Opportunities to Introduce Green Infrastructure into CSO Plans

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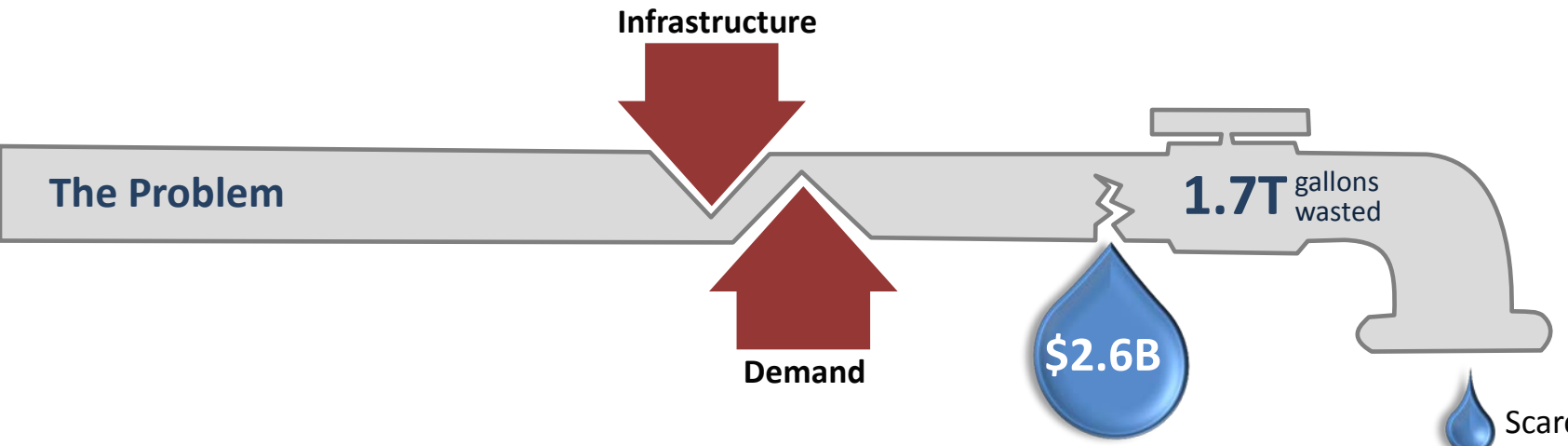
US EPA Office of Water



Scarcity

Suitability

Sustainability

Current Issue: Failing Infrastructure

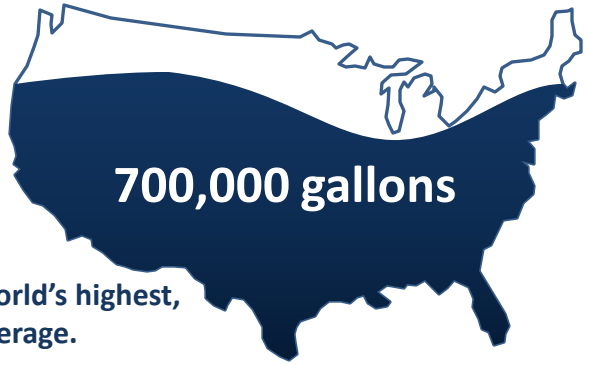
100 YEARS
THE AGE OF SOME
U.S. WATER INFRASTRUCTURE

Efficient water use depends on working, modern infrastructure, but leaking water collection and distribution systems and inadequate wastewater treatment continue to plague municipalities. Modern, efficient water infrastructure is crucial to meet the needs of expanding populations.

