

Resilient by Design

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Executive in Residence/Professor of the Practice

NC State University, College of Design

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Re•sil•ience

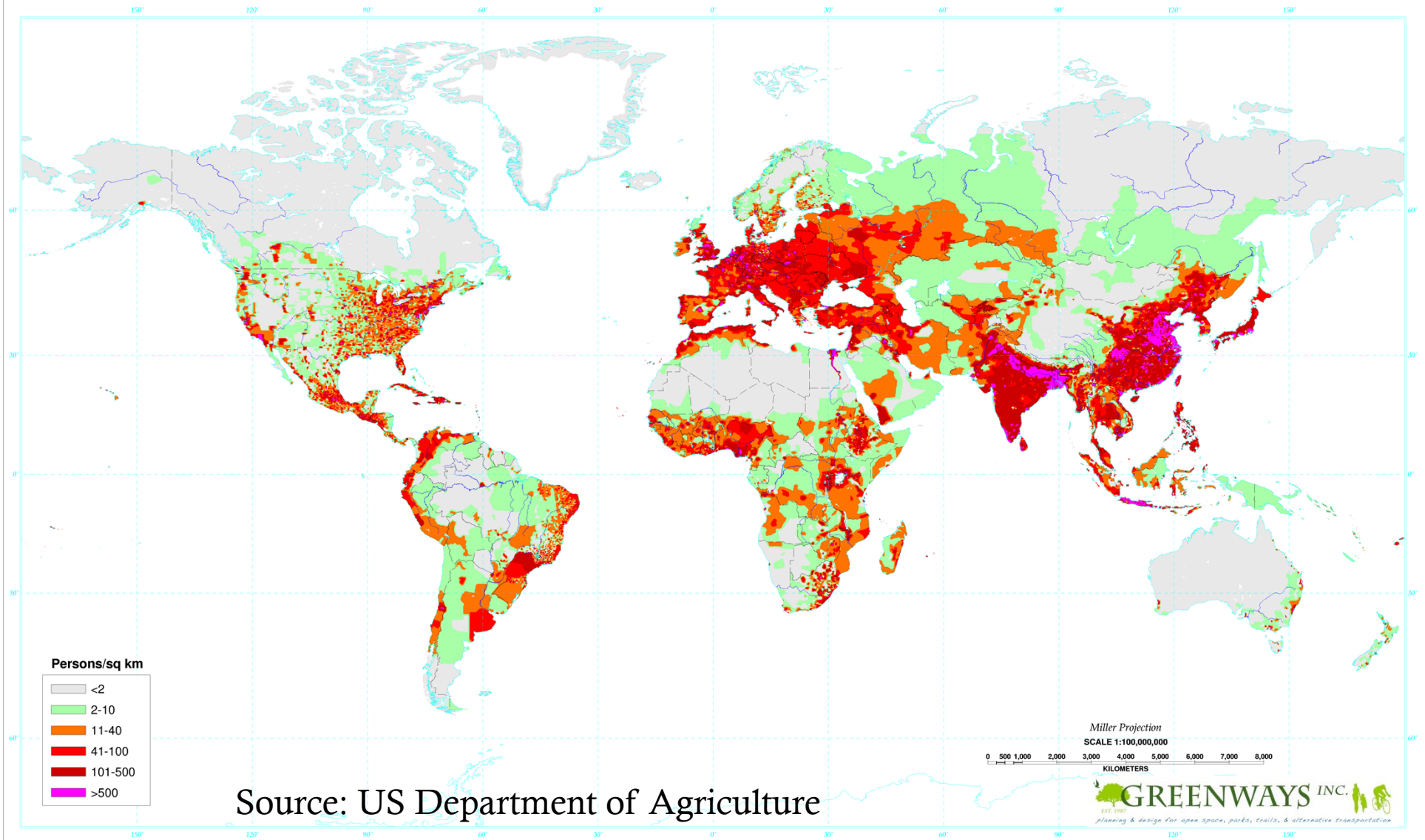
- The capacity to recover quickly from difficulties; toughness
- The ability to spring back into shape; elasticity
- The ability to become strong, healthy or successful again after something bad has happened

Source: Webster's Dictionary

Coastal Exposure

- In 2003, 3 billion people lived within 200 km of a coastline. By 2025 that number will double. (source: Population Reference Bureau)
- 39% of the United States population, or 123 million people live in counties directly on a shoreline. This population will increase by 8% from 2010 to 2020. (source: NOAA, 2010)

Coastal Exposure

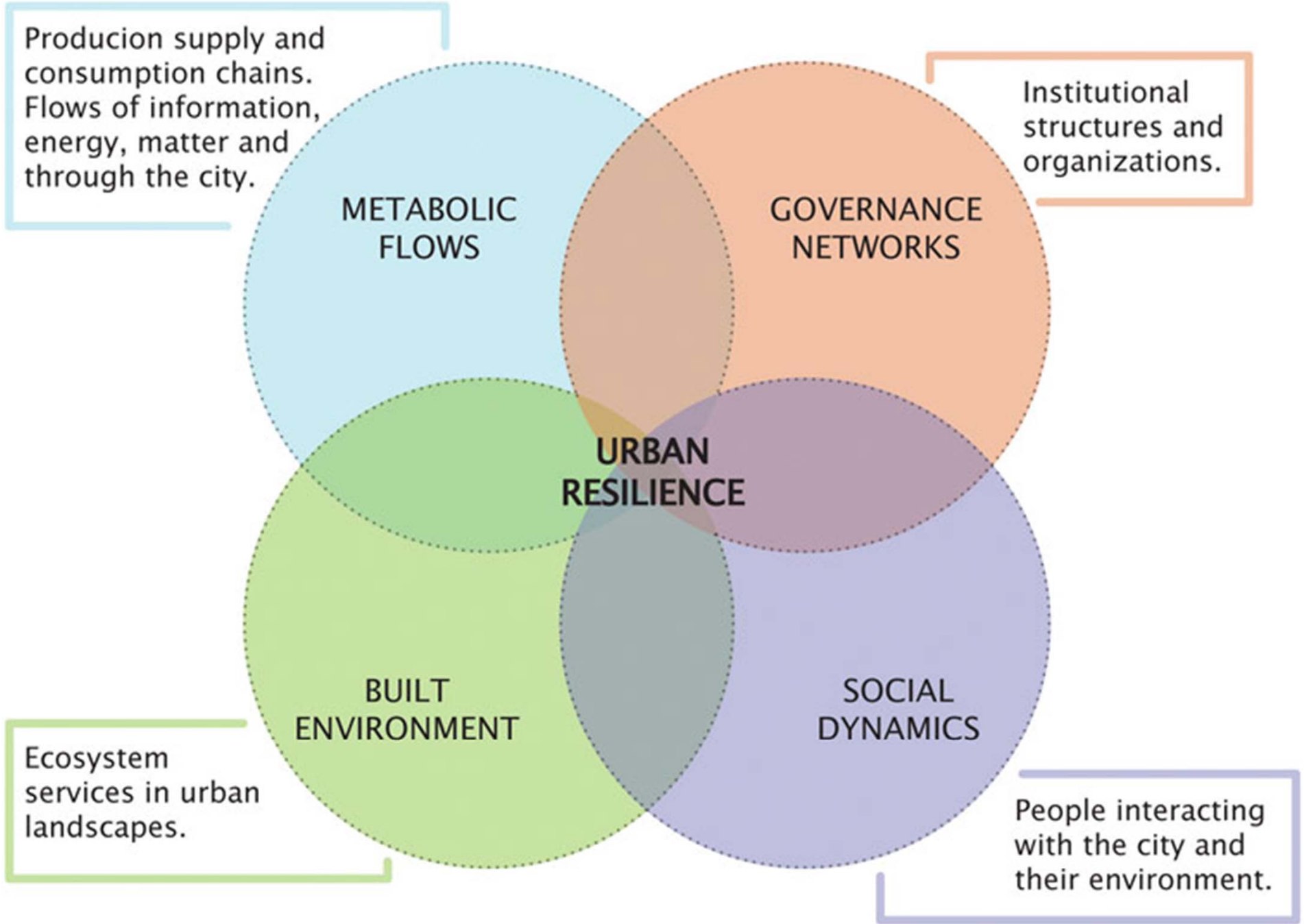


What Does it Mean to be Resilient?

Urban Resilience: Defined

Urban resilience understands **people** and **nature** as linked and equated players in socio-ecological systems. Urban resilience assumes that the complex socio-ecological systems of cities are in fact always in flux and subject to change and disturbance. When faced with lesser or greater degrees of disturbance, the measure of their resilience is found in their capacity to **innovate** and use their available assets, to subsequently **renew** and **rebuild** themselves.

