Operation and Maintenance of Green Infrastructure Practices

Presented for:

DES PLAINES RIVER WATERSHED WORKGROUP

Presented by:

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What is Green Infrastructure?

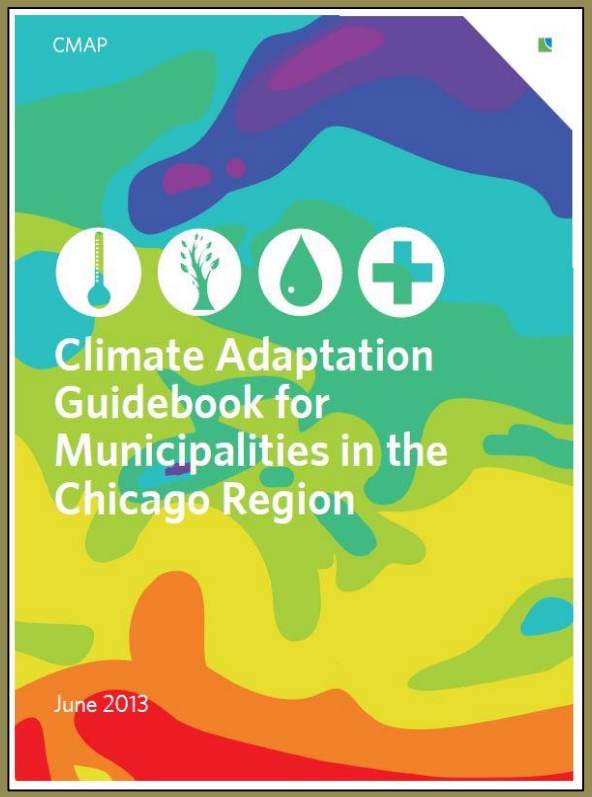
- Landscape features designed to ameliorate some of the negative impacts associated with stormwater runoff by limiting and treating surface outflow
- Scale – regional or on-site
- Part of the toolbox for BMPs

What is Green Infrastructure?

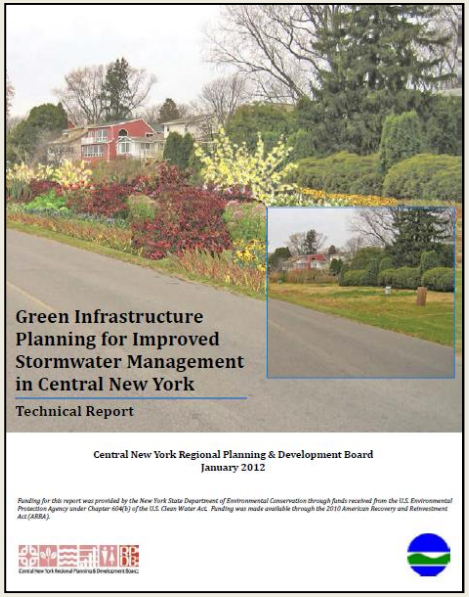
- East and Chesapeake Bay Area – wooded buffers, often associated with WQ objectives
- Out West – thermal objectives for salmon
- Midwest – regional corridors for humans and habitat, and on-site stormwater offsets

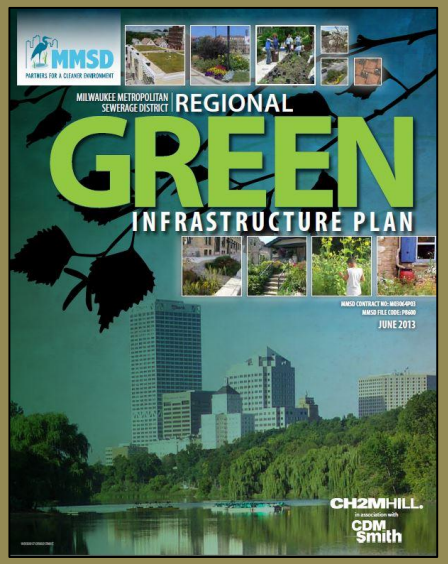
Adapting to Climate Change Impacts

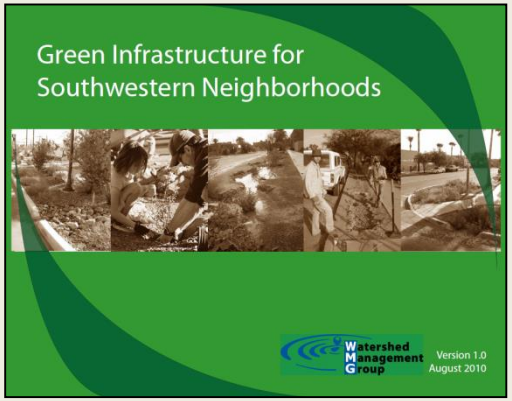
- Drainage and Flood Protection
- CSO's
- Standards for Building and Site Planning
- Managing Heat
- Air Quality
- Open Space and Urban Forestry
- Runoff Volume Reduction (RVR)