Growing Problem: Water Scarcity

$2.6 BILLION
AND 1.7TRILLION GALLONS
LOST EVERY YEAR FROM
BROKEN AND LEAKING PIPES

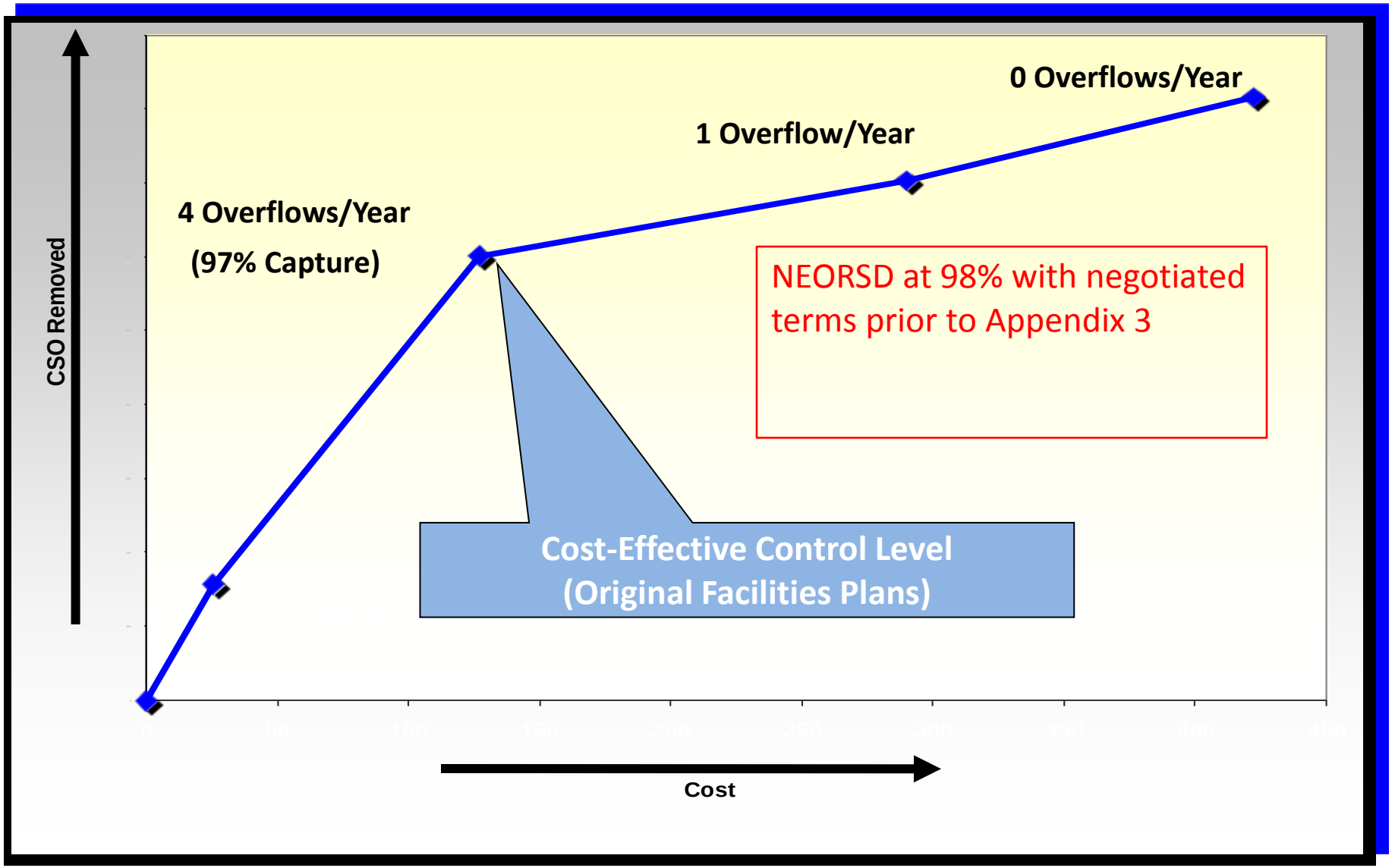
Safe drinking water is a precious asset. The one percent of the total water resources on earth are available for human use is under threat as a result of population growth, urbanization, crumbling infrastructure, and climate change.



U.S. water footprint is among the world's highest, and more than double the global average.