Source: Rust 2 Green, Cornell University, 2015



100 Resilient Cities

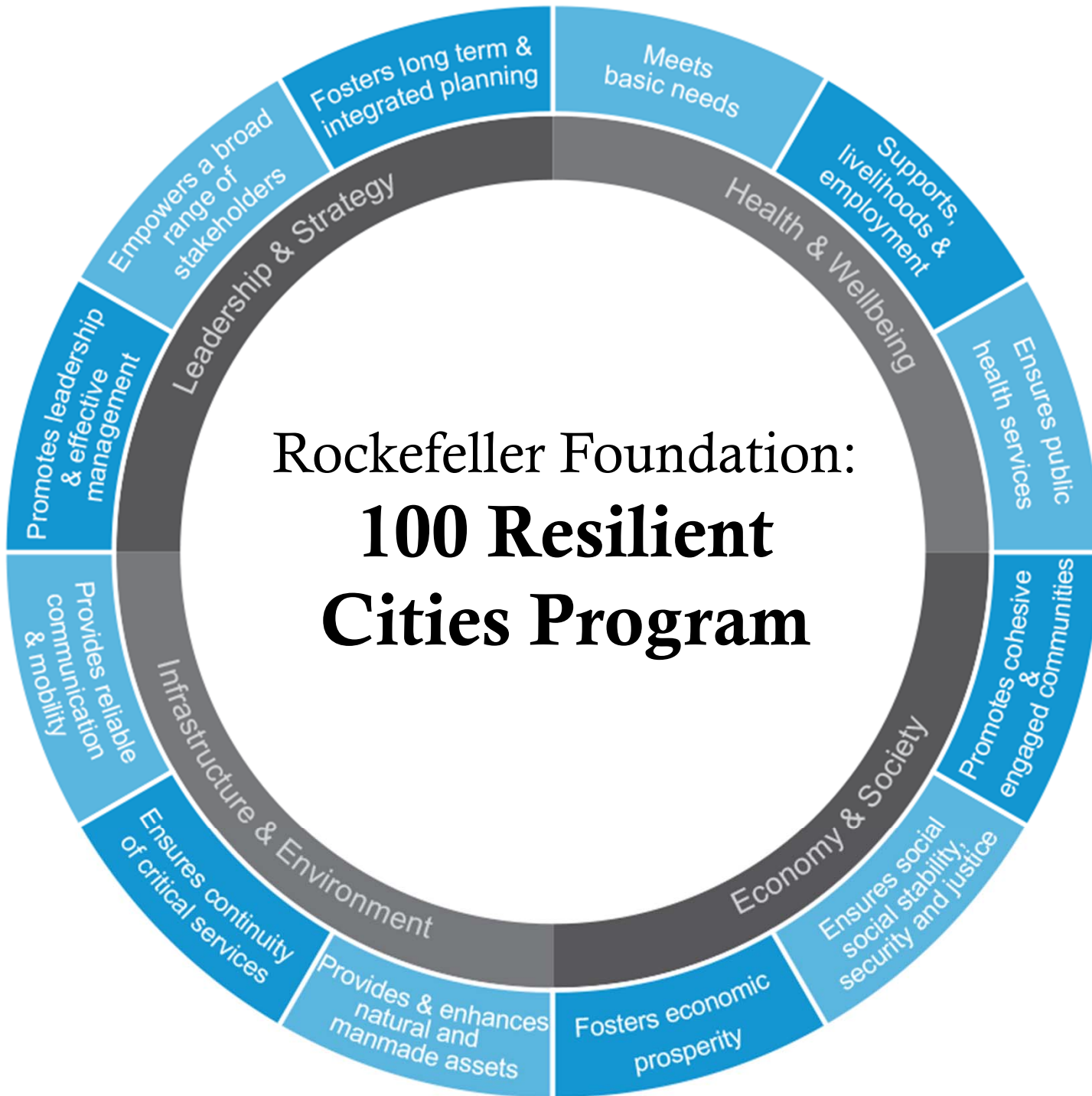
- **Rockefeller Foundation**
 - Making cities better for short term and long term
 - Chronic Stresses: high unemployment, inefficient public transportation, chronic food and water shortages
 - Acute Shocks: floods, disease, terrorism, earthquakes

Resilient Cities Are . . .

- Robust
- Resourceful
- Flexible
- Redundant
- Inclusive
- Integrated
- Reflective

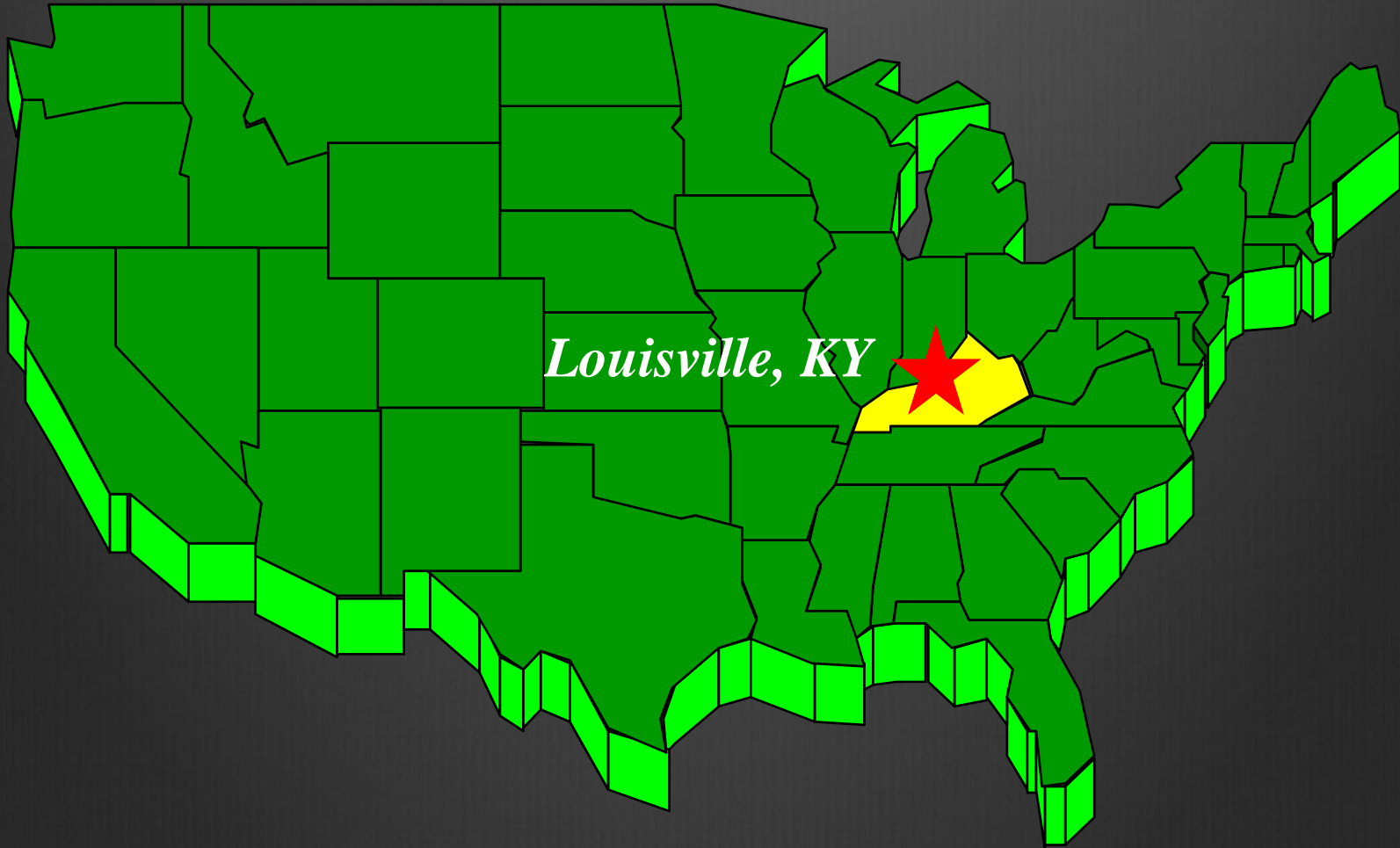
City Resilient Framework

- Health and Wellbeing
- Economy and Society
- Infrastructure and Environment
- Leadership and Strategy