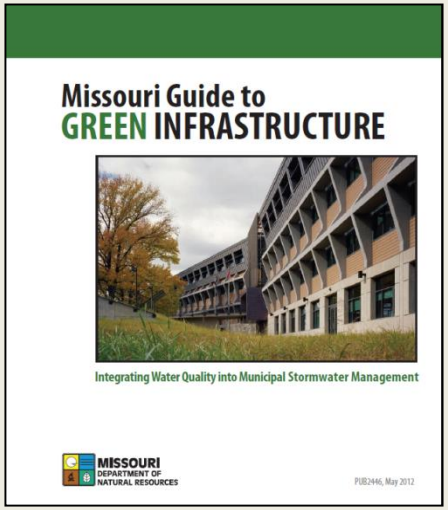


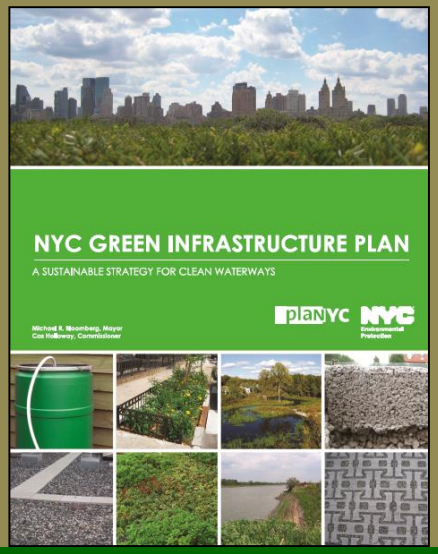
Municipal Green Infrastructure Plans



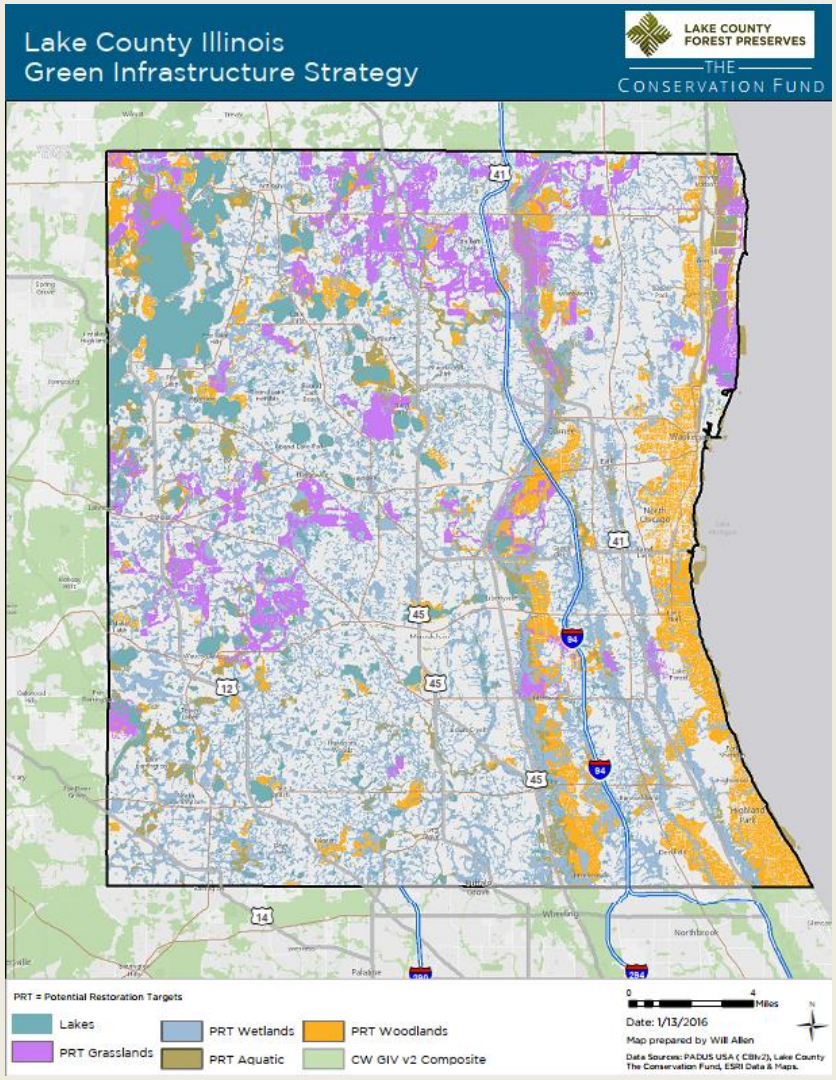








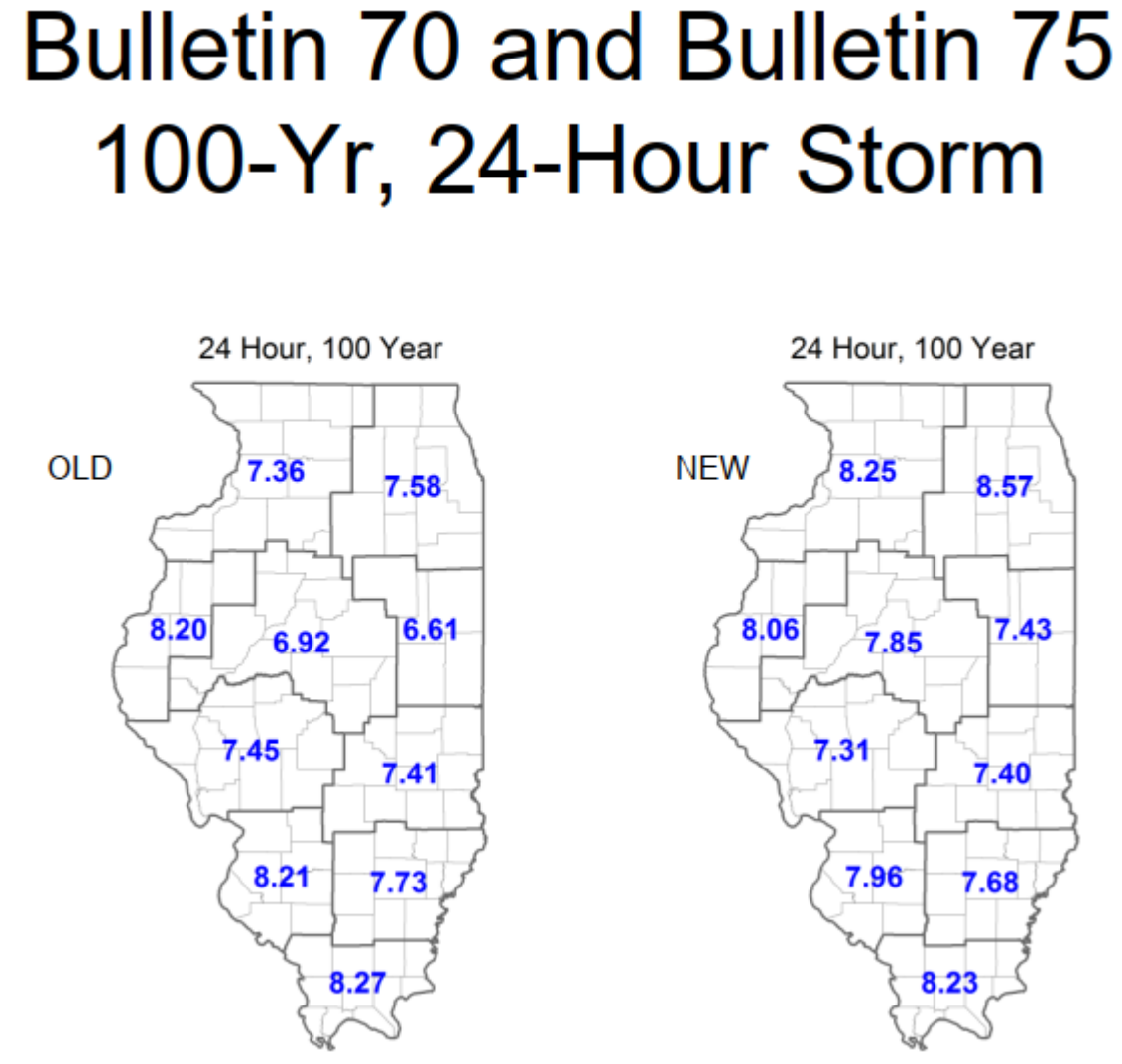
Lake County



Regional greenway and Green Infrastructure Vision approach with urban components