Greatest Civil Engineering Feat & Advance in Public Health

NEORSD CSO Control:
Costs substantially increase beyond 97% capture



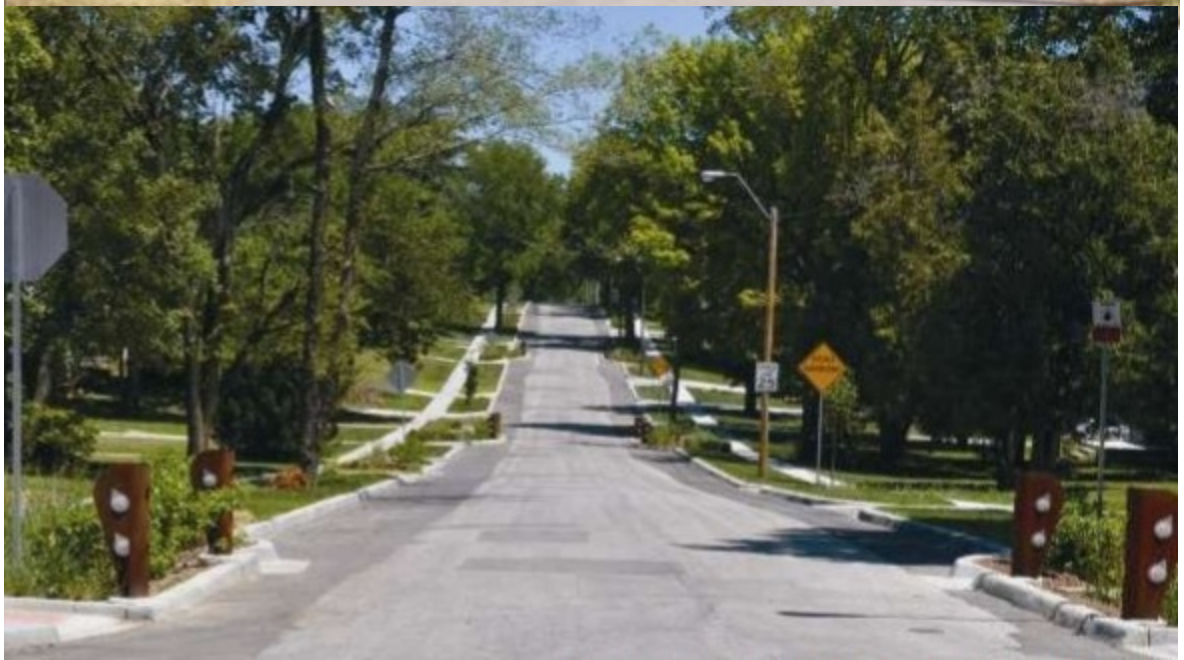
Integrating Green Infrastructure

Seattle bioswale. *Photo courtesy of Seattle Public Utilities.*

Bioretention Cell in El Monte, CA. *Photo courtesy of Bill DePoto.*

Permeable pavement and bioretention in Albuquerque, NM. *Photo courtesy of AridLID.org.*

