

## Leveraging Ecological and Community Benefits in a Changing World

Steve Wise  
Natural Resources Program Director

Green Infrastructure in NE Ohio  
November 4, 2009



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## The Center for Neighborhood Technology

- 30 year old Chicago-based non-profit
- Sustainable energy, transportation, natural resource, climate strategies:
  - Research
  - Advocacy
  - Demonstration projects
  - Scaling up, replication
- Green Infrastructure agenda
  - Planning/Analysis Toolbox
  - Policy
  - Education
  - Practice



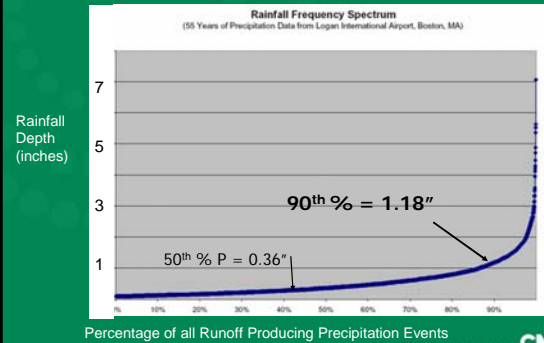
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## Why Green Infrastructure?

- **Highly effective** for stormwater runoff reduction and pollutant removal
- **Restores, recycles, extends** natural and built regional infrastructure
- **Saves money** compared to conventional infrastructure
- **Delivers multiple community benefits** in addition to stormwater management

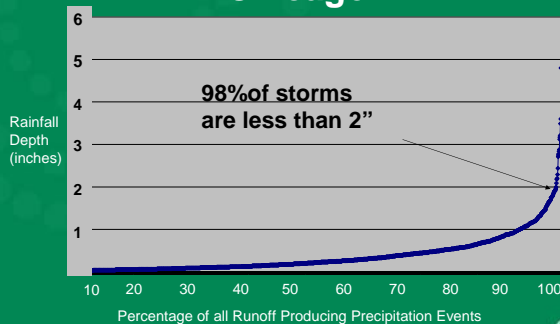
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## Effectiveness and Performance: Boston



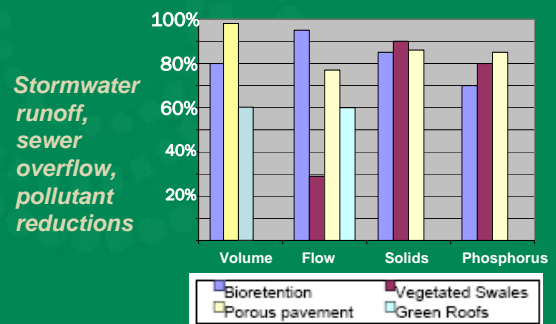
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## Effectiveness and Performance: Chicago



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## High Performance Standard



Portland, Oregon Sustainable Stormwater Program © Copyright Center for Neighborhood Technology **CNT**

## Monitored Demonstrations



Bellwood, IL Water Department Rain Garden w native (class C) soil:  
2.3" 24-hr storm



St. Margaret Mary Bioswale w. amended soil over sandy soil:  
6+" 24-hour storm

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## Integrated Site Practices – Chicago Center for Green Technology

- Redeveloped brownfield
- Partial green roof, permeable surfaces, constructed wetland, water harvest
- **81% annual volume capture**



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## Climate and Water

“The frequency of heavy precipitation events (or proportion of total rainfall from heavy falls) will *very likely* increase over most areas during the 21st century, with consequences to the risk of rain-generated floods.”

*Intergovernmental Panel on Climate Change  
Technical Paper on Climate Change and Water, April '08*

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## Regional Climate Future: More Intense Heat, Storms, Floods



- “...More than triple the number of high flow days toward the end of the century.”