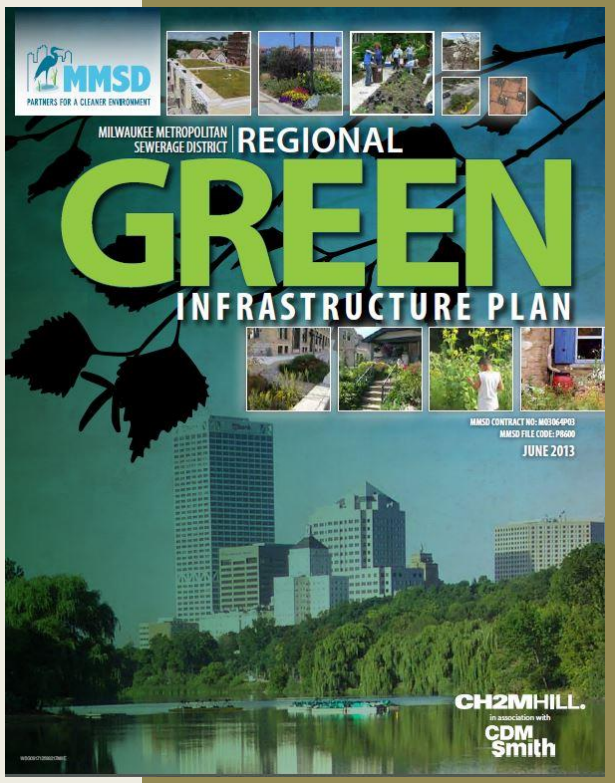
Annual Precipitation Increase

Illinois (Midwest) rainfall totals and storm intensities on the rise



MMSD Regional GI Plan

- MMSD Regional Green Infrastructure Plan
- Establishes 2035 vision of capturing 0.5” of runoff from impervious surfaces
- 91 mi^2 impervious
- 740 million gallons
- $1.3 billion