Kansas City, MO Overflow Control Plan



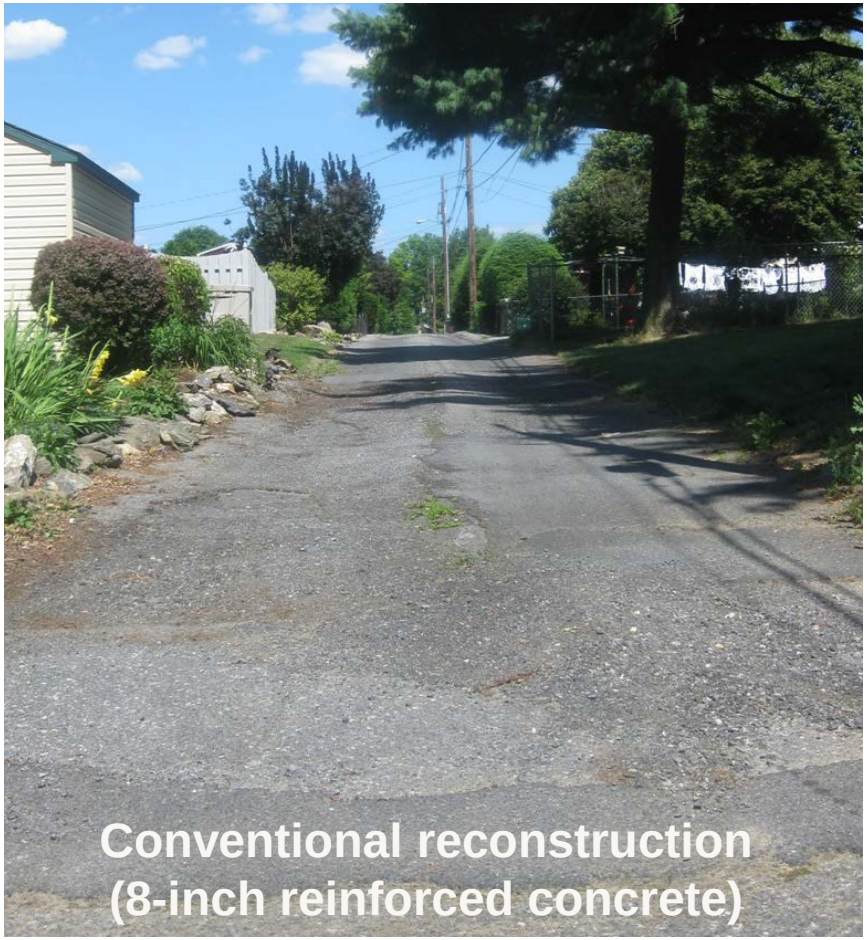
Syracuse Connective Corridor

- Part of the Save the Rain CSO Program.
- Creates a visual and physical link along the major street connections between Syracuse University and the downtown business districts.
- Uses tree trenches and porous pavement in traffic-calming designs that feature bicycle lanes, landscape buffers between vehicular and enhanced pedestrian zones.

Connective Corridor Phase 1, Project 1: University Ave, Onondaga County, NY.

Lancaster, PA Alley 148 Greened for 10% Added Cost + 200,000 gallons captured per year

Before (July 2011) ~$20.30/SF



Conventional reconstruction
(8-inch reinforced concrete)

After (February 2012) ~$22.40/SF

Green alley retrofit
(permeable pavers with infiltration)

Chicago Green Alleys

High albedo concrete and permeable concrete trench in Chicago alley. *Photo courtesy of Abby Hall, U.S. EPA.*

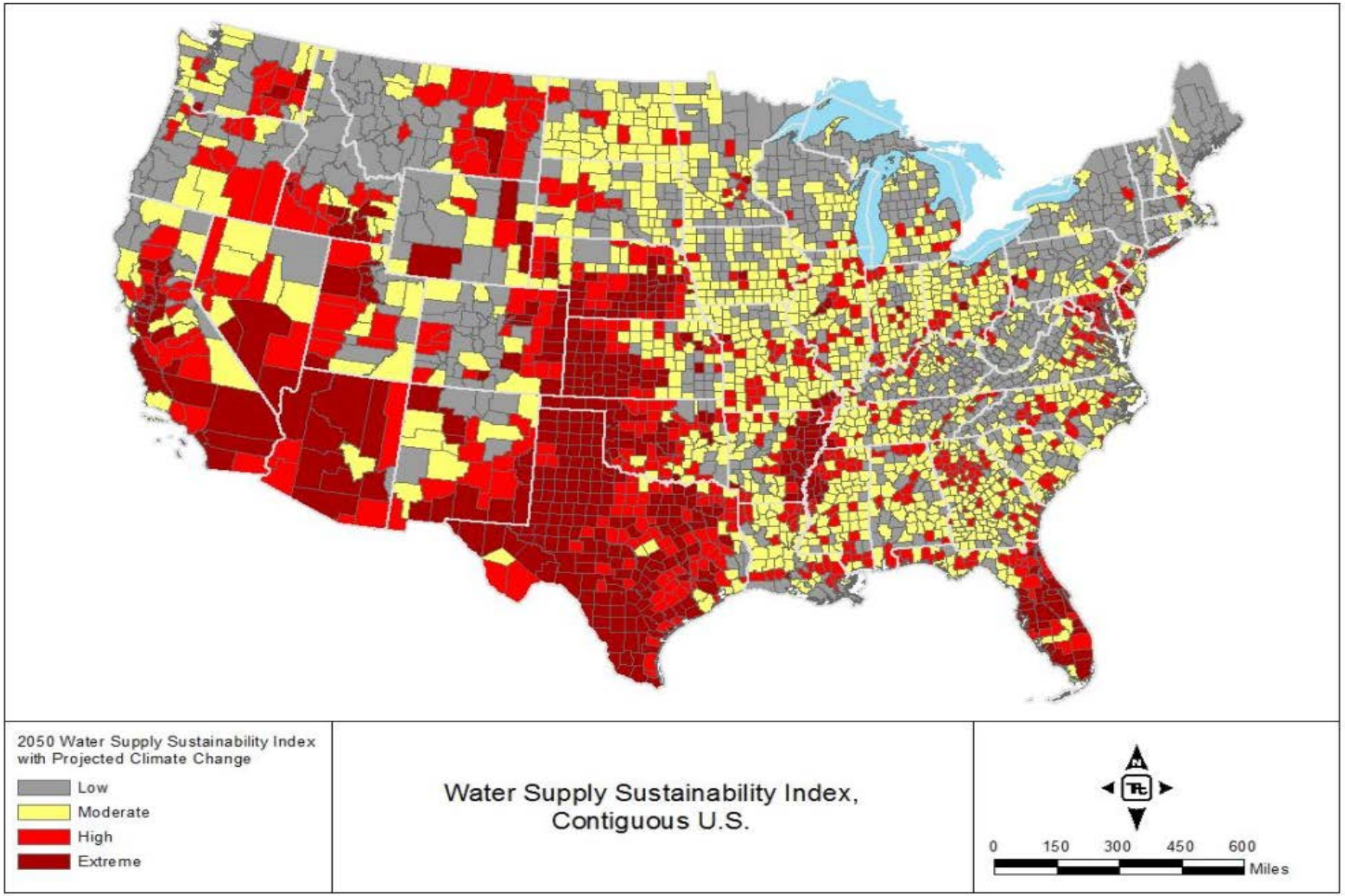
http://www.cityofchicago.org/dam/city/depts/cdot/Green_Alley_Handbook_2010.pdf

