. Louis Sewer District



# Kansas City Performing Arts Center Parking Garage Green Roof

306,144 gallons of  
water storage



Water harvesting system  
diagram for KCPAC Garage.  
Source: Reed Hilderbrand, Landscape Architects

# Low Impact Development (& GI) Principles

1. Plan First.
2. Prevent, then mitigate.
3. Minimize the disturbance.
4. Manage stormwater as a resource – not a waste.
5. Mimic the natural water cycle.
6. Disconnect, decentralize, distribute.
7. Integrate natural systems.
8. Maximize multiple benefits.
9. Make maintenance a priority.

*Low Impact Development Manual for Michigan: A Design Guide for Implementers and Reviewers* (Southeast Michigan Council of Governments, 2008):

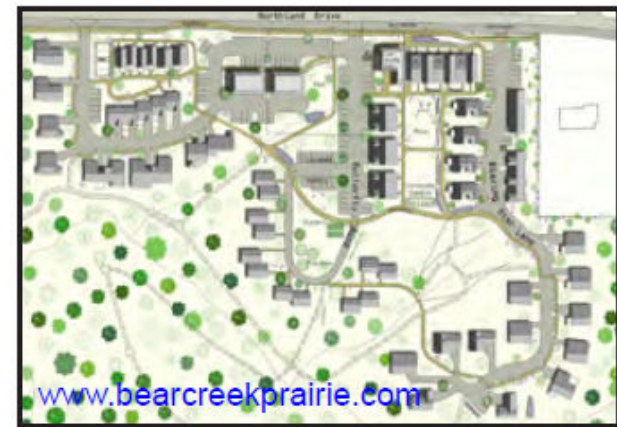
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Regional Scale



Municipal/ Watershed Scale



Neighborhood/Site Plan Scale

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**CHAMPION  
DEVELOPMENTS  
NEEDED**

# Banking on Green

The report's top findings:

1. Not only does green infrastructure cost less, but these practices can further reduce costs of treating large amounts of polluted runoff.
2. Green infrastructure can help municipalities reduce energy expenses.
3. Green infrastructure can reduce flooding and related flood damage.
4. Green infrastructure improves public health — it reduces bacteria and pollution in rivers and streams, preventing gastrointestinal illnesses in swimmers and boaters.

## ***Chapter 1: Introduction to Green Infrastructure***

1.1 Concepts, Terminology and Trends

1.2 A Vision for Urban Sustainability

1.3 Principles of Green Infrastructure and Its Tools

1.4 Benefits of Green Infrastructure: Environmental, Social and Economical

1.5 Rethinking Stormwater

1.6 Leadership is Key

1.7 Use and Organization of this Guide

## ***Chapter 2: Sustainable Site Design, Development Plan and Land Use Planning***

2.1 Sustainable Development Planning and Site Design.

2.2 Planning and Permitting at the Municipal Scale

2.3 Green Infrastructure Planning at the Watershed Scale

2.4 Green Infrastructure Planning at the Regional Scale.

2.5 Considering Physiographic Regions

Case Studies



## ***Chapter 3: Green Infrastructure for MS4 Post-Construction Runoff Management***

3.1 MS4 Program Requirements

3.2 Establishing, Adapting or Adopting SCM Design Manuals

3.3 Integrating Green Infrastructure into Program Development

3.4 Enhancing and Implementing Your Stormwater Management Program

Case Studies

## ***Chapter 4: Integrating Green Infrastructure into Ordinances***

4.1 Develop/Enhance and Implement Policies to Preserve and Restore Pre-Construction Runoff Conditions

4.2 Directing Development

4.3 Updating Codes and Ordinances

Case Studies

## ***Chapter 5: Green Infrastructure Implementation Methods***

5.1 Sustainable Site Design Principles

5.2 Defining the Source

5.3 Controlling the Source through Sustainable Site Design Methods and Practices

5.4 Green Infrastructure and Structural Stormwater Control Measures

## ***Chapter 6: Stormwater Control Measures - Strategies, Practices and Tools***

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## **Appendices**

A. Glossary

B. References

C. Additional Resources

## Supporting Resources

- **Banking on Green – ASLA**
- **The Value of Green Infrastructure – CNT/AR**
- **Rooftops to Rivers – NRDC**
- **Bloomberg New Energy Finance (Nov 2011) “US Stormwater Programme Poised For Green Growth”**
- **Charting New Waters (January 2012) Financing Sustainable Water Infrastructure**
- **Environmental Health Perspectives (December 2011) “Stormwater Strategies: Cities Prepare Aging Infrastructure for Climate Change”**

- **Draft Report to Illinois EPA** (June 2010) “Using Green Infrastructure to Manage Urban Stormwater Quality: A Review of Selected Practices and State Programs”: <http://www.epa.state.il.us/green-infrastructure/docs/public-act-recommendations.pdf>
- **Northeast Ohio Regional Sewer District** Project Clean Lake and Green Infrastructure Plan: <http://neorsd.org/projectcleanlake.php>
- **NRDC** Financing Stormwater Retrofits in Philadelphia and Beyond: <http://www.nrdc.org/water/stormwater-financing.asp>

- **NRDC** Looking Up: How Green Roofs and Cool Roofs Can Reduce Energy Use in Southern California:

<http://www.nrdc.org/water/pollution/green-roofs.asp>

- International BMP Performance (& cost) Database

<http://www.bmpdatabase.org/BMPPerformance.htm>

# Questions?



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