Source: Union of Concerned Scientists, 2009 © Copyright Center for Neighborhood Technology CNT

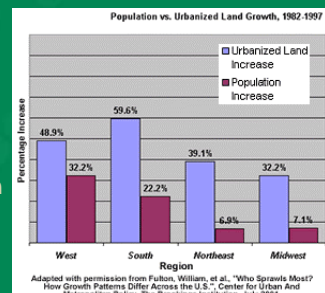
## Storm Intensity and Infrastructure

- 36% increase in design rainfall intensity (5 year return storm) from 1<sup>st</sup> to 2<sup>nd</sup> half of 1900s
- “to maintain the same design and service standards, **the diameter of every sewer pipe in the Chicago region would have been increased by up to 17%** if rainfall IDF relationships were updated properly in time.” (Guo, 2006)
- “Using 6.4 cm (2.5 in) of daily precipitation as the threshold for initiating combined sewer overflow into Lake Michigan, **the frequency of these events is expected to rise by 50% to 120% by the end of this century.**” (Patz 2008)

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## Increasing Development Intensity

- Between 1982 and 1997 Chicago Population increased 12 %
- Land Developed increased 25%
- 10-24 Billion Gallon loss in infiltration



— Paving our Way to Water Shortages (2002)

Adapted with permission from Fulton, Williams, et al., “Who Spravels Most? How Growth Patterns Differ Across the U.S.,” Center for Urban and Metropolitan Policy, The Brookings Institution, July 2001.

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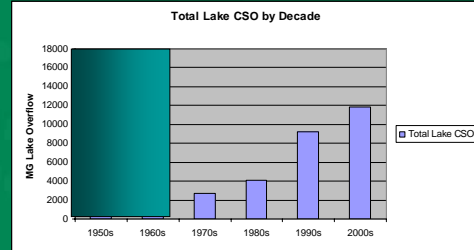
## Chicago, September 13, 2008

- 500 year storm (6-9 inches in 24 hours), following days of rain
- ~ **11 Billion** gallons CSO into Lake Michigan
- + **50 Billion** overflow to Mississippi



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## Chicago Lake Overflows: Don't Look Back



Source: MWRD

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## Thinking Outside the Pipe: Redefining Performance

- Measured in anti-gallons infiltrated, evapotranspired, reused in natural drainage
- **Distributed, On-site = upstream:** Water quality Green Infrastructure as **source & supply protection**
- Making it work in **new and retrofit**
- Need for **cost effective solutions** that deliver **multiple benefits**



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## U.S. EPA: GI/LID Saves Money

Table 2. Summary of Cost Comparisons Between Conventional and LID Approaches\*

| Project                         | Conventional Development Cost | LID Cost    | Cost Difference <sup>b</sup> | Percent Difference <sup>b</sup> |
|---------------------------------|-------------------------------|-------------|------------------------------|---------------------------------|
| 2nd 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              | \$755,700                     | \$1,502,900 | -\$737,200                   | -96%                            |
| Laurel Springs                  | \$1,654,021                   | \$1,149,552 | \$504,469                    | 30%                             |
| Mill Creek <sup>c</sup>         | \$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%                             |

EPA 'Reducing Stormwater Costs through LID Strategies and Practices'

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## The Cost (Savings) of Doing Nothing



Before

University Research Park – Madison, WI  
(Conservation Design Forum)

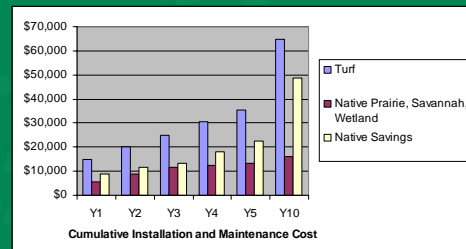


After

- Not just what you have to do; what you don't
- Less is Mow – fertilizer, mowing vs. weeding, burning

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## Native Maintenance Savings – 1 acre



Changing Cost Perceptions, Conservation Design Forum, 2005  
([www.cdfinc.com/images/download/Cost\\_Analysis\\_Part1\\_Report\\_with\\_Exec\\_Summary.pdf](http://www.cdfinc.com/images/download/Cost_Analysis_Part1_Report_with_Exec_Summary.pdf))

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## Obstacles to Opportunities:

### Chicago's Green Alleys

100 miles of public alleyways in Chicago, the largest of any city in the world = 3,500 acres of impermeable surface, = 5 Midway Airports.