Parks

Brandon Park;
Lancaster, PA

Cliveden Park;
Philadelphia, PA

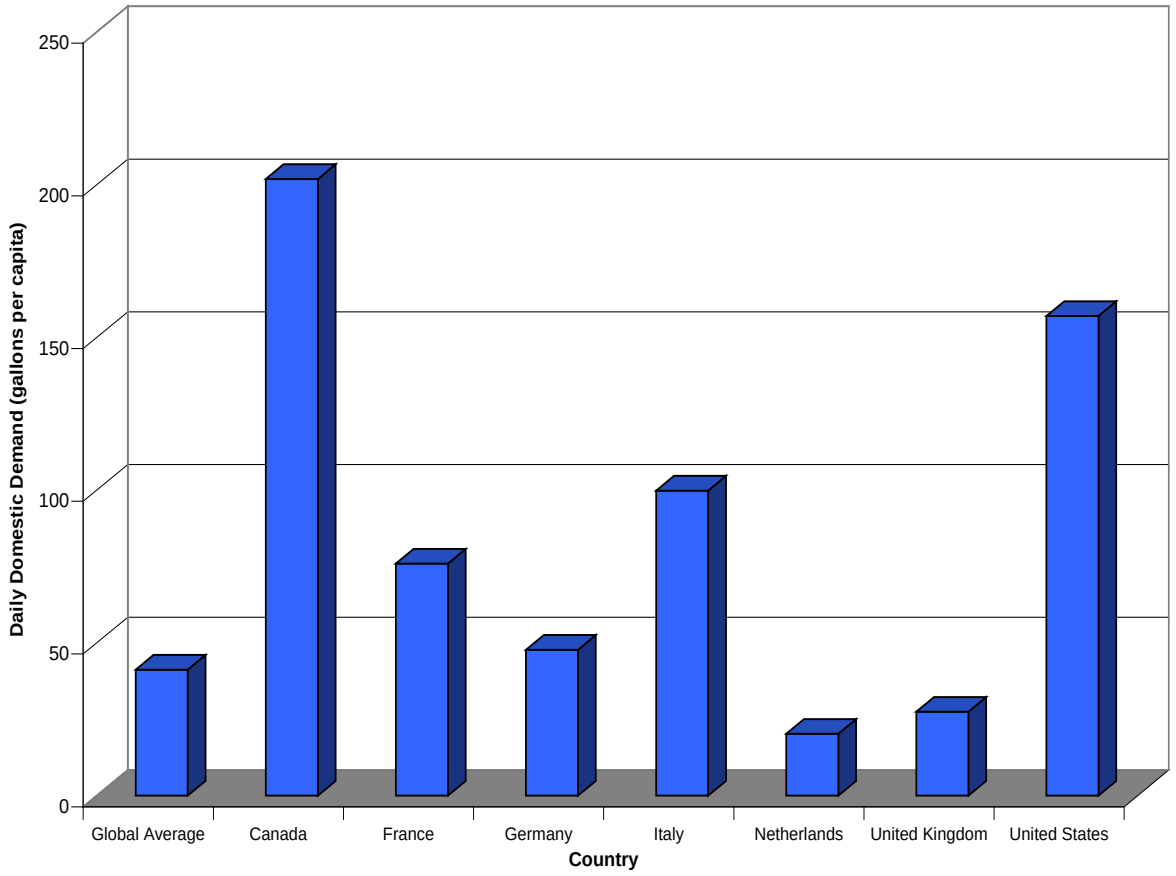
Water Supply Sustainability - 2050



Water Supply Sustainability Index for the Contiguous U.S. (Tetra Tech, 2011)

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.