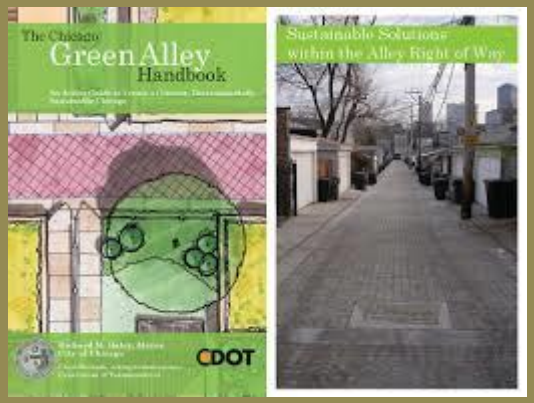


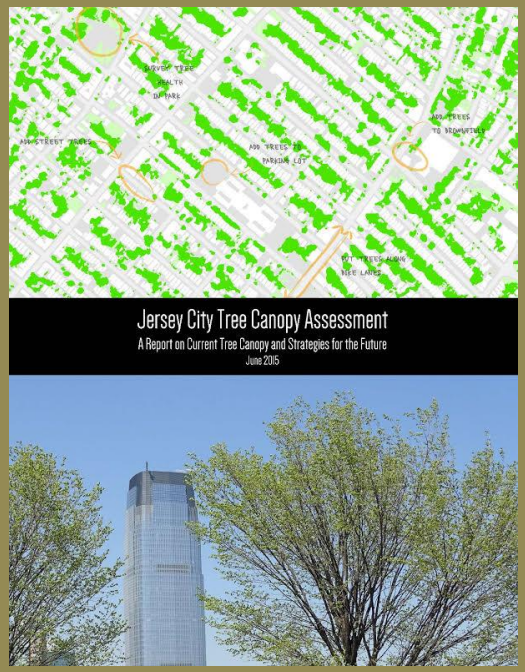
MWRDGC Service Area

- 893 sq. miles in Cook County
- 27,000 gallons in an acre-inch
- 15.5 billion gallons of potential runoff from each inch of rainfall!
- That’s a lot of rain gardens!

Design Considerations

- Regional networks of GI are often linear connected networks usually along riparian corridors
- Urban retrofits or new development designs are site specific
- Need to consider design and watershed objectives when picking appropriate BMPs – water quality, heat, habitat, etc.





Soil Considerations

- Amount of sand, silt and/or clay controls how much water will seep into the ground and how much will run off
- Often use amended soils – e.g. 1/3 sand, 1/3 compost, 1/3 topsoil
- Fertility is a blessing and a curse
- New data (Bannerman, WI) that compost may actually EXPORT nutrients out of the facility rather than sequester

Planting "Guidance"

- "Obligate wetland species are not recommended if the soils in the root zone are sandy. Upland species are also not recommended, due to frequent periods of inundation. We suggest planting a variety of species at first, allowing conditions to "proof" the choice of plant selection. Plan to replace some species after the first growing season."
- "…..ask a local nursery."
- *From Design Guidelines for Stormwater Bioretention Facilities* – UW Madison, 2006