Case Studies: Recovering from Disaster

Case Study: Louisville, Kentucky



1936 Ohio River Flood



Source: LOJIC MSD

1997 Flood

40,000 homes damaged by 1997 Flood

Source: Louisville Courier Journal



Source: US Coast Guard

Gordon Garner, Executive Director MSD



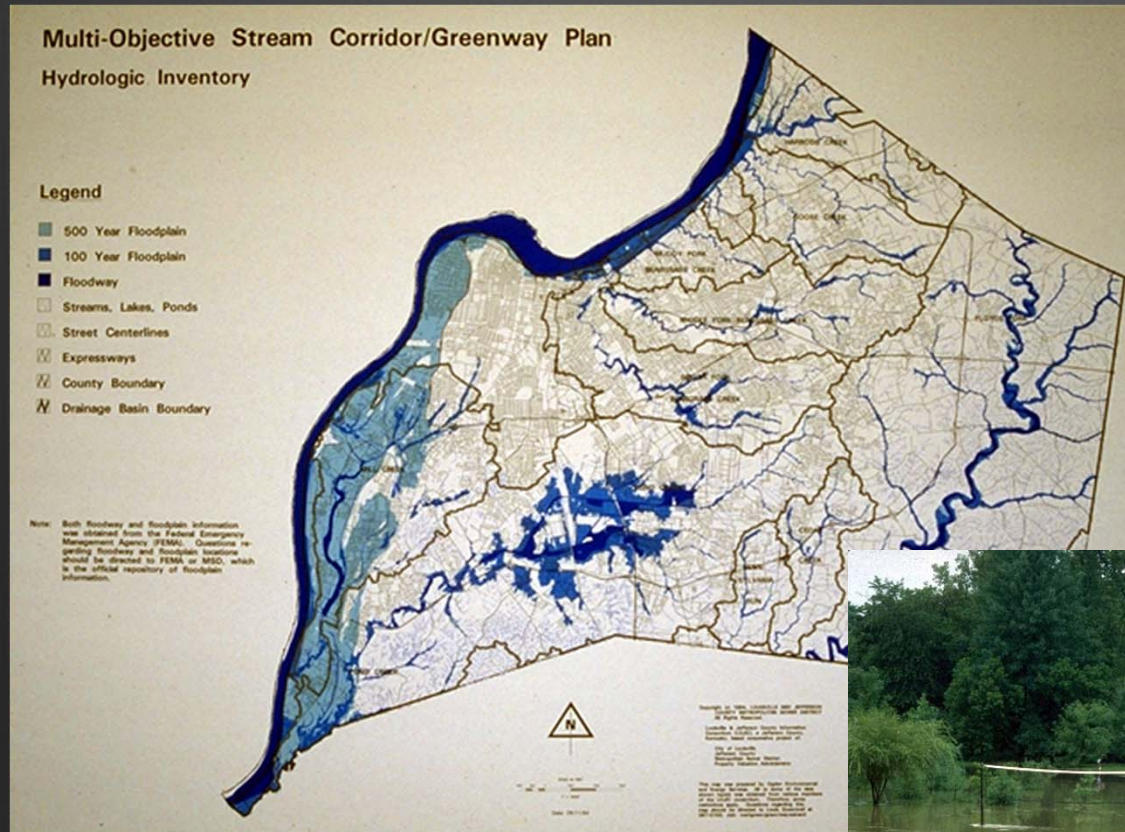
Source: LOJIC MSD



The Recovery – Toward a more Resilient City/County

- New floodplain ordinance (national model)
- Repetitive Flood Loss Prevention Program
- FEMA Sponsored Buyout – “River Rats”
- New sediment and erosion control ordinance
- New focus on watershed planning – yes everyone lives in a watershed
- Implementation of countywide greenway plan – conserved and restore streams and creeks

Greenprint: Louisville, KY



***Louisville & Jefferson
County Metropolitan
Sewer District***



LOUISVILLE LOOP

City of Parks



Source: Louisville Metro Parks



BOARD OF PARK COMMISSIONERS OF THE CITY OF GREENVILLE, S.C.
**GENERAL PLAN
FOR
CHEROKEE PARK**

SCALE
1" = 100'

F. L. & OLMSTED, LANDSCAPE ARCHITECTS
GREENVILLE, S. C. 29607

BOARD OF PARK COMMISSIONERS:

JOHN B. HARRIS, Chairman
WALTER B. HARRIS, Vice Chairman
WALTER B. HARRIS, Secretary
WALTER B. HARRIS, Treasurer
WALTER B. HARRIS, Member
WALTER B. HARRIS, Member
WALTER B. HARRIS, Member
WALTER B. HARRIS, Member
WALTER B. HARRIS, Member
WALTER B. HARRIS, Member