Typical U.S. 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.

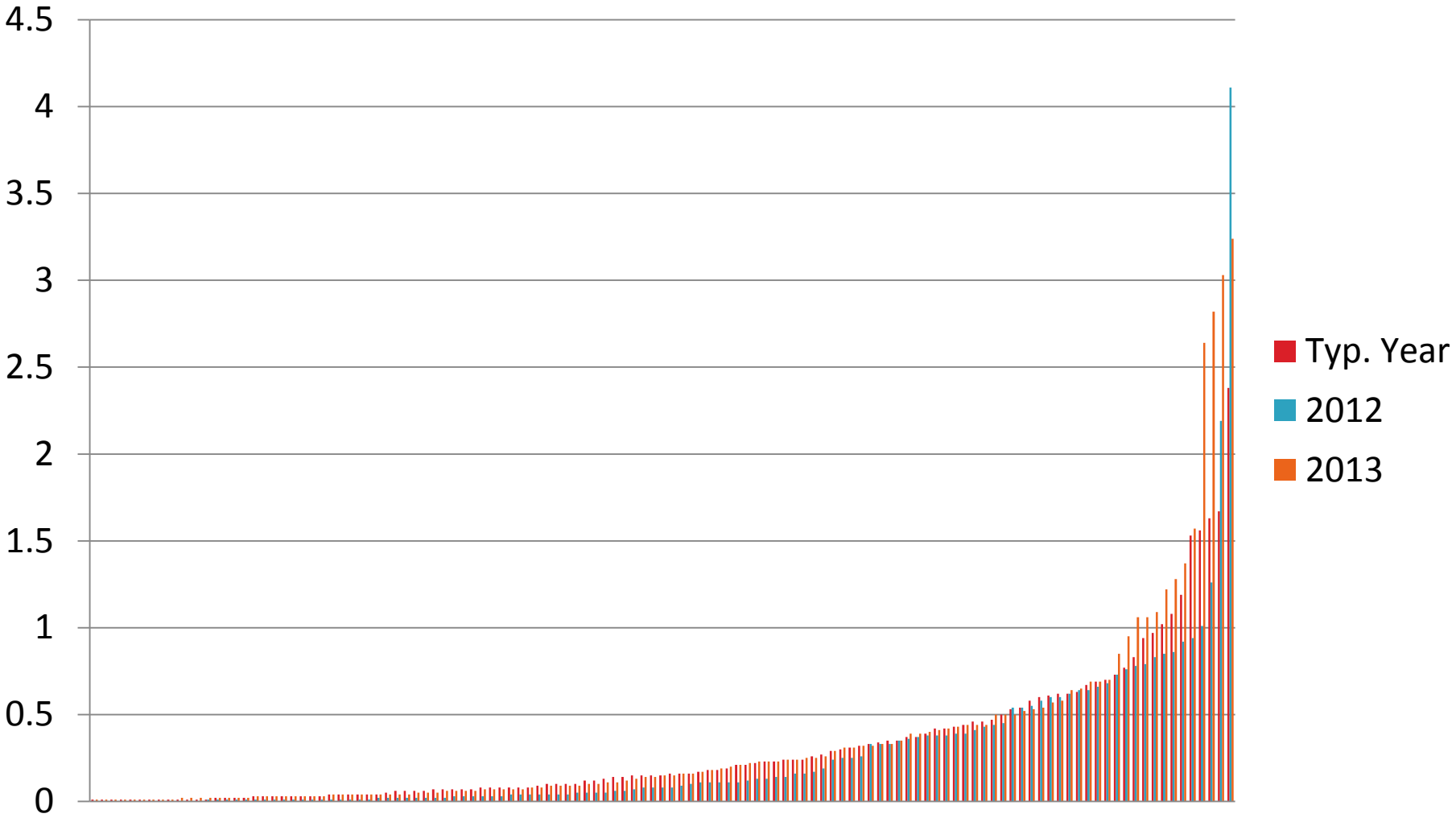
Pacific Institute, *Waste Not, Want Not: The Potential for Urban Water Conservation in California*, November 2003.