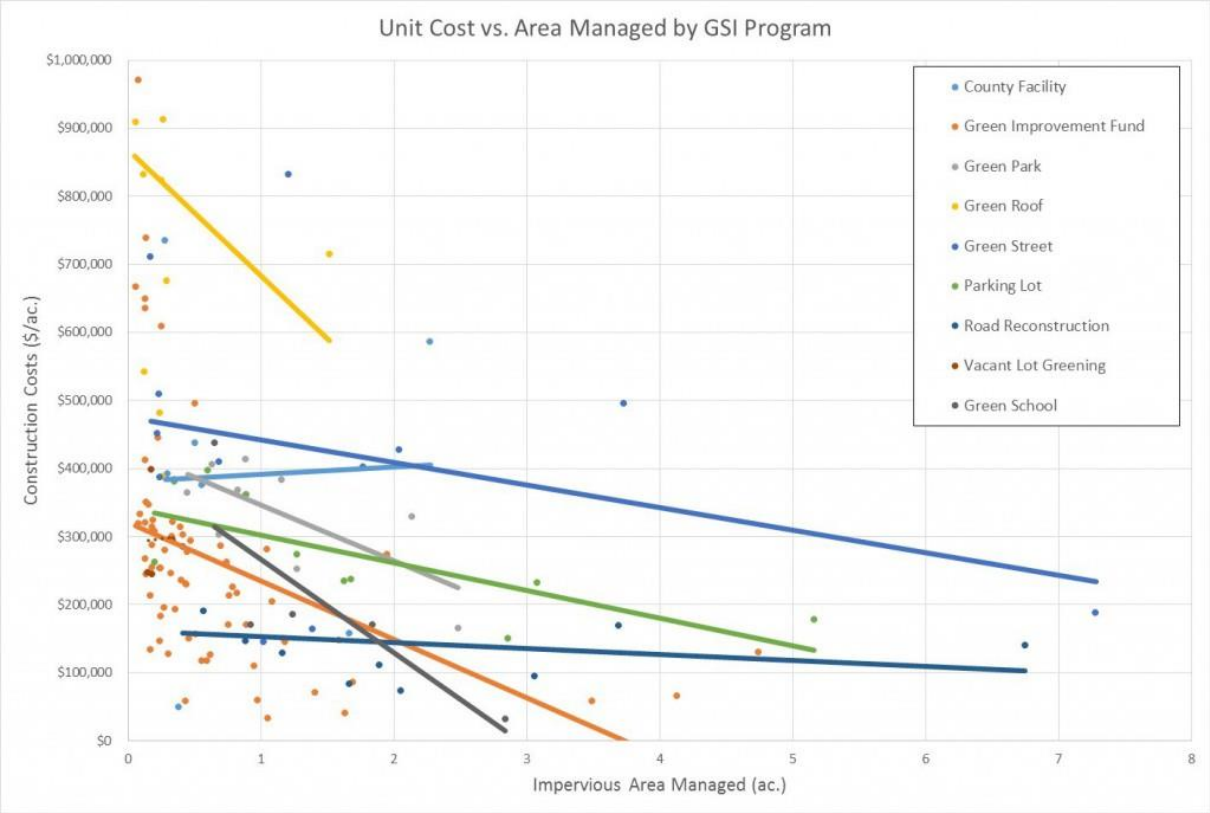
Plant Choice Considerations

- Native vs. turf
- Salt tolerance
- Sun/shade
- Plant height
- Plant appearance
- Tolerate wet and dry cycles

BMPs in Urban Areas

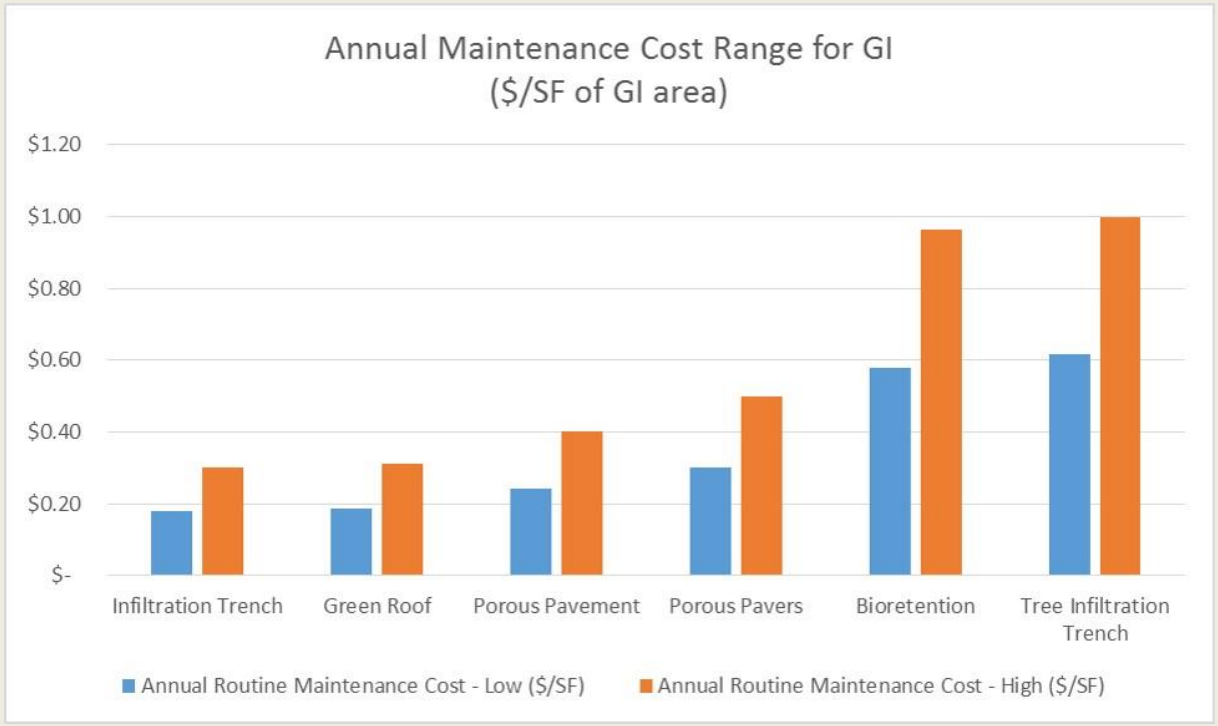
- Need to consider context
  - Public safety – not too tall!
  - Traffic sight lines if close to roadways
  - Appearance and public acceptance
  - Trash and debris accumulation
  - Impacts of road salt
  - How and by whom will it be maintained?