- Standards for design, construction
- Locally developed materials emphasizing recycled content
- Materials costs dropping to 1/3 original as market competition develops
- Techniques extended to other installations



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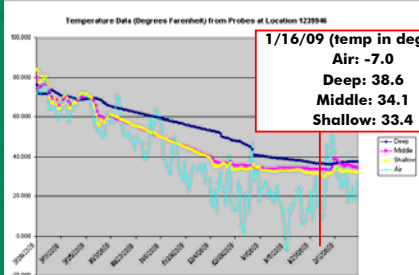
## Unpaving the Way : Seattle SEA Streets

- vegetated strips, no curbs = 11% reduction in impermeable surface
- 90+% runoff reduction
- 25% cost savings compared to conventional design
- Green Grid: 5 blocks (49 acres) served in 1; double the benefit for same cost



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## Permeable Pavement vs. Salt



1/16/09 (temp in degrees)  
Air: -7.0  
Deep: 38.6  
Middle: 34.1  
Shallow: 33.4

- Up to 75% reduced salt use (Toronto & NH)
- IL Dept of Transportation developed salt tolerant native seed mix

Chicago Dept. of Transportation Road 2009 Fall 2009

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## New and Updated: National Green Values Calculator




- Compares green and conventional 'grey' infrastructure hydrological impact, life cycle costs, + benefits
- Adaptable to local ordinance compliance

greenvalues.cnt.org

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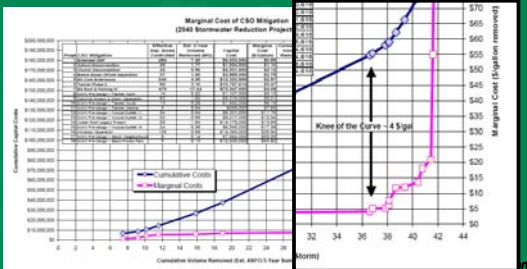
## Regional Metric: Permeability Index



- Targets where urban GI Capacity can be extended
- Tracks installation of GI projects and impact on neighborhood, sewershed drainage
- Project Registry could serve as maintenance database

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## Next Steps: Least Cost Planning



- Demand side strategies into planning
- Valuing Conservation equally or as priority

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## Long Term Control Plan Savings

### go green louisville

- Proposed sewer upgrade plan includes \$86 million for green roofs, streets, biofiltration
- Saves estimated \$40 million from original plan of \$324 million
- "green infrastructure can be a very cost competitive solution, with successful partnerships and cost sharing, when compared to more traditional gray controls"



-- Louisville Metropolitan Sewer District  
Integrated Overflow Abatement Program  
Draft summary 9/20/08

(Photo: budsmith.com)

## Green Roof Energy Potential

- Chicago citywide projection: \$100 million energy savings and 720 megawatts (= 3 coal fired power plants) -- Weston Design Consultants



## Air Quality

- One square meter green roof can remove .2 kg particulates per year
- 5 square meters = capture from 10,000 vehicle miles traveled



Sydney Conservatorium of Music (image courtesy www.wsud.org)

## Chicago Roofs Less Graveled

2 million square feet built, 7 million planned/permitted



~ annual particulate capture from 130,000 cars

## Heat Island Damper: LA

- 15% Green Roof Coverage
- 5-9 degree heat island reduction
- .5 - 1 Gigawatt peak power savings



Lawrence Berkeley Labs Heat Island Group, 2000

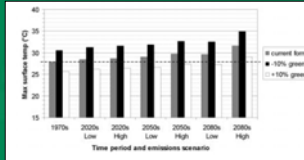
## Urban Forest Cooling

- 10% canopy increase → 5-10% energy savings from shading, windblocking
- Carbon sequestration important, but small fraction of daily transportation C output



## Manchester, UK Climate-GI Study

- Surface temp + runoff key climate-affected variables
- 10% green increase → **compensates for projected surface temp increase** over most scenarios up to 2080 high



Projected temperature change in residential areas with or without 10% greening

Gill et. Al, Adapting Cities for Climate Change: The Role of the Green Infrastructure, *Built Environment Vol 33, 2007.*

## “Tree Increment Financing”

- Tree Plantings:**
- 10% property value gain = \$4 million
  - 20 years taxed at 2.64% = \$2,112,000

- Lot Improvements:**
- 30% gain = \$12 million
  - 20 years taxed at 2.64% = \$6,336,000

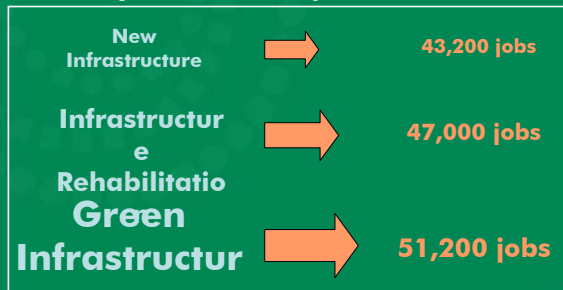
Now citywide: 423 parcels (13 acres) since 2000



PA Horticultural Society photos

## Boosting Community Vitality

For every 1.25 Billion spent...