Price Effects

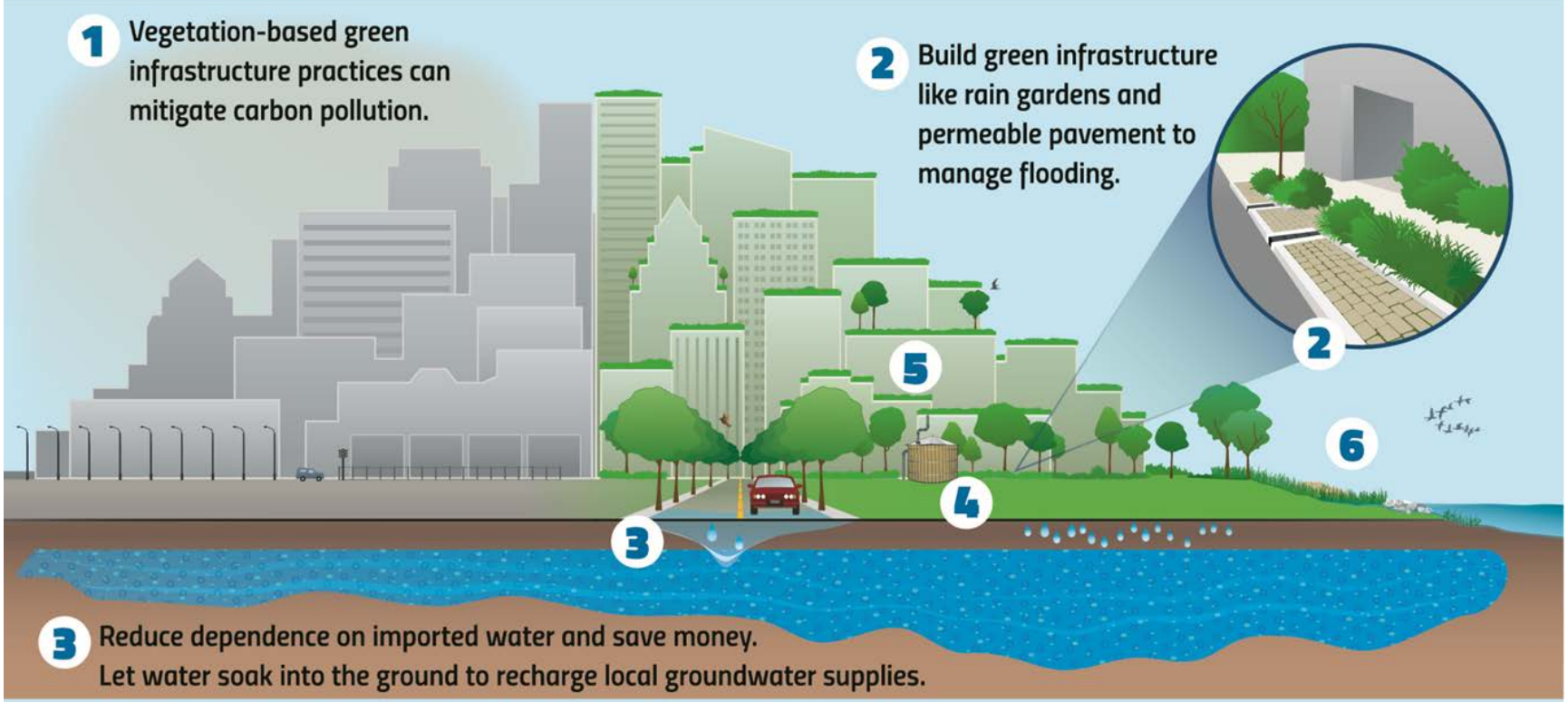
- Cost of water is among the lowest in the world.
  - 70¢ - $4 per 1,000 gallons
  - Average cost nationally approximately $2.50 per 1,000 gallons

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

NEORSD - Rainfall patterns suggest resiliency planning is prudent



Green Infrastructure Builds Resiliency



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

http://water.epa.gov/infrastructure/greeninfrastructure/climate_res.cfm

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.

