Mid-South Regional Resilience Master Plan

Project Update

ETC & TPB Meetings
May 16, 2019
Project Overview

• Funded by 2016 HUD National Disaster Resilience Competition grant

• Plan will function as a resource with strategies, tools, and data that agencies can use as they deem appropriate

Threats Addressed

- River Flooding
- Flash Flooding
- Extreme Heat & Drought
- Damaging Wind
- Earthquakes
- Winter Weather
- Tornadoes
HUD Resilience Definition

“Resilience is the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow, no matter what kinds of chronic stresses and acute shocks they experience.”

National Disaster Resilience Competition
Project Boundary

Same as MPO:

23 Cities

4 Counties

2 States
2.1 Large Scale Water Detention

Store Water Upstream to Mitigate Flooding Downstream

Key Benefits:
1. Increases water storage capacity and reduces destructive flooding.
2. Reduces flash flooding and slows river flow.
3. Provides year-round social and ecological benefits.
4. May store water for use during droughts.

Overview

Riparian Corridors serve a vital role in flood control and watershed function. When healthy and intact, they help slow the flow of water through the watershed. Gently sloping banks support trees and shrubs that slow and filter and absorb water. Wetlands and floodplains along the river contain, assimilate, and infiltrate floodwaters. All the while, birds, animals, and fish thrive in the diverse habitats created by tree canopy, shrubs, grasses, gravel, and thick soil.

A couple of steps towards reducing flooding is to address the rivers, streams, flood plains, and wetlands that have been impacted by development. Eroded, channelized and straightened rivers directly contribute to flooding. These conditions also present the local community from using the river and cause poor water quality and loss of habitat.

Natives and native riparian corridors also bring value to the local community. Restoration projects can create recreational trails, build community pride, and provide a sense of the local flooding. These rails also give the community a window into the transformation that occurs during restoration, showing the regrowth of vegetation and reintroduction of birds, animals, and fish over time. The local community can even help with tasks such as invasive species removal and new plantings. Longer term volunteer groups could serve an important role in maintaining the site by removing litter and invasive species or as a wildlife bank and monitoring post-construction.

Given the direct reduction in flood risk and the benefits to the local community and ecology, restoring riparian corridors is a strong strategy for resiliency.
2.1 Large Scale Water Detention
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Overview

Riparian Corridors serve a vital role in flood control and watershed function. When healthy and stable, riparian corridors slow the flow of water through the watershed. Gently sloping banks support trees and shrubs that slow and filter and absorb runoff. Wetlands and floodplains along the river contain, mediate and inculcate floodwaters. All the while, birds, animals, and fish thrive in the diverse habitats created by tree canopy, shrubs, grasses, gravel, and thick soil.

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Attractions and vibrant riparian corridors also bring value to the local community. Restoration projects can create recreational trails, build community programs, and provide access to the river for boating. These trails also give the community a window into the transformation that occurs during restoration, showcasing the regrowth of vegetation and reintroduction of birds, animals, and fish over time. The local community can even help with tasks such as invasive species removal and new plantings. Longer term volunteer groups could serve an important role in maintaining the site by removing litter and invasive species on a regular basis, and monitoring post-construction.

Given the direct reduction in flood risk and the benefits to the local community and ecology, restoring riparian corridors is a strong strategy for resiliency.
1.1 Increase Floodplain Capacity

River flooding and flash flooding have gotten worse over time because the natural floodplains and resilient mechanisms have been degraded by development. Rivers were corrected, channelized, and straightened to contain water flow and extend buildable land. Unfortunately, such disruptions to hydrology have many negative effects as well.

Rivers that have been armored or channelized speed water flow and reduce absorption. They can also create bottlenecks that cause erosion upstream.

Many rivers have been artificially straightened. Where erosion and channelization has occurred, the natural ability of streams to slow water flow is lessened. Riverbeds that have been smoothed over increase stream velocity. The result is uncontrollable waters and destructive floods.

Fortunately, there are many ways to increase the natural flood reduction capacity of a river. These are necessary first steps in riparian corridor restoration.