PREPARED BY
F. L. & OLMSTED, LANDSCAPE ARCHITECTS
GREENVILLE, S. C. 29607

DATE
MAY 1910



FREDERICK LAW
**OLMSTED
PARKS**

Supported by Olmsted Parks Conservancy



Source: Louisville Courier Journal



Source: Louisville Courier Journal



Source: Louisville Courier Journal

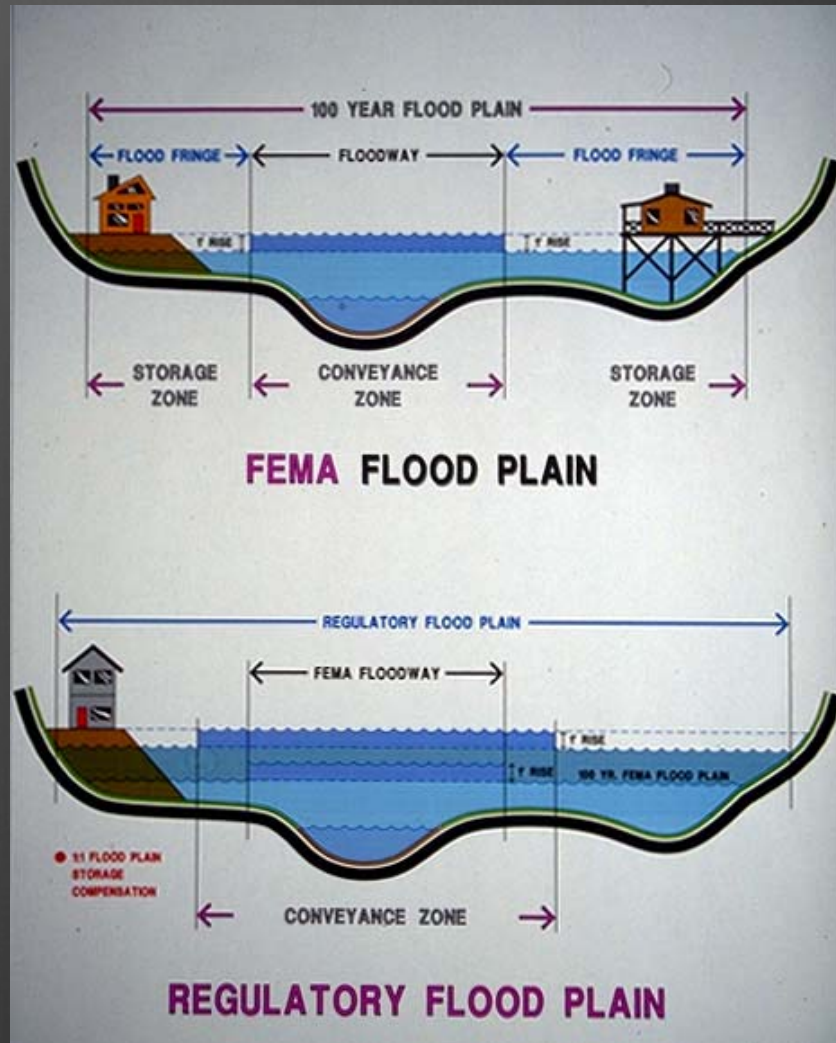
MSD Floodplain Ordinance



The highest and best use of floodplain land is for the storage of flood waters



MSD Floodplain Ordinance



CORNERSTONE
2020
Local and State
County Commissioners

**Louisville & Jefferson County
Multi-Objective Stream
Corridor/Greenway Plan**

DEVELOPMENT CODE
for all of
JEFFERSON COUNTY, KENTUCKY

LEGAL INSTRUMENT

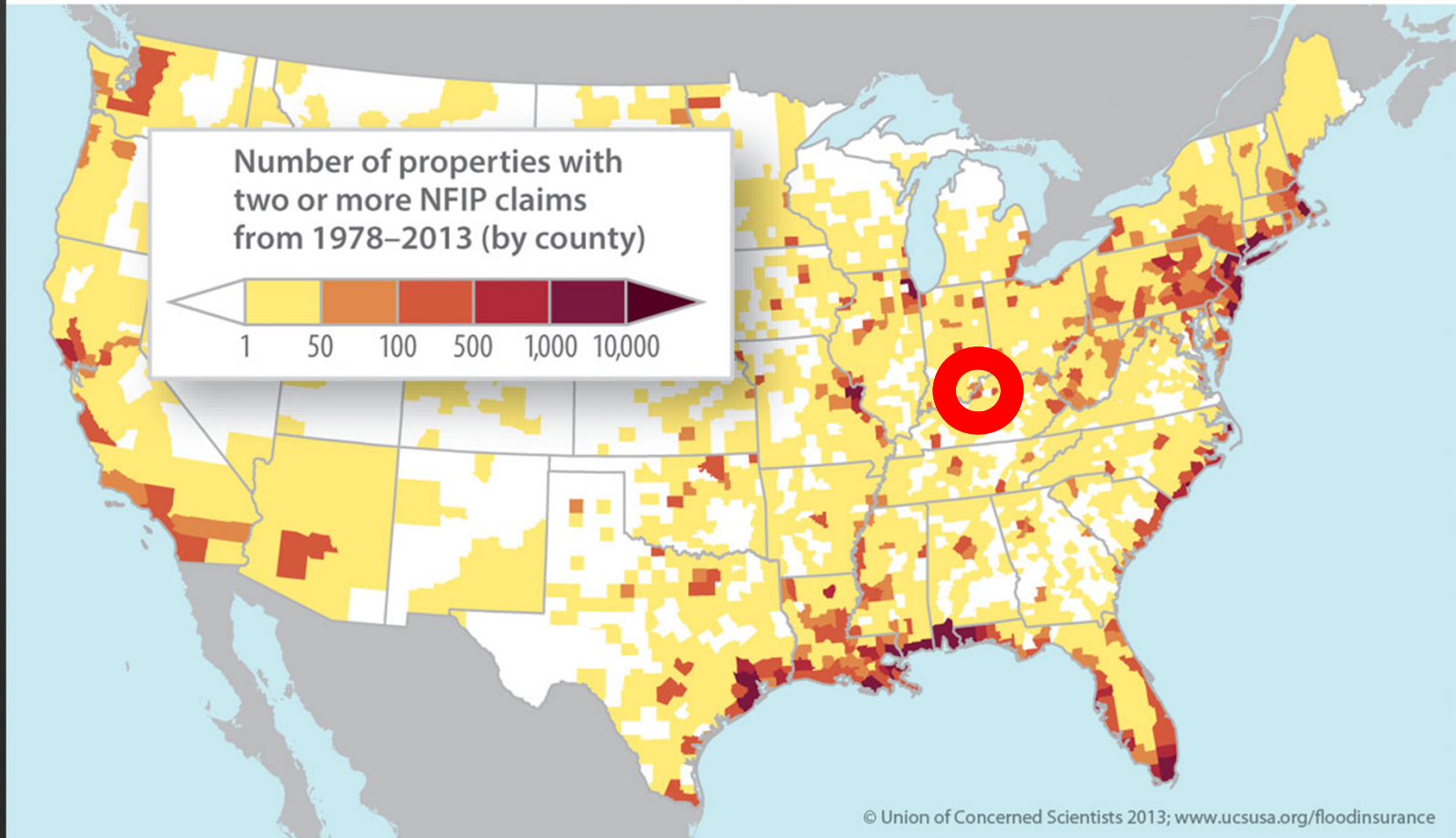
Phase 3 Implementation
DRAFT
Article 13
Floodplain
Regulations
July 1996

A part of the Greenways
Advisory Committee
Created by the Legislative
Power District

Buy Out the “River Rats”

Source: Louisville Courier Journal

Repetitive-Loss Properties by U.S. County



Insurance claims on properties that are repeatedly damaged by flooding, or “repetitive losses,” are of particular concern to the National Flood Insurance Program (NFIP). NFIP has paid out almost \$9 billion in claims to repetitive-loss properties, which amounts to about a quarter of all NFIP payments since 1978. Repetitive-loss properties, shown here, account for just 1.3 percent of all policies but are responsible for fully 25 percent of all NFIP claim payments since 1978. The darker colors show counties particularly affected by repetitive losses. Map based on data from FEMA as of May 2013.

Beargrass Creek Watershed, Louisville, KY



Source: Beargrass Alliance



Beargrass Creek: An Urbanized Stream



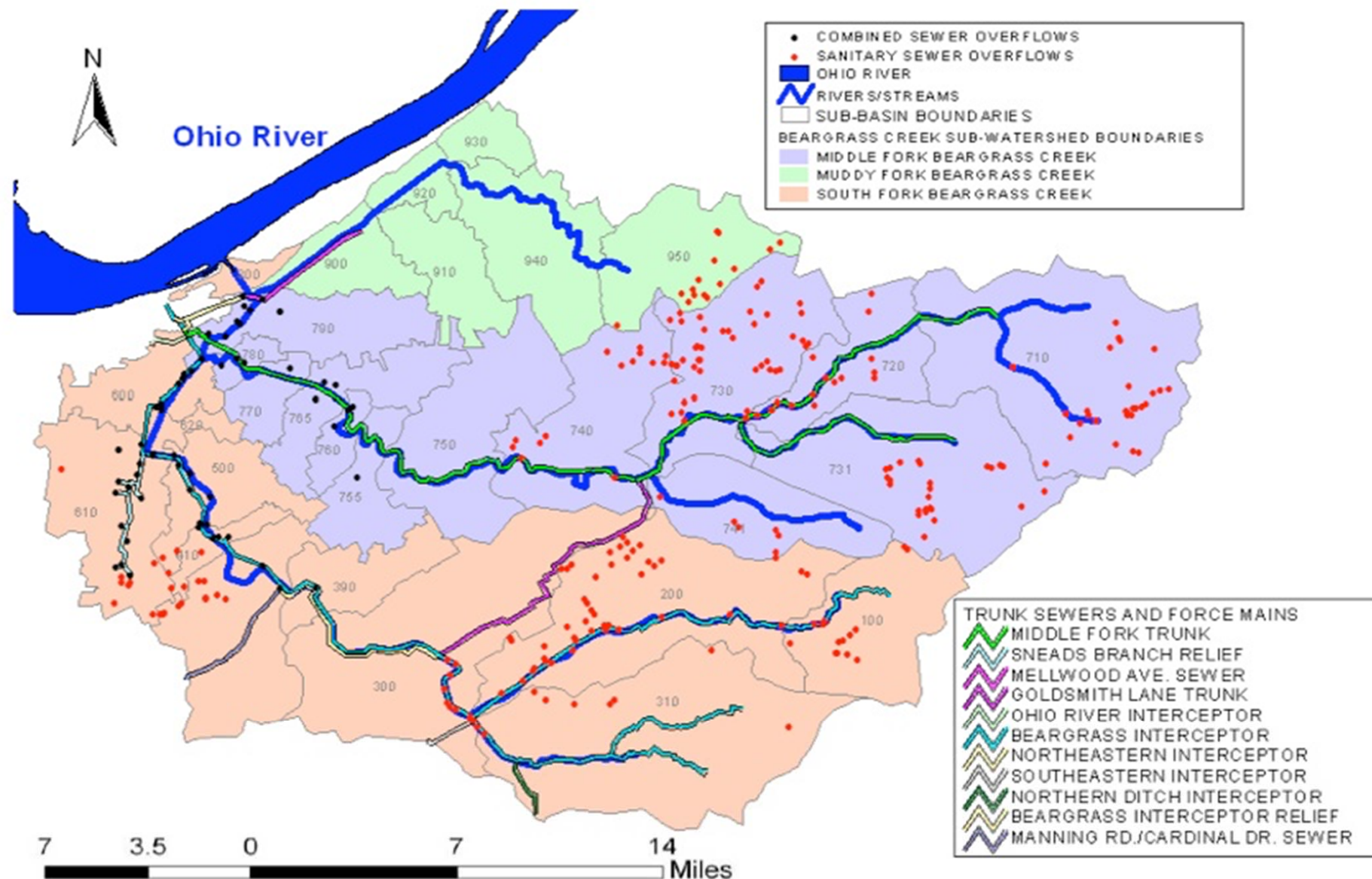
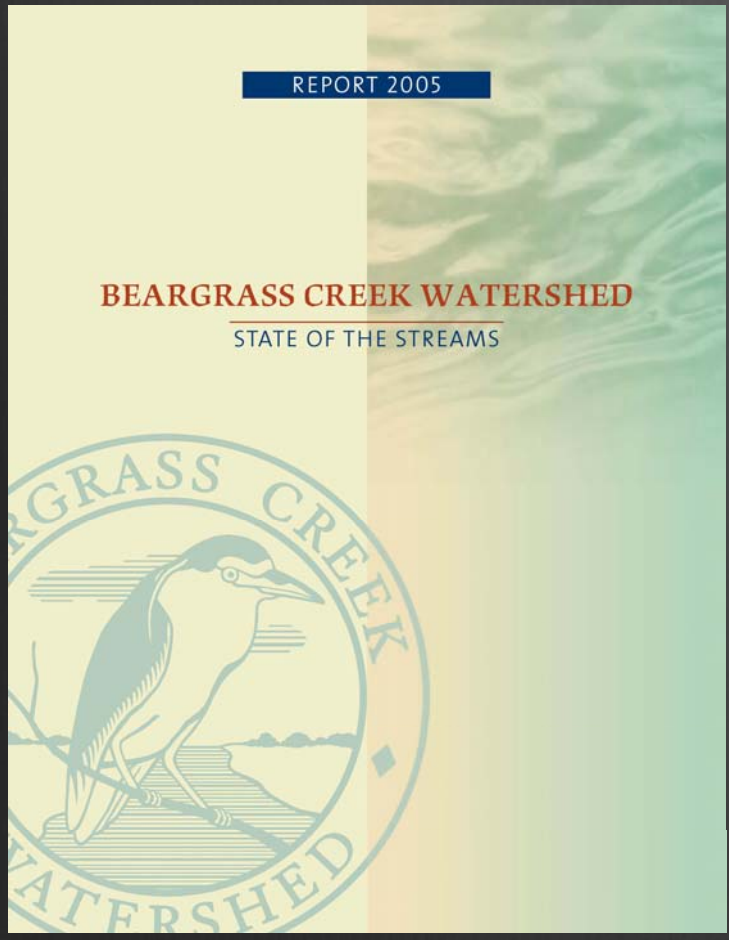