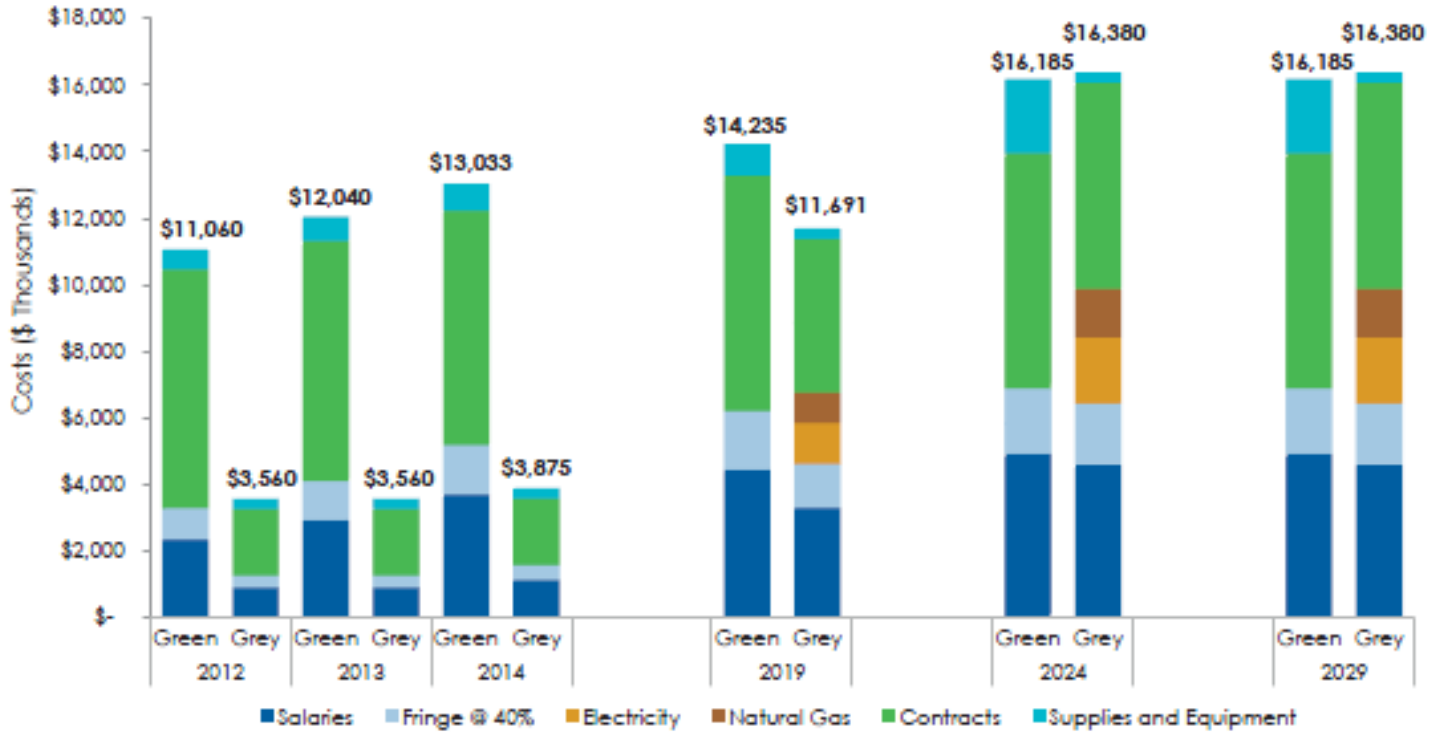
Chicago Green Roofs

- 5.5 million square feet of green roofs estimated to capture 1,300 lbs of PM_{10} each year - equivalent to the emissions of more than 10,000 cars.

Slide courtesy of the Center for Neighborhood Technology.

NY Estimated O&M Costs

Figure 11: O&M Costs to the City of CSO Control Scenarios



Green Infrastructure Grants: $3 million to Public Square Renovation, 3 MG of stormwater controlled annually

Green Infrastructure Grants:

Transformed Public Square

EPA United States Environmental Protection Agency

Greening CSO Plans:

Planning and Modeling Green Infrastructure for Combined Sewer Overflow (CSO) Control

U.S. Environmental Protection Agency

www.epa.gov/greeninfrastructure

http://water.epa.gov/infrastructure/greeninfrastructure/upload/Greening_CSO_Plans.PDF