Issues

1. Loss of floodplain exacerbates flooding
2. Development up to and over stream
3. Pollutant and litter drain to stream
4. Loss of riparian habitat
5. Heat pollution in shallow water
6. Impermeable surface precludes infiltration

Methods

Remove Constraints and Lay-back Slopes

Daylight covered streams and channels and add volume for flood storage

Reconnect or Introduce Meanders

Reconnecting old meanders and introducing new ones expands the floodplain and slows river flow

Add Variation to Slow Stream Flow

Introducing variation on the bottom bar banks creates obstacles that slow river flow and increase water infiltration.

Increase Flood Storage Volume

Loss of floodplain causes severe floods

Reconnect or Introduce Meanders

Floods beyond historic floodplain

Add Variation to Slow Stream Flow

Fast and high volume flow

Plants and soil take up water

Reduce floods and slowest flow

Increase surface area increase infiltration

Upstream erosion and flooding

Natural absorbs and filters floodwater

Meander slows flow

Large and frequent floods

Restore habitat

Reduce floods and slowest flow

Restoration of a river's natural flow takes time, planning, and a comprehensive approach.
### Methods

#### Types

The most common park-based flood mitigation strategies fall into the categories listed here. Methods are flexible and the variations shown in this list can be adapted to meet sites and budgets.

**Underground Storage**

 Tanks beneath park structures like sports fields and plaza hold stormwater overflow. Stormwater is directed to the tanks through some combination of drains, channels, or permeable surfaces. Water is drained or pumped out for reuse or gray water purposes.

**Floodable Fields**

Class A and B soils provide quick absorption of water. A thick gravel layer underneath can provide storage.

**Sports or Naturalistic Field**

- Permeable Soil
- Sand Filter
- Optional Gravel Storage
- Infiltration to Groundwater

**Permeable Paving**

Permeable pavement provides quick absorption of water. A thick gravel layer underneath provides storage.

**Courts and Parking Lots**

- Permeable Paving
- Surfacing or Pavers
- Sand Infiltration
- Gravel Storage
- Infiltration

### Seasonal Wetland

Low-lying area vegetated with water-loving species. A gentle slope allows the flooded area to expand after storm events. An impermeable layer under the soil ensures some water retention.

### Berms

Delineating where a park trail could become a berm requires analysis that is more detailed than the regional scale. Berms along the river’s edge can serve many purposes but also may have negative effects on downstream flooding or the community’s connection to the river. Ideally, the berm expands the floodplain and adds interest and views to the park. Factors to look for include whether:

- The berm will mitigate flood damage in developed areas.
- There is a local alternative place to store floodwater so that flooding does not increase downstream.
- People can continue to access the river over the berm.
- The berm could expand the floodplain inside the floodplain.

### Functional Variation of Park-Trellis Berms

- Expand River Storage Capacity
- Define Floodable Areas
- Protect River Assets

### Retention Pond

A small pond within a park that is designed to store a specific volume of stormwater. During non-flood conditions, the pond maintains a size suitable for fishing, wildlife, views, or other purposes.
Sample BMPs and Design Guidelines

Recommended best practices to include in Design Guidelines and Unified Development Code

The Memphis and Shelby County Unified Development Code has outlined the arrangement of streetscape plates for several different development scenarios. These cross-sections provide ample space for most street trees (8’ minimum). The UDC would benefit from the addition of below-ground details including minimum soil volumes, aeration, and drainage. It would also benefit from recommendations for the layout of trees on a site for solar shading, flooding, and storm water management. Local language is shown in italics.

The section 4.6.9 Approved Plant List includes several species that are known to have challenges as street trees (e.g., Norway Maple can be invasive, zelkovas break open to breaking off).