Figure 1.11 Locations of CSOs, Documented SSOs and Major Trunk Sewers
 (Developed using data from LOJIC, 2007; and base map from Tetra Tech et al., 2007)



Source: Beargrass Alliance

Beargrass Creek Watershed Greenway

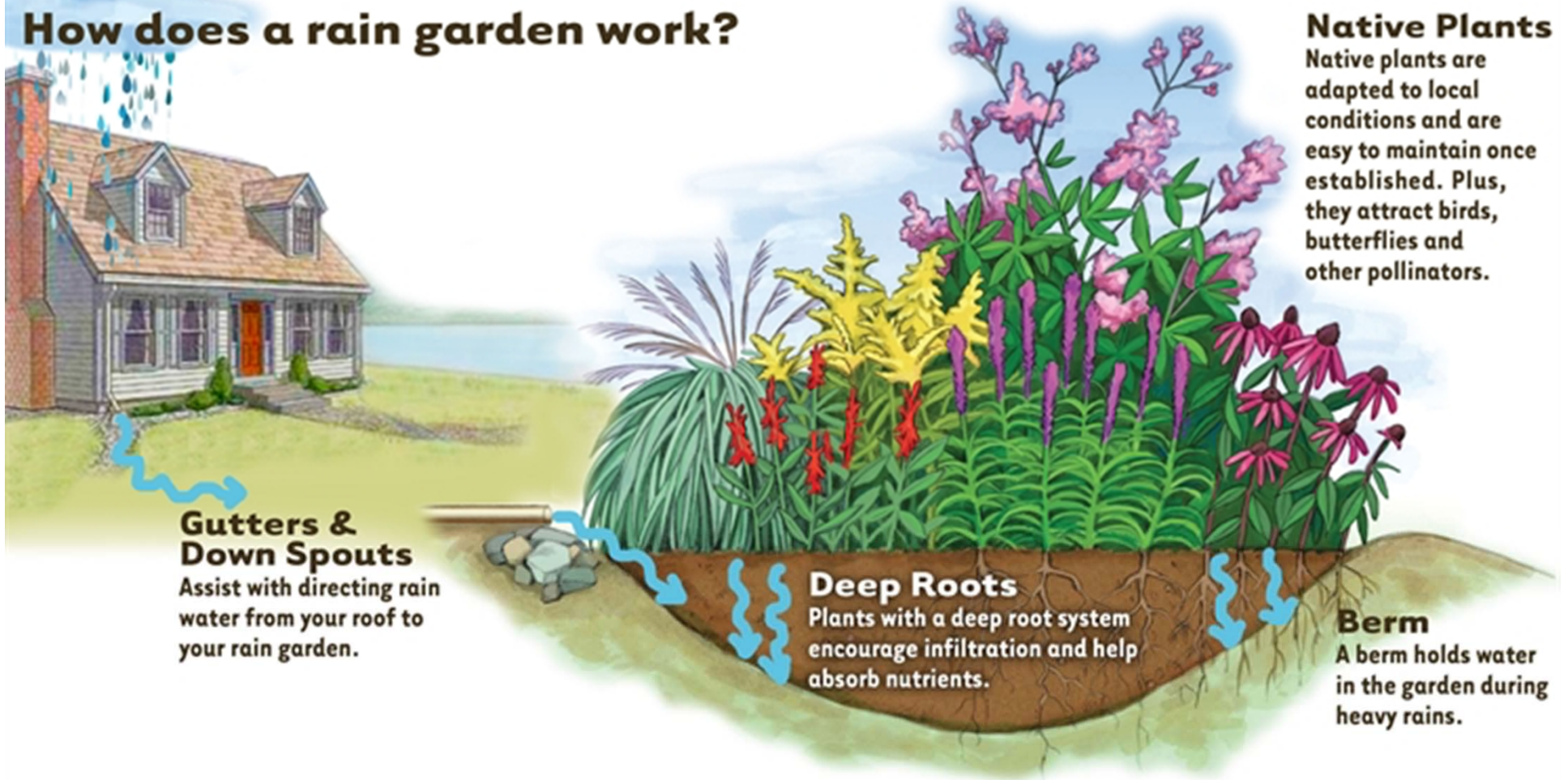


Beargrass Creek Watershed Greenway



Rain Barrels and Rain Gardens

How does a rain garden work?



Gutters & Down Spouts
Assist with directing rain water from your roof to your rain garden.

Deep Roots
Plants with a deep root system encourage infiltration and help absorb nutrients.

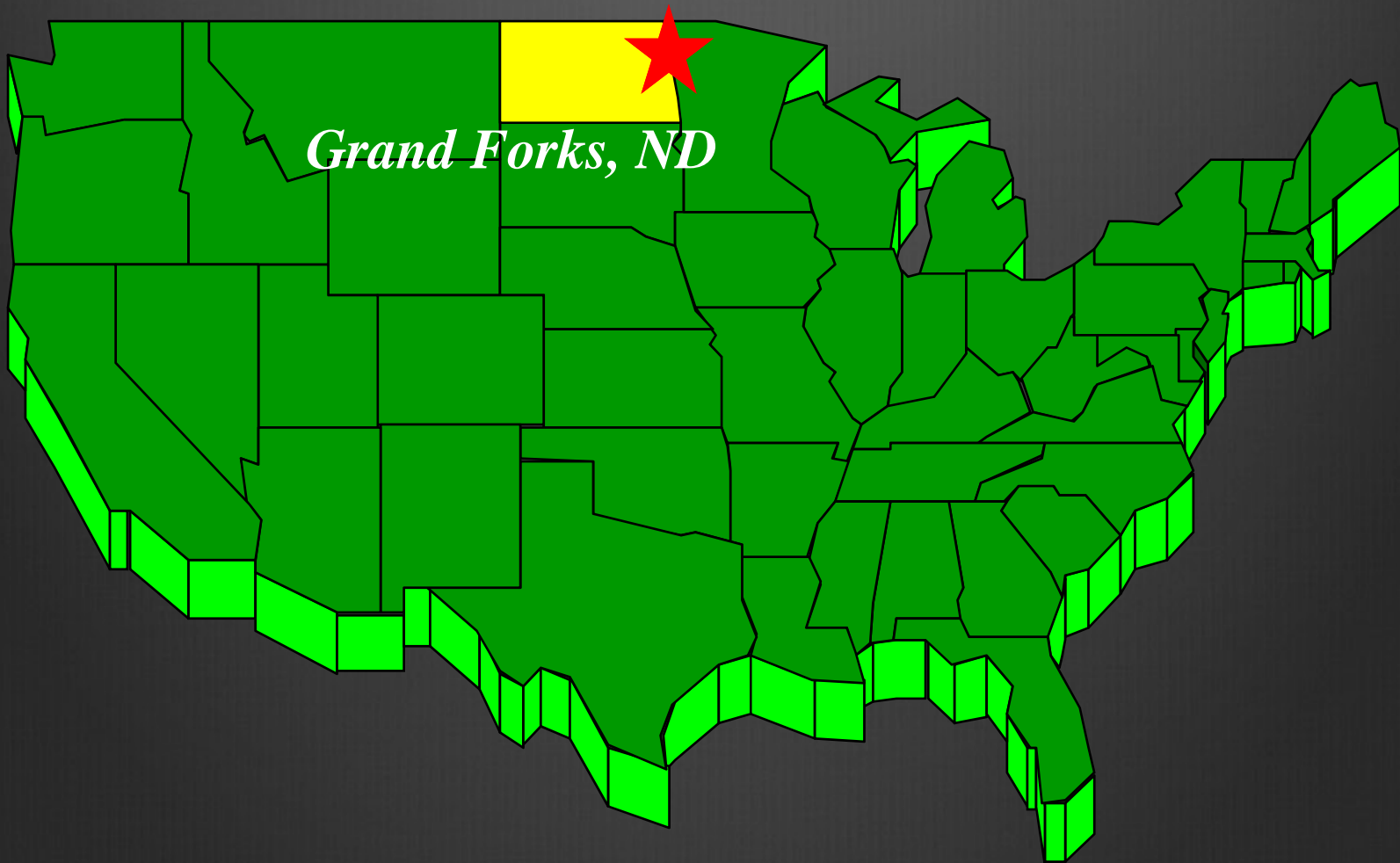
Berm
A berm holds water in the garden during heavy rains.