New York State Costs



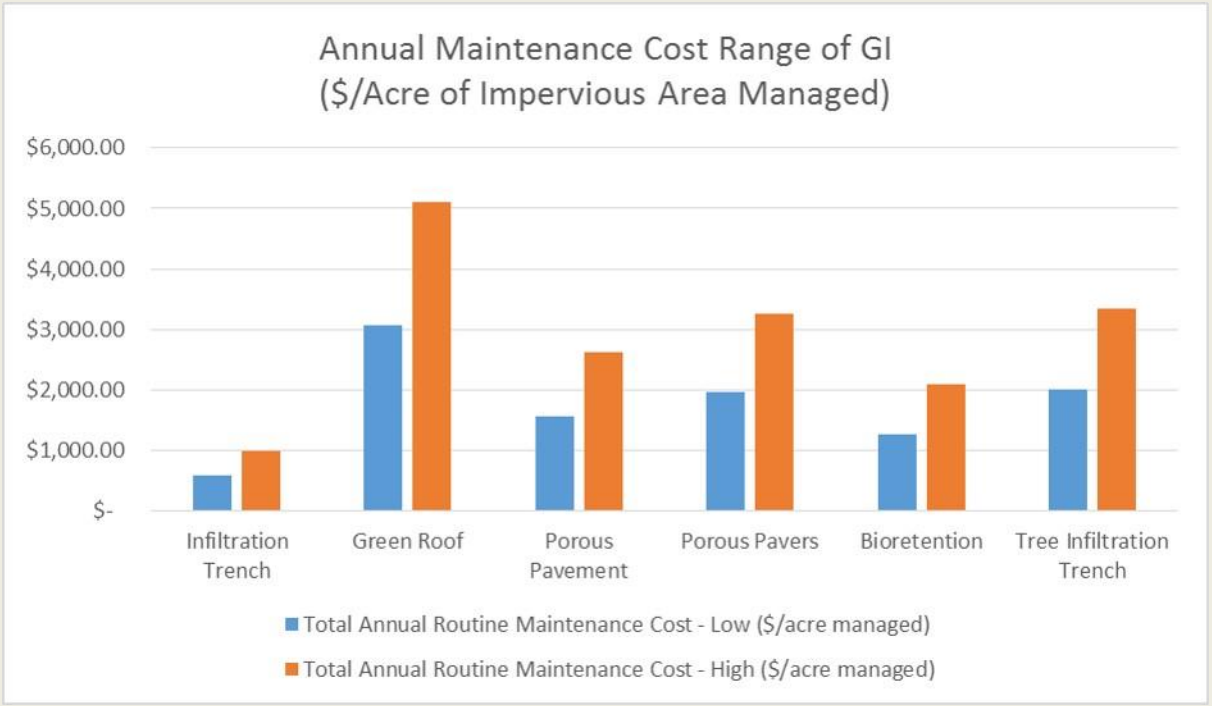
- Biggest project was under 8 acres treated impervious area
- Economies of scale but still pricey
- From WEF Report by CH2M

NOT CHEAP PER SQ. FOOT



- Tree Infiltration Trench *annual* routine maintenance costs ranged from $26-$43,000 per acre!!!
- Infiltration trench was estimated between $7-13K
- Almost don't believe the costs…..

Per impervious area



- Still very high annual costs for routine maintenance

"Average constructed costs of $462,000 per hectare of impervious area managed ($187,000 per acre) are competitive with other cost-effective implementation programs."