Biodiversity Layout

Encourage the use of multiple species, families, and genera by providing guidelines such as:

- Below are recommended species distributions for tree planting, intended to promote biodiversity and tree canopy resilience:
  - 1-5 Trees: 1 Species
  - 6-10 Trees: No more than 50% of 1 species
  - 11-20 Trees: No more than 30% of 1 species, at least 2 families
  - 21-50 Trees: No more than 20% of 1 species, at least 2 families
  - 50+ Trees: Follow Maryland Dept. of Natural Resources Guidelines

Planting near Power Lines and Utilities

Very few species are small enough to grow under power lines, which range from 12 to 18 feet off the ground in most areas. Only three on the Memphis Tree Board Street Tree List:

Guidelines and code should make every effort to support appropriate planting and around power lines. Sample Guidelines:

- Development within 60’ of an overhead powerline should comply with the following guidelines based on anticipated mature height (AMH) and other species characteristics:
  - Directly underneath and up to 10’ on either side of the AMH – trees must have an AMH of 50’ or less. See above ground obstacles with narrow fronds as needed at a ratio of at least 4 shrubs per tree
  - Directly underneath and up to 10’ on either side of the AMH – trees must have AMH of 20’ or less.
  - 10’ and up: AMH must be no more than 4 times the horizontal distance to the power line.
  - Species planted with 60% of AMH must be no more than 16’ deep and no more than 4 times the horizontal distance to the power line.
  - Species planted with 30% of AMH must be no more than 4 times the horizontal distance to the power line.

- Underground Utilities: No trees shall be planted within 10’ of an underground utility unless combined from the utility by a root barrier at least 4’ deep, and as long as the AMH of the tree. Small and medium trees may be planted within 11-30’. Large trees must be planted at least 50’ every 25’.

Drainage, Depth, and Trenching

An example of underground design details is shown here, overlaid in color over the UDO 4.3.5 S-1 Streetscape Plate.

- Continuous tree pit is highly encouraged. Exceptions for minimum soil volumes may be granted in the case of continuous tree pits wider than 10’.
- Minimum 18’ graded drainage area under tree pit, where possible, connect overflow pipe to storm drain.
- Root barrier at least 4’ deep and as long as unoccupied height of tree.

Minimum Soil Volumes

Trees need certain minimums of soil volume in order to thrive. The volume depends on the size of the tree. The depth of a tree pit usually does not need to be more than three to four feet because most roots are two feet of the surface.

Pruning for Tree Health

Given the risk of top-sided and selected trees falling over, design guidelines should provide a systematic representation of pruning practices that result in the need for tree removal. Property owners will be compensated with the woodchips and replacement trees.

Lap sided trees, lap sided trees, and top-heavy trees may be removed from public or private property if they determined to be a fall hazard. When an private property, the owner may keep the woodchips from the downed tree. In public areas owners may also receive up to § appropriately sized replacement trees.
Reducing Flooding Depends on Watershed Management

Controlling flooding relies on responsible management of the entire watershed, not just rivers and streams. The watershed includes all of the land in the basin that drains to a river, from the upland headwaters to the low-lying delta. Development and land use changes within a watershed can increase the amount of water flowing downstream, resulting in more frequent and intense flooding. The focus of Chapter 2 is effective strategies to manage excess water at the regional scale. In the Mid-South, these strategies include dispersed water management, protecting land surrounding water bodies, and controlling stormwater runoff.

Section 2.1 addresses dispersed water management, a technique where low-lying fields are configured to hold large volumes of water and control its release. This technique is very cost-effective: simple detention ponds start at $0.07 per gallon. For the Mid-South, a target system size would be 1,500 acres across dozens of sites.

Section 2.2 focuses on protecting valuable natural assets within the watershed: wetlands and aquifer recharge areas. Zoning based on proximity to the watershed is a common and effective way to ensure long-term protection. Regulations are typically placed on building and land development within 100 to 500 feet of the sensitive water asset.

Section 2.3 describes the benefits, types, and funding of low-impact development (LIDs) techniques. Increasing the widespread use of LIDs across the watershed, will lower the impact of continued upstream development.

Finally, section 2.4 covers the logistics of using land within the floodplain for both recreation and emergency floodwater storage. GIS analysis reveals that the Mid-South has nearly 10,000 acres that meet initial criteria: large, flat, public open space within the floodplain. Strategy 2.4 recommends studying these sites to determine the appropriateness for use in temporary floodwater storage.
Case Studies

Tom Hanafan Rivers Edge Park Council Bluffs, IA

Completed in 2013, the Council Bluffs Riversfront Park is a 50-acre public park situated within the broad riparian floodplain of the great Missouri River. It is a park integrated within a levee system that provides flood protection while allowing the site to be publicly accessible.