Native Plants
Native plants are adapted to local conditions and are easy to maintain once established. Plus, they attract birds, butterflies and other pollinators.

Louisville Nature Center



Case Study: Grand Forks, North Dakota



Grand Forks, North Dakota

Spring 1997



Source: Grand Forks Herald

Grand Forks, North Dakota



Source: Grand Forks Herald



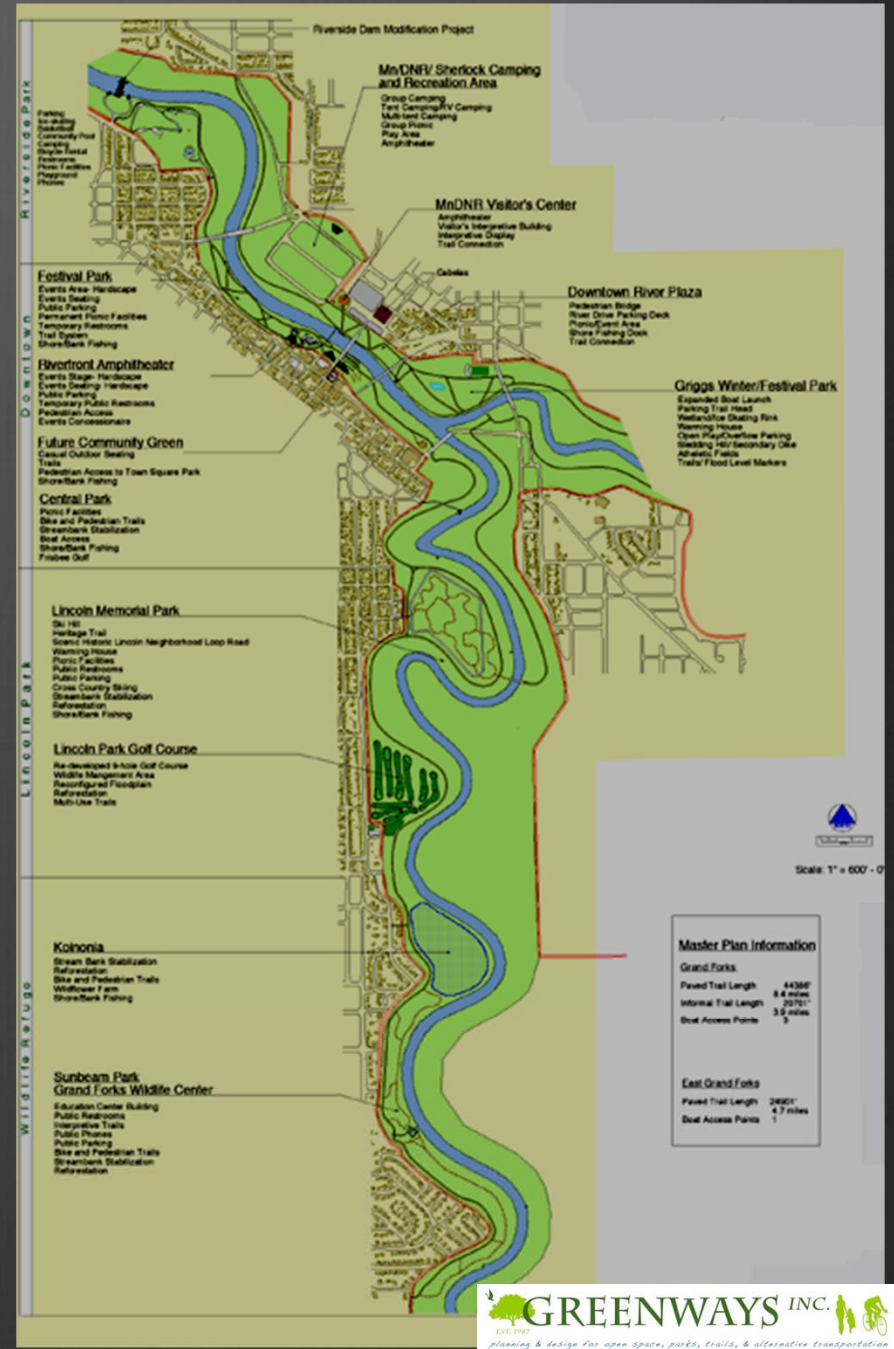


Source: Grand Forks Herald

The Recovery – Toward a more resilient Red River community

- FEMA buyout of repetitive flood loss properties
- Build a protective, flexible floodwall/levee system
- Reimagine/rebuild the downtown
- Implement a 2,200-acre greenway plan
- Program the greenway for activity

Greater Grand Forks Greenway Master Plan















Granitoid: Paving the Way for Progress

The early 1880s saw an exciting time of development in Grant Park. Commercial business districts and residential neighborhoods were experiencing tremendous growth in the community as well as a rapid economic lift.

Along with this rapid growth came a shift from horse-drawn transportation to motor vehicles, a change that was occurring nationwide. That this time, horse and carriage had been the main mode of transport of working the city streets, the relative affordability and maintenance of the motorized vehicle would change transportation forever.

The introduction of motor vehicles to the community proved a dilemma for city leaders. The roads that had once served well for horse and carriage were no longer suitable for automobiles. The constant jarring clatter and heavy noise of motorized transportation the city's streets into a sea of mud, impeding by pedestrians and carriage drivers, much less a motor vehicle.

The community wanted to build a high quality pavement that could withstand a severe climate, a material that was durable and that did not require watering to replace the dirt roads that had long since been abandoned. The only options available being gravel, crushed stone, or concrete. Each had its own set of challenges. Gravel and crushed stone would not last in the winter. Concrete would be too expensive and would require a lot of water to cure. Gravel and crushed stone would not last in the winter. Concrete would be too expensive and would require a lot of water to cure.

Granitoid was made of crushed granite, crushed stone, crushed granite, and sand bound with a special surface, and it was the perfect choice for the city. The product cost to pave the city streets was much less than the cost of concrete. The new streets of Granitoid were built in the late 1880s and 1890s. Some of these streets are still in use today, and some are being restored. The streets were built in the National Register of Historic Places.

Cabelas,

East Grand Forks, MN



Grand Forks Greenway



*50,000 attended first
Greenway Day in 2003*



FRIENDS
OF THE
GREENWAY
SUMMER CHILI COOKOFF



FRIENDS
OF THE
GREENWAY
GRAND FORKS/EAST GRAND FORKS









Source: Grand Forks Herald



Grand Forks Greenway









Revenue Projections

Greater Grand Forks Greenway



Annual Revenue Projections for Greenway

	Base Dollars	Total Dollars (multiplier effect)
Direct Revenue	\$28,860	\$50,148
Indirect Revenue	\$600,660	\$1,081,188
Community Revenue	<u>\$8,580,863</u>	<u>\$15,445,553</u>
Grand Totals	\$9,209,383	\$16,576,889

Grand Forks Greenway - Press

GRAND FORKS **BEST PLACES** NORTH DAKOTA

River Revival

Grand Forks, N.D. has come back a long way since a disastrous flood in 1997. Could it teach New Orleans a thing or two? ▶ By Christopher Steiner

WHEN THE ORDER TO EVACUATE GRAND FORKS, N.D. came down, Jon C. Larson and his 20 Sure Foot Corp. employees scrambled to their vehicles and scattered. Hours after the decreed exodus on Apr. 18, 1997 the cantankerous Red River crashed over levees and mauled the town. Two days later Larson and his general sales manager, Wayne Waage, returned to the chaos. "Anything downstairs that wasn't bolted down was floating," Jon says. He recalls turning to Waage to ask, "Is that the compressor going by right there?" It was.