Source: FHWA Jobs

## Green Jobs Cultivator

- Entry level landscaping: Job skills with inspiring purpose
- “For the first time, I can go home and tell my mother I’m proud of what I’m doing”



Chicago GreenCorps at Our Lady Gate of Heaven project site

## Green Jobs Ladder

- **Certified installers:**
  - Permeable pavement
  - EPA Watersense
- **High skilled engineering, landscape architecture, monitoring**



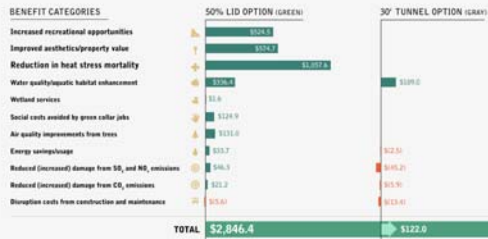
## Green Values in Finance, Policy

- NY, Philadelphia **green roof tax credits**
- LA Proposition O: **\$500M referendum bond for clean water**
- Minnesota Heritage Fund state sales tax for water, open space protection
- Chicago Green Permit expediting



## Philly Triple Bottom Line

Benefits of CSO options: Cumulative through 2049 in millions of US dollars



Philadelphia Watersheds (Stratus Consulting) 2009

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## Raising the (Water Policy) Bar

- Stormwater utilities
- Pre-development Hydrology standards
- Parking, street width maximums
- Regional public-private cost-share + collaboration
- State Revolving Fund (SRF) Green Reserve
- State sustainable stormwater portfolio standards



Stormwater Utility Survey  
Western Kentucky University, 2008

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## Restoring Habitat Connectivity



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## Maintaining Habitat



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## Getting to Scale – Water Supply

- Cook County Potential: Apply scaled Green Infrastructure → 40% runoff reduction
- Infiltration = Aquifer & lake recharge equivalent to additional supply for >1 million people
- Great Lakes Compact conservation plans should incorporate green infrastructure



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## Super Barrels: H2O Harvesting Cubed



- Water Harvesting displaces source water withdrawals
- One 330 gallon 'superbarrel' could serve 1 week's toilet flushing for family of four

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## Community Health

Compared with those with limited vegetation, buildings with greenery had 52% fewer crimes



"...exposure to green surroundings reduces mental fatigue and the feelings of irritability that come with it. The ability to concentrate is refreshed by green views, along with the ability and willingness to deal with problems thoughtfully and less aggressively. And, in this study, **even small amounts of greenery—a few trees and a patch of grass — helped inner city residents have safer, less violent domestic environments.**"

Landscape and Human Health Laboratory  
University of Illinois at Urbana-Champaign

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## Community Spirit

**"We are ahead of the Pope."**

-- Fr. Jim Barrett

**"...to be the greenest ward in the greenest city in America."**

-- Alderman Joe Moore



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## Community Connection

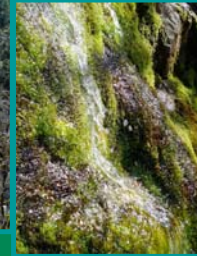


*They may not remember the pythagorean theorem, but they'll never forget planting this rain garden.*

-- Hansen Park School Teacher Mark Hans

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## Beauty



[www.epa.gov](http://www.epa.gov)

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## Recreation

Onondaga Creek Walk: "a lakeside revitalization and open space project, ...including pervious pavement for walkways and parking areas, rain gardens, bioretention swales, and stormwater tree trenches."



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## Green Infrastructure Quality of Life Quote of the Year

**"You can't tailgate or barbecue inside a deep tunnel."**

-- Milwaukee Mayor Tom Barrett,  
U.S. House Transportation and Infrastructure Committee



Image: [TravelWisconsin.com](http://TravelWisconsin.com)

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*Thank You*

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