Per Facility Cost

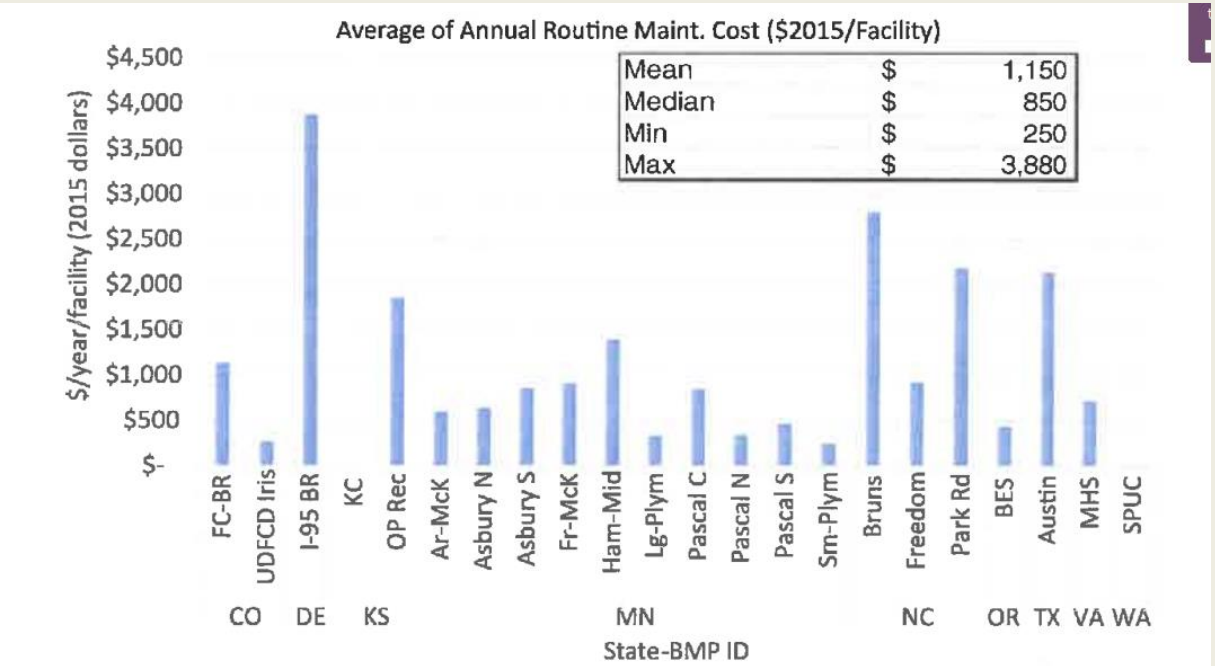
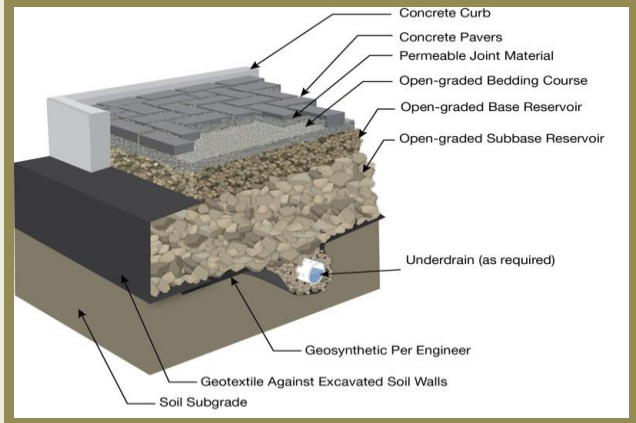


Figure 3-2. Range of Total Annual Bioretention Maintenance Costs (per facility, 2015 dollars)

- More modest costs but level of maintenance not well defined

Local Considerations

- Largely dependent on design considerations and practices
- Scattered BMPs will be more expensive to maintain than more concentrated ones
- Access for equipment could be an issue if not planned for
- Entity doing work will greatly affect prices – contractor versus staff; public versus private



Local Considerations

- Quality of installation and initial establishment will define level of effort in maintenance activities
- Annual disturbance potential (e.g. snow piles/salt damage) would influence annual work
- Aesthetic expectation of owner could require more gardening

Routine maintenance

Weed Control

- A few acres of on-site BMPs with a contractor – budget something around $2-3,000 per year, not necessarily every year
- Backpack spraying and hand pulling
- Dormant season mowing an option if accessible by equipment
- Weed whipping/removal of biomass is a good option too for smaller practices

Routine maintenance

Prescribed Burning

- Big wildcard, due to complexity, infrastructure and risk
- Minimum cost for a burn – probably $2,000
- Bigger site, scattered practices, add $1,000's more
- Likely not needed or desirable annually

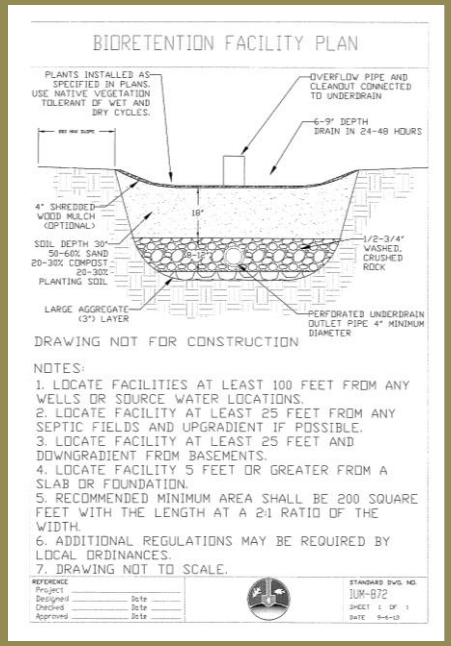
Routine maintenance – Rain "garden"