Before and after: The Coast Guard inspects damage in 1997; today's new flood wall along the Red River.



184 FORBES MAY 22, 2006

MALIN FERRY/COMBINE LAND SERVICES / GETTY IMAGES FOR FORBES

FORTUNE
SMALL BUSINESS

Does Your Accountant
Work For The IRS?
▶ PAGE 22

2008

BEST PLACES

to LIVE and LAUNCH

100 GREAT TOWNS FOR BUSINESS OWNERS
▶ PAGE 60

#1 Bellevue, Wash.
Earl Overstreet's tech company flourishes near pristine lakes and abundant engineering talent.

MR. CHARLES A FLINK II
GREENWAYS INC
5050 FAYETTEVILLE RD
STE 2111
DURHAM NC 27713-6289

fab.com AOL Keyword: FSB APRIL 2008







Grand Forks Greenway



Source: Grand Forks Herald



Source: Grand Forks Herald

6 7:59 AM

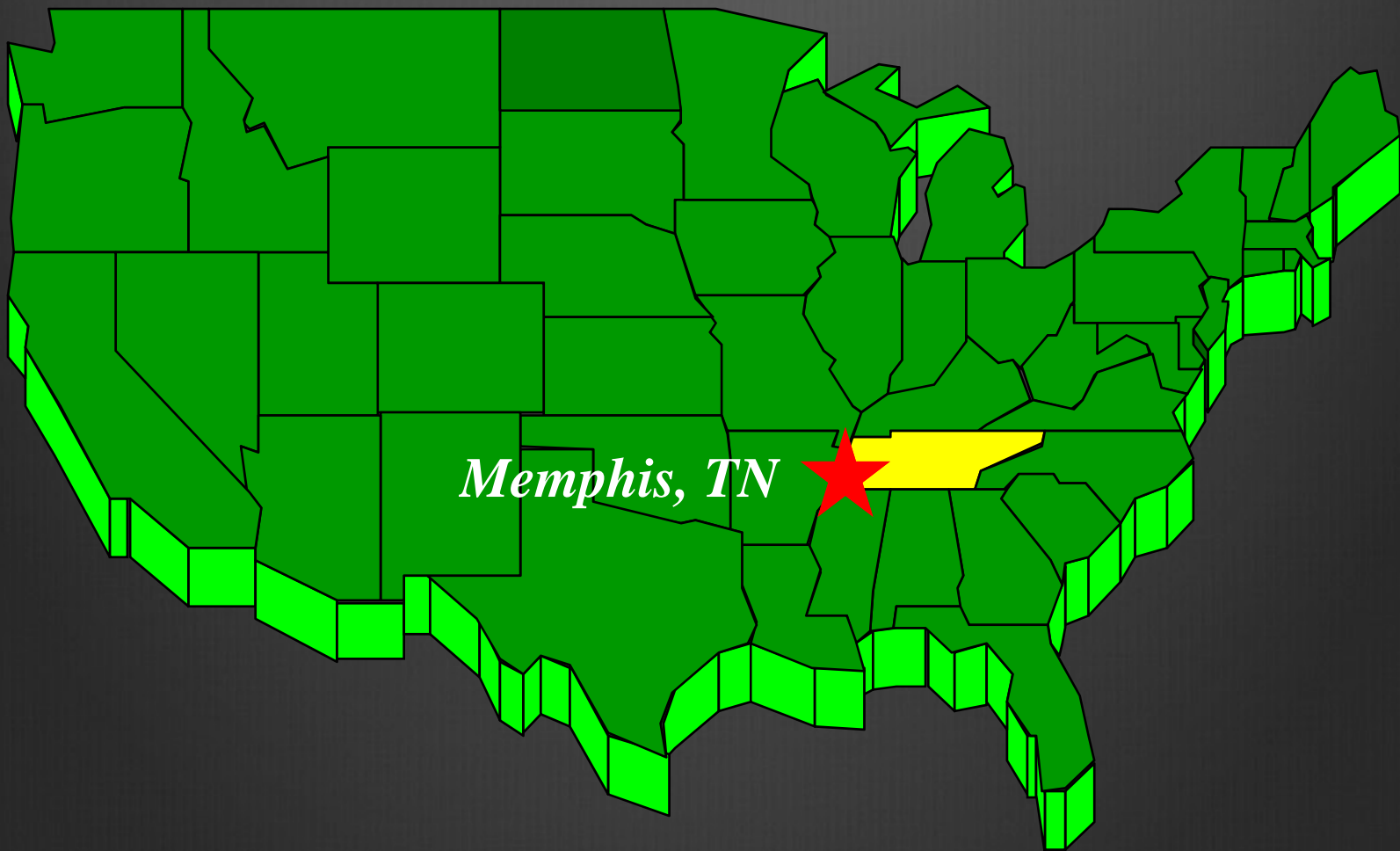




“about the best example we have to date” when it comes to flood protection as a public amenity