The design of the park focuses intensity of public use and development in a core area of the flooding site which allows access to the river and also preserves key habitat and riparian floodplain. Strategies to increase the ecological function of the site include nearly 20 acres of reforestation, nature trails, grasses, porous pavement, diverse native plantings, and parking lot rain gardens. The ecologically sensitive areas north and south of the bridge’s landing are reinforced by reforestation and wetland enhancement strategies and accessed via a series of trails and environmental interpretation.

At the bridge landing, a “window” is carved out of the forest, creating an open landscape down to the river’s edge that can accommodate the city’s significant festivals and events and provide a view of the dramatic Omaha skyline. The edges of the window provide shaded groves for picnicking and a riverside sandbox for play at the water’s edge. All of these improvements are designed to withstand occasional flooding of the site and are coordinated with the US Army Corps of Engineers and the Iowa Department of Natural Resources.

The integration of public art is a key component of the park design. Environmental artist Doug Hollis is an integral member of the design team and will contribute an iconic weather-inspired tower and water feature to the park’s landing—an active water play and ice-skating plaza atop the existing levee. The plan accommodates the works of other artists, from lighting installations to sculptural elements, and will be implemented over time.
Recommendations

Waterways

1.1 River and Stream Restoration: Mitigate Flooding by Improving Waterway Health
1.2 Flood Barriers: Construct Barriers to Protect Against Flooding

Watersheds

2.1 Large-Scale Water Detention: Store Water Upstream to Mitigate Flooding Downstream
2.2 Watershed Conservation: Protect Critical Watershed Assets
2.3 Low Impact Development: Encourage Development that Supports Healthy Watersheds
2.4 Open Space Strategies: Use Parks, Trails, and Other Open Space to Protect Against Flooding

Recommendations Master List
Recommendations

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Recommendations

Buildings

3.1 Floodproofing Buildings: Retrofit Critical Buildings for Flood Protection
3.2 Earthquake Resilient Buildings: Update Codes and Building Stock to Provide Seismic Resilience
3.3 Emergency Shelters: Ensure Adequate Emergency Shelter Capacity
3.4 Roof Design: Encourage Green / Cool Roofs for Thermal Regulation and Resource Efficiency
3.5 Green Building Retrofits: Support Retrofits that Improve Building Performance and Resilience

Land Planning

4.1 Resilient Sites: Incorporate Site Resilience Factors into Land Planning Decisions
4.2 Smart Growth: Encourage Selective Compact and Infill Development
4.3 Flood Smart Development: Exceed the Minimum Requirements of the NFIP
Recommendations

Infrastructure

5.1 Critical Infrastructure Planning: Create Critical Facilities Protection Plans
5.2 Drainage Systems: Enhance the Capacity of Waste and Stormwater Systems
5.3 Power Lines: Selectively Bury Overhead Electrical Lines
5.4 Smart Grid: Implement a Smart Grid System to Mitigate Power Outages
5.5 Community Energy: Expand Cooperative and Community-Based Energy Systems
5.6 Snow and Ice: Fund Additional Resources for Post-Storm Snow and Ice Removal
5.7 Trees: Modify Tree Programs for Improved Resilience and Ecological Health
Recommendations

Post Disaster

6.1 Voluntary Buyouts: Implement a Voluntary Buyout Program for High Risk Sites
6.2 Debris Recycling: Recover and Recycle Post-Storm Debris
6.3 Temporary Housing: Prototype Rapid, Temporary Post-Disaster Housing Solutions

Governance

7.1 Resilience Database: Maintain Up-to-Date Resilience Data and Projections
7.2 Outreach: Expand Resilience-Related Public Outreach and Engagement Efforts
7.3 Vulnerable Communities: Identify Resilience Strategies for Vulnerable Communities
7.4 Economic Development: Align Job-Training Programs with Resilience-Related Workforce Needs
7.5 Capital Market Funding: Fund Disaster Mitigation and Recovery Through Private Capital Markets
Next Steps
• Final round of public meetings this week
• Feedback on draft recommendations
• Final report compilation through summer 2019

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Project Website
https://resilientshelby.com/overview/resilience-activities/resilience-plan/