- Seen $1 to $3 per square yard per maintenance event
- For a 150 SY RG, once/month from May through September could range from $750 to $2250 per year per rain garden depending on level of maintenance and contract
- Some economies of scale but still subject to multiplier factor and standard of care

ROUTINE MAINTENANCE

Infrastructure

- Cleaning of pipes and catchments may need to be done periodically
- Cost per vacuum and disposal? Highly dependent on site - $350/hour for one catch basin
- Could be $250 for each catch basin if on a standard route.
- Culling and replacing soil matrix is sometimes called for in design guidance



General Comments

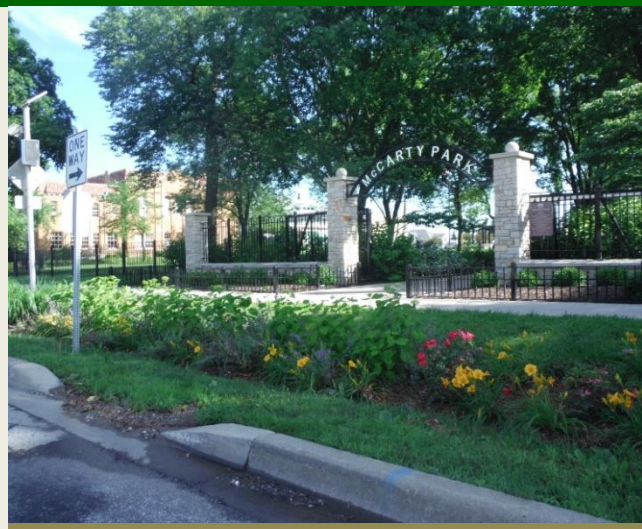
- Lean towards simpler designs that are less futsy/technical
- Monitoring data is limited and contradictory
- Larger, more landscape sized practices are better rather than a bunch of postage stamps
- Chemistry and biology matters depending on goals

View from the field – Various Practices

Lincoln Ave. METRA Lot

Runoff from parking lot flows into basin, flows through plantings and seeps into engineered topsoil, is collected via tile system, and discharges into local sewer after being detained and cleansed.

Spring Street & McCarty park



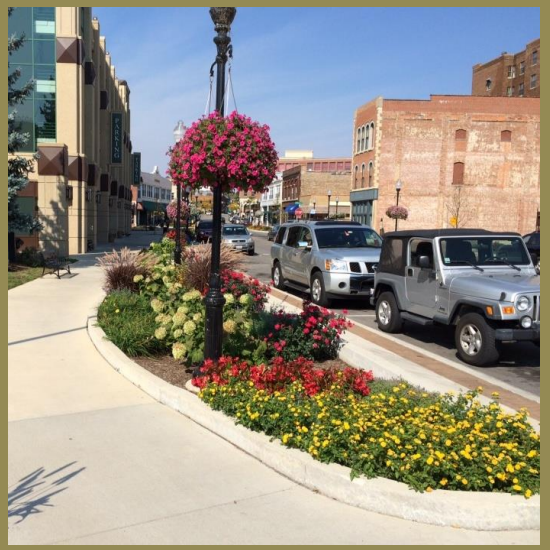
Rain gardens constructed in parkway after combined sewer separation projects.

Downtown Aurora

Plant palette had to match existing downtown streetscape.

City's horticulturalist added annuals for more color.

Very popular!!!



GI FOR CSO CONTROL

Chicago Public Schools

Rain Garden – McHenry County, IL

Rain Garden - Pingree Grove, IL

Bioswale - Madison, Wisconsin

Unmowed Turf Grass in Infiltration basin

Unmowed Turf Grass Sideslope and Native Bottom

Mowed Sideslopes and Unmowed Bottom

Level Spreader
Morton Arboretum

Native vegetation in Infiltraton basin

Old Basin with Mowing and Drywells

Parking Lot Bioswale

Good establishment is key to keeping costs down!!!

Parking Lot Bioswale

Owner didn't like the look!!!

Routinely mowed

Mowed Basin with Trenches

Mowed infiltration basin

Natural Drainageways

Maintenance Considerations

- Starts in the beginning
- Weed seeds apparently came in with imported topsoil.
- Reed canary grass nearly took over in less than two years; common reed and teasel also present.
- Cost of “remedial” work far greater than what it would have cost to maintain from the start.

Long-term Considerations

- Remember practitioners:

Design once, maintain forever.

- Don’t burden owner with high/expensive maintenance
- Spending OPM – be cognizant of goals and outcomes, not just lofty design concepts
- The goals should be realistic and situational – habitat versus loadings
- May be better ways to get similar results

Long-term Considerations

- Should have some type of Operations and Maintenance manual for the HOA/municipality
- Covenants of private development should indicate who is responsible
- Line item in budget for GI features, not just general fund – will get the short stick
- Signage or demarcation of common area of features will minimize "homesteading" by adjacent landowners

Questions?

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