Kevin Holden, US Army
Corps of Engineers

Case Study: Memphis, TN



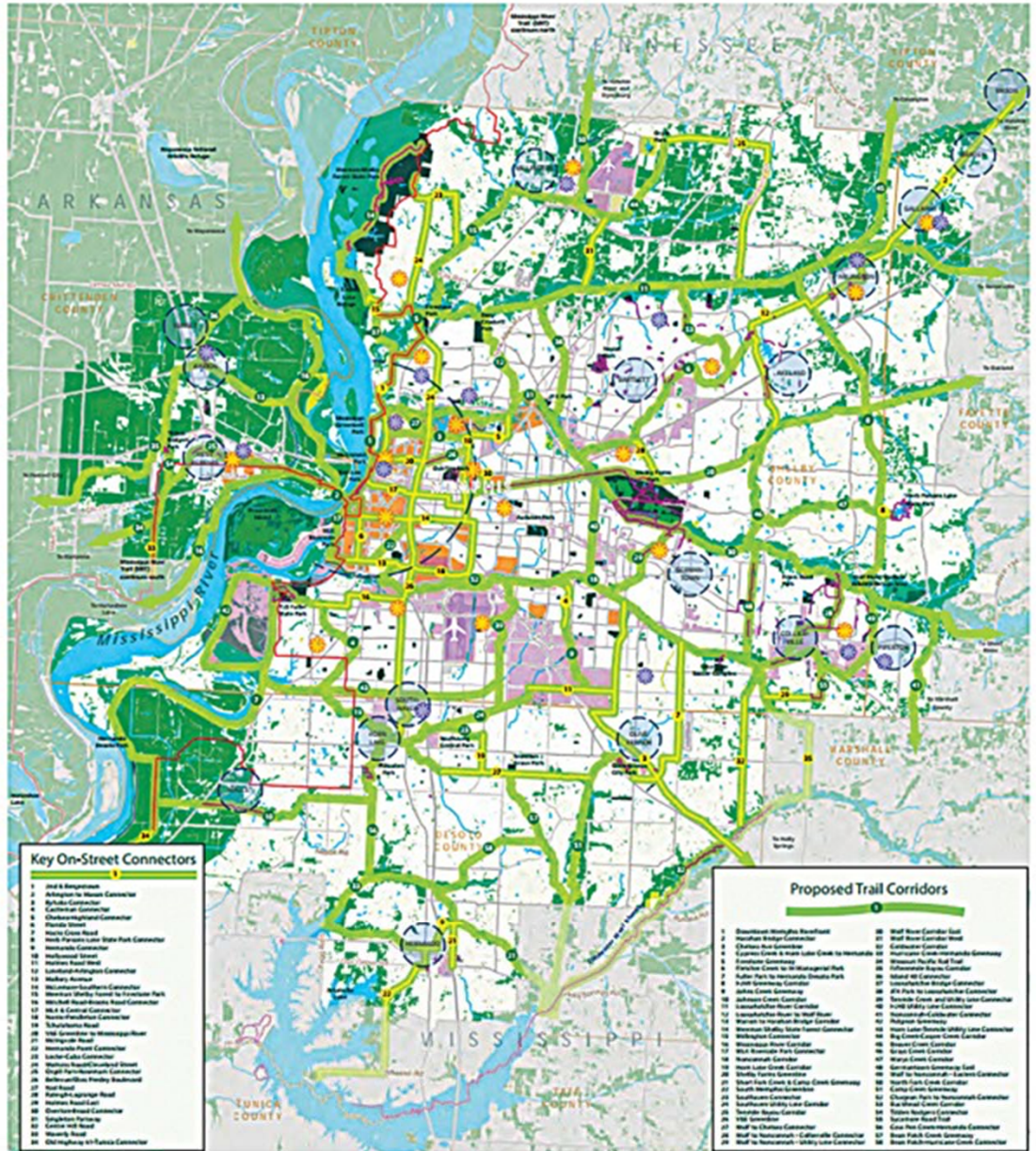
Urban Flooding in Memphis





MID-SOUTH REGIONAL GREENPRINT CONCEPT MAP

Concept for a Regional Network of Connected Green Infrastructure



Key On-Street Connectors

1. 1st & Georgetown
2. Arlington to Walnut Connector
3. Bayou Connector
4. Carrollton Connector
5. Chatham/Highway 10 Connector
6. Florida Street
7. Harris Green Road
8. Hickory Green Lane State Park Connector
9. Interstate Connector
10. Jefferson Street
11. Louisiana/Highway 10 Connector
12. Malibu Avenue
13. Mississippi Boulevard Connector
14. Newbern Street to Foyeville Park
15. Old Shell Road to State Park Connector
16. Old & Central Connector
17. Northwood Connector
18. Schriber Road
19. 10th Connector to Mississippi River
20. Springdale Road
21. Westwood Road Connector
22. East-Cala Connector
23. Westwood Road/Highway 10 Connector
24. 10th/Highway 10 Connector
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Proposed Trail Corridors

1. American Heights Boulevard
2. American Bridge Connector
3. American Bridge Connector
4. American Bridge Connector
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Key Inputs:

- Parks and Recreation Areas
- Employment Centers
- Social Equity Areas
- City Centers and Team Centers
- Commercial/Recreation Focus Areas
- Employment Centers and High-Priority Areas
- Parks and Recreation Areas
- Wetlands
- Water/Bodies and Streams

MID-SOUTH REGIONAL GREENPRINT

2015 GREENPRINT SUMMIT



National Disaster Resiliency Grants

California - \$70,359,459

Virginia - \$120,549,000

Connecticut - \$54,277,359

New York City - \$176,000,000

Iowa - \$96,887,177

Minot, ND - \$74,340,770

Louisiana - \$92,629,249

Shelby County - \$60,445,163

New Jersey - \$15,000,000

Springfield, MA - \$17,056,880

Tennessee - \$44,502,374

Why Give the Grants?

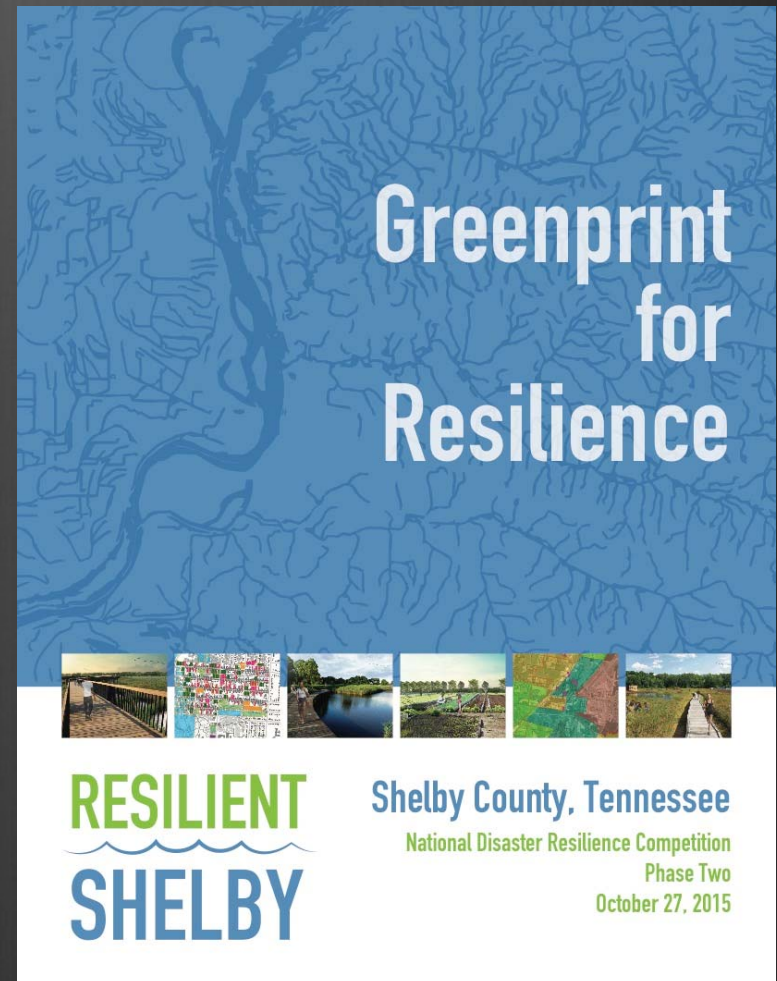


“The grants we award today, and the other sources of capital these grants will leverage, will make communities stronger, more resilient and better prepared for future natural disasters such as floods and wildfires. ”

Julian Castro, HUD Secretary, January 2016

Greenprint for Resiliency

1. Big Creek Wetland and Recreation Area
2. Wolf River Restoration and Greenway
3. South Cypress Creek Watershed and Neighborhood Development
4. Resilience Research



WOLF RIVER GREENWAY



36 MILE TRAIL SYSTEM



WOLF RIVER GREENWAY



Corridor of Opportunity



CONSERVE



RESTORE



EDUCATE



EMPLOY



TRANSPORT



RECREATE



REVITALIZE



CONNECT



ENGAGEMENT

MEMPHIS GETS MOVING

HEALTH & ECONOMIC IMPACTS
OF BUILDING THE
WOLF RIVER GREENWAY

PREPARED FOR
WOLF RIVER

CONSERVANCY

PREPARED BY

PLANNING + DESIGN

Photo: Dale Sanders

HEALTH BENEFITS



1,190,000

MILES WALKED
PER YEAR

=

390

CROSS-COUNTRY
ROAD TRIPS



1,254,000

MILES BIKED
PER YEAR

=

50

TRIPS AROUND
THE EARTH



\$1,467,000

IN ANNUAL HEALTHCARE
COST SAVINGS

=

4,900

FEWER TRIPS TO THE DOCTOR

=

2,449,000

FEWER MILES TRAVELD BY
AUTOMOBILES

Walk for Health and Fitness



ECONOMIC BENEFITS



\$261,000

IN ANNUAL TAX
REVENUE FROM
TOURISM SPENDING

499
MORE JOBS



SUPPORTED BY THE EXPECTED
INCREASE IN TOURISM AND
CONSTRUCTION SPENDING
(INCLUDING PERMANENT & ONE-TIME JOBS)



\$2,659,000

IN ANNUAL PROPERTY
TAX REVENUE

\$44,987,000

IN ONE-TIME, UPFRONT
CONSTRUCTION SPENDING
(INCLUDING DIRECT & INDIRECT SPENDING)

ECONOMICS



TRANSPORT BENEFITS



\$1,396,000

IN REDUCED HOUSEHOLD
VEHICLE OPERATION
COSTS PER YEAR



\$1,446,000

IN REDUCED COMMUNITY-WIDE
VEHICLE OPERATION
COSTS PER YEAR



57,000
RESIDENTS

WITHIN A 10 MINUTE WALK OF
THE GREENWAY WITH NEW
ACCESS TO TRAILS

CONNECTIONS



TOTAL BENEFITS

1,126,000 MORE BIKE TRIPS PER YEAR

4,650,000 MORE WALK TRIPS PER YEAR

\$1,467,000 IN HEALTH BENEFITS PER YEAR

\$2,842,000 IN TRANSPORTATION BENEFITS PER YEAR

\$7,185,000 IN ENVIRONMENTAL BENEFITS PER YEAR

\$2,920,000 IN ECONOMIC BENEFITS PER YEAR

over

\$14 MILLION
IN TOTAL BENEFITS PER YEAR

Resilient Communities

“Resilience favors diversity. It favors more choices. It favors innovation. It favors connectedness and cohesion. It must focus on the most vulnerable geography and the most vulnerable people, because how people fare in the event of a shock of some kind is extremely different based on whether they have the resources to bounce back. Communities have to decide what kind of future they want to have, and then they have to make very difficult and deliberate changes to get these sustainable smarter growth outcomes.”

Harriett Tregoning, U.S. Office of Economic Resilience

Our Only Spaceship !



Home to 7.4 billion people

Source: NASA



